

Underlier Supplement No. 42 to the Prospectus and the Prospectus Supplement, each as may be amended from time to time, that form a part of Registration Statement No. 333-269296



## GS Finance Corp.

Medium-Term Notes, Series F

Warrants, Series G

guaranteed by

**The Goldman Sachs Group, Inc.**

### Underlier Supplement

#### Securities Linked to the Performance of One or More Indices

GS Finance Corp. may from time to time offer and sell notes or warrants (which we refer to collectively as securities), the payments and performance of which will be linked to the performance of one or more indices. We refer to these indices as underliers.

The accompanying prospectus and the accompanying prospectus supplement, each as may be amended from time to time, that form a part of Registration Statement No. 333-269296 describe some of the terms that may apply generally to the securities, including any securities you purchase. A separate pricing supplement, which we refer to as the applicable pricing supplement and, if specified in the applicable pricing supplement, a separate product supplement, which we refer to as the applicable product supplement, and, if specified in the applicable pricing supplement, a separate general terms supplement, which we refer to as the applicable general terms supplement, will describe additional terms that apply to your securities. The applicable pricing supplement will identify whether any of the underliers described herein will be used to calculate a return on your securities. If the description in the applicable pricing supplement of any underlier to which your securities are linked is inconsistent with the description herein, the description of the underlier in the applicable pricing supplement is controlling.

This underlier supplement no. 42 contains the following:

- Certain underlier risks applicable to the securities. You should read these risks in conjunction with the risks described in the applicable pricing supplement, the applicable product supplement, if any, the applicable general terms supplement, if any, the accompanying prospectus supplement and the accompanying prospectus.
- A description of the following underliers to which your securities may be linked:
  - Dow Jones Industrial Average<sup>®</sup>
  - Dow Jones Industrial Average Futures Excess Return Index
  - Dow Jones U.S. Select Dividend Index
  - EURO STOXX 50<sup>®</sup> Index
  - FTSE<sup>®</sup> 100 Index
  - MSCI Indices
  - MSCI USA Momentum Top 50 Select Index
  - Nasdaq-100 Futures Excess Return<sup>™</sup> Index
  - Nasdaq-100 Index<sup>®</sup>
  - Nasdaq-100 Technology Sector Index
  - Nikkei 225
  - Russell 2000<sup>®</sup> Futures Excess Return Index
  - Russell 2000<sup>®</sup> Index
  - Russell 2000<sup>®</sup> Value Index
  - S&P/ASX 200 Index
  - S&P 500<sup>®</sup> Daily Risk Control 5% USD Excess Return Index
  - S&P 500<sup>®</sup> Daily Risk Control 10% USD Excess Return Index
  - S&P 500<sup>®</sup> Futures Excess Return Index
  - S&P 500<sup>®</sup> Futures Volatility Plus Daily Risk Control Index
  - S&P 500<sup>®</sup> Index
  - S&P 500<sup>®</sup> Value Index
  - S&P 500<sup>®</sup> Volatility Plus Daily Risk Control Index
  - S&P MidCap 400<sup>®</sup> Index
  - Swiss Market Index
  - TOPIX
  - Non-Seasonally Adjusted U.S. City Average All Items Consumer Price Index for All Urban Consumers

*Your investment in the securities involves certain risks. See "Additional Risk Factors Specific to the Securities" beginning on page S-2 to read about investment risks relating to the securities.*

**Neither the Securities and Exchange Commission nor any other regulatory body has approved or disapproved of these securities or passed upon the accuracy or adequacy of this underlier supplement no. 42, the applicable pricing supplement, the applicable product supplement, if any, the applicable general terms supplement, if any, the accompanying prospectus supplement or the accompanying prospectus. Any representation to the contrary is a criminal offense.**

**The securities are not bank deposits and are not insured by the Federal Deposit Insurance Corporation or any other governmental agency, nor are they obligations of, or guaranteed by, a bank.**

GS Finance Corp. may use this underlier supplement no. 42 in the initial sale of the securities. In addition, Goldman Sachs & Co. LLC (GS&Co.), or any other affiliate of GS Finance Corp., may use this underlier supplement no. 42 in a market-making transaction in a security after its initial sale. ***Unless GS Finance Corp. or its agent informs the purchaser otherwise in the confirmation of sale, this underlier supplement no. 42 is being used in a market-making transaction.***

**Goldman Sachs & Co. LLC**

Underlier Supplement No. 42 dated December 18, 2024.

## ADDITIONAL RISK FACTORS SPECIFIC TO THE SECURITIES

*In this underlier supplement no. 42, when we refer to a “security” we mean a security linked to one of the underliers specified herein unless the context requires otherwise. Please note that in this underlier supplement no. 42, references to “GS Finance Corp.”, “we”, “our” and “us” refer only to GS Finance Corp. and do not include its consolidated subsidiaries or affiliates. Also, references to “The Goldman Sachs Group, Inc.”, our ultimate parent company, refer only to The Goldman Sachs Group, Inc. and do not include its consolidated subsidiaries, while references to “Goldman Sachs” mean The Goldman Sachs Group, Inc. together with its consolidated subsidiaries and affiliates, including us. References to “holders” mean those who own securities registered in their own names, on the books that we or the trustee maintain for this purpose, and not those who own beneficial interests in securities registered in street name or in securities issued in book-entry form through The Depository Trust Company (“DTC”).*

*An investment in your securities is subject to the risks described below as well as the risks and considerations described in the applicable pricing supplement, the applicable product supplement, if any, the applicable general terms supplement, if any, the accompanying prospectus supplement and the accompanying prospectus.*

*Your securities are a riskier investment than ordinary debt securities. Also, your securities are not equivalent to investing directly in the underlier stocks, i.e., with respect to an underlier to which your securities are linked, the stocks comprising such underlier. You should carefully consider whether the offered securities are appropriate given your particular circumstances.*

### **Risks Relating to Securities Linked to Underliers**

#### **The Estimated Value of Your Securities At the Time the Terms of Your Securities Are Set On the Trade Date (as Determined By Reference to Pricing Models Used By GS&Co.) Is Less Than the Original Issue Price Of Your Securities**

The original issue price for your securities exceeds the estimated value of your securities as of the time the terms of your securities are set on the trade date, as determined by reference to GS&Co.’s pricing models and taking into account our credit spreads. Such estimated value on the trade date will be set forth under “Estimated Value of Your Securities” in the applicable pricing supplement; after the trade date, the estimated value as determined by reference to these models will be affected by changes in market conditions, the creditworthiness of GS Finance Corp., as issuer, the creditworthiness of The Goldman Sachs Group, Inc., as guarantor, and other relevant factors. If specified in the applicable pricing supplement, the price at which GS&Co. would initially buy or sell your securities (if GS&Co. makes a market, which it is not obligated to do), and the value that GS&Co. will initially use for account statements and otherwise, also exceeds the estimated value of your securities as determined by reference to these models. If specified in the applicable pricing supplement, as agreed by GS&Co. and the distribution participants, this excess (i.e., the additional amount described under “Estimated Value of Your Securities” in the applicable pricing supplement) will decline to zero on a straight line basis over the period from the date thereof through the applicable date set forth under “Estimated Value of Your Securities” in the applicable pricing supplement. Thereafter, if GS&Co. buys or sells your securities it will do so at prices that reflect the estimated value determined by reference to such pricing models at that time. The price at which GS&Co. will buy or sell your securities at any time also will reflect its then current bid and ask spread for similar sized trades of structured securities.

In estimating the value of your securities as of the time the terms of your securities are set on the trade date, as disclosed under “Estimated Value of Your Securities” in the applicable pricing supplement, GS&Co.’s pricing models consider certain variables, including principally our credit spreads, interest rates (forecasted, current and historical rates), volatility, price-sensitivity analysis and the time to maturity of the securities. These pricing models are proprietary and rely in part on certain assumptions about future events, which may prove to be incorrect. As a result, the actual value you would receive if you sold your securities in the secondary market, if any, to others may differ, perhaps materially, from the estimated value of your securities determined by reference to our models due to, among other things, any differences in pricing models or assumptions used by others. See “— The Market Value of Your Securities May Be Influenced by Many Unpredictable Factors” below.

The difference between the estimated value of your securities as of the time the terms of your securities are set on the trade date and the original issue price is a result of certain factors, including principally the underwriting discount and commissions, the expenses incurred in creating, documenting and marketing the securities, and an estimate of the difference between the amounts we pay to GS&Co. and the amounts GS&Co. pays to us in connection with your securities. We pay to GS&Co. amounts based on what we would pay to holders of a non-structured security with a similar maturity. In return for such payment, GS&Co. pays to us the amounts we owe under your securities.

In addition to the factors discussed above, the value and quoted price of your securities at any time will reflect many factors and cannot be predicted. If GS&Co. makes a market in the securities, the price quoted by GS&Co. would reflect any changes in market conditions and other relevant factors, including any deterioration in our creditworthiness or perceived creditworthiness or the creditworthiness or perceived creditworthiness of The Goldman Sachs Group, Inc. These changes may adversely affect the value of your securities, including the price you may receive for your securities in any market making transaction. To the extent that GS&Co. makes a market in the securities, the quoted price will reflect the estimated value determined by reference to GS&Co.’s pricing models at that time, plus or minus its then current bid and ask spread for similar sized trades of structured securities (and, if applicable, subject to the declining excess amount described above).

Furthermore, if you sell your securities, you will likely be charged a commission for secondary market transactions, or the price will likely reflect a dealer discount. This commission or discount will further reduce the proceeds you would receive for your securities in a secondary market sale.

There is no assurance that GS&Co. or any other party will be willing to purchase your securities at any price and, in this regard, GS&Co. is not obligated to make a market in the securities. See “— Your Securities May Not Have an Active Trading Market” below.

**Your Securities Are Subject to the Credit Risk of GS Finance Corp., as Issuer, and the Credit Risk of The Goldman Sachs Group, Inc., as Guarantor**

Although the return on the securities will be based on the performance of one or more underliers, the payment of any amount due on the securities is subject to the credit risk of GS Finance Corp., as issuer of the securities, and the credit risk of The Goldman Sachs Group, Inc., as guarantor of the securities. The securities are our unsecured obligations. Investors are dependent on our ability to pay all amounts due on the securities, and therefore investors are subject to our credit risk and to changes in the market's view of our creditworthiness. Similarly, investors are dependent on the ability of The Goldman Sachs Group, Inc., as guarantor of the securities, to pay all amounts due on the securities, and therefore are also subject to its credit risk and to changes in the market's view of its creditworthiness. See “Description of Notes We May Offer — How the Notes Rank Against Other Debt” or “Description of Warrants We May Offer — How the Warrants Rank Against Other Debt”, as applicable, in the accompanying prospectus supplement and “Description of Debt Securities We May Offer — Guarantee by The Goldman Sachs Group, Inc.” or “Description of Warrants We May Offer — Guarantee by The Goldman Sachs Group, Inc.”, as applicable, in the accompanying prospectus.

**The Market Value of Your Securities May Be Influenced by Many Unpredictable Factors**

The following factors, among others, many of which are beyond our control, may influence the market value of your securities:

- the volatility — i.e., the frequency and magnitude of changes — of the values of the underlier or underliers;
- whether your securities are linked to one or more underliers;
- the level of the underlier or underliers to which your securities are linked;
- the dividend rates of the underlier stocks or, in the case of securities linked to the non-seasonally adjusted U.S. City Average All Items Consumer Price Index for All Urban Consumers, consumer confidence in the United States economy and real or perceived scarcity of consumer goods, global trade imbalances, scarcity of energy resources, availability of raw materials, and other supply chain factors;
- economic, financial, regulatory, political, military, public health and other events that affect stock markets generally and the underlier stocks, as applicable, and which may affect the closing level of the underlier or underliers;
- interest rates and yield rates in the market;
- the time remaining until your securities mature; and
- our creditworthiness and the creditworthiness of The Goldman Sachs Group, Inc., whether actual or perceived, and including actual or anticipated upgrades or downgrades in our credit ratings or the credit ratings of The Goldman Sachs Group, Inc. or changes in other credit measures.

Without limiting the foregoing, the market value of your securities may be negatively impacted by increasing interest rates. Such adverse impact of increasing interest rates could be significantly enhanced in securities with longer dated maturities, the market values of which are generally more sensitive to increasing interest rates.

These factors may influence the market value of your securities if you sell your securities before maturity, including the price you may receive for your securities in any market making transaction. If you sell your securities prior to maturity, you may receive less than the face amount of your securities. You cannot predict the future performance of the applicable underlier or underliers based on their historical performance.

**If the Value of an Underlier Changes, the Market Value of Your Securities May Not Change in the Same Manner**

Your securities may trade quite differently from the performance of the applicable underlier or underliers. Changes in the values of the underlier or underliers may not result in a comparable change in the market value of your securities. We discuss some of the reasons for this disparity under “— The Market Value of Your Securities May Be Influenced by Many Unpredictable Factors” above.

**The Return on Your Securities Will Not Reflect Any Dividends Paid on Any Underlier Stock**

If the underlier is an equity index the level of which the underlier sponsor calculates by reference to the prices of its underlier stocks without taking account of the value of dividends paid on those underlier stocks, the return on your securities will not reflect the return you would realize if you actually owned the underlier stocks and received the dividends paid on those underlier stocks. You will not receive any dividends that may be paid on any of the underlier stocks by the issuers of the underlier stocks. See “—You Have No Shareholder Rights or Rights to Receive Any Underlier Stock” below for additional information.

**You Have No Shareholder Rights or Rights to Receive Any Underlier Stock**

Investing in your securities will not make you a holder of any of the underlier stocks. Neither you nor any other holder or owner of your securities will have any rights with respect to the underlier stocks, including any voting rights, any rights to receive dividends or other distributions, any rights to make a claim against the underlier stocks or any other rights of a holder of the underlier stocks. Your securities will be paid in cash, and you will have no right to receive delivery of any underlier stocks.

### **Past Performance is No Guide to Future Performance**

The actual performance of the underlier or underliers over the life of the securities, as well as the amount payable on your securities, may bear little relation to the historical closing levels of the underlier or underliers set forth in the applicable pricing supplement or to the hypothetical return examples set forth in the applicable product supplement, if any, and the applicable pricing supplement. We cannot predict the future performance of the underlier or underliers.

### **If Your Securities Are Linked to Certain Types of Underliers, Your Investment in the Securities May Be Subject to Concentration Risks**

The underlier stocks may be stocks of companies representing a particular market sector, a particular geographic region or some other sector. As a result, your investment in the securities may be concentrated in a single sector. Although your investment in the securities will not result in the ownership or other direct interest in the underlier stocks, if the underlier stocks are concentrated in this manner, the return on your investment in the securities will be subject to certain risks similar to those associated with direct equity investments in the market, geographic region or sector represented by the relevant underlier stocks.

### **Additional Risks Relating to Securities Linked to Underliers that are Equity Indices**

#### **If Your Securities Are Linked to an Equity Index, the Policies of the Applicable Underlier Sponsor and Changes that Affect Such Underlier, or the Constituent Indices or Underlier Stocks Comprising Such Underlier, Could Affect the Amount Payable on Your Securities and Their Market Value**

If your securities are linked to an underlier that is an equity index, the policies of the applicable underlier sponsor concerning the calculation of the level of an underlier to which your securities are linked, additions, deletions or substitutions of the constituent indices, if applicable, and/or the underlier stocks comprising such underlier, and the manner in which changes affecting the underlier stocks or their issuers, such as stock dividends, reorganizations or mergers, are reflected in the underlier level, could affect the level of the applicable underlier and, therefore, the amount payable on your securities and the market value of your securities. The amount payable on your securities and their market value could also be affected if the applicable underlier sponsor changes these policies, for example, by changing the manner in which it calculates the underlier level or the method by which it constructs the underlier, or if the underlier sponsor discontinues or suspends calculation or publication of the underlier level, in which case it may become difficult to determine the market value of your securities. If events such as these occur, the calculation agent — which initially will be GS&Co., our affiliate — may determine the underlier level — and thus the amount payable on your securities — in a manner it considers appropriate, in its sole discretion. We describe the discretion that the calculation agent will have in determining an underlier level on any trading day and the amount payable on your securities more fully under “Discontinuance or Modification of an Underlier” in any applicable product supplement, any applicable general terms supplement or the applicable pricing supplement.

#### **If Your Securities Are Linked to an Equity Index, Except to the Extent The Goldman Sachs Group, Inc. Is One of the Companies Whose Common Stock Comprises the Applicable Underlier, and Except to the Extent That We or Our Affiliates May Currently or in the Future Own Securities of, or Engage in Business With, the Applicable Underlier Sponsor or the Issuers of the Underlier Stocks, There Is No Affiliation Between the Issuers of the Underlier Stocks or Such Underlier Sponsor and Us**

The common stock of The Goldman Sachs Group, Inc. is one of the underlier stocks comprising the Dow Jones Industrial Average®, the S&P 500® Index and the S&P 500® Value Index, and its common stock may be represented in any number of underliers that are not specifically described herein. In addition, we or our affiliates may currently or from time to time in the future own securities of, or engage in business with, the applicable underlier sponsor or the issuers of the underlier stocks. Unless otherwise disclosed in the applicable pricing supplement, we are not otherwise affiliated with the issuers of the underlier stocks or the underlier sponsor. Neither we nor any of our affiliates have participated in the preparation of any publicly available information or made any “due diligence” investigation or inquiry with respect to any underlier or issuer of any underlier stock. You, as an investor in your securities, should make your own investigation into the underliers and the issuers of the underlier stocks. See “The Underliers” below for additional information about certain underliers to which your securities may be linked.

Neither the underlier sponsor nor the issuer of any other underlier stock is involved in the offering of your securities in any way and none of them have any obligation of any sort with respect to your securities. Thus, neither the underlier sponsor nor the issuer of any underlier stock has any obligation to take your interests into consideration for any reason, including in taking any corporate actions that might affect the market value of your securities.

### **Additional Risks Relating to Securities Linked to Underliers Denominated in Foreign Currencies or that Contain Foreign Stocks**

#### **If Your Securities Are Linked to Underliers Denominated in a Non-U.S. Dollar Currency and Such Underliers Are Adjusted to Reflect Their U.S. Dollar Value, Your Securities Will Be Subject to Foreign Currency Exchange Rate Risk**

Your securities may be linked to one or more underliers denominated in a non-U.S. dollar currency. If specified in the applicable pricing supplement, the level of an underlier denominated in a non-U.S. dollar currency will be adjusted to reflect its U.S. dollar value by converting the level of such underlier from the non-U.S. dollar underlying currency to U.S. dollars. Consequently, if the value of the U.S. dollar strengthens against the non-U.S. dollar currency in which such underlier is denominated, you may lose a significant part of your investment in the securities, even if the value of such underlier increases over the life of your securities.

Foreign currency exchange rates vary over time, and may vary considerably during the life of your securities. Changes in a particular exchange rate result from the interaction of many factors directly or indirectly affecting economic and political conditions. Of particular importance are:

- rates of inflation;
- interest rate levels;
- the balance of payments among countries;
- the extent of government surpluses or deficits in the relevant foreign country and the United States; and
- other financial, economic, military, public health and political factors.

All of these factors are, in turn, sensitive to the monetary, fiscal and trade policies pursued by the governments of the relevant foreign countries and the U.S. and other countries important to international trade and finance.

The price of the securities and any payment on the securities could also be adversely affected by delays in, or refusals to grant, any required governmental approval for conversions of a local currency and remittances abroad with respect to the underlier or underliers or other de facto restrictions on the repatriation of U.S. dollars.

#### **Even Though Currencies Trade Around-The-Clock, Your Securities Will Not**

Your securities may be linked to one or more underliers denominated in a non-U.S. dollar currency and adjusted to reflect its U.S. dollar value. The interbank market in foreign currencies is a global, around-the-clock market. Therefore, the hours of trading for your securities, if any trading market develops, will not conform to the hours during which the currencies in which such underlier is denominated or, if applicable, in which the underlier stocks of such underlier trade. Significant price and rate movements may take place in the underlying foreign currency exchange markets that will not be reflected immediately in the price of your securities. The possibility of these movements should be taken into account in relating the value of your securities to those in the underlying foreign currency exchange markets. There is no systematic reporting of last-sale information for foreign currencies. Reasonably current bid and offer information is available in certain brokers' offices, in bank foreign currency trading offices and to others who wish to subscribe for this information, but this information will not necessarily be reflected in the value of the underlier or underliers used to calculate the amount payable on your securities. There is no regulatory requirement that those quotations be firm or revised on a timely basis. The absence of last-sale information and the limited availability of quotations to individual investors may make it difficult for many investors to obtain timely, accurate data about the state of the underlying foreign currency exchange markets.

#### **If Your Securities Are Linked to Certain U.S. Dollar Denominated Indices, Your Investment in the Securities Will Be Subject to Foreign Currency Exchange Rate Risk**

For securities linked to one or more U.S. dollar denominated equity indices whose underlier stock prices are converted by the underlier sponsor into U.S. dollars for purposes of calculating the value of the underlier, investors of the securities will be exposed to currency exchange rate risk with respect to each of the currencies represented in the underlier which are converted in such manner. An investor's net exposure will depend on the extent to which the currencies represented in such an underlier strengthen or weaken against the U.S. dollar and the relative weight of each relevant currency represented in the overall underlier. If, taking into account such weighting, the dollar strengthens against the component currencies, the value of the underlier will be adversely affected and the amount payable on your securities may be reduced.

#### **Regulators Are Investigating Potential Manipulation of Published Currency Exchange Rates**

Regulators in various countries are in the process of investigating the potential manipulation of published currency exchange rates. If such manipulation has occurred or is continuing, certain published exchange rates may have been, or may be in the future, artificially lower (or higher) than they would otherwise have been. Any such manipulation could have an adverse impact on any payments on, and the value of, your securities and the trading market for your securities. In addition, we cannot predict whether any changes or reforms affecting the determination or publication of exchange rates or the supervision of currency trading will be implemented in connection with these investigations. Any such changes or reforms could also adversely impact your securities.

For considerations relating to foreign currency exchange rate risk, please see the applicable product supplement, if any, the applicable general terms supplement, if any, or the applicable pricing supplement.

#### **If Your Securities Are Linked to Underliers Denominated in Non-U.S. Dollars and the Calculation Agent Adjusts Such Underliers to Reflect Their U.S. Dollar Value, a Decline in the Currency of One Underlier Against the U.S. Dollar May Offset Increases in the Currency of Other Underliers Against the U.S. Dollar Over the Life of the Securities**

Your securities may be linked to two or more underliers that are denominated in non-U.S. dollar currencies and that the calculation agent adjusts to reflect their U.S. dollar value. The applicable pricing supplement will specify whether a non-U.S. dollar denominated underlier will be so adjusted. Declines in the currency in which one underlier is denominated (i.e., if the value of the U.S. dollar strengthens against the non-U.S. dollar currency in which that underlier is denominated) may offset increases in the currencies in which the other underlier(s) are denominated. As a result, even if the non-U.S. dollar currencies in which certain of the underliers are denominated have appreciated against the U.S. dollar over the term of your securities, you may lose a significant amount of your investment if some or all of the currencies in which the other underlier(s) are denominated decline versus the U.S. dollar.

**If Your Securities Are Linked to Underliers Denominated in Non-U.S. Dollars or the Underlier Stocks of Which Trade in Foreign Currencies and Such Underliers Are Adjusted to Reflect Their U.S. Dollar Value, Intervention in the Foreign Currency Exchange Markets by the Countries Issuing any Underlying Currency Could Materially and Adversely Affect the Value of Your Securities**

Specific foreign currencies' exchange rates are volatile and are affected by numerous factors specific to each foreign country. Foreign currency exchange rates can be fixed by the sovereign government, allowed to float within a range of exchange rates set by the government, or left to float freely. Governments, including those issuing the currencies in which the underliers are denominated or in which underlier stocks of the underlier trade, use a variety of techniques, such as intervention by their central bank or imposition of regulatory controls or taxes, to affect the exchange rates of their respective currencies. Currency developments may occur in any of the countries issuing the currencies in which the underliers are denominated or in which underlier stocks of the underlier trade to which your securities are linked. Often, these currency developments impact foreign currency exchange rates in ways that cannot be predicted.

Governments may also issue a new currency to replace an existing currency, fix the exchange rate or alter the exchange rate or relative exchange characteristics by devaluation or revaluation of a currency. Thus, a special risk in purchasing securities linked to underliers that are denominated in a non-U.S. dollar currency or that convert the currencies in which non-U.S. dollar underlier stocks trade is that their liquidity, trading value and payment amount could be affected by the actions of sovereign governments that could change or interfere with previously freely determined currency valuations, fluctuations in response to other market forces and the movement of currencies across borders.

The calculation agent is not obligated to make any offsetting adjustment or change in the event of any other devaluation or revaluation or imposition of exchange or other regulatory controls or taxes or in the event of other developments affecting any underliers that are denominated in a non-U.S. dollar currency or that convert the currencies in which non-U.S. dollar underlier stocks trade.

If the applicable pricing supplement specifies that you are exposed to foreign currency risk (because the calculation agent converts the underlier level into U.S. dollars, a U.S. dollar-denominated underlier itself converts the prices of underlier stocks that trade in foreign currencies to their U.S. dollar equivalents, or otherwise), a weakening in the exchange rate of any such foreign currency relative to the U.S. dollar may have a material adverse effect on the value of your securities and the return on an investment in your securities.

**If Your Securities Are Linked to Underliers Denominated in Non-U.S. Dollars or the Underlier Stocks of Which Trade in Foreign Currencies and Such Underliers Are Adjusted to Reflect Their U.S. Dollar Value, Suspensions or Disruptions of Market Trading in One or More Foreign Currencies May Adversely Affect the Value of Your Securities**

The foreign currency exchange markets are subject to temporary distortions or other disruptions due to various factors, including government regulation and intervention, the lack of liquidity in the markets and the participation of speculators. If the applicable pricing supplement specifies that you are exposed to foreign currency risk (because the calculation agent converts the underlier level into U.S. dollars, a U.S. dollar-denominated underlier itself converts the prices of its underlier stocks that trade in foreign currencies to their U.S. dollar equivalents, or otherwise), these circumstances could adversely affect the relevant foreign currency exchange rates and, therefore, the value of your securities.

**If Your Securities Are Linked to Underliers That Are Comprised of Underlier Stocks Which Are Traded in Foreign Currencies But Are Not Adjusted to Reflect Their U.S. Dollar Value, the Return on Your Securities Will Not Be Adjusted for Changes in the Foreign Currency Exchange Rate**

If your securities are linked to one or more underliers whose underlier stocks are traded in foreign currencies but are not adjusted to reflect their U.S. dollar value, the amount payable on your securities will not be adjusted for changes in the applicable foreign currency/U.S. dollar exchange rates. The amount payable on your securities will be based solely upon the overall change in the level of the applicable underlier or underliers. Changes in foreign currency exchange rates, however, may reflect changes in the economy of the foreign countries in which the underlier stocks are listed that, in turn, may affect the levels of the applicable underlier or underliers.

**If Your Securities Are Linked to Underliers Which Are Listed or Located Outside the U.S. or to Underliers Which Have Underlier Stocks Listed or Located Outside the United States, Your Investment in the Securities Will Be Subject to Risks Associated with Foreign Securities Markets**

Your securities may be linked to one or more underliers, or to one or more underliers which have underlier stocks, that have their primary listing on an exchange located outside the U.S. or may include stocks issued by foreign companies. Investments linked to the value of foreign equity securities involve particular risks. Any foreign securities market may be less liquid, more volatile and affected by global or domestic market developments in a different way than the U.S. securities market or other foreign securities markets. Both government intervention in a foreign securities market, either directly or indirectly, and cross-shareholdings in foreign companies, may affect trading prices and volumes in that market. Also, there is generally less publicly available information about foreign companies than about those U.S. companies that are subject to the reporting requirements of the Securities and Exchange Commission. Further, foreign companies are subject to accounting, auditing and financial reporting standards and requirements that differ from those applicable to U.S. reporting companies.

The prices of securities in a foreign country are subject to political, economic, financial and social factors that are unique to such foreign country's geographical region. These factors include: recent changes, or the possibility of future changes, in the applicable foreign government's economic and fiscal policies; the possible implementation of, or changes in, currency exchange laws or other laws or restrictions applicable to foreign companies or investments in foreign equity securities;

fluctuations, or the possibility of fluctuations, in currency exchange rates; and the possibility of outbreaks of hostility, political instability, natural disaster or adverse public health developments. For example, the United Kingdom ceased to be a member of the European Union on January 31, 2020 (an event commonly referred to as "Brexit"). The effects of Brexit are uncertain, and, among other things, Brexit has contributed, and may continue to contribute, to volatility in the prices of securities of companies located in Europe (or elsewhere) and currency exchange rates, including the valuation of the euro and British pound in particular. Any one of these factors, or the combination of more than one of these factors, could negatively affect such foreign securities market and the price of securities therein. Further, geographical regions may react to global factors in different ways, which may cause the prices of securities in a foreign securities market to fluctuate in a way that differs from those of securities in the U.S. securities market or other foreign securities markets. Foreign economies may also differ from the U.S. economy in important respects, including growth of gross national product, rate of inflation, capital reinvestment, resources and self-sufficiency, which may have a positive or negative effect on foreign securities prices.

Some underliers may have a primary listing in a country that may be considered to be a country with an emerging market. Countries with emerging markets may have relatively less stable governments, may present the risks of nationalization of businesses, restrictions on foreign ownership and prohibitions on the repatriation of assets, and may have less protection of property rights than more developed countries. The economies of countries with emerging markets may be based on only a few industries, may be highly vulnerable to changes in local or global trade conditions, and may suffer from extreme and volatile debt burdens or inflation rates. Local securities markets may trade a small number of securities and may be unable to respond effectively to increases in trading volume, potentially making prompt liquidation of holdings difficult or impossible at times.

**Government Regulatory Action, Including Legislative Acts and Executive Orders, Could Result in Material Changes to the Composition of an Underlier with Underlier Stocks from One or More Foreign Securities Markets and Could Negatively Affect Your Investment in Your Securities**

Government regulatory action, including legislative acts and executive orders, could cause material changes to the composition of an underlier with underlier stocks from one or more foreign securities markets and could negatively affect your investment in your securities in a variety of ways, depending on the nature of such government regulatory action and the underlier stocks that are affected. For example, recent executive orders issued by the United States Government prohibit United States persons from purchasing or selling publicly traded securities of certain companies that are determined to operate or have operated in the defense and related materiel sector or the surveillance technology sector of the economy of the People's Republic of China, or publicly traded securities that are derivative of, or that are designed to provide investment exposure to, those securities (including indexed securities). If the prohibitions in those executive orders (or prohibitions under other government regulatory action) become applicable to underlier stocks that are currently included in an underlier or that in the future are included in an underlier, such underlier stocks may be removed from an underlier. If government regulatory action results in the removal of underlier stocks that have (or historically have had) significant weight in an underlier, such removal could have a material and negative effect on the level of such underlier and, therefore, your investment in your securities. Similarly, if underlier stocks that are subject to those executive orders or subject to other government regulatory action are not removed from an underlier, the value of your securities could be materially and negatively affected, and transactions in, or holdings of, your securities may become prohibited under United States law. Any failure to remove such underlier stocks from an underlier could result in the loss of a significant portion or all of your investment in your securities, including if you attempt to divest your securities at a time when the value of your securities has declined.

**Additional Risks Relating to Securities Linked to the Dow Jones U.S. Select Dividend Index**

**Although the Dow Jones U.S. Select Dividend Index Is Designed To Measure the Stock Performance of 100 High Dividend-Paying Stocks Trading in the U.S., the Return on Your Securities Will Not Reflect Any Dividends Paid on the Underlier Stocks**

The Dow Jones U.S. Select Dividend Index is designed to measure the stock performance of 100 high dividend-paying stocks trading in the U.S. Although the Dow Jones U.S. Select Dividend Index measures the performance of high dividend-paying stocks, it is a "price return index" and the return on the Dow Jones U.S. Select Dividend Index will not include any dividends paid on the stocks that make up the Dow Jones U.S. Select Dividend Index. Therefore, the return on your securities will not reflect the return you would realize if you actually owned the stocks that make up the Dow Jones U.S. Select Dividend Index and received the dividends paid on those stocks.

**Additional Risks Relating to Securities Linked to the MSCI USA Momentum Top 50 Select Index**

**Momentum Securities Risk**

The MSCI USA Momentum Top 50 Select Index is designed to measure the performance of an equity momentum strategy by emphasizing stocks that have experienced high price momentum within a designated measurement period. Stocks that have previously exhibited high momentum characteristics within a given measurement period may not experience positive momentum in the future or may experience more volatility than the market as a whole. The index sponsor may be unsuccessful in creating an index that emphasizes momentum securities. In addition, there may be periods when the momentum style of investing is out of favor and the investment performance of the MSCI USA Momentum Top 50 Select Index may suffer.

**The MSCI USA Momentum Top 50 Select Index Has a Limited Operating History**

The MSCI USA Momentum Top 50 Select Index was launched on August 4, 2020. Because the MSCI USA Momentum Top 50 Select Index has no live underlier level history prior to that date, limited historical underlier level information will be available for

you to consider in making an independent investigation of the underlier performance, which may make it difficult for you to make an informed decision with respect to your securities.

**Additional Risks Relating to Securities Linked to the Nasdaq-100 Futures Excess Return™ Index**

**The Nasdaq-100 Futures Excess Return™ Index Has a Limited Operating History**

The Nasdaq-100 Futures Excess Return™ Index was launched on April 1, 2024. Because the Nasdaq-100 Futures Excess Return™ Index has no live underlier level history prior to that date, limited live historical underlier level information will be available for you to consider in making an independent investigation of the underlier performance, which may make it difficult for you to make an informed decision with respect to your securities.

**As Compared to Other Index Sponsors, Nasdaq, Inc. Retains Significant Control and Discretionary Decision-Making Over the Nasdaq-100 Futures Excess Return™ Index, Which May Have an Adverse Effect on the Level of the Nasdaq-100 Futures Excess Return™ Index and on Your Securities**

Pursuant to the Nasdaq-100 Futures Excess Return™ Index methodology, Nasdaq, Inc. retains the right, from time to time, to exercise reasonable discretion as it deems appropriate in order to ensure Nasdaq-100 Futures Excess Return™ Index integrity, including, but not limited to, changes to quantitative inclusion criteria. Nasdaq, Inc. may also, due to special circumstances, apply discretionary adjustments to ensure and maintain quality of the Nasdaq-100 Futures Excess Return™ Index. Although it is unclear how and to what extent this discretion could or would be exercised, it is possible that it could be exercised by Nasdaq, Inc. in a manner that materially and adversely affects the level of the Nasdaq-100 Futures Excess Return™ Index and therefore your securities. Nasdaq, Inc. is not obligated to, and will not, take account of your interests in exercising the discretion described above.

**Additional Risks Relating to Securities Linked to the Nasdaq-100 Index®**

**As Compared to Other Index Sponsors, Nasdaq, Inc. Retains Significant Control and Discretionary Decision-Making Over the Nasdaq-100 Index®, Which May Have an Adverse Effect on the Level of the Nasdaq-100 Index® and on Your Securities**

Pursuant to the Nasdaq-100 Index® methodology, Nasdaq, Inc. retains the right, from time to time, to exercise reasonable discretion as it deems appropriate in order to ensure Nasdaq-100 Index® integrity, including, but not limited to, changes to quantitative inclusion criteria. Nasdaq, Inc. may also, due to special circumstances, apply discretionary adjustments to ensure and maintain quality of the Nasdaq-100 Index®. Although it is unclear how and to what extent this discretion could or would be exercised, it is possible that it could be exercised by Nasdaq, Inc. in a manner that materially and adversely affects the level of the Nasdaq-100 Index® and therefore your securities. Nasdaq, Inc. is not obligated to, and will not, take account of your interests in exercising the discretion described above.

**Additional Risks Relating to Securities Linked to the Nasdaq-100 Technology Sector Index**

**As Compared to Other Index Sponsors, Nasdaq, Inc. Retains Significant Control and Discretionary Decision-Making Over the Nasdaq-100 Technology Sector Index, Which May Have an Adverse Effect on the Level of the Nasdaq-100 Technology Sector Index and on Your Securities**

Pursuant to the Nasdaq-100 Technology Sector Index methodology, Nasdaq, Inc. retains the right, from time to time, to exercise reasonable discretion as it deems appropriate in order to ensure Nasdaq-100 Technology Sector Index integrity, including, but not limited to, changes to quantitative inclusion criteria. Nasdaq, Inc. may also, due to special circumstances, apply discretionary adjustments to ensure and maintain quality of the Nasdaq-100 Technology Sector Index. Although it is unclear how and to what extent this discretion could or would be exercised, it is possible that it could be exercised by Nasdaq, Inc. in a manner that materially and adversely affects the level of the Nasdaq-100 Technology Sector Index and therefore your securities. Nasdaq, Inc. is not obligated to, and will not, take account of your interests in exercising the discretion described above.

**Additional Risks Relating to Securities Linked to the Russell 2000® Futures Excess Return Index**

**The Russell 2000® Futures Excess Return Index Has a Limited Operating History**

The Russell 2000® Futures Excess Return Index was launched on May 20, 2024. Because the Russell 2000® Futures Excess Return Index has no live underlier level history prior to that date, limited live historical underlier level information will be available for you to consider in making an independent investigation of the underlier performance, which may make it difficult for you to make an informed decision with respect to your securities.

**Additional Risks Relating to Securities Linked to the Russell 2000® Value Index**

**There Is No Guarantee That the Methodology of the Russell 2000® Value Index Will Be Successful**

The Russell 2000® Value Index is generally considered to be a “small-cap” U.S. equity index and is predominantly comprised of value stocks, meaning stocks issued by companies thought to be undervalued by the market relative to comparable companies. There is no guarantee that the Russell 2000® Value Index will outperform any other index or strategy that tracks U.S. small-capitalization selected using other criteria. Companies that are considered to be value oriented may have lower growth potential than other securities, which may cause the level of the Russell 2000® Value Index to decrease over the term of the securities. Accordingly, the investment strategy represented by the Russell 2000® Value Index may not be successful, and your investment in the securities may result in a loss. An investment in the securities may also underperform an investment linked only to the Russell 2000® Index.



**Additional Risks Relating to Securities Linked to the S&P 500® Daily Risk Control 5% USD Excess Return Index or the S&P 500® Daily Risk Control 10% USD Excess Return Index (each, an Excess Return Index)**

**Notwithstanding That the Title of the Excess Return Index Includes the Phrase “Risk Control,” the Excess Return Index May Decrease Significantly More or Increase Significantly Less Than the S&P 500® Total Return Index**

The Excess Return index, through its Risk Control index (the S&P 500® Daily Risk Control 5% USD Total Return Index with respect to the S&P 500® Daily Risk Control 5% USD Excess Return Index or the S&P 500® Daily Risk Control 10% USD Total Return Index with respect to the S&P 500® Daily Risk Control 10% USD Excess Return Index), is intended to provide investors with exposure to the S&P 500® Total Return Index (Total Return index) subject to a risk control strategy that dynamically increases or decreases the exposure to the Total Return index in an attempt to achieve its volatility target (5% with respect to the S&P 500® Daily Risk Control 5% USD Excess Return Index or 10% with respect to the S&P 500® Daily Risk Control 10% USD Excess Return Index). The Risk Control index's exposure to the Total Return index can be greater than, less than or equal to 100%. The performance of the Excess Return index is not taken into account when implementing the risk control strategy and could result in leveraged exposure to the Total Return index in a falling stock market or deleveraged exposure to the Total Return index in a rising stock market. Additionally, the Excess Return index is the excess return version of the Risk Control index. As an excess return index, the Excess Return index is designed to measure the return on a hypothetical investment in the Risk Control index that is made with hypothetically borrowed funds. Borrowing costs for these funds are assessed at a rate of SOFR plus 0.02963%. Any positive performance of the Risk Control index will be offset by such hypothetical borrowing costs. Therefore, although the title of the Excess Return index includes the phrase “Risk Control,” the Excess Return index may decrease significantly more or increase significantly less than the Total Return index and your securities are not necessarily less risky than, and will not necessarily have better returns than, securities linked to the Total Return index.

**The Return on Your Securities is Based on the Excess Return Index Which Reflects Excess Return and Will Be Reduced By Borrowing Costs at the Excess Return Index Level**

The Excess Return index is the excess return version of the Risk Control index, meaning that it is designed to measure the return on a hypothetical investment in the Risk Control index that is made with hypothetically borrowed funds. Borrowing costs for these funds are assessed at a rate of SOFR plus 0.02963%. Such costs will reduce any positive performance of the Risk Control index (and, thereby, the Excess Return index) and will increase any negative performance of the Risk Control index (and, thereby, the Excess Return index). In order to receive a positive return on your securities, the return of the Risk Control index must exceed the borrowing costs at the Excess Return index level. Because the return of the Excess Return index is equal to the return of the Risk Control index minus borrowing costs, the return of the Excess Return index will always be less than the return of the Risk Control index.

**There Is No Assurance that Calculating Realized Volatility as the Greater of Short-Term Volatility and Long-Term Volatility Is the Best Way to Measure Realized Volatility**

With regard to the Risk Control index, “realized volatility” is a measurement of variations in the historical daily returns of the Total Return index from the day that is two Risk Control index calculation days before the inception date (September 10, 2009 with respect to the S&P 500® Daily Risk Control 5% USD Excess Return Index and May 13, 2009 with respect to the S&P 500® Daily Risk Control 10% USD Excess Return Index) of the Risk Control index to the day that is two Risk Control index calculation days before the current Risk Control index calculation day. As a result, the measurement period for realized volatility will always have the same start date and will continue to get longer with each new Risk Control index calculation day. Realized volatility is calculated as the greater of short-term volatility and long-term volatility. When the volatility of the Total Return index increases (or decreases), short-term volatility will increase (or decrease) more quickly than long-term volatility. Because realized volatility is the greater of short-term volatility and long-term volatility, realized volatility will increase quickly when volatility increases, which will quickly reduce exposure to the Total Return index. Conversely, because realized volatility is the greater of short-term volatility and long-term volatility, realized volatility will decrease slowly when volatility decreases, which in turn will gradually increase exposure to the Total Return index. There is no assurance that calculating realized volatility as the greater of short-term volatility and long-term volatility or using a measurement period with a set start date that continues to get longer with each new Risk Control index calculation day is the best way to measure realized volatility. It is possible that exclusively relying on short-term volatility or long-term volatility or on the lesser of short-term volatility and long-term volatility is a more reliable way to measure realized volatility.

**The Excess Return Index Will Not Reflect the Most Current Volatility of the Total Return Index**

The Risk Control index is rebalanced using a leverage factor at the close of each Risk Control index calculation day in order to adjust its exposure to the Total Return index based on the applicable realized volatility. Although the Risk Control index is rebalanced at the close of each Risk Control index calculation day, because of how the leverage factor is calculated, there is a lag of two Risk Control index calculation days between the calculation of the leverage factor and the rebalancing of the Risk Control index in accordance with that leverage factor. Therefore, on any given Risk Control index calculation day, the leverage factor that determines the Risk Control index's exposure to the Total Return index for such Risk Control index calculation day will be based on the realized volatility of the Total Return index from two Risk Control index calculation days prior. Due to this two-day lag and the fact that realized volatility can fluctuate significantly during this period, and even during a single day, the Risk Control index will not be rebalanced to reflect (and therefore the Excess Return index will not reflect) the realized volatility of the Total Return index as of the rebalancing day and will not have an actual volatility of 5% in the case of the S&P 500® Daily Risk Control 5% USD Excess Return Index or 10% in the case of the S&P 500® Daily Risk Control 10% USD Excess Return Index. As a result, if there is a rapid and severe decline in the level of the Total Return index, due to the two-day lag, the Risk

Control index may not rebalance into the hypothetical cash position until the Excess Return Index has declined by a substantial amount.

**There Is No Guarantee that the Excess Return Index Will Achieve Its Volatility Target**

The exposure of the Risk Control index (and therefore the Excess Return index) to the Total Return index is subject to a maximum leverage factor of 150%, which may limit the ability of the Risk Control index (and therefore the Excess Return Index) to fully achieve its volatility target if achieving such volatility target would require a leverage factor in excess of 150%. Therefore, there is no guarantee that the Risk Control index (and therefore the Excess Return index) will achieve its volatility target.

**You May Be Exposed to Borrowing Costs at the Risk Control Index Level**

The exposure of the Risk Control index to the Total Return index can be greater than, less than or equal to 100%. Exposure in excess of 100% (i.e., leverage) is achieved by hypothetically borrowing cash at a rate of SOFR plus 0.02963% for the exposure above 100%. As leverage increases, borrowing costs increase.

The cost of borrowing is ignored when determining leverage above 100% (subject to a maximum leverage factor of 150%), even if a prudent investor would choose not to borrow money to invest in the Total Return index at such time. The cost of borrowing may exceed the returns from the Total Return index if the return of the Total Return index decreases or if the rate of SOFR plus 0.02963% increases (or both).

**Controlled Volatility Does Not Mean the Excess Return Index Will Have Lower Volatility Than the Total Return Index**

The Excess Return index, through the Risk Control index, employs a risk-control strategy that uses mathematical equations to target 5% volatility (in the case of the S&P 500® Daily Risk Control 5% USD Excess Return Index) or 10% volatility (in the case of the S&P 500® Daily Risk Control 10% USD Excess Return Index). The strategy does not have a goal of achieving lower volatility than the Total Return index. In fact, if the realized volatility of the Total Return index is less than its volatility target, the exposure to the Total Return index will be increased in an attempt to raise the volatility of the Risk Control index to 5% (in the case of the S&P 500® Daily Risk Control 5% USD Excess Return Index) or 10% (in the case of the S&P 500® Daily Risk Control 10% USD Excess Return Index). Any time the exposure to the Total Return index is greater than 100%, the Risk Control index would be more volatile than the Total Return index.

**Low Volatility Does Not Necessarily Mean the Risk Control Index Will Outperform the Total Return Index or that the Excess Return Index Will Have Positive Performance**

The Excess Return index, through the Risk Control index, employs a risk-control strategy that uses mathematical equations to target 5% volatility (in the case of the S&P 500® Daily Risk Control 5% USD Excess Return Index) or 10% volatility (in the case of the S&P 500® Daily Risk Control 10% USD Excess Return Index). Even if the Risk Control index achieves its volatility target, there is no guarantee that the Risk Control index will outperform the Total Return index or that the underlier return will be positive. For example, if the performance of the Total Return index remains stable or steadily decreases over time, its volatility target will not cause the Risk Control index to outperform the Total Return index or result in a positive Risk Control index return. Moreover, the underlier return will be less than the Risk Control index return due to its excess return feature and the borrowing costs thereof.

**There May Be Overexposure to the Total Return Index in Falling Stock Markets or Underexposure in Rising Stock Markets**

The Excess Return index, through the Risk Control index, is designed to achieve its volatility target regardless of the direction of price movements in the market. Therefore, in rising stock markets if realized volatility is higher than its volatility target, some of the Risk Control index's exposure (and therefore the Excess Return index's exposure) will be moved from the Total Return index to the hypothetical cash position, and the Risk Control index (and therefore the Excess Return index) will experience lower returns than if the full exposure was maintained in the Total Return index. In contrast, if realized volatility is less than its volatility target in a falling stock market, the Risk Control index (and therefore the Excess Return index) will be exposed to more than 100% of the losses in the Total Return index and the Risk Control index (and therefore the Excess Return index) will experience lower returns than the Total Return index. The hypothetical cash position has represented a very significant portion of the Risk Control index in the past. Any rebalancing into a hypothetical cash position will limit your return on the securities.

**The Exposure to the Total Return Index May Be Rebalanced Into a Hypothetical Cash Position on Any or All Days During the Term of the Securities**

The Excess Return Index, through the Risk Control index, has a daily rebalancing feature which can result in a rebalancing between the exposure to the Total Return index and the hypothetical cash position. This could have the effect of reducing the exposure of the Total Return index to less than 100% in an attempt to reduce the volatility to 5% (in the case of the S&P 500® Daily Risk Control 5% USD Excess Return Index) or 10% (in the case of the S&P 500® Daily Risk Control 10% USD Excess Return Index). The minimum leverage factor is 0%. Therefore, there is no guarantee that the Risk Control index will not be rebalanced so that the hypothetical cash position represents a significant portion of the Risk Control index (up to 100% of the Excess Return Index). Any rebalancing into a hypothetical cash position will limit your return on the securities.

***Typically, a portion of the Risk Control index's exposure has been to the hypothetical cash position.***

**On December 20, 2021, Each of the Excess Return Index and the Risk Control Index Discontinued Its Use of Overnight U.S. Dollar LIBOR For All Purposes and Replaced Such Rate**

On December 20, 2021, the Excess Return index discontinued use of overnight U.S. dollar LIBOR for all purposes and replaced such rate with SOFR *plus* 0.02963%. Therefore, beginning on such date, the Excess Return index measures the

return on a hypothetical investment in the Risk Control index that is made with hypothetically borrowed funds at costs assessed at a rate of SOFR *plus* 0.02963%. Further, from such date, if the Risk Control index increases its exposure to the Total Return index to more than 100% to achieve its volatility target, such exposure will be achieved by hypothetically borrowing cash at a rate of SOFR *plus* 0.02963%. If the Risk Control index decreases its exposure to the Total Return index to less than 100% to achieve its volatility target, such exposure will be achieved by hypothetically selling some of the exposure to the Total Return index, which results in a hypothetical cash position that accrues interest at SOFR *plus* 0.02963%.

Replacement of overnight U.S. dollar LIBOR with SOFR *plus* 0.02963% could potentially result in higher borrowing costs being deducted from the return of the Risk Control index. As discussed above under “— The Return on Your Securities is Based on the Excess Return Index Which Reflects Excess Return and Will Be Reduced By Borrowing Costs at the Excess Return Index Level”, increases in the borrowing costs will offset any positive performance of the Risk Control index (and, thereby, the Excess Return index) and will increase any negative performance of the Risk Control index (and, thereby, the Excess Return index). As a result, the use of SOFR *plus* 0.02963% may adversely affect the performance of the Excess Return index and the Risk Control index and could reduce the amount payable in respect of your securities.

Historical information regarding the performance of the Excess Return index and the Risk Control index as of any date, or for any period, prior to December 20, 2021 was during a period in which the Excess Return index and the Risk Control index used overnight U.S. dollar LIBOR instead of SOFR *plus* 0.02963%. Extremely limited historical information regarding the performance of the Excess Return index and the Risk Control index subsequent to their discontinued use of overnight U.S. dollar LIBOR is available, which may make it difficult for you to make an informed decision with respect to the securities.

#### **The Historical Levels of SOFR Are Not an Indication of the Future Levels of SOFR**

In the past, the level of SOFR has experienced significant fluctuations. You should note that historical levels, fluctuations and trends of SOFR are not necessarily indicative of future levels. Any historical upward or downward trend in SOFR is not an indication that SOFR is more or less likely to increase or decrease at any time, and you should not take the historical levels of SOFR as an indication of its future performance.

#### **Certain Risks Related to SOFR**

On June 22, 2017, the Alternative Reference Rates Committee (“ARRC”) convened by the Board of Governors of the Federal Reserve System and the Federal Reserve Bank of New York identified SOFR, a broad U.S. treasuries repurchase financing rate to be published by the Federal Reserve Bank of New York, as the rate that, in the consensus view of the ARRC, represented best practice for use in certain new U.S. dollar derivatives and other financial contracts. SOFR is a broad measure of the cost of borrowing cash overnight collateralized by U.S. treasury securities and has been published by the Federal Reserve Bank of New York since April 2018. The Federal Reserve Bank of New York has also published historical indicative Secured Overnight Financing Rates going back to 2014. Investors should not rely on any historical changes or trends in SOFR as an indicator of future changes in SOFR.

Because SOFR is published by the Federal Reserve Bank of New York based on data received from other sources, we have no control over its determination, calculation or publication. The Federal Reserve Bank of New York notes on its publication page for SOFR that use of SOFR is subject to important limitations and disclaimers, including that the Federal Reserve Bank of New York may alter the methods of calculation, publication schedule, rate revision practices or availability of SOFR at any time without notice.

There can be no guarantee, particularly given its relatively recent introduction, that SOFR will not be discontinued or fundamentally altered in a manner that is materially adverse to the interests of investors in the securities. If the manner in which SOFR is calculated is changed, that change may result in a reduction of the level of the Risk Control index and, therefore, the amount payable on your securities and the trading prices of such securities. In addition, the Federal Reserve Bank of New York may withdraw, modify or amend published SOFR data in its sole discretion and without notice.

Additionally, daily changes in SOFR have, on occasion, been more volatile than daily changes in other benchmark or market rates. The return on and value of your securities may fluctuate more than if the Risk Control index used a less volatile rate. In addition, the volatility of SOFR has reflected the underlying volatility of the overnight U.S. Treasury repo market. The Federal Reserve Bank of New York has at times conducted operations in the overnight U.S. Treasury repo market in order to help maintain the federal funds rate within a target range. There can be no assurance that the Federal Reserve Bank of New York will continue to conduct such operations in the future, and the duration and extent of any such operations is inherently uncertain. The effect of any such operations, or of the cessation of such operations to the extent they are commenced, is uncertain and could be materially adverse to the level of the Risk Control index and, therefore, the amount payable on your securities.

**Additional Risks Relating to Securities Linked to the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index, the S&P 500® Futures Excess Return Index or the S&P 500® Futures Volatility Plus Daily Risk Control Index (each, an Equity Futures Index)**

#### **The Policies of the Underlier Sponsor and Changes That Affect the Equity Futures Index or the Securities Comprising the Applicable Reference Equity Index Could Affect the Payment Amount on Your Securities and Their Market Value**

The policies of the underlier sponsor concerning the calculation of the level of the Equity Futures index, additions, deletions or substitutions of securities comprising the applicable reference equity index (the Dow Jones Industrial Average® with respect to the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Index® with respect to the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Index with respect to the Russell 2000® Futures Excess Return Index or the S&P 500® Index with respect to the S&P 500® Futures Excess Return Index and the S&P 500® Futures Volatility Plus Daily Risk Control Index) and the manner in which changes affecting the securities comprising such reference equity index or their

issuers, such as stock dividends, reorganizations or mergers, are reflected in the level of the Equity Futures index or such reference equity index, as applicable, could affect the level of the Equity Futures index and, therefore, the amount payable on your securities and the market value of your securities. The amount payable on your securities and their market value could also be affected if the underlier sponsor changes these policies, for example, by changing the manner in which it calculates the level of the Equity Futures index or if the underlier sponsor discontinues or suspends calculation or publication of the level of the Equity Futures index, in which case it may become difficult to determine the market value of your securities. If events such as these occur, the calculation agent — which initially will be GS&Co., our affiliate — may determine the closing level of the Equity Futures index — and thus the amount payable on your securities — in a manner it considers appropriate, in its sole discretion. We describe the discretion that the calculation agent will have in determining the closing level of the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index, the S&P 500® Futures Excess Return Index and the S&P 500® Futures Volatility Plus Daily Risk Control Index on any trading day and the amount payable on your securities more fully under “Discontinuance or Modification of an Underlier” in any applicable product supplement, any applicable general terms supplement or the applicable pricing supplement.

**Except to the Extent The Goldman Sachs Group, Inc. Is One of the Companies Whose Common Stock Comprises the Reference Equity Index, and Except to the Extent That We or Our Affiliates May Currently or in the Future Own Securities of, or Engage in Business With, the Issuers of Securities Comprising the Reference Equity Index or Own the Underlying Futures Contracts, There Is No Affiliation Between Us and the Issuers of Securities Comprising the Reference Equity Index**

Each of the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index and the S&P 500® Futures Excess Return Index is linked to its underlying futures contract (the E-mini Dow (\$5) futures contract with respect to the Dow Jones Industrial Average Futures Excess Return Index, the E-mini Nasdaq-100 futures contract with respect to the Nasdaq-100 Futures Excess Return™ Index, the E-mini Russell 2000 futures contract with respect to the Russell 2000® Futures Excess Return Index or the E-mini S&P 500 futures contract with respect to the S&P 500® Futures Excess Return Index) currently listed for trading on the Chicago Mercantile Exchange. The S&P 500® Futures Volatility Plus Daily Risk Control Index is designed to provide leveraged exposure to the S&P 500® Futures Excess Return Index based on a dynamic volatility target. In each case, the common stock of The Goldman Sachs Group, Inc. is one of the securities comprising the applicable reference equity index. In addition, we or our affiliates may currently or from time to time in the future own securities of, or engage in business with, the issuers of securities comprising the reference equity index or own the underlying futures contracts. We are not otherwise affiliated with the issuers of securities comprising the reference equity index or the sponsor of the reference equity index. Neither we nor any of our affiliates have participated in the preparation of any publicly available information or made any “due diligence” investigation or inquiry with respect to the Equity Futures index or the reference equity index, any of the other issuers of the securities comprising the reference equity index or the underlying futures contract. You, as an investor in your securities, should make your own investigation into the Equity Futures index, the reference equity index, the issuers of the securities comprising the reference equity index and its underlying futures contract. See “The Underliers” below for additional information about the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index, the S&P 500® Futures Excess Return Index, the S&P 500® Futures Volatility Plus Daily Risk Control Index, the E-mini Dow (\$5) futures contract, the E-mini Nasdaq-100 futures contract, the E-mini Russell 2000 futures contract, the E-mini S&P 500 futures contract, the Dow Jones Industrial Average®, the Nasdaq-100 Index®, the Russell 2000® Index and the S&P 500® Index.

None of the issuers of securities comprising any reference equity index are involved in the offering of your securities in any way and none of them have any obligation of any sort with respect to your securities. Thus, none of the issuers of securities comprising any reference equity index have any obligation to take your interests into consideration for any reason, including in taking any corporate actions that might adversely affect the level of any Equity Futures index or any reference equity index or making any investment decision for any Equity Futures index or any reference equity index.

#### **Linking to an Equity Futures Contract Is Different From Linking to the Applicable Reference Equity Index**

The return on your securities will be related to the performance of an equity futures contract and not the applicable reference equity index. On a given day, a “futures price” is the price at which market participants may agree to buy or sell the asset underlying a futures contract in the future, and the “spot price” is the current price of such underlying asset for immediate delivery. A variety of factors can lead to a disparity between the price of a futures contract at a given point in time and the spot price of its underlying asset, such as the expected dividend yields of any stocks that comprise such underlying asset, the implicit financing cost associated with the futures contract and market expectations related to the future price of the futures contract’s underlying asset. Purchasing an equity futures contract is similar to borrowing money to buy the underlying asset of such futures contract because it enables an investor to gain exposure to such underlying asset without having to pay the full cost of such exposure up front, and therefore entails a financing cost. As a result, the Equity Futures index is expected to reflect not only the performance of the applicable reference equity index, but also the implicit financing cost in its underlying futures contract, among other factors. Such implicit financing cost will adversely affect the level of the Equity Futures index. Any increase in market interest rates will be expected to further increase this implicit financing cost and will have an adverse effect on the level of the Equity Futures index and, therefore, the value of and return on the securities.

The price movement of a futures contract is typically correlated with the movements of the price of its underlying asset, but the correlation is generally imperfect, and price movements in the spot market may not be reflected in the futures market (and vice versa).

versa). Accordingly, your securities may underperform a similar investment that more directly reflects the return on the applicable reference equity index.

**Negative Roll Yields Will Adversely Affect the Level of the Equity Futures Index Over Time and Therefore the Amount Payable on the Securities**

The Equity Futures index is linked to its underlying futures contract rather than the applicable reference equity index. Futures contracts normally specify a certain date for cash settlement of a financial future (such as a futures contract on a securities index) or delivery of the underlying physical commodity for a deliverable future. As the exchange-traded futures contract that comprises the Equity Futures index approaches expiration, it is replaced by a similar contract that has a later expiration. Thus, for example, a futures contract purchased and held in September may specify a December expiration. As time passes, the contract expiring in December may be replaced by a contract for delivery in March. This process is referred to as "rolling."

As a futures contract approaches expiration, its value will generally approach the spot price of its underlying asset because by expiration it will closely represent a contract to buy or sell such underlying asset for immediate delivery. If the market for a futures contract is in "contango," where the price of the futures contract with a later expiration date during a rolling period is higher than the spot price of its underlying asset, then the value of such futures contract would tend to decline over time (assuming the spot price and other relevant factors remain unchanged), because the higher futures price would decline as it approaches the lower spot price by expiration. This negative effect on the futures price is referred to as a negative "carry" or "roll yield" and is realized over the term of such contract. A negative roll yield will adversely affect the level of the Equity Futures index over time and therefore the amount payable on your securities. Because of the potential effects of negative roll yields, it is possible for the level of the Equity Futures index to decrease significantly over time even when the level of the applicable reference equity index is stable or increasing.

**Futures Contracts Are Not Assets with Intrinsic Value**

Each of the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index and the S&P 500® Futures Excess Return Index is linked to its underlying futures contract currently listed for trading on the Chicago Mercantile Exchange. The S&P 500® Futures Volatility Plus Daily Risk Control Index is designed to provide leveraged exposure to the S&P 500® Futures Excess Return Index based on a dynamic volatility target. Trading in futures contracts transfers the risk of future price movements from one market participant to another. This means that for every gain, there is an equal and offsetting loss. Futures contracts themselves are not assets with intrinsic value, and simply reflect, in the case of cash-settled contracts, certain rights to payment or obligations to make payments to the other party to the contract. Accordingly, market participants taking the opposite side of the applicable underlying futures contract trades may believe that the level of the applicable reference equity index will move against the interests of the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index or the S&P 500® Futures Excess Return Index, as applicable.

**You Have No Rights in Any Futures Contract Tracked by the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index or the S&P 500® Futures Excess Return Index**

Investing in your securities will not make you a holder of any futures contract tracked by the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index or the S&P 500® Futures Excess Return Index. Neither you nor any other holder or owner of your securities will have any rights with respect to the futures contracts tracked by the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index or the S&P 500® Futures Excess Return Index, including any rights of a holder of the futures contracts. Your securities will be paid in cash and you will have no right to receive delivery of any futures contract tracked by the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index or the S&P 500® Futures Excess Return Index.

**Owning the Securities Is Not the Same as Directly Owning the Securities or Futures Contract Directly or Indirectly Tracked by the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index or the S&P 500® Futures Excess Return Index**

Your return on the securities will not reflect the return you would have realized on a direct investment in the applicable underlying futures contract currently listed for trading on the Chicago Mercantile Exchange or any of the securities comprising the applicable reference equity index. For example, as an investor in the securities, you will not have rights to receive dividends or other distributions or any other rights, including voting rights, with respect to any securities comprising the reference equity index. The calculation agent for the securities will calculate the amount payable to you at maturity by reference to the level of the applicable Equity Futures index on the determination date, and will not include the amount of any of those dividend payments or other distributions. Therefore, the return on your investment will not be the same as the return based on the purchase of any stocks or futures contracts that are tracked directly or indirectly by the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index or the S&P 500® Futures Excess Return Index.

**Suspension or Disruptions of Market Trading in Stocks or Futures Contracts May Adversely Affect the Value of the Securities**

Securities markets and futures markets are subject to temporary distortions or other disruptions due to various factors, including the lack of liquidity in the markets, the participation of speculators, and government regulation and intervention. In

addition, futures markets typically have regulations that limit the amount of fluctuation in some futures contract prices that may occur during a single business day. These limits are generally referred to as "daily price fluctuation limits," and the maximum or minimum price of a contract on any given day as a result of these limits is referred to as a "limit price." Once the limit price has been reached in a particular contract, no trades may be made at a price beyond the limit, or trading may be limited for a specified period of time. Limit prices have the effect of precluding trading in a particular contract or forcing the liquidation of contracts at potentially disadvantageous times or prices. These circumstances could affect the level of the Dow Jones Industrial Average Futures Excess Return Index, the Nasdaq-100 Futures Excess Return™ Index, the Russell 2000® Futures Excess Return Index or the S&P 500® Futures Excess Return Index, and therefore, could adversely affect the level of the S&P 500® Futures Volatility Plus Daily Risk Control Index, if applicable, and the payments on the securities.

**Additional Risks Relating to Securities Linked to the S&P 500® Futures Volatility Plus Daily Risk Control Index or the S&P 500® Volatility Plus Daily Risk Control Index (each, a Volatility Plus Index)**

**Notwithstanding That the Title of the Volatility Plus Index Includes the Phrase "Risk Control," the Volatility Plus Index May Decrease Significantly More or Increase Significantly Less Than the Underlying Index**

The Volatility Plus index is intended to provide investors with leveraged exposure to the underlying index (the S&P 500® Futures Excess Return Index with respect to the S&P 500® Futures Volatility Plus Daily Risk Control Index or the S&P 500® Index with respect to the S&P 500® Volatility Plus Daily Risk Control Index) based on a dynamic volatility target. The dynamic volatility target is the applicable realized volatility of the underlying index plus 10%. Therefore, the Volatility Plus index is not designed to target a fixed realized volatility target, nor is it designed to target a realized volatility that is lower than that of the underlying index. Further, the expected performance of the Volatility Plus index is not taken into account when calculating the amount of leveraged exposure and therefore the leverage factor may be high during a falling stock market and may be low during a rising stock market. Therefore, although the title of the Volatility Plus index includes the phrase "Risk Control," the future returns of the Volatility Plus index are actually more uncertain, and therefore riskier than, the underlying index and your securities are riskier than, and will not necessarily have better returns than, securities linked to the underlying index.

**There Is No Assurance that Calculating Realized Volatility as the Average of Short-Term Volatility and Long-Term Volatility Is the Best Way to Measure Realized Volatility**

With regard to the Volatility Plus index, "realized volatility" is a measurement of variations in the historical daily returns of the underlying index from the day that is two index calculation days before the base date of the Volatility Plus index (February 5, 1998 with respect to the S&P 500® Futures Volatility Plus Daily Risk Control Index and December 31, 1991 with respect to the S&P 500® Volatility Plus Daily Risk Control Index) to the day that is two index calculation days before the current index calculation day (the leverage factor that is calculated on this index calculation day will be used to calculate the level of the Volatility Plus index on the following index calculation day). As a result, the measurement period for realized volatility will always have the same start date and will continue to get longer with each new index calculation day. Realized volatility is calculated as the average of short-term volatility and long-term volatility. When the volatility of the underlying index increases (or decreases), short-term volatility will increase (or decrease) more quickly than long-term volatility. There is no assurance that calculating realized volatility in this manner is the best way to measure realized volatility. For example, it is possible that exclusively relying on short-term volatility or long-term volatility or on the greater of or lesser of short-term volatility and long-term volatility is a more reliable way to measure realized volatility. Further, if realized volatility were calculated in a different manner, the Volatility Plus index would perform differently, including potentially having higher returns.

**The Volatility Plus Index Will Not Reflect the Most Current Volatility of the Underlying Index**

The Volatility Plus index is rebalanced using a leverage factor at the close of each index calculation day in order to adjust its exposure to the underlying index based on the applicable realized volatility of the underlying index. Although the Volatility Plus index is rebalanced at the close of each index calculation day, because of how the leverage factor is calculated, there is a lag of two index calculation days between the measurement of realized volatility of the underlying index and the calculation of the leverage factor. Therefore, on any given index calculation day ("T"), the leverage factor that determines the Volatility Plus index's exposure to the underlying index for the following index calculation day ("T+ 1") will be based on the realized volatility of the underlying index from two index calculation days prior to the index calculation day ("T - 2"). Due to this lag and the fact that realized volatility can fluctuate significantly during this period, and even during a single day, the leverage factor will not reflect the realized volatility of the underlying index as of the rebalancing day. As a result, the Volatility Plus index may have greater exposure to the underlying index when the level of the underlying index is decreasing than it would have had if the leverage factor were calculated based on more current levels of realized volatility.

**The Relative Performance of the Volatility Plus Index As Compared to the Underlying Index Cannot Be Predicted**

The Volatility Plus index is rebalanced to the applicable leverage factor at the close of *each* index calculation day. The effect of daily rebalancing is that the Volatility Plus index performance over a period spanning *more than one* index calculation day will depend on the daily leveraged returns of the underlying index for each index calculation day during the period. Therefore, over such longer periods, the performance of the Volatility Plus index will differ from the performance of the underlying index by an unpredictable factor. For example, consider a hypothetical 2-day period during which the underlying index decreases by 5.00% on day-1 and increases by 5.00% on day-2. The underlying index over the hypothetical 2-day period will lose 0.25% in value. If the leverage factor is 200% on each day during the period, the Volatility Plus index level will decrease by 10.00% on day-1 and then increase by 10.00% on day-2, resulting in a period loss of -1.00%, or four times the period loss for the underlying index.

**The Volatility Plus Index Is Subject to Risks Associated With Leveraged Exposure and There Is a Greater Risk You Will Not Receive a Coupon, If Applicable, and a Greater Risk You Will Receive Less than the Face Amount of Your Securities Relative to Securities Linked to the Underlying Index, Assuming All Other Terms Remain the Same**

The Volatility Plus index is designed to provide leveraged exposure to the underlying index based on a dynamic volatility target. Because the Volatility Plus index is designed to provide leveraged exposure to the underlying index, the Volatility Plus index will be more volatile than the underlying index and daily changes in the level of the underlying index will necessarily have a greater impact on the Volatility Plus index than the underlying index, which does not contain a leverage component.

The examples below illustrate the effect of the leverage factor calculated on any given index calculation day ("T") on the level of the Volatility Plus index for the following index calculation day ("T+ 1"). In particular, as the examples below demonstrate, any decrease in the level of the underlying index will result in a greater decrease in the level of the Volatility Plus index. **As a result, there will be a greater risk you will not receive a coupon, if applicable, and a greater risk you will receive less than the face amount of your securities at maturity, including the risk of losing all or a significant portion of your investment in the securities, as compared to securities linked to the underlying index (which does not contain a leverage component), assuming all other terms remained the same.** These examples are not exhaustive, and are based on assumptions that are entirely hypothetical and should not be taken as an indication or prediction of future performance of the underlying index or the Volatility Plus index. The percentages in Column A represent the hypothetical realized volatility of the underlying index on index calculation day ("T - 2"). The percentages in Column B represent the hypothetical dynamic volatility target on index calculation day ("T"), which equals the *sum* of Column A *plus* 10%, and will be applied to the index calculation on the following index calculation day ("T + 1"). The percentages in Column C represent the hypothetical leverage factor on index calculation day ("T"), which equals the *quotient* of the percentage in Column B *divided by* the percentage in Column A, subject to a minimum leverage factor of 100% and a maximum leverage factor of 200%, and will be applied to the index calculation on the following index calculation day ("T + 1"). The amounts in Column D represent the hypothetical underlying index percentage change on index calculation day ("T + 1"), which equals the *quotient of* (i) the closing level for the underlying index on index calculation day T + 1 *minus* the closing level for the underlying index on index calculation day ("T") *divided by* (ii) the closing level for the underlying index on index calculation day T, expressed as a percentage. The amounts in Column E represent the hypothetical underlier percentage change on index calculation day ("T + 1"), which equals the *product of* the percentage in Column C *times* the percentage in Column D, expressed as a percentage.

Example	Column A Hypothetical Realized Volatility of the Underlying Index On T - 2	Column B Hypothetical Dynamic Volatility Target On T (Column A + 10%)	Column C Hypothetical Leverage Factor On T (Column B / Column A, Subject to a Minimum of 100% and a Maximum of 200%)	Column D Hypothetical Underlying Index Percentage Change On T + 1	Column E Hypothetical Underlier Percentage Change On T + 1 (Column C × Column D)
#1	50%	60%	120%	-10%	-12%
#2	20%	30%	150%	-10%	-15%
#3	5%	15%	200%*	-10%	-20%

\* a maximum leverage factor of 200% applies.

**There Is No Guarantee that the Volatility Plus Index Will Achieve the Volatility Target**

The exposure of the Volatility Plus index to the underlying index is subject to a maximum leverage factor of 200%, which may limit the ability of the Volatility Plus index to fully achieve the dynamic volatility target, if achieving the dynamic volatility target would require a leverage factor in excess of 200%. Therefore, there is no guarantee that the Volatility Plus index will achieve the dynamic volatility target.

**The Volatility Plus Index Will Have Leveraged Exposure to the Underlying Index in Falling Stock Markets**

The Volatility Plus index is designed to provide leveraged exposure to the underlying index based on a dynamic volatility target. Therefore, in a falling stock market the Volatility Plus index will be exposed to more than 100% of the losses in the underlying index and the Volatility Plus index will likely experience lower returns than the underlying index.

**The Volatility Plus Index Has a Limited Operating History**

The Volatility Plus index was launched on the launch date (April 25, 2022 with respect to the S&P 500® Futures Volatility Plus Daily Risk Control Index and March 21, 2022 with respect to the S&P 500® Volatility Plus Daily Risk Control Index). Because the Volatility Plus index has no live level history prior to that date, limited live historical underlier level information will be available for you to consider in making an independent investigation of the underlier performance, which may make it difficult for you to make an informed decision with respect to your securities.

**If the Closing Level of the Volatility Plus Index Becomes Zero or Negative, the Closing Level of the Volatility Plus Index Will Remain Zero**

The Volatility Plus index is designed to provide leveraged exposure to the underlying index based on a dynamic volatility target, which means that any decrease in the level of the underlying index will result in a larger decrease in the level of the Volatility Plus index. If the closing level of the Volatility Plus index becomes zero or negative on any trading day, the underlier sponsor may discontinue or restart the Volatility Plus index. Regardless of whether the underlier sponsor discontinues or restarts the Volatility Plus index, the closing level of the Volatility Plus index will remain zero for the remainder of the term of your securities (even if the Volatility Plus index is discontinued and even if the Volatility Plus index is restarted with a new base value).

**Additional Risks Relating to Securities Linked to the S&P 500® Value Index**

**There Is No Guarantee That the S&P 500® Value Index Methodology Will Be Successful**

The S&P 500® Value Index is designed to measure the performance of companies included in the S&P 500® Index that exhibit relatively strong value characteristics (determined by reference to (1) book-value-to-price ratio, (2) earnings-to-price ratio and (3) sales-to-price ratio) and relatively weak growth characteristics (determined by reference to (1) three-year change in earnings-per-share growth (excluding extra items) over price per share, (2) three-year sales-per-share growth rate and (3) momentum (12-month percentage price change)). There is no guarantee that the S&P 500® Value Index will outperform any other index or strategy that tracks U.S. stocks using other criteria. Companies that are considered to exhibit strong value characteristics may have lower growth potential relative to comparable companies, which may cause the level of the S&P 500® Value Index to decrease over the term of the securities. Accordingly, the investment strategy represented by the S&P 500® Value Index may not be successful, and your investment in the securities may result in a loss. An investment in the securities may also underperform an investment linked to the S&P 500® Index as a whole.

**Additional Risks Relating to Securities Linked to TOPIX**

**TOPIX Recently Implemented Methodology Changes That Are Being Carried Out In Stages Through January 2025; Limited Historical Underlier Performance Information Is Available Incorporating the Changes That Have Been Carried Out To Date**

Prior to April 4, 2022, TOPIX was comprised of all domestic common stocks listed on the First Section of the Tokyo Stock Exchange (TSE). On April 4, 2022, the TSE was restructured into three new market segments: the Prime Market, Standard Market or Growth Market. On such date, in conjunction with the restructuring, TOPIX changed its methodology and, among other things, began revisions to its constituents that will be carried out in stages from October 2022 to January 2025. As a result, limited historical underlier performance information incorporating methodology changes that have been carried out to date is available for you to consider in making an independent investigation of the underlier performance, which may make it difficult for you to make an informed decision with respect to an investment in the securities. In addition, as the recent methodology changes are being carried out in stages, no historical underlier performance information will be available with all currently contemplated changes until after implementation of the final stage in January 2025.

**Additional Risks Relating to Securities Linked to the Non-Seasonally Adjusted U.S. City Average All Items Consumer Price Index for All Urban Consumers**

**The Policies of the Bureau of Labor Statistics of the U.S. Department of Labor and Changes that Affect the Non-Seasonally Adjusted U.S. City Average All Items Consumer Price Index for All Urban Consumers Could Affect the Amount Payable on Your Securities and Their Market Value**

The policies of the Bureau of Labor Statistics of the U.S. Department of Labor ("BLS") concerning the calculation of the level of the non-seasonally adjusted U.S. City Average All Items Consumer Price Index for All Urban Consumers ("CPI") could affect the CPI level and, therefore, the amount payable on your securities and the market value of your securities. The amount payable on your securities and their market value could also be affected if the BLS changes these policies, for example, by changing the manner in which it calculates the CPI level, or if the BLS discontinues or suspends calculation or publication of the CPI level, in which case it may become difficult to determine the market value of your securities. If events such as these occur, the calculation agent — which initially will be GS&Co., our affiliate — may determine the CPI level — and thus the amount payable on your securities — in a manner it considers appropriate, in its sole discretion. We describe the discretion that the calculation agent will have in determining a CPI level on any trading day and the amount payable on your securities more fully under "Discontinuance or Modification of an Underlier" in any applicable product supplement, any applicable general terms supplement or the applicable pricing supplement.

**There Is No Affiliation between the BLS and Us**

The CPI is currently calculated and published by the BLS, a division of the U.S. federal government. We have not participated in the preparation of any of publicly available information or made any "due diligence" investigation or inquiry with respect to the CPI or the BLS. You, as an investor in your securities, should make your own investigation into the CPI and the BLS. See "The Underliers" below for additional information about the CPI to which your securities may be linked.

The BLS is not involved in the offering of your securities in any way and has no obligation of any sort with respect to your securities. Thus, the BLS has no obligation to take your interests into consideration for any reason, including in taking any actions that might affect the market value of your securities.



## THE UNDERLIERS

All information contained in this underlier supplement and the applicable pricing supplement regarding any underlier, including, without limitation, its make-up, its method of calculation (if applicable) and changes in its components and its historical closing levels, is derived from information prepared by the applicable underlier sponsor. Such information reflects the policies of, and is subject to change by, the applicable underlier sponsor. Each underlier is calculated and maintained by its respective underlier sponsor. Neither GS Finance Corp., The Goldman Sachs Group, Inc. nor GS&Co., in its role as calculation agent, has participated in the preparation of such documents or made any due diligence inquiry with respect to any underlier or underlier sponsor in connection with the offering of the securities. In connection with the offering of the securities, neither GS Finance Corp., The Goldman Sachs Group, Inc. nor GS&Co., in its role as calculation agent, makes any representation that such information regarding any underlier or underlier sponsor is accurate or complete. Furthermore, we cannot give any assurance that all events occurring prior to the date of any offering of securities (including events that would affect the accuracy or completeness of the information described in this underlier supplement or in the applicable pricing supplement) that would affect the level of any underlier have been publicly disclosed. Subsequent disclosure of any such events could affect the value received on your securities and therefore the market value of the securities.

**Our affiliates may presently or from time to time engage in business with one or more of the issuers of the underlier stocks of any underlier without regard to your interests, including extending loans to or entering into loans with, or making equity investments in, one or more of such issuers or providing advisory services to one or more of such issuers, such as merger and acquisition advisory services. In the course of our affiliates' business, we or our affiliates may acquire non-public information about one or more of such issuers and neither we nor any of our affiliates undertakes to disclose any such information to you. In addition, our affiliates from time to time have published and in the future may publish research reports with respect to such issuers. These research reports may or may not recommend that investors buy or hold the securities of such issuers. As a prospective purchaser of securities, you should undertake an independent investigation of the applicable underlier or of the issuers of the underlier stocks of the applicable underlier to the extent required, in your judgment, to allow you to make an informed decision with respect to an investment in any securities.**

In this underlier supplement and the applicable product supplement, if any, the applicable general terms supplement, if any, and/or the applicable pricing supplement, unless the context requires otherwise, references to any underlier listed below will include any successor underlier to such underlier and references to the underlier sponsor include any index sponsor, underlier investment advisor or underlier trustee, as applicable, and, in each case, will include any successor thereto.

### ***Some Initial and Common Concepts***

An equity index is a hypothetical calculation of stocks that fit certain selection criteria and are selected for inclusion in the index by the index sponsor. One example might be an index that seeks to include all of the large capitalization stocks traded on the stock market in a certain country or region. The level of an index is calculated using a methodology developed by the index sponsor. Typically, the closing prices of each of the stocks included in the index on each trading day are the basis for the index level. Although it is not possible to invest directly into an index, buying an index-linked product such as an index-linked security allows an investor to gain exposure to the performance of the relevant portions of a stock market or markets without owning all of the stocks that underlie the index.

Some indices limit themselves to companies having a certain size of market capitalization, as described below. You will see these terms in the descriptions below.

- **Large cap** — a company with a large market capitalization (market capitalization is the number of shares outstanding, which may be adjusted to exclude certain shares, multiplied by the stock's trading price) relative to other common stocks traded within the same market
- **Mid cap** — a company with a market capitalization that is within range of the median relative to other common stocks traded within the same market

- Small cap — a company with a small market capitalization relative to large cap and mid cap common stocks traded within the same market
- Developed market — a developed, high income country with a formally regulated equity market that is characterized by having developed custody settlement mechanisms, dealing landscape and a relatively high total market capitalization; decisions on whether a market is developed, emerging or otherwise, and as to other categorization matters, are made by the underlier sponsor only and not by us or our affiliates
- Emerging market — a developing country that is in the process of rapid industrialization with an income level that is generally less than developed countries and an equity market with reasonable or advanced market infrastructure

The companies included in each of the underliers may be divided into industry sectors by the applicable underlier sponsor. Sector designations are determined by the underlier sponsor using criteria it has selected or developed. Any underlier sponsor may use very different standards from another underlier sponsor to determine sector designations. In addition, many companies operate in a number of sectors, but are listed in only one sector and the basis on which that sector is selected may also differ. As a result, sector comparisons between underliers with different underlier sponsors may reflect differences in methodology as well as actual differences in the sector composition of the underliers.

#### *Additional Information*

No underlier sponsor is under any obligation to continue to publish or sponsor an underlier and may discontinue it at any time. Additional information regarding underliers may be obtained from other sources including, but not limited to, press releases, newspaper articles, other publicly available documents, and underlier sponsor websites. We are not incorporating by reference any underlier sponsor website, the sources listed above or below or any material they include in this underlier supplement or any applicable pricing supplement.

#### *Licensing*

Unless otherwise specified in the applicable pricing supplement, GS Finance Corp. or its affiliate has contracted or, to the extent required, will seek to acquire a contract with the sponsor or publisher of the index or indices to which your securities may be linked for the rights to use such index or indices and certain associated trademarks or service marks for each index. GS Finance Corp. or its affiliate generally obtains these licenses either on an individual basis for a particular offering of securities or for a term of years. Although each of GS Finance Corp. and its affiliates anticipates that it will continue to enter into and renew such licenses, any such license could be terminated upon the occurrence of certain events in the future.

## Dow Jones Industrial Average®

The Dow Jones Industrial Average®, which we also refer to in this description as the “DJIA” or the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first calculated on May 26, 1896 with a base value of 40.94 and twelve constituent stocks; and
- is sponsored by S&P Dow Jones Indices LLC (“Dow Jones Indices”).

The DJIA is a price-weighted index composed of 30 stocks that measures the performance of some of the largest U.S. companies. The stocks are selected at the discretion of an Averages Committee comprised of three representatives of Dow Jones Indices and two representatives of *The Wall Street Journal*. While stock selection is not governed by quantitative rules, a stock typically is added to the DJIA only if the Averages Committee believes the company has an excellent reputation, demonstrates sustained growth and is of interest to a large number of investors. The Averages Committee evaluates stock price when considering a company for inclusion. The Averages Committee monitors whether the highest-priced stock in the index has a price more than 10 times that of the lowest. Maintaining adequate sector representation within the Dow Jones Industrial Average is also a consideration in the selection process. Each company should be incorporated and headquartered in the U.S. and a plurality of such company's revenue should be derived from the U.S. The DJIA covers all industries except for the Global Industry Classification Standard (“GICS”) transportation industry group for the industrials sector and the utilities sector.

The U.S. dollar price return calculation (which does not include dividends or other distributions, only the trading prices of the stocks) of the DJIA is reported by Bloomberg under the ticker symbol “INDU Index”. Dow Jones is under no obligation to continue to publish the DJIA and may discontinue publication of the DJIA at any time. Additional information regarding the DJIA (including the sector weights) may be obtained the following website: [djindexes.com/averages/](http://djindexes.com/averages/). We are not incorporating by reference the website or any material it includes in this underlier supplement.

Dow Jones intends for the DJIA to serve as a measure of the entire U.S. market, and therefore the economy, and the DJIA is not limited to traditionally defined industrial stocks. Changes in the composition of the DJIA are made on an as-needed basis by the Averages Committee without consultation with the component companies represented in the DJIA, any stock exchange, any official agency or us. There is no annual or semi-annual reconstitution and changes in response to corporate actions and market developments can be made at any time. In order to maintain continuity, changes to the index stocks included in the DJIA tend to be made infrequently and generally occur only after a component company goes through a major change, such as a shift in its core business, corporate acquisition, or merger. Index reviews do not occur on any established or regular schedule, but only when corporate events with respect to a constituent stock require it. When one component stock is replaced, the entire index is reviewed. As a result, multiple component changes are often implemented simultaneously. The component stocks of the DJIA may be changed at any time for any reason. Constituent changes are typically announced one to five days before they are scheduled to be implemented.

Components with more than one listing of common stock outstanding will only be represented by their designated listing, which is the share class with both the highest one-year (or all available data if less than one year of trading data is available as of the reference date, as defined below) trading liquidity (as defined by median daily value traded) and largest float-adjusted market capitalization. All other share classes are referred to as secondary listings. When the liquidity and market capitalization indicators are in conflict, Dow Jones analyzes the relative differences between the two values, placing a greater importance on liquidity. Once established, the designated listing is only changed if both the liquidity and market capitalization of a secondary listing exceed the liquidity and market capitalization of the designated listing by more than 20%. If only one measure exceeds 20%, Dow Jones analyzes the data as described above to determine if the designated listing should be changed. Otherwise, the designated listing remains unchanged. Dow Jones Indices reviews designated listings on an annual basis and any changes are implemented after the close of the third Friday of September. The last trading day in July is used as the reference date for the liquidity and market capitalization data.

The DJIA is price weighted rather than market capitalization weighted. Therefore, the component stock weightings are affected only by changes in the stocks' prices, in contrast with the weightings of other indices that are affected

by both price changes and changes in the number of shares outstanding. The value of the DJIA is the *sum* of the primary exchange prices of each of the 30 common stocks included in the DJIA, *divided* by a divisor. The divisor is changed in accordance with a mathematical formula to adjust for any price impacting corporate action on one of its member stocks; this includes price adjustments, special dividends, stock splits, rights offerings, constituent additions and constituent deletions. The current divisor of the DJIA is published daily in the WSJ and other publications. While this methodology reflects current practice in calculating the DJIA, no assurance can be given that Dow Jones will not modify or change this methodology in a manner that may affect the return on your securities. In addition to its daily governance of indices and maintenance of the DJIA methodology, at least once within any 12 month period, the Averages Committee reviews the DJIA methodology to ensure the DJIA continues to achieve the stated objective, and that the data and methodology remain effective. Where any index component stock price is unavailable on any trading day, the index sponsor will generally use the last reported price for such component stock.

#### *Adjustments for Corporate Actions*

There is a large range of corporate actions that may affect companies included in the DJIA. Certain corporate actions require Dow Jones Indices to make an adjustment to the divisor to prevent the value of the DJIA from changing as a result of the corporate action. Corporate actions are applied after the close of trading on the day prior to the ex-date. Several types of corporate actions, and their related adjustments, are listed in the table below.

<b>Corporate Action</b>	<b>Adjustment Made To Index</b>	<b>Divisor Adjustment?</b>
Spin-off	The price of the parent company is adjusted to the price of the parent company minus the price of the spun-off company/share exchange ratio. Any potential impacts on index constituents from a spin-off are evaluated by the Index Committee on a case by case basis.	Yes
Rights Offering	The price is adjusted according to the terms of the rights offering.	Yes
Stock dividend, stock split, reverse stock split	The price is adjusted according to the terms of the stock split.	Yes
Share Issuance, Share Repurchase, Equity Offering or Warrant Conversion	Index does not use a number of shares or investable weight factors – no impact	No
Special Dividends	Price of the stock making the special dividend payment is reduced by the per share special dividend amount after the close of trading on the day before the dividend ex-date.	Yes
Constituent Change	Deletions due to delistings, acquisition or any other corporate event resulting in the deletion of the stock from the index will be replaced on the effective date of the drop. In the case of a zero price spin-off, the spun-off company is not replaced.	Yes

#### *Recalculation Policy*

Dow Jones Indices reserves the right to recalculate an index under certain limited circumstances. Dow Jones Indices may choose to recalculate and republish an index if it is found to be incorrect or inconsistent within two trading days of the publication of the index level in question for one of the following events:

1. Incorrect or revised closing price of a stock on a given day
2. Missed or misapplied corporate event

3. Incorrect application of an index methodology
4. Late announcement of a corporate event
5. Incorrect calculation or data entry error

Late information that does not impact the divisor is applied at the earliest opportunity Dow Jones Indices becomes aware of the event. Late information impacting the divisor results in a correction and reposting within two trading days. All errors due to Dow Jones Indices' mistakes (e.g., data entry, methodology misapplication, etc.) are corrected and reposted, provided the error is identified within two trading days. Any other restatements or recalculations beyond two trading days will be determined by the Index Committee, which will review the possible market impact or disruption of such recalculations.

#### *Unexpected Exchange Closures*

An unexpected exchange closure is when an exchange fully or partially fails to open or trading is temporarily halted. This can apply to a single exchange or to a market as a whole, when all of the primary exchanges are closed and/or not trading. Unexpected exchange closures are usually due to unforeseen circumstances, such as natural disasters, inclement weather, outages, or other events.

To a large degree, Dow Jones Indices is dependent on the exchanges to provide guidance in the event of an unexpected exchange closure. Dow Jones Indices' decision making is dependent on exchange guidance regarding pricing and mandatory corporate actions.

NYSE Rule 123C provides closing contingency procedures for determining an official closing price for listed securities if the exchange is unable to conduct a closing transaction in one or more securities due to a system or technical issue.

3:00 PM ET is the deadline for an exchange to determine its plan of action regarding an outage scenario. As such, Dow Jones Indices also uses 3:00 PM ET as the cutoff.

If all exchanges fail to open or unexpectedly halt trading intraday due to unforeseen circumstances, Dow Jones Indices will take the following actions:

#### *Market Disruption Prior to Open of Trading:*

- (i) If all exchanges indicate that trading will not open for a given day, Dow Jones Indices will treat the day as an unscheduled market holiday. The decision will be communicated to clients as soon as possible through the normal channels. Indices containing multiple markets will be calculated as normal, provided that at least one market is open that day. Indices which only contain closed markets will not be calculated.
- (ii) If exchanges indicate that trading, although delayed, will open for a given day, Dow Jones Indices will begin index calculation when the exchanges open.

#### *Market Disruption Intraday:*

- (i) If exchanges indicate that trading will not resume for a given day, the index level will be calculated using prices determined by the exchanges based on the NYSE Rule 123C hierarchy. Intraday index values will continue to use the last traded composite price until the primary exchange publishes official closing prices.

#### *License Agreement between Dow Jones Opco, LLC, a subsidiary of S&P Dow Jones Indices LLC and GS Finance Corp.*

Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC ("S&P") and Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones"). The Dow Jones Industrial Average® is a product of S&P Dow Jones Indices LLC and/or its affiliates, and has been licensed for use by GS Finance Corp. ("Goldman"). The securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, S&P, any of their third party licensors, or any of their respective affiliates (collectively, "S&P Dow Jones Indices"). S&P Dow Jones Indices make no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the Dow Jones Industrial Average® to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the Dow Jones Industrial Average® is the licensing of the Index and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices. The Dow Jones Industrial Average® is determined, composed and calculated by S&P

Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the Dow Jones Industrial Average®. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the Dow Jones Industrial Average® will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC and its subsidiaries are not investment advisors. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

S&P DOW JONES INDICES DO NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE DOW JONES INDUSTRIAL AVERAGE OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO, ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIM ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE DOW JONES INDUSTRIAL AVERAGE OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES INCLUDING BUT NOT LIMITED TO, LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

## Dow Jones Industrial Average Futures Excess Return Index

The Dow Jones Industrial Average Futures Excess Return Index, which we also refer to in this description as the “index”:

- is an equity futures index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of April 8, 2015, with a base value of 100 as of its base date, June 14, 2002; and
- is sponsored by S&P Dow Jones Indices LLC (“S&P”).

The Dow Jones Industrial Average Futures Excess Return Index measures the performance of the nearest maturing quarterly E-mini Dow (\$5) futures contract (which is the E-mini Dow Jones Industrial Average<sup>SM</sup> Index futures contract (symbol: “YM”)) trading on the Chicago Mercantile Exchange (“CME”). E-mini Dow futures contracts are quarterly contracts to buy or sell standardized trading “units”. One trading unit of the E-mini Dow (\$5) futures contracts equals \$5 multiplied by the Dow Jones Industrial Average<sup>®</sup> (price return version). The Dow Jones Industrial Average<sup>®</sup> is a price-weighted index composed of 30 stocks that measures the performance of some of the largest U.S. companies. The index is calculated in U.S. dollars (\$) on an excess return basis. The index and the Dow Jones Industrial Average<sup>®</sup> are calculated, maintained and published by S&P. Additional information about the index and the Dow Jones Industrial Average<sup>®</sup> (including sector weights) is available on the following websites: [spglobal.com/spdji/en/indices/other-strategies/dow-jones-industrial-average-futures-index](http://spglobal.com/spdji/en/indices/other-strategies/dow-jones-industrial-average-futures-index), [spglobal.com/spdji/en/indices/equity/dow-jones-industrial-average](http://spglobal.com/spdji/en/indices/equity/dow-jones-industrial-average) and [spglobal.com](http://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

### Calculation of the Index

The index is constructed from the front-month E-mini Dow (\$5) futures contract and includes a provision for the replacement of the current E-mini Dow (\$5) futures contract as the contract approaches maturity (also referred to as “rolling” or “the roll”). This replacement occurs over a one-day rolling period every March, June, September, and December, effective after the close of trading five business days preceding the last trading date of the E-mini Dow (\$5) futures contract.

The index is calculated from the price change of the underlying E-mini Dow (\$5) futures contract. The level of the index on a trading date is calculated as follows: the *product* of (i) the level of the index on the preceding business day, which is any date on which the index is calculated, *multiplied by* (ii) one *plus* the contract daily return (described below) on such date.

On each trading date, the contract daily return is calculated as the *result* of (i) the *quotient* of (a) the daily contract reference price (the official closing price per futures contract, as designated by the relevant exchange) on such date *divided by* (b) the daily contract reference price on the immediately preceding trading date.

### Index Committee

An index committee maintains the index. The index committee may revise index policy covering rules for including currencies, the timing of rebalancing or other matters. The index sponsor considers information about changes to its indices and related matters to be potentially market moving and material. Therefore, all index committee discussions are confidential.

The index committee reserves the right to make exceptions when applying the methodology if the need arises. In any scenario where the treatment differs from the general rules, notice will be provided, whenever possible.

In addition to the daily governance and maintenance of the index methodology, at least once within any 12-month period, the index committee reviews the methodology to ensure the index continues to achieve the stated objective, and that the data and methodology remain effective.

### *Recalculation Policy*

The index sponsor may recalculate the index if settlement prices are amended or there is a deviation from what is stated in the index methodology. If amended settlement prices due to vendor errors or exchange updates are discovered within two business days of its occurrence, the index manager may, at their discretion, recalculate the index without involving the index committee. In the event any such recalculation event is discovered beyond such two business day period, the index committee shall decide whether the index should be recalculated. Errors identified prior to the next day open are corrected and the indices are reposted. Other errors are reviewed by the index committee, which is responsible for determining which actions should be taken. Errors due to index sponsor data entry errors, methodology misapplication or other similar errors are reviewed by the index committee. The index committee then determines whether the index is impacted by such error(s) to an extent that it should be recalculated and reposted.

### *Unexpected Exchange Closures*

An unexpected exchange closure occurs when an exchange fully or partially fails to open or trading is temporarily halted. If an exchange fails to open due to unforeseen circumstances, such as natural disasters, inclement weather, outages, or other events, the index uses the prior day's settlement prices. In situations where an exchange is forced to close early due to unforeseen events, such as computer or electric power failures, weather conditions, or other events, the index sponsor calculates the settlement price of the index based on (i) the settlement prices published by the exchange, or (ii) if no settlement price is available, the index committee determines the course of action and notifies clients accordingly.

**For information about the construction, calculation methodology and maintenance of the Dow Jones Industrial Average®, please see “— Dow Jones Industrial Average®” above.**

*License Agreement between S&P Opco, LLC, a subsidiary of S&P Dow Jones Indices LLC and GS Finance Corp.*

The Dow Jones Industrial Average Futures Excess Return Index, the Dow Jones Industrial Average Futures Index and the Dow Jones Industrial Average® are products of S&P Dow Jones Indices LLC, and have been licensed for use by GS Finance Corp. (“Goldman”). Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC; Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC (“Dow Jones”) and these trademarks have been licensed for use by S&P Dow Jones Indices LLC and sublicensed for certain purposes by Goldman. Goldman's securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, Standard & Poor's Financial Services LLC or any of their respective affiliates (collectively, “S&P Dow Jones Indices”). S&P Dow Jones Indices makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the Dow Jones Industrial Average Futures Excess Return Index, the Dow Jones Industrial Average Futures Index and the Dow Jones Industrial Average® to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the Dow Jones Industrial Average Futures Excess Return Index, the Dow Jones Industrial Average Futures Index and the Dow Jones Industrial Average® is the licensing of these indices and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The Dow Jones Industrial Average Futures Excess Return Index, the Dow Jones Industrial Average Futures Index and the Dow Jones Industrial Average® are determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the Dow Jones Industrial Average Futures Excess Return Index, the Dow Jones Industrial Average Futures Index and the Dow Jones Industrial Average®. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the Dow Jones Industrial Average Futures Excess Return Index, the Dow Jones Industrial Average Futures Index and the Dow Jones Industrial Average® will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.



S&P DOW JONES INDICES DOES NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE DOW JONES INDUSTRIAL AVERAGE FUTURES EXCESS RETURN INDEX, THE DOW JONES INDUSTRIAL AVERAGE FUTURES INDEX OR THE DOW JONES INDUSTRIAL AVERAGE® OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE DOW JONES INDUSTRIAL AVERAGE FUTURES EXCESS RETURN INDEX, THE DOW JONES INDUSTRIAL AVERAGE FUTURES INDEX OR THE DOW JONES INDUSTRIAL AVERAGE® OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

## **Dow Jones U.S. Select Dividend Index**

The Dow Jones U.S. Select Dividend Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was launched on November 3, 2003, based on an initial index value of 100 as of December 31, 1991; and
- is sponsored by S&P Dow Jones Indices LLC.

The Dow Jones U.S. Select Dividend Index measures the stock performance of 100 high dividend-paying stocks trading in the U.S. The Dow Jones U.S. Select Dividend Index is calculated in U.S. dollars on a price return basis. Additional information regarding the Dow Jones U.S. Select Dividend Index (including the sector weights) may be obtained from the following websites: [us.spindices.com/indices/strategy/dow-jones-us-select-dividend-index](http://us.spindices.com/indices/strategy/dow-jones-us-select-dividend-index) and [spglobal.com/spdji](http://spglobal.com/spdji). We are not incorporating by reference the websites, the sources listed above or any material they include in this underlier supplement.

### ***Dow Jones U.S. Select Dividend Index Universe***

The Dow Jones U.S. Select Dividend Index universe is defined as all dividend-paying companies in the Dow Jones U.S. Index, excluding real estate investment trusts (“REITs”). For more information about the Dow Jones U.S. Index, see “Dow Jones U.S. Index” below.

All stocks included in the Dow Jones U.S. Index must pass the following screens to be included in the Dow Jones U.S. Select Dividend Index universe: (i) a dividend-per-share for the current year (trailing 12 months) that is greater than or equal to the company’s five-year average dividend-per-share; (ii) a five-year average dividend coverage ratio (the average of the earnings per share divided by the annual dividend per share for the previous five years) of greater than or equal to 167%; (iii) paid dividends in each of the previous five years; (iv) a non-negative trailing 12-month earnings-per-share; (v) a float-adjusted market capitalization of at least US\$3 billion (US\$2 billion for current constituents); and (vi) a three-month average daily volume of at least 200,000 shares (100,000 shares for current constituents).

Current Dow Jones U.S. Select Dividend Index constituents are included in the universe regardless of their dividend growth rate, coverage ratio, and current year earnings-per-share. With the exception of float-adjusted market capitalization and average daily trading volume, the reference date for the above data points is the last business day of December. The reference date for float-adjusted market capitalization and average daily trading volume is the third Friday in February.

### ***Dow Jones U.S. Select Dividend Index Construction***

The Dow Jones U.S. Select Dividend Index has an annual rebalancing constituent selection process. Stocks passing all screens are ranked in descending order by indicated annual dividend (“IAD”) yield, defined as a stock’s IAD (not including any special dividends) divided by its price. All remaining current constituent stocks ranked 200 and above are retained in the Dow Jones U.S. Select Dividend Index assuming they continue to meet all other eligibility requirements. The highest ranked stocks that are not current constituents are added to the Dow Jones U.S. Select Dividend Index until the constituent count reaches 100. The IAD and stock price used in the calculation of a stock’s dividend yield are as of the third Friday in February.

### ***Constituent Weightings***

Constituent weightings are assigned annually based on IAD yield, subject to the following restrictions: (i) the weight of any individual company is restricted to the lower of (a) 10% or (b) five *times* a constituent’s float-adjusted market capitalization *divided by the sum* of the float-adjusted market capitalizations of all index constituents, as measured at the time of the annual reconstitution; and (ii) each Global Industry Classification Standard (“GICS”) sector is restricted to 30% within the Dow Jones U.S. Select Dividend Index, as measured at the time of the annual reconstitution.

Additionally, on a quarterly basis, any company whose weight exceeds 10% of the Dow Jones U.S. Select Dividend Index is capped at 10% with the excess weight distributed proportionately. Such quarterly capping, if required, is effective after the close of the third Friday of June, September, and December. The reference pricing date is after the close of the Wednesday prior to first Friday of the quarterly review month.

### ***Dow Jones U.S. Select Dividend Index Calculation***

The discussion below describes the “price return” calculation of the Dow Jones U.S. Select Dividend Index. The applicable pricing supplement will describe the calculation if the underlier for your securities is not the price return calculation. The Dow Jones U.S. Select Dividend Index is a non-market capitalization weighted index, which is an index where index constituents have a user-defined weight (based on IAD yield, as described above). Between index rebalancings, most corporate actions generally have no effect on stock weights. As stock prices move, the weights will shift and the modified weights will change. Therefore, the Dow Jones U.S. Select Dividend Index must be rebalanced from time to time to re-establish the user-defined weights.

The value of the Dow Jones U.S. Select Dividend Index on any day for which an index value is published is determined by a fraction, the numerator of which is the *sum* of, for each index stock, the market price of the index stock *times* the number of shares of such index stock *times* the investable weight factor (“IWF”) of such index stock *times* the adjustment factor of such index stock, and the denominator of which is the divisor. The “adjustment factor” for any index stock is the number that is needed to adjust (multiply) the float-adjusted market value of an index stock so that the weight of the index stock in the Dow Jones U.S. Select Dividend Index equals the user-defined weight. The float-adjusted market value of a stock in the Dow Jones U.S. Select Dividend Index is the float-adjusted market value of a stock in the Dow Jones U.S. Index. See “Dow Jones U.S. Index — Float Adjustment” below. The divisor is a value calculated by the index sponsor that is intended to maintain conformity in index values over time and is adjusted for all changes in the index stocks’ share capital, as described below.

The Dow Jones U.S. Select Dividend Index is rebalanced quarterly in March, June, September and December to re-establish the user-defined weights. The index level is not altered by index rebalancings. However, since prices and outstanding shares will have changed since the last rebalancing, the divisor will change at the rebalancing.

### ***Dow Jones U.S. Select Dividend Index Maintenance***

Constituents with significant negative dividend growth and negative earnings from continuing operations over the past 12-month period are reviewed to determine if the affected company can sustain an appropriate dividend program to remain in the Dow Jones U.S. Select Dividend Index. In the event that the index committee determines that the company’s dividend program is at significant risk, the company will be removed from the Dow Jones U.S. Select Dividend Index after the close of trading on the third Friday of March, June, September or December. Constituent changes and their weights resulting from the quarterly review process are announced on the first Friday of the quarterly review month.

Additionally, on a quarterly basis, any company whose weight exceeds 10% of the Dow Jones U.S. Select Dividend Index is capped at 10% with the excess weight distributed proportionately. Such quarterly capping, if required, is effective after the close of the third Friday of June, September, and December. The reference pricing date is after the close of the Wednesday prior to first Friday of the quarterly review month.

Securities under consideration for addition to, or deletion from, the Dow Jones U.S. Select Dividend Index are assessed by the index committee on the basis of the six-month data ending the month prior to the quarterly review. The quarterly rebalancing changes take effect on the first business day following the third Friday of March, June, September and December. Intra-quarter changes are made on an as-needed basis. IWF updates are only made annually at the September quarterly review. Changes also occur in response to corporate actions and market developments, as described below.

### ***Corporate Actions and Index Adjustments***

A constituent stock is immediately removed from the Dow Jones U.S. Select Dividend Index, independent of the reconstitution, if the constituent stock is affected by a corporate action such as a delisting or bankruptcy. In addition, constituent stocks are reviewed on a monthly basis for ongoing eligibility. At the discretion of the index committee, a constituent stock may be removed effective prior to the open of the first business day of the following month, if: (i) an issuer of a constituent stock announces that it will cease paying dividends for an undetermined period; or (ii) an issuer of a constituent stock announces a reduced dividend amount and S&P Dow Jones Indices LLC determines that it will no longer qualify for the Dow Jones U.S. Select Dividend Index at the subsequent reconstitution as a result.

The determination of ongoing eligibility and qualifying for the Dow Jones U.S. Select Dividend Index at the subsequent reconstitution is at the discretion of the index committee.

Where an issuer of a constituent stock postpones or defers a scheduled dividend payment, but does not cancel it, S&P Dow Jones Indices LLC will generally take no action until the constituent stock makes a further announcement, or the Dow Jones U.S. Select Dividend Index undergoes a rebalancing, whichever occurs sooner.

Issuers of constituent stocks that omit a single scheduled dividend payment will have their revised (reduced) total annual dividend amount reviewed for continuing eligibility. In the case of issuers of constituent stocks that typically pay a single dividend annually, omission may result in a zero dividend being recorded in the reference period for the subsequent rebalancing.

The review of ongoing eligibility is conducted based on information publicly announced by the issuer of the constituent stock up to and including the 21st of the month (in February, this date will be the 18th). Any changes to the Dow Jones U.S. Select Dividend Index are effective prior to the open of the first business day of the following month and will be announced with five business days' notice.

*Spin-Offs*

In the case of a spin-off involving a constituent stock, the spun-off company is added to the Dow Jones U.S. Select Dividend Index, at a zero price at the market close of the day before the ex-date (with no divisor adjustment). If a spin-off is determined to be ineligible for continued index inclusion, it is removed after at least one day of regular way trading (with a divisor adjustment).

For merger and acquisition events, the index sponsor, at its discretion, may retain dividend history for newly formed entities from their predecessor companies.

Several additional types of corporate actions, and their related treatment, are listed in the table below.

Corporate Action	Treatment
Company Addition/Deletion	<u>Addition</u> Generally, no companies are added to the Dow Jones U.S. Select Dividend Index between annual reconstitutions except for IPOs and spin-offs. <u>Deletion</u> The weights of all stocks in the Dow Jones U.S. Select Dividend Index will proportionately change but relative weights will stay the same. The Dow Jones U.S. Select Dividend Index divisor will change due to the net change in the index market capitalization.
Change in shares outstanding	Shares outstanding changes are offset by an adjustment factor. There is no change to the index market capitalization and no divisor adjustment.
Split/reverse split	Shares outstanding are adjusted by split ratio. Stock price is adjusted by split ratio. There is no change to the index market capitalization and no divisor adjustment.
Spin-off	The spin-off is added to the Dow Jones U.S. Select Dividend Index on the ex-date at a price of zero. The spin-off index shares are based on the spin-off ratio. On the ex-date the spin-off will have the same attributes and capping adjustment factor as its parent company, and will remain in the Dow Jones U.S. Select Dividend Index for at least one trading day. As a result, there will be no change to the index divisor on the ex-date.  If the spin-off is ineligible for continued inclusion, it will be removed after the ex-date. The weight of the spin-off being deleted is reinvested across all the Dow Jones U.S. Select Dividend Index components proportionately such that the relative weights of all Dow Jones U.S. Select Dividend Index components are unchanged. The net change in index market capitalization will cause a divisor change.
Change in IWF	IWF changes are offset by an adjustment factor. There is no change to the index market capitalization and no divisor adjustment.
Special dividend	The stock price is adjusted by the amount of the dividend. The net change to the index market capitalization causes a divisor adjustment.

Rights offering

All rights offerings that are in the money on the ex-date are applied under the assumption the rights are fully subscribed. The stock price is adjusted by the value of the rights and the shares outstanding are increased by the rights ratio. The change in price and shares is offset by an adjustment factor to keep the index market capitalization (stock weight) unchanged. There is no change to the index market capitalization and no divisor adjustment.

#### **Other Adjustments**

In cases where there is no achievable market price for a stock being deleted, it may be removed at a zero or minimal price at the index committee's discretion, in recognition of the constraints faced by investors in trading bankrupt or suspended stocks.

#### **Index Governance**

The Dow Jones U.S. Select Dividend Index is maintained by an index committee. The index committee meets regularly. All committee members are full-time professional members of the index sponsor's staff. At each meeting, the index committee may review pending actions that may affect index constituents, statistics comparing the composition of the Dow Jones U.S. Select Dividend Index to the market, securities being considered as candidates for addition to the Dow Jones U.S. Select Dividend Index, and any significant market events. In addition, the index committee may revise index policy rules.

The index sponsor considers information about changes to its indices and related matters to be potentially market moving and material. Therefore, all index committee discussions are confidential. The index committee reserves the right to make exceptions when applying the methodology if the need arises.

In addition to the daily governance of the Dow Jones U.S. Select Dividend Index and maintenance of index methodology, at least once within any 12-month period the index committee reviews the methodology to ensure the Dow Jones U.S. Select Dividend Index continues to achieve the stated objectives, and that the data and methodology remain effective.

#### **Recalculation Policy**

The index sponsor reserves the right to recalculate and republish the Dow Jones U.S. Select Dividend Index at its discretion in the event one of the following issues has occurred: (1) incorrect or revised closing price of one or more constituent securities; (2) missed or misapplied corporate event; (3) late announcement of a corporate action; (4) incorrect calculation or data entry error; or (5) incorrect application of an index methodology. The decision to recalculate the Dow Jones U.S. Select Dividend Index is made at the discretion of the index manager and/or index committee, as further discussed below. The potential market impact or disruption resulting from the potential recalculation is considered when making any such decision. In the event of an incorrect closing price, a missed or misapplied corporate action, a late announcement of a corporate action, or an incorrect calculation or data entry error that is discovered within two trading days of its occurrence, generally the Dow Jones U.S. Select Dividend Index is recalculated. In the event any such event is discovered beyond the two-trading day period, the index committee shall decide whether the Dow Jones U.S. Select Dividend Index should be recalculated. In the event of an incorrect application of the methodology that results in the incorrect composition and/or weighting of index constituents, the index committee shall determine whether or not to recalculate the Dow Jones U.S. Select Dividend Index following specified guidelines. In the event that the Dow Jones U.S. Select Dividend Index is recalculated, it shall be done within a reasonable timeframe following the detection and review of the issue.

#### **Calculations and Pricing Disruptions**

Prices used for the calculation of real time index values are based on the "Consolidated Tape". The Consolidated Tape is an aggregation of trades for each constituent over all regional exchanges and trading venues and includes the primary exchange. If there is a failure or interruption on one or more exchanges, real-time calculations will continue as long as the "Consolidated Tape" is operational.

If an interruption is not resolved prior to the market close, official closing prices will be determined by following the hierarchy set out in NYSE Rule 123C.

A notice is published on the index sponsor's website at [spglobal.com/spdji](http://spglobal.com/spdji) indicating any changes to the prices used in Dow Jones U.S. Select Dividend Index calculations. In extreme circumstances, the index sponsor may

decide to delay index adjustments or not publish the Dow Jones U.S. Select Dividend Index. Real-time indices are not restated.

### ***Unexpected Exchange Closures***

An unexpected market/exchange closure occurs when a market/exchange fully or partially fails to open or trading is temporarily halted. This can apply to a single exchange or to a market as a whole, when all of the primary exchanges are closed and/or not trading. Unexpected market/exchange closures are usually due to unforeseen circumstances, such as natural disasters, inclement weather, outages, or other events.

To a large degree, the index sponsor is dependent on the exchanges to provide guidance in the event of an unexpected exchange closure. The index sponsor's decision making is dependent on exchange guidance regarding pricing and mandatory corporate actions.

NYSE Rule 123C provides closing contingency procedures for determining an official closing price for listed securities if the exchange is unable to conduct a closing transaction in one or more securities due to a system or technical issue.

3:00 PM ET is the deadline for an exchange to determine its plan of action regarding an outage scenario. As such, the index sponsor also uses 3:00 PM ET as the cutoff.

If all major exchanges fail to open or unexpectedly halt trading intraday due to unforeseen circumstances, the index sponsor will take the following actions:

**Market Disruption Prior to Open of Trading:**

(i) If all exchanges indicate that trading will not open for a given day, the index sponsor will treat the day as an unscheduled market holiday. The decision will be communicated to clients as soon as possible through the normal channels. Indices containing multiple markets will be calculated as normal, provided that at least one market is open that day. Indices which only contain closed markets will not be calculated.

(ii) If exchanges indicate that trading, although delayed, will open for a given day, the index sponsor will begin index calculation when the exchanges open.

**Market Disruption Intraday:**

(i) If exchanges indicate that trading will not resume for a given day, the Dow Jones U.S. Select Dividend Index level will be calculated using prices determined by the exchanges based on NYSE Rule 123C. Intraday Dow Jones U.S. Select Dividend Index values will continue to use the last traded composite price until the primary exchange publishes official closing prices.

### **Dow Jones U.S. Index**

The Dow Jones U.S. Index is a float-adjusted market capitalization index that is calculated, published and disseminated by the index sponsor. The Dow Jones U.S. Index aims to provide 95% market capitalization coverage of U.S.-traded stocks. The Dow Jones U.S. Index is calculated in U.S. dollars on a price return basis. The Dow Jones U.S. Index was launched on February 14, 2000, based on an initial index value of 100 as of December 31, 1991. Additional information regarding the Dow Jones U.S. Index may be obtained from the following websites: [us.spindices.com/indices/equity/dow-jones-us-index](http://us.spindices.com/indices/equity/dow-jones-us-index) and [spglobal.com/spdji](http://spglobal.com/spdji). We are not incorporating by reference the websites, the sources listed above or any material they include in this underlier supplement.

### ***Calculation and Dissemination***

The closing values of the Dow Jones U.S. Index are calculated on a 24-hour day that ends at 5:30 p.m. New York time and, following the determination of the previous day's closing price, the Dow Jones U.S. Index values for the current day are updated and disseminated on a real-time basis beginning at 5:30 p.m. whenever any of the exchanges represented in the Dow Jones U.S. Index are open.

If trading in a stock is suspended while its market is open, the last traded price for that stock is used for all subsequent index computations until trading resumes. If trading is suspended before the opening, the stock's adjusted closing price from the previous day is used to calculate the Dow Jones U.S. Index. Until a particular stock opens, its adjusted closing price from the previous day is used in the Dow Jones U.S. Index computation.

If a market is closed due to an exchange holiday, the previous adjusted closing price for each of its index underlying assets, coupled with the most-recent intraday currency bid price, is used to determine the Dow Jones U.S. Index's current U.S. dollar value.

To be included in the Dow Jones U.S. Index, a stock must be part of the index universe, defined as all stocks traded on major U.S. stock exchanges minus any non-common issues and illiquid stocks. Dow Jones U.S. Index candidates must be common shares or other securities that have the characteristics of common equities. All classes of common shares, both fully and partially paid, are eligible. Convertible bonds, preferred stocks that provide a guaranteed fix return, equity warrants, convertible preferred stocks, ETFs, fixed-dividend shares, ETNs, business development companies, closed-end funds, limited liability companies, mutual fund shares, limited partnerships, investment trusts, master limited partnerships, unit trusts, and special purpose acquisition companies are ineligible. Temporary issues arising from corporate actions, such as "when-issued shares," are considered on a case-by-case basis when necessary to maintain continuity in a company's index membership. REITs, listed property trusts, and similar real property-owning pass-through structures taxed as REITs by their domiciles also are eligible.

Each stock must also meet two separate liquidity criteria to be considered eligible for inclusion in the Dow Jones U.S. Index. Stocks must have a 12-month median value traded ratio (MVTR) of at least 20% to be eligible, or at least 14% for current constituents to remain eligible. The MVTR for a stock is calculated by taking the median daily value traded amount for each of the 12 months preceding the rebalancing reference date, multiplying the amount by the number of days that the stock traded during that month, and then dividing the result by its end-of-month float-adjusted market capitalization. The sum of the 12 monthly values is the MVTR for such stock. If a stock has traded for less than 12 months, the average of the available monthly values is taken and multiplied by 12 to obtain the MVTR. In addition, stock must have a 6-month median daily traded value (MDVT) over the 6 months prior to the rebalancing reference date of at least \$250,000 to be eligible, or at least \$175,000 for current constituents to remain eligible. If a stock has traded for less than 6 months, the MDVT amount for as long as the stock has been trading is used.

After determination of the Dow Jones U.S. Index universe, the Dow Jones U.S. Index universe is then sorted by float-adjusted market capitalization and stocks in the top 95% of the Dow Jones U.S. Index universe are categorized into Industries, Supersectors, Sectors and Subsectors as defined by a proprietary classification system used by the index sponsor. Segments are designed to capture the risk characteristics of a specific market by grouping together constituents that respond in similar ways to economic, political and environmental factors.

The Dow Jones U.S. Index level is calculated using a fraction, the numerator of which is the price of each stock in the Dow Jones U.S. Index multiplied by the number of shares used in the Dow Jones U.S. Index calculation (total shares outstanding times the IWF), and summed across all the stocks in the Dow Jones U.S. Index. The denominator is the Dow Jones U.S. Index divisor.

#### ***The Dow Jones U.S. Index Divisor***

To assure that the Dow Jones U.S. Index's value, or level, does not change when stocks are added or deleted, the divisor is adjusted to offset the change in market value of the Dow Jones U.S. Index. Thus, the divisor plays a critical role in the Dow Jones U.S. Index's ability to provide a continuous measure of market valuation when faced with changes to the stocks included in the Dow Jones U.S. Index. In a similar manner, some corporate actions that cause changes in the market value of the stocks in an index should not be reflected in the Dow Jones U.S. Index level. Adjustments are made to the divisor to eliminate the impact of these corporate actions. Any change to the stocks in the Dow Jones U.S. Index that alters the total market value of the Dow Jones U.S. Index while holding stock prices constant will require a divisor adjustment.

Divisor adjustments are made "after the close" meaning that after the close of trading the closing prices are used to calculate the new divisor based on whatever changes are being made. It is, then, possible to provide two complete descriptions of the Dow Jones U.S. Index – one as it existed at the close of trading and one as it will exist at the next opening of trading. If the same stock prices are used to calculate the Dow Jones U.S. Index level for these two descriptions, the Dow Jones U.S. Index levels are the same.

With prices constant, any change that changes the total market value included in the Dow Jones U.S. Index will require a divisor change. For cataloging changes, it is useful to separate changes caused by the management of the Dow Jones U.S. Index from those stemming from corporate actions of the constituent companies. Among those changes driven by index management are adding or deleting companies, adjusting share counts and changes to IWFs and other factors affecting share counts or stock prices.

When a company is added to or deleted from the Dow Jones U.S. Index, the net change in the market value of the Dow Jones U.S. Index is calculated and this is used to calculate the new divisor. The market values of stocks being added or deleted are based on the prices, shares outstanding, IWFs and any other share count adjustments.

**Fast track IPOs.** Certain large IPOs may be eligible for fast track entry, subject to the following conditions:

- Only newly public IPOs and IPO direct placement listings will be considered eligible for fast track entry. Formerly bankrupt companies that switch from over-the-counter exchange or a non-covered exchange to an S&P Dow Jones Indices LLC covered exchange are ineligible.
- Fast track IPO additions must meet a minimum float-adjusted market capitalization threshold of \$2 billion, calculated using the shares offered (excluding over-allotment options) and the closing price on the first day of trading on an eligible exchange. The threshold level is reviewed from time to time and updated as needed to assure consistency with market conditions.
- Fast track direct placement listing IPO additions must meet a minimum float-adjusted market capitalization threshold of \$2 billion, calculated using the shares available to the public as determined by its investable weight factor, and the closing price on the first day of trading on an eligible exchange.
- In addition, the IPO will need to meet all other applicable index eligibility rules except for the liquidity requirements. If all necessary public information is available, S&P Dow Jones Indices LLC verifies that the fast track conditions have been met. Once S&P Dow Jones Indices LLC announces that the IPO is eligible for fast track addition, it is added to the index with five business days' notice. At the discretion of the Index Committee, fast track IPO additions eligible to be added during a quarterly rebalancing freeze period may instead be added on the rebalancing effective date.

The size classification of a fast tracked IPO is determined using its total market capitalization as of the first trading day and comparing the result to the total market capitalization of all index constituents within the same country as of the previous reference date for quarterly sizing. IPOs and direct listings for which S&P Dow Jones Indices LLC is unable to confirm the number of shares and/or calculate an accurate IWF based on available information are not considered for fast track entry, and in instances where this information is not available before a rebalancing cut-off reference date, may not be eligible for inclusion during the rebalancing.

**Spin-offs.** Spin-offs from current index constituents are eligible for index inclusion and are included in the Dow Jones U.S. Index on their ex-dates. Spin-offs are assigned the same size and style as the parent company at the time of the event. All spin-off sizes are evaluated at the next quarterly review.

Several additional types of corporate actions, and their related treatment, are listed in the table below.

Corporate Action	Treatment
Company addition/deletion	<u>Addition</u> Companies are added at the float market capitalization weight. The net change to the index market capitalization causes a divisor adjustment. <u>Deletion</u> The weights of all stocks in the index will proportionally change. Relative weights will stay the same. The index divisor will change due to the net change in the index market capitalization
Change in shares outstanding	Increasing (decreasing) the shares outstanding increases (decreases) the market capitalization of the index. The change to the index market capitalization causes a divisor adjustment.
Split/reverse split	Shares outstanding are adjusted by split ratio. Stock price is adjusted by split ratio. There is no change to the index market capitalization and no divisor adjustment.
Change in IWF	Increasing (decreasing) the IWF increases (decreases) the market capitalization of the index. A net change to the index market capitalization causes a divisor adjustment.
Ordinary dividend	When a company pays an ordinary cash dividend, the index does not make any adjustments to the price or shares of the stock. As a result there are no divisor adjustments to the index.



Special dividend	The stock price is adjusted by the amount of the dividend. The net change to the index market capitalization causes a divisor adjustment
Rights offering	All rights offerings that are in the money on the ex-date are applied under the assumption the rights are fully subscribed. The stock price is adjusted by the value of the rights and the shares outstanding are increased by the rights ratio. The net change in market capitalization causes a divisor adjustment.

**Annual Reconstitution, Quarterly Reviews and Dow Jones U.S. Index Maintenance**

The Dow Jones U.S. Index reconstitutes annually in September. The process includes the review of all stocks in their respective markets to determine eligibility according to the existing criteria. The reference date for data used in the reconstitution is the last business day in July. In addition, the investable weight factor ("IWF"), for each stock is reviewed and updated as needed. Changes are implemented at the opening of trading on the Monday following the third Friday of September. Changes in IWFs resulting from corporate actions which exceed 5% are implemented as soon as possible; changes of less than 5% are implemented at the next annual review.

Generally, no companies are added to the Dow Jones U.S. Index between annual reconstitutions except for initial public offerings and spinoffs. Any exceptions to this rule are announced with ample lead time. Any stocks considered for addition at the quarterly rebalance must have a float market cap larger than that of the smallest stock included in the Dow Jones U.S. Index at the time of the previous reconstitution.

Changes to shares and IWFs are implemented at the open of trading on the Monday following the third Friday of March, June, September and December. Size classification is reviewed as part of the quarterly update, with the reference date for size classification being five weeks prior to the rebalancing effective date. Confirmed share changes that are at least 5% of the total current shares outstanding are implemented weekly. Total shares outstanding (not float-adjusted shares) are used to determine whether the share change meets this 5% threshold. The 5% rule applies to share changes only. IWF changes are only considered if a share change meets the 5% threshold. Share changes of 5% or greater resulting from aggregated smaller share change events are implemented when the index sponsor is able to validate the cumulative change.

Corporate actions (such as stock splits, stock dividends, spin-offs and rights offerings) are applied after the close of trading on the day prior to the ex-date. Share changes resulting from exchange offers are applied on the ex-date.

Initial public offerings and new listings on eligible exchanges are added to at the next quarterly update if the new listing occurs on or before the final trading day of February, May, August or November and meets all other eligibility requirements. Spinoffs of Dow Jones U.S. Index constituents are added to the Dow Jones U.S. Index at a zero price at the market close on the day before the ex-date (with no divisor adjustment). If a spun-off company is determined not to be eligible to remain in the Dow Jones U.S. Index, it will be removed after at least one day of regular way trading (with a divisor adjustment). Spinoffs are assigned the same size and style as the parent company at the time of the action. All spinoff sizes are evaluated at the next quarterly update.

Whenever possible, the index sponsor will announce changes in the Dow Jones U.S. Index at least two business days prior to their implementation date.

If a Dow Jones U.S. Index constituent is suspended by its primary market, it may be removed from the Dow Jones U.S. Index at the discretion of the Index Committee. When this occurs, the index sponsor will use the best-available alternate pricing source to determine the value at which the company should be removed from the Dow Jones U.S. Index.

**Float Adjustment**

The Dow Jones U.S. Index is float-adjusted, meaning that the share counts used in calculating the Dow Jones U.S. Index reflect only those shares available to investors rather than all of a company's outstanding shares. The index sponsor seeks to exclude shares held by long-term, strategic shareholders concerned with the control of a company, a group that generally includes the following: officers and directors and related individuals whose holdings are publicly disclosed, private equity, venture capital, special equity firms, asset managers and insurance companies with direct board of director representation, publicly traded companies that hold shares in another company, holders of restricted shares (except for shares held as part of a lock-up agreement), company-sponsored employee share plans/trusts, defined contribution plans/savings, investment plans, foundations or

family trusts associated with the company, government entities at all levels (except government retirement or pension funds), sovereign wealth funds and any individual person listed as a 5% or greater stakeholder in a company as reported in regulatory filings (collectively, "strategic holders"). To this end, the index sponsor excludes all share-holdings (other than depository banks, pension funds (including government pension and retirement funds), mutual funds, exchange traded fund providers, investment funds, hedge funds, asset managers that do not have direct board of director representation (including (i) stakeholders who may have the right to appoint a board of director member but choose not to do so; (ii) stakeholders who have exercised a right to appoint a board of director "observer" even if that observer is employed by the stakeholder and (iii) stakeholders who have exercised an independent director who is not employed by the stakeholder), investment funds of insurance companies and independent foundations not associated with the company) with a position greater than 5% of the outstanding shares of a company from the float-adjusted share count to be used in Dow Jones U.S. Index calculations.

The exclusion is accomplished by calculating an IWF for each stock that is part of the numerator of the float-adjusted index fraction described above:

$$\text{IWF} = (\text{available float shares})/(\text{total shares outstanding})$$

where available float shares is defined as total shares outstanding less shares held by strategic holders. In most cases, an IWF is reported to the nearest one percentage point. For companies with multiple share class lines, a separate IWF is calculated for each share class line.

For traditional IPOs, the IWF is generally calculated using the total shares offered (excluding overallotment options) for that share class, divided by the total shares outstanding for the same share class post-IPO.

For IPO direct placement listings on ex-U.S. exchanges, the IWF is calculated using the number of shares listed after excluding the strategic/controlling shareholders.

For direct placement listings on U.S. exchanges, the IWF is calculated using the total registered shares as announced in official documents, subtracting out all control holders and then dividing that result by the total shares outstanding for that share class post IPO.

*License Agreement between Dow Jones Opco, LLC, a subsidiary of S&P Dow Jones Indices LLC and GS Finance Corp.*

Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC ("S&P") and Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones"). The Dow Jones U.S. Select Dividend Index and the Dow Jones U.S. Index are products of S&P Dow Jones Indices LLC and/or its affiliates, and have been licensed for use by GS Finance Corp. ("Goldman"). The securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, S&P, any of their third party licensors, or any of their respective affiliates (collectively, "S&P Dow Jones Indices"). S&P Dow Jones Indices make no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the Dow Jones U.S. Select Dividend Index or the Dow Jones U.S. Index to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the Dow Jones U.S. Select Dividend Index or the Dow Jones U.S. Index is the licensing of the Dow Jones U.S. Select Dividend Index and the Dow Jones U.S. Index and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices. The Dow Jones U.S. Select Dividend Index and the Dow Jones U.S. Index are determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the Dow Jones U.S. Select Dividend Index or the Dow Jones U.S. Index. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the Dow Jones U.S. Select Dividend Index or the Dow Jones U.S. Index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC and its subsidiaries are not investment advisors. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

S&P DOW JONES INDICES DO NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE DOW JONES INDUSTRIAL AVERAGE OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO, ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIM ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE DOW JONES INDUSTRIAL AVERAGE OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES INCLUDING BUT NOT LIMITED TO, LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

## EURO STOXX 50® Index

The EURO STOXX 50® Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first published on February 26, 1998, based on an initial index value of 1,000 as of December 31, 1991; and
- was created and is sponsored and maintained by STOXX Limited.

The EURO STOXX 50® Index is a free-float market capitalization-weighted index of 50 European blue-chip stocks. The 50 stocks included in the EURO STOXX 50® Index trade in Euros, and are allocated, based on their country of incorporation, primary listing and largest trading volume, to one of the following countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain, which we refer to collectively as the Eurozone. Companies allocated to a Eurozone country but not traded in Euros are not eligible for inclusion in the EURO STOXX 50® Index. The level of the EURO STOXX 50® Index is disseminated on the STOXX Limited website. STOXX Limited is under no obligation to continue to publish the EURO STOXX 50® Index and may discontinue publication of it at any time. Additional information regarding the EURO STOXX 50® Index (including the top ten constituent stocks and weights, sector weights and country weights) may be obtained from the STOXX Limited website: [stox.com](http://stox.com). We are not incorporating by reference the website or any material it includes in this underlier supplement.

### *EURO STOXX 50® Index Composition.*

The EURO STOXX 50® Index is composed of 50 index stocks chosen by STOXX Limited from the 20 EURO STOXX Supersector indices, which represent the Eurozone portion of the STOXX Europe 600 Supersector indices. The 20 supersectors from which stocks are selected for the EURO STOXX 50® Index are: Automobiles & Parts; Banks; Basic Resources; Chemicals; Construction & Materials; Consumer Products & Services; Energy; Financial Services; Food, Beverages & Tobacco; Health Care; Industrial Goods & Services; Insurance; Media; Personal Care, Drug & Grocery Stores; Real Estate; Retailers; Technology; Telecommunications; Travel & Leisure; and Utilities; although stocks from each of these supersectors are not necessarily included at a given time.

### *Component Selection*

The composition of the EURO STOXX 50® Index is reviewed by STOXX Limited annually in September. Within each of the 20 EURO STOXX Supersector indices, the respective index component stocks are ranked by free-float market capitalization. The largest stocks are added to the selection list until the coverage is close to, but still less than, 60% of the free-float market capitalization of the corresponding EURO STOXX Total Market Index Supersector Index. If the next highest-ranked stock brings the coverage closer to 60% in absolute terms, then it is also added to the selection list. All remaining stocks that are current EURO STOXX 50® Index components are then added to the selection list. The stocks on the selection list are then ranked by free-float market capitalization. The 40 largest stocks on the selection list are chosen as index components. The remaining 10 stocks are then selected from the largest current stocks ranked between 41 and 60. If the number of index components is still below 50, then the largest remaining stocks on the selection list are added until the EURO STOXX 50® Index contains 50 stocks. In exceptional cases, the STOXX Limited Management Board may make additions and deletions to the selection list.

### *Ongoing Maintenance of Component Stocks*

The component stocks of the EURO STOXX 50® Index are monitored on an ongoing monthly basis for deletion and quarterly basis for addition. Changes to the composition of the EURO STOXX 50® Index due to corporate actions (including mergers and takeovers, spin-offs, sector changes and bankruptcy) are announced immediately, implemented two trading days later and become effective on the next trading day after implementation.

The component stocks of the EURO STOXX 50® Index are subject to a “fast exit” rule. A component stock is deleted if it ranks 75 or below on the monthly selection list and it ranked 75 or below on the selection list of the previous month. Additionally, any component stocks that are not traded for 10 trading days, are suspended from trading for 10 consecutive days or more and have not announced a resumption trading date, are officially delisted or are the subject of ongoing bankruptcy proceedings will be deleted from the EURO STOXX 50® Index. The

highest-ranked non-component stock will replace the exiting component stock. The EURO STOXX 50® Index is also subject to a “fast entry” rule. All stocks on the latest selection lists and initial public offering (IPO) stocks are reviewed for a fast-track addition on a quarterly basis. A stock is added if it qualifies for the latest blue-chip selection list generated at the end of February, May, August or November and if it ranks within the lower buffer (between 1 and 25) on the selection list. If added, the stock replaces the smallest component stock.

A deleted stock is replaced immediately to maintain the fixed number of stocks. The replacement is based on the latest monthly selection list. In the case of a merger or takeover where a component stock is involved, the original component stock is replaced by the new component stock. Generally, non-surviving stock(s) are deleted at the last traded price of the security. If any non-surviving stock is not trading anymore (delisted or suspended before its deletion), a new artificial price based on the acquisition/merger terms is calculated and the company is kept/deleted with this price instead of the last traded one. For the calculation of the artificial price only ordinary cash and stock terms will be used. Other instruments such as contingent value rights will not be considered. In the case of a spin-off, if the original stock was a component stock, then each spin-off stock qualifies for addition if it lies within the upper buffer (between 1 and 40) on the latest selection list. The largest qualifying spin-off stock replaces the original component stock, while the next qualifying spin-off stock replaces the lowest ranked component stock and likewise for other qualifying spin-off stocks.

The free float factors and outstanding number of shares for each index stock that STOXX Limited uses to calculate the EURO STOXX 50® Index, as described below, are reviewed, calculated and implemented on a quarterly basis and are fixed until the next quarterly review. Certain extraordinary adjustments to the free float factors and/or the number of outstanding shares are implemented and made effective more quickly. The timing depends on the magnitude of the change. Each component's weight is capped at 10% of the EURO STOXX 50® Index's total free float market capitalization. The free float factor reduces the index stock's number of shares to the actual amount available on the market. All holdings that are larger than five percent of the total outstanding number of shares and held on a long-term basis are excluded from the index calculation (including, but not limited to, stock owned by the company itself, stock owned by governments, stock owned by certain individuals or families, and restricted shares).

*Index Calculation*

STOXX Limited calculates the EURO STOXX 50® Index using the “Laspeyres formula,” which measures the aggregate price changes in the index stocks against a fixed base quantity weight. The discussion below describes the “price return” calculation of the EURO STOXX 50® Index. The applicable pricing supplement will describe the calculation of the EURO STOXX 50® Index if the underlier for your securities is not the price return calculation. The formula for calculating the EURO STOXX 50® Index value can be expressed as follows:

EURO STOXX 50® Index =

Free Float Market Capitalization of the  
EURO STOXX 50® Index

Divisor

The “free float market capitalization of the EURO STOXX 50® Index” is equal to the sum of the product of the price, the number of shares, the free float factor and the weighting cap factor for each index stock as of the time the EURO STOXX 50® Index is being calculated. The index stocks trade in Euros and thus, no currency conversion is required. Where any index component stock price is unavailable on any trading day, the index sponsor will generally use the last reported price for such component stock.

In case the investability and tradability of the EURO STOXX 50® Index and index based products is affected by an upcoming market or company event that is considered significant or “extreme” by the STOXX Management Board, the following actions or a combination of the following actions are taken. For all such changes a minimum notification period of two full trading days will be observed. The action scope may include but is not limited to:

- application of expert judgment for index component pricing data,
- adjustment of operational procedures,
- postponement of index adjustments,
- adjustment of selection lists,

- change of weights of index constituents by adjusting the number of shares, free-float factors or weighting cap-factors, or
- adjustment of index compositions.

#### *EURO STOXX 50 Divisor*

The EURO STOXX 50® Index is calculated using a divisor that helps to maintain the continuity of the EURO STOXX 50® Index's value so that corporate actions do not artificially increase or decrease the level of the EURO STOXX 50® Index.

The divisor is calculated by starting with the previous divisor in effect for the EURO STOXX 50® Index (which we call the “original divisor value”) and multiplying it by a fraction, the numerator of which is the previous free float market capitalization of the EURO STOXX 50® Index, plus or minus the difference between the closing market capitalization of the EURO STOXX 50® Index and the adjusted closing market capitalization of the EURO STOXX 50® Index, and the denominator of which is the previous free float market capitalization of the EURO STOXX 50® Index. The adjusted free float market capitalization is calculated for stocks of companies that have experienced a corporate action of the type described below as of the time the new divisor value is being calculated using the free float market capitalization calculated with adjusted closing prices, the new number of shares, and the new free float factor minus the free float market capitalization calculated with that stock's original closing price, number of shares, and free float factor, in each case as used in calculating the original divisor value. Errors in divisor calculation are corrected on an intraday basis if discovered on the same day the new divisor is effective. If the error is discovered later, the error is corrected on an intraday basis if feasible and only if the error is considered significant by the STOXX Limited Management Board.

#### *Divisor Adjustments*

STOXX Limited adjusts the divisor for the EURO STOXX 50® Index to maintain the continuity of the EURO STOXX 50® Index values across changes due to corporate actions. Changes in weights due to corporate actions are distributed proportionally across all index components and equal an investment into the portfolio. The following is a summary of the adjustments to any index stock made for corporate actions and the effect of such adjustments on the divisor, where shareholders of the index stock will receive “B” new shares for every “A” share held (where applicable) and assuming that the version of the EURO STOXX 50® Index to which your securities are linked is the price return version. If your securities are linked to the total return calculation of the EURO STOXX 50® Index, please see the discussion in your pricing supplement regarding divisor adjustments. All adjusted prices consider withholding taxes, where applicable, based on the new shares being distributed, using “B \* (1 – withholding tax where applicable)”.

##### *(1) Special cash dividend:*

New adjusted price = closing price on the day before the ex- date – dividend announced by the company \* (1- withholding tax)

Divisor: decreases

##### *(2) Split and reverse split:*

New adjusted price = closing price on the day before the ex- date \* A / B

New adjusted number of shares = number of shares on the day before the ex-date \* B / A

Divisor: unchanged

##### *(3) Rights offering:*

New adjusted price = (closing price on the day before the ex- date \* A + subscription price \* B) / (A + B)

New adjusted number of shares = number of shares on the day before the ex-date \* (A + B) / A

Divisor: increases

If the subscription price is not available or if the subscription price is equal to or greater than the closing price on the day before the ex-date (out-of-the-money), then no adjustment is made.

If the subscription price is available as a price range and not as a fixed price, the price and share adjustment is performed only if both lower and upper range are in the money. The average value between lower and upper range will be used as a subscription price.

A rights offering is considered to be a highly dilutive rights issue if the share ratio is larger than or equal to 200%.

If a highly dilutive rights issuance is fully underwritten, it will be implemented as described above.

If a highly dilutive rights issuance is not fully underwritten and the rights are tradable on the ex-date on the same eligible stock exchange as the parent company:

- The rights will be included into the EURO STOXX 50<sup>®</sup> Index with a theoretical price on the ex-date with the same parameters as the parent company.
- The rights will be removed at the close of the day they start to trade based on its closing price.
- If the rights issue results into listing of new shares and satisfies the free-float factors and share adjustments criteria, then the number of shares will be increased after the new shares have been listed.

If a highly dilutive rights issuance is not fully underwritten and the rights are not tradable on the ex-date or not tradable on the ex-date on the same eligible stock exchange as the parent company:

- The rights will be included into the EURO STOXX 50<sup>®</sup> Index with a theoretical price on the ex-date with the same parameters as the parent company.
- The rights will be removed on the ex-date at close, using a price of 0.0000001 in local currency.
- If the rights issue results into listing of new shares and satisfies the free-float factors and share adjustments criteria, then the number of shares will be increased after the new shares have been listed.

*(4) Stock dividend:*

New adjusted price = closing price on the day before the ex- date \* A / (A + B)

New adjusted number of shares = number of shares on the day before the ex-date \* (A + B) / A

Divisor: unchanged

*(5) Stock dividend from treasury stock if treated as extraordinary dividend:*

New adjusted price = closing price on the day before the ex- date – closing price on the day before the ex- date \* B / (A + B)

Divisor: decreases

*(6) Stock dividend (from redeemable shares) if treated as extraordinary dividend.*

Stock dividends from redeemable shares will be adjusted as cash dividends. In such a case redeemable shares are considered as:

- A separated share line with a fixed price
- Ordinary shares that are self-tendered on the same ex-date

New adjusted price = closing price on the day before the ex- date - closing price on the day before the ex- date \* B / (A + B)

Divisor: decreases

*(7) Stock dividend of another company:*

New adjusted price = [(closing price on the day before the ex- date \* A) – [(1 – withholding tax) \* price of other company \* B]] / A

Divisor: decreases

*(8) Return of capital and share consolidation:*

New adjusted price = [closing price on the day before the ex- date – capital return announced by company \* (1– withholding tax)] \* A / B

New adjusted number of shares = number of shares on the day before the ex-date \* B / A

Divisor: decreases

*(9) Repurchase of shares / self-tender:*

New adjusted price = [(closing price on the day before the ex- date \* number of shares on the day before the ex-date) – (tender price \* number of tendered shares)] / new adjusted number of shares

New adjusted number of shares = number of shares on the day before the ex-date – number of tendered shares

Divisor: decreases

*(10) Spin-off:*

New adjusted price of parent company = (closing price on the day before the ex- date \* A – price of spun-off shares \* B) / A

New number of shares for the spun-off company = number of shares on the day before the ex-date of parent company \* B

Divisor: unchanged on ex-date

*(11) Combination of stock distribution (dividend or split) and rights offering:*

For this corporate action, the following additional assumptions apply:

Shareholders receive B new shares from the distribution and C new shares from the rights offering for every A share held.

If A is not equal to one, all the following “new number of shares” formulas need to be divided by A.

If rights are applicable after stock distribution (one action applicable to another):

New adjusted price = [closing price on the day before the ex- date \* A + subscription price \* C \* (1 + B / A)] / [(A + B) \* (1 + C / A)]

New adjusted number of shares = number of shares on the day before the ex-date \* [(A + B) \* (1 + C / A)] / A

Divisor: increases

If stock distribution is applicable after rights (one action applicable to another):

New adjusted price = (closing price on the day before the ex- date \* A + subscription price \* C) / [(A + C) \* (1 + B / A)]

New adjusted number of shares = number of shares on the day before the ex-date \* (A + C) \* (1 + B / A)

Divisor: increases

Stock distribution and rights (neither action is applicable to the other):

New adjusted price = (closing price on the day before the ex- date \* A + subscription price \* C) / (A + B + C)

New adjusted number of shares = number of shares on the day before the ex-date \* (A + B + C) / A

Divisor: increases

*(12) Addition/deletion of a company*

No price adjustments are made. The change in market capitalization determines the divisor adjustment.

If the change in market capitalization between added and deleted companies of the EURO STOXX 50® Index increases (decreases), then the divisor increases (decreases). If the change is null, then the divisor remains unchanged.

*(13) Free float and shares changes*

No price adjustments are made. The change in market capitalization determines the divisor adjustment.



If the change in market capitalization of the EURO STOXX 50® Index increases (decreases), then the divisor increases (decreases). If the change is null, then the divisor remains unchanged.

*License Agreement between STOXX Limited and Goldman Sachs*

STOXX and its licensors (the "Licensors") have no relationship to GS Finance Corp., other than the licensing of the EURO STOXX 50® Index and the related trademarks for use in connection with the securities.

STOXX and its Licensors do not:

- Sponsor, endorse, sell or promote the securities.
- Recommend that any person invest in the securities or any other securities.
- Have any responsibility or liability for or make any decisions about the timing, amount or pricing of the securities.
- Have any responsibility or liability for the administration, management or marketing of the securities.
- Consider the needs of the securities or the owners of the securities in determining, composing or calculating the EURO STOXX 50® Index or have any obligation to do so.

**STOXX and its Licensors will not have any liability in connection with the securities. Specifically,**

- **STOXX and its Licensors do not make any warranty, express or implied and disclaim any and all warranty about:**
  - **The results to be obtained by the securities, the owner of the securities or any other person in connection with the use of the EURO STOXX 50® Index and the data included in the EURO STOXX 50® Index;**
  - **The accuracy or completeness of the EURO STOXX 50® Index and its data;**
  - **The merchantability and the fitness for a particular purpose or use of the EURO STOXX 50® Index and its data;**
- **STOXX and its Licensors will have no liability for any errors, omissions or interruptions in the EURO STOXX 50® Index or its data;**
- **Under no circumstances will STOXX or its Licensors be liable for any lost profits or indirect, punitive, special or consequential damages or losses, even if STOXX or its Licensors knows that they might occur.**

**The licensing agreement between Goldman Sachs International and STOXX is solely for their benefit, and the benefit of certain affiliates of Goldman Sachs International, and not for the benefit of the owners of the securities or any other third parties.**

## FTSE® 100 Index

The FTSE® 100 Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first launched with a base level of 1,000 as of December 30, 1983; and
- is sponsored, calculated, published and disseminated by FTSE Russell, a company owned by the London Stock Exchange Group companies (the “Exchange”) that we refer to as FTSE.

The FTSE® 100 Index is a market capitalization-weighted index of the 100 most highly capitalized U.K.-listed blue chip companies traded on the London Stock Exchange. Additional information on the FTSE® 100 Index (including the top five constituent stocks and weights and sector weights) is available from the following website: [ftse.com/products/indices/uk](http://ftse.com/products/indices/uk). We are not incorporating by reference the website or any material it includes in this underlier supplement.

### *FTSE® 100 Index Composition and Selection Criteria*

The FTSE® 100 Index consists of the 100 largest U.K.-listed blue chip companies, based on full market capitalization, that pass screening tests for free-float and liquidity. The FTSE® 100 Index is reviewed on a quarterly basis in March, June, September and December based on data at the end of day on the Tuesday before the first Friday of the review month. The FTSE Russell Europe, Middle East & Africa Regional Equity Advisory Committee, which we refer to as the Committee, meets quarterly to approve the constituents of the FTSE® 100 Index. For the avoidance of doubt, free float and shares in issue are updated in accordance with the index methodology. As a result, the free float or shares in issue at the index review cut-off date (and used for ranking purposes) may not mirror the most up-to-date company free float or shares in issue number at that date. Any constituent changes are implemented after the close of business on the third Friday of the review month (i.e. effective Monday), following the expiration of the Intercontinental Exchange Futures Europe futures and options contracts.

### *Eligibility Standards*

Only equity shares listed on the equity shares (commercial companies) or closed-ended investment fund categories, as defined by the Financial Conduct Authority in its Listing Rules Sourcebook, are eligible for inclusion in the FTSE® 100 Index.

For the avoidance of doubt, sovereign controlled commercial companies listed on the equity shares (commercial companies) category are eligible.

Equity shares listed on the following categories are not eligible:

- Equity shares (international commercial companies secondary listing)
- Equity shares (transition)
- Equity shares (shell companies)
- Non-equity shares and non-voting equity shares

Eligible stocks must pass free-float and liquidity screens before being included in the FTSE® 100 Index.

**Free-Float Screen** — With regard to free-float, a stock must have a minimum free float (as described below) of 10% if the issuing company is incorporated in the United Kingdom and 25% if it is a non-United Kingdom incorporated company. A new company may be initially included in the FTSE® 100 Index with a free float outside of the above parameters so long as it has an initial free float above 5% and it is expected to meet the minimum free float requirements within 12 months of its first day of trading.

**Foreign Ownership Restrictions and Minimum Headroom Requirement** — For the avoidance of doubt, a stock which restricts the number of shares that a UK investor can hold may be included in the FTSE® 100 Index with an investability weight equal to the foreign ownership limit. However, the actual calculated free float will be referenced to determine if the stock meets the minimum free float criteria for index eligibility.

**Minimum Voting Rights Screen** — Companies are required to have greater than 5% of the company's voting rights (aggregated across all its equity securities, including, where identifiable, those that are not listed or trading) in the hands of unrestricted shareholders in order to be eligible for index inclusion. The voting rights screen is applied to any potential new constituents on a quarterly basis, and existing constituents will be tested on an annual basis in conjunction with the June review. Current constituents who do not meet this requirement will be removed from the FTSE® 100 Index.

**Liquidity Screen** — With regard to liquidity, each eligible stock is tested for liquidity annually in June by calculating its median daily trading per month. When calculating the median of daily trades per month of any security, a minimum of five trading days in each month must exist, otherwise the month is excluded from the test. For the avoidance of doubt, where liquidity is tested up to the index review cut-off date, the index review month (e.g. March, June, September, December) will only be included in the test if there are a minimum of five trading days up to the index review cut-off date. Liquidity is tested from the first business day in May of the previous year to the last business day of April. The median trade is calculated by ranking each daily trade total and selecting the middle-ranking day. Any period of suspension is not included in the test. Where a security has a market quote in multiple currencies, only volume data from the eligible Sterling quote will be used in the liquidity test. The liquidity test is applied on a pro-rata basis where the testing period is less than 12 months. When conducting the liquidity test, no rounding is applied. For example, a constituent company with a monthly median turnover of 0.0149% will not be deemed to have passed the minimum 0.0150% threshold for the month tested. A stock not presently included in the FTSE® 100 Index that does not turnover at least 0.0250% of its shares in issue (after application of any investability weightings) based on its median daily trade per month in at least ten of the 12 months prior to the annual index review in June will not be eligible for inclusion until the next annual review. An existing constituent failing to trade at least 0.0150% of its shares in issue (after the application of any investability weightings) based on its median daily trade per month for at least eight of the 12 months prior to the annual index review will be removed from the FTSE® 100 Index and will not be eligible for inclusion until the next annual review. New issues or newly eligible securities must have a minimum trading record of at least 20 trading days prior to the review date and new issues must turnover at least 0.0250% of their shares in issue (after the application of any investability weightings) based on their median daily trade each month, on a pro-rata basis since eligible category listing or UK Nationality assignment date if non-UK incorporated.

For new issues or newly eligible securities that have a sole UK eligible category listing, no liquidity test is required for the purposes of nationality assignment. However, new issues or newly eligible securities must have a minimum 20 day trading record when reviewed at the index review cut-off date. In addition, they must have turnover of at least 0.0250% of their shares in issue (after the application of any investability weightings) based on their monthly median each month, on a pro-rata basis since the first day of unconditional dealings on the eligible category listing.

For new issues or newly eligible securities with multiple eligible exchange listings, a liquidity test is required to determine nationality assignment. The securities will be tested from the first day of unconditional dealings on the eligible category listing until the business day proceeding the nationality screen cut-off date. A security must demonstrate that it would pass the FTSE UK Index Series liquidity test (on a pro-rata basis) to be assigned UK nationality.

Once a UK nationality has been assigned, liquidity will be tested up to the index review cut-off date for the purposes of FTSE UK Index Series inclusion. They must turn over at least 0.0250% of their shares in issue (after the application of any investability weightings) based on their monthly median each month, on a pro-rata basis since the first day of unconditional dealings on the eligible category listing (where UK incorporated) or since the date of UK nationality assignment (where non-UK incorporated). A nationality assignment will be reviewed in the event that the country with greatest liquidity of an existing constituent is different to that assigned for two consecutive years. The eligible exchanges of listing will be reviewed using 12 month volume data up to the business day proceeding the nationality screen cut-off date. For the avoidance of doubt, country of greatest liquidity is determined by comparing each of the monthly liquidity test percentage results for a 12-month testing period. If as a result of the above, there is an even split (e.g., each country has 6 months where it exhibits greatest monthly median liquidity percentage when tested over a 12 month testing period), the following treatment shall apply: (i) an existing constituent will retain its current nationality and (ii) a new issue or newly eligible company will have its nationality assignment based on the country which exhibits the greatest liquidity using the latest three months of volume data.

For the avoidance of doubt, where a security has multiple eligible exchange listings and one or more listings has less than 12 months of available trading record, the liquidity test will use the maximum volume data available for each individual listing. A nationality assignment will be reviewed should a company make a change to its circumstances (e.g., a change in incorporation or adoption of an additional listing). The evolution of liquidity may be reviewed for a minimum period of three months up to a maximum period of up to 12 months. The country of greatest liquidity will be assessed as detailed above. At the conclusion of this review, the nationality of the company will either be retained or changed. For the avoidance of doubt, once nationality has been confirmed, liquidity would then need to be greatest in another location for two consecutive years to trigger a switch in nationality (or until current location fails the liquidity test).

**Price**— With regard to price, the Committee must be satisfied that an accurate and reliable price exists for purposes of determining the market value of a company. To be eligible for inclusion in the FTSE® 100 Index, a stock must have a full listing on the London Stock Exchange with a Sterling-denominated trading price on SETS (SETS is the London Stock Exchange's trading service for among other securities, those included in the FTSE® 100 Index).

**Market Capitalization Ranking** — Eligible stocks that pass the free-float and liquidity screens and that have an accurate and reliable price are ranked by the Committee according to their market capitalization before the application of any adjustments based on the extent to which the shares are publicly traded. Only the quoted equity capital of a constituent company will be included in the calculation of its market capitalization. Where a company has two or more classes of equity, secondary lines will be included in the calculation of the market capitalization of the company only if those lines are significant and liquid. For companies with a dual class share structure, the unlisted specified weighted voting rights shares will not be included in the calculation of the company's full market capitalization for ranking purposes. The Committee will add a stock to the FTSE® 100 Index at the quarterly review if it has risen to 90th place or above on the full market capitalization rankings and will delete a stock at the quarterly review if it has fallen to 111th place or below on these rankings. Market capitalization rankings are calculated using data as of the close of business on the day before the review. For the avoidance of doubt, the full and investable market capitalizations at the quarterly review cut-off date will be used to evaluate eligibility and index membership. However, free float and shares in issue updates which are due to be implemented on the review effective date will not be included in such calculation.

**100 Constituent Limitation** — The FTSE® 100 Index always contains 100 constituents. If a greater number of companies qualify to be inserted in the FTSE® 100 Index than qualify to be removed, the lowest ranking constituents of the FTSE® 100 Index will be removed so that the total number of stocks remains at 100 following inclusion of those that qualify to be inserted. Likewise, if a greater number of companies qualify to be removed than to be inserted at the quarterly review, securities of the highest ranking companies that are then not included in the FTSE® 100 Index will be inserted to match the number of companies being removed, in order to maintain the total at 100.

#### **Index Calculation**

The FTSE® 100 Index is a market capitalization weighted index. This means that the price movement of a larger company (that is, one representing larger percentage of the index) will have a greater effect on the price of the index than will the price movement of a smaller company (that is, one representing a smaller percentage of the index).

The value of the FTSE® 100 Index is represented by a fraction, (a) the numerator of which is the *sum* of the *product* of (i) the price of each component stock, (ii) the number of shares issued for each such component and (iii) a free float factor for each such component (described more fully below), and (b) the denominator of which is a divisor. The divisor represents the total issued share capital of the FTSE® 100 Index on the base date; the divisor may be adjusted as necessary to allow for changes in issued share capital of individual securities without distorting the FTSE® 100 Index.

As noted above, a free float factor is applied to each index component. By employing this approach, FTSE uses the investable market capitalization, not the total market capitalization, of each constituent to determine the value of the FTSE® 100 Index. Investable market capitalization depends on free float. The following are excluded from free float: shares directly owned by state, regional, municipal and local governments (excluding shares held by independently managed pension schemes for governments); shares held by directors, senior executives and managers of the company, and by their family and direct relations, and by companies with which they are affiliated; shares held within employee share plans; shares held by public companies or by non-listed subsidiaries

of public companies; shares held by sovereign wealth funds, founders, promoters, former directors, founding venture capital and private equity firms, private companies, individuals (including employees) and shares held by several holders acting in concert where the holding is 10% or greater of the total number of shares in issue; all shares where the holder is subject to a lock-up clause or has a stated incentive to retain the shares (for the duration of that clause or incentive, after which free float changes resulting from the expiration of a lock-up clause or incentive will be implemented at the next quarterly review subject to the expiration date of such lock-up clause or incentive occurring on or prior to the share and float change information cut-off date); shares held by an investor, investment company or an investment fund for publicly announced strategic reasons and shares held by an investor, investment company or an investment fund that has an employee on the board of directors of a company, has a shareholder agreement, has successfully placed a current member to the board of directors or has nominated a current member to the board of directors alongside a shareholder agreement with the company; and shares that are subject to ongoing contractual agreements (such as swaps) where they would ordinarily be treated as restricted. Shares disclosed as being held by a nominee account are typically regarded as free float, unless a restricted shareholder is identified as holding shares through such nominee account, in which case that portion of shares will be restricted from free float. In addition, while portfolio holdings such as pension funds, insurance funds or investment companies will generally not be considered as restricted from free float, where a single portfolio holding is 30% or greater it will be regarded as strategic and therefore restricted (and will remain restricted until the holding falls below 30%).

The FTSE® 100 Index is recalculated whenever inaccuracies occur that are deemed to be significant. Users of the FTSE® 100 Index are notified through appropriate media.

#### *Index Maintenance*

The FTSE® 100 Index is reviewed quarterly for changes in free float. A constituent's free float is updated during the June review regardless of the size of the change. At the March, September and December quarterly updates, a constituent with a free float greater than 15% will have its free float updated if it moves by more than 3% above or below the existing free float. A constituent with a free float of 15% or below will be subject to a 1% threshold. Free float changes resulting from corporate events will not be subject to the percentage change requirements, and will be implemented in line with the event. If a constituent is the target of a tender offer but the conditions for removal from the FTSE® 100 Index are not met, FTSE may implement a free float change when (i) the minimum acceptance level as stipulated by the acquirer has been met, (ii) shareholders have validly tendered and the shares have been irrevocably accepted for payment, and (iii) all pertinent offer conditions have been reasonably met.

If a merger or takeover results in one index constituent being absorbed by another constituent, the resulting company will remain a constituent and a vacancy will be created. This vacancy will be filled by selecting the highest ranking constituent of the FTSE All-Share Index (which is not currently a member of the FTSE® 100 Index) as at the close of the FTSE® 100 Index calculation two days prior to the deletion and related index adjustment. If an index constituent is taken over by a non-constituent company, the original constituent will be removed and may be replaced by the acquiring company where eligible for the FTSE® 100 Index. Otherwise the highest ranking constituent of the FTSE All-Share Index (which is not currently a member of the FTSE® 100 Index) will serve as the replacement. If a constituent company is split to form two or more companies, both eligible for the FTSE® 100 Index, then the resulting companies' index memberships will be re-assessed to rebalance the FTSE® 100 Index back to 100. The full market capitalizations at the close on the first day of trading of the spun-off company will be used to determine the most appropriate index memberships for continued inclusion. The changes will then be applied at market close giving two days' notice. Consequently, the FTSE® 100 Index may have more than 100 companies for three days (or more if the spun-off company does not trade on effective date). If the market price of a company resulting from a split is unavailable it may be retained in the FTSE® 100 Index for up to 20 business days and if trading has not commenced, it will be deleted at zero value. If a split results in the inclusion of an ineligible company, then the ineligible company will remain in the FTSE® 100 Index for two trading days and then be deleted at the market price. The eligible company will be retained in the FTSE® 100 Index as the replacement company and its continued index membership will be reviewed at the next quarterly index review. If a constituent is delisted, ceases to have a firm quotation or is subject to a takeover offer that has been declared wholly unconditional or has ceased to be a viable constituent as defined by the index methodology, it will be removed from the list of constituents and be replaced by the highest ranking constituent of the FTSE All-Share Index (which is not currently a member of the FTSE® 100 Index).

Adjustments due to mergers and acquisitions are applied to the FTSE® 100 Index after the action is determined to be final. In the event that a constituent is being acquired for cash or is delisted subsequent to an index review, such constituent will be removed from the FTSE® 100 Index in conjunction with the index review, assuming that the action is determined to be final and a minimum of two days' notice can be provided.

**Between constituents:** When mergers and acquisitions take place between companies that are both constituents of the FTSE® 100 Index for cash, the target company is deleted from the FTSE® 100 Index at the last traded price. When mergers and acquisitions take place between companies that are both constituents of the FTSE® 100 Index for stock, the target company is deleted from the FTSE® 100 Index and the shares of the acquiring stock are increased according to the offer terms. When mergers and acquisitions take place between companies that are both constituents of the FTSE® 100 Index for cash or stock or a combination thereof, the target company is deleted from the FTSE® 100 Index and the shares of the acquiring company are simultaneously increased per the merger terms.

**Between a constituent and a non-constituent:** If the target company is a member of the FTSE® 100 Index, it is deleted from the FTSE® 100 Index and the acquiring company will be included initially in the FTSE® 100 Index provided it is eligible in all other respects at the time of the merger, regardless of previous eligibility screenings. If the acquiring company is deemed eligible it will be added to the FTSE® 100 Index on the effective date and the opening price will be calculated using the offer terms. When a FTSE® 100 index constituent acquires a non-constituent that is a FTSE Russell Universe member, the shares of the member acquiring company will be updated to reflect the merger. Any share update will be made giving appropriate notice.

Given sufficient market hours after the confirmation of a merger or acquisition, FTSE effects the action after the close on the last day of trading of the target company, or at an appropriate time once the transaction has been deemed to be final.

If a constituent is the target of a tender offer, it will normally be removed from the FTSE® 100 Index with a minimum T+2 notice when (i)(a) the bidder's shareholding has reached at least 90%, (b) shareholders have validly tendered and the shares have been irrevocably accepted for payment, and (c) all pertinent offer conditions have been reasonably met and the acquirer has not explicitly stated in the official offer or results filings or press releases that it does not intend to acquire or squeeze out the remaining shares; (ii) there is reason to believe that the remaining free float is under 5% based on information available at the time; or (iii) following completion of the offer, the acquirer has stated that the offer has been declared wholly unconditional.

Where the conditions for index deletion are not met, FTSE Russell may implement a free float change based on the reported acceptance results at the expiration of the initial, subsequent or final offer period where (i) the minimum acceptance level as stipulated by the acquiror has been met; (ii) shareholders have validly tendered and the shares have been irrevocably accepted for payment; (iii) all pertinent offer conditions have been reasonably met and (iv) the change to the current float factor is greater than 3%. FTSE Russell uses the published results of the offer to determine the new free float of the target company. If no information is published in conjunction with the results from which FTSE Russell can determine which shareholders have and have not tendered, the free float change will reflect the total shares now owned by the acquiring company. A minimum T+2 notice period of the change is generally provided. Any subsequent disclosure on the updated shareholder structure will be reviewed during the quarterly review cycle. If the offer includes a stock consideration, the acquiring company's shares will be increased proportionate to the free float change of the target company. If the target company's free float change is greater than 3%, the associated change to the acquiring company's shares will be implemented regardless of size. Additionally, if the change to the target company is less than 3%, then no change will be implemented to the target or the acquiring company at the time of the event, regardless of any change to the acquiring company's shares. The target company will then be deleted as a second-step, if the conditions for deletion are achieved at the expiration of a subsequent offer period.

In exceptional circumstances, any review changes due to be effective for the companies involved in a tender offer may be retracted if FTSE Russell becomes aware of a tender offer which is due to complete on or around the effective date of such index review changes. Such exceptional circumstances may include undue price pressure being placed on the companies involved, or if proceeding with the review changes would compromise the replicability of the FTSE® 100 Index.

A stock will be deleted as a constituent if it is delisted from all eligible exchanges. A stock will be deleted if FTSE Russell becomes aware (in its country of its assigned nationality) that it has become bankrupt, has filed for bankruptcy protection, enters administration or receivership, commenced accelerated safeguarding procedures, is

insolvent or is liquidated (or local equivalents); or has filed for delisting and no regulatory or shareholder approvals are outstanding, converts into an ineligible corporate structure, or where evidence of a change in circumstances makes it ineligible for index inclusion. A stock which has been deleted from the FTSE® 100 Index as a result of bankruptcy protection or insolvency will only be re-considered for index eligibility after a period of 12 months from its deletion. For purposes of index eligibility, it will be treated as a new issue.

A stock will also be deleted if FTSE Russell becomes aware (at a quarterly review) that the price of an existing constituent has reached its minimum permissible trade price. The constituent will be removed from the index in line with the review subject to it still being at the minimum permissible trade price up to the start of the quarterly review lock down period.

*Capitalization Adjustments*

A secondary line of a company will be considered for index inclusion if its total market capitalization before the application of any adjustments based on the extent to which the shares are publicly traded, is greater than 25% of the total market capitalization of the company's principal line and the secondary line is eligible, in its own right. Should the total market capitalization of a secondary line fall below 20% of the total market capitalization of the company's principal line at an annual review, the secondary line will be deleted from the FTSE® 100 Index unless its total market capitalization remains above the qualification level for continued inclusion as a constituent of the FTSE® 100 Index at that review. Should the investable market capitalization of a secondary line, which is already a constituent of the FTSE All-Share Index, fall below the minimum investable market capitalization threshold for two consecutive quarters, it will be deleted from the FTSE® 100 Index at that quarterly or annual review. Where a company has partly paid shares, these shares, together with the outstanding call(s), are both included in the FTSE® 100 Index.

Share Weighting Changes — For the purposes of computing the FTSE® 100 Index, to prevent a large number of insignificant weighting changes, the number of shares in issue for each constituent security is amended only when the total shares in issue held within the index system changes by more than 1% on a cumulative basis or the total free float changes by more than 3% on a cumulative basis. A company with a free float of 15% or below will not be subject to the 3% threshold and will instead be updated if the change is greater than 1%. Changes will be made quarterly after the close of business on the third Friday of March, June, September and December. The data for these changes will be taken from the close of business on the last business day of January, April, July and October, respectively. If a corporate action is applied to a constituent which involves a change in the number of shares in issue, the change in shares will be applied simultaneously with the corporate action.

Shares in Issue Increase — When a company increases the number of shares it has in issue, the market capitalization of that company increases and the total market capitalization will rise accordingly. The FTSE® 100 Index divisor is adjusted to maintain a constant index value.

Weighting Amendments — The market capitalization of a company is adjusted to take account of various corporate actions. To prevent the value of the FTSE® 100 Index from changing due to such an event, all corporate actions which affect the market capitalization of the FTSE® 100 Index require an offsetting divisor adjustment. By adjusting the divisor, the value of the FTSE® 100 Index remains constant before and after the event. Below is a summary of the more frequent corporate actions and their resulting adjustment.

Type of Corporate Action	Adjustment	Adjustment to Divisor
Issue of new shares	Share weighting increased	Yes
Bonus issue of same stock or stock split	Number of shares held before issue or split divided by number of shares held after issue or split	No

Rights Issues/Entitlement Offers - These are an entitlement issued to shareholders which give them the right to buy additional shares directly from the company in proportion to existing holdings. FTSE will only adjust the FTSE® 100 Index to account for a right if the subscription price of the right is at a discount to the market price of the stock. Provided FTSE has been alerted to the rights offer prior to the ex-date, a price adjustment and share increase proportionate to the terms of the offer will be implemented before the open on the ex-date. The rights become attached to the shares on the ex-date.

Where the rights issue/entitlement offer subscription price remains unconfirmed on the ex-date, FTSE will estimate the subscription price using the value being raised and the offer terms. If the rights issue is greater than ten to one, FTSE will consider this "highly dilutive" and, to facilitate replication, will include on the ex-date a separate temporary line to reflect the market value of the rights (together with a temporary line at a fixed value to reflect the subscription cash) until the end of the subscription period, at which point the temporary lines will be deleted and the new shares will be consolidated into the existing share line.

Where the shares being issued are not entitled to the next dividend, FTSE will deviate from the standard index treatment and include on the ex-date a separate temporary line to reflect the market value of the rights (together with a temporary line at a fixed value to reflect the subscription cash). If the dividend ex-date occurs prior to the end of the rights subscription period, the temporary lines will be deleted and the new shares assimilated into the ordinary line at the open on the dividend ex-date. If the dividend ex-date occurs after the expiration of the rights subscription period, the temporary rights and cash line will be deleted after the close on the last day of the rights subscription period, and replaced by a temporary dummy line equal to the ordinary line close price minus the upcoming dividend. On the open of the ex-dividend date, the dummy line is deleted and the shares are aggregated with the ordinary line.

In the event the rights issue involves a non-constituent (including non-equity) and the value of the right cannot be determined, there will be no adjustment on the ex-date. If the rights are scheduled to trade, a rights line will be added to the FTSE® 100 Index at a value of zero on the ex-date and will be deleted from the FTSE® 100 Index at the market price when it commences trading, with T+5 notice. If the rights have not commenced trading within 20 business days of the ex-date, they will be removed at zero value. No cash temporary line will be included as the FTSE® 100 Index will not subscribe to the rights.

Where a company announces an open offer or a rights issue with an ex-entitlement date on the same day, FTSE will apply an index adjustment either before the market-open on the ex-entitlement day or as an intra-day adjustment as soon as possible thereafter. The adjustment will be applied based on the previous day's closing price with the new shares included in the index weighting at the open offer price.

In the case of an accelerated rights offer, where the ex-date is theoretical and typically not quoted by the exchange, shares are increased and a price adjustment is applied according to the terms of the offer before the open on the day the security resumes trading.

#### *Market Disruption*

If there is a system problem or situation in the market that is judged by FTSE to affect the quality of the constituent prices at any time when an index is being calculated, the index will be declared indicative (e.g. normally where a "fast market" exists in the equity market). The message "IND" will be displayed against the index value calculated by FTSE.

#### *License Agreement between FTSE and GS Finance Corp.*

The securities are not in any way sponsored, endorsed, sold or promoted by FTSE International Limited ("FTSE") or the London Stock Exchange Group companies ("LSEG") (together the "Licensor Parties") and none of the Licensor Parties make any claim, prediction, warranty or representation whatsoever, expressly or impliedly, either as to (i) the results to be obtained from the use of the FTSE® 100 Index (the "Index") (upon which the securities are based), (ii) the figure at which the Index is said to stand at any particular time on any particular day or otherwise, or (iii) the suitability of the Index for the purpose to which it is being put in connection with the securities. None of the Licensor Parties have provided or will provide any financial or investment advice or recommendation in relation to the Index to GS Finance Corp. or to its clients. The Index is calculated by FTSE or its agent. None of the Licensor Parties shall be (a) liable (whether in negligence or otherwise) to any person for any error in the Index or (b) under any obligation to advise any person of any error therein.

All rights in the Index vest in FTSE. "FTSE®" is a trade mark of LSEG and is used by FTSE under license.



## MSCI Indices

The MSCI EAFE Index, MSCI Singapore Free Index, MSCI Taiwan Index, MSCI Emerging Markets Index and the MSCI USA Index (each, an “index” and, collectively, the “MSCI Indices”):

- are equity indices, and therefore cannot be invested in directly;
- do not file reports with the SEC because they are not issuers; and
- are sponsored, calculated, published and disseminated daily by MSCI Inc., which we refer to as “MSCI”, through numerous data vendors, on the MSCI website and in real time on Bloomberg Financial Markets and Reuters Limited.

The MSCI Indices are all free float adjusted market capitalization indices and are part of the MSCI Global Investable Market Indices. The MSCI Indices are considered “standard” indices, which means they consist of all eligible large capitalization and mid-capitalization stocks, as determined by MSCI, in the relevant market. MSCI divides the companies included in the MSCI Indices into eleven Global Industry Classification Sectors: Communication Services, Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Information Technology, Materials, Real Estate and Utilities. Additional information about the MSCI Global Investable Market Indices (including the top ten constituent stocks and weights, sector weights and country weights) is available on the following website: [msci.com/index-methodology](https://www.msci.com/index-methodology). Daily closing level information for the MSCI Indices is available on the following website: [msci.com](https://www.msci.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

**MSCI EAFE Index.** The MSCI EAFE Index is intended to provide performance benchmarks for the developed equity markets in Australia, Austria, Belgium, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland and the United Kingdom. The constituent stocks of the MSCI EAFE Index are derived from the constituent stocks in the 21 MSCI standard single country indices for the developed market countries listed above. The MSCI EAFE Index has a base date of December 31, 1969.

**MSCI Singapore Free Index.** The MSCI Singapore Free Index is a developed market index that is designed to measure the market performance of equity securities in Singapore. The constituent stocks of the MSCI Singapore Free Index are selected from an eligible universe of equity securities listed on the Singapore Stock Exchange that includes companies listed on the Singapore Exchange Mainboard and Catalist market segments. Eligible classes of securities include ordinary shares, business trusts and stapled securities. The MSCI Singapore Free Index has a base date of December 31, 1987.

**MSCI Taiwan Index.** The MSCI Taiwan Index is an emerging market index that is designed to measure the market performance of equity securities in Taiwan. The constituent stocks of the MSCI Taiwan Index are selected from an eligible universe of stocks listed on the Taiwan Stock Exchange and the Taipei Exchange. Eligible classes of securities include ordinary shares and preferred shares that exhibit characteristics of equity securities. The MSCI Taiwan Index has a base date of December 31, 1987.

**MSCI Emerging Markets Index.** The MSCI Emerging Markets Index is intended to provide performance benchmarks for the emerging equity markets in the Americas, Europe, the Middle East, Africa and Asia, which are, as of the date of this underlier supplement, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Kuwait, Malaysia, Mexico, Peru, Philippines, Poland, Qatar, Saudi Arabia, South Africa, Taiwan, Thailand, Turkey and United Arab Emirates. The constituent stocks of the MSCI Emerging Markets Index are derived from the constituent stocks in the 24 MSCI standard single country indices for the emerging market countries listed above. As of the close on March 9, 2022, MSCI reclassified Russia from emerging markets status to standalone markets status. As a result, at that time, all stocks assigned to Russia were deleted from the MSCI Emerging Markets Index at a price that was effectively zero. The MSCI Emerging Markets Index has a base date of December 31, 1987.

**MSCI USA Index.** The MSCI USA Index is a free-float adjusted market capitalization weighted index that is designed to measure the performance of the large- and mid-cap segments of the U.S. equity market. The MSCI USA Index is member of the MSCI Global Equity Indices and represents the U.S. equity portion of the global benchmark MSCI ACWI Index. The MSCI USA Index has a base date of December 31, 1969.

### Construction of the MSCI Indices

MSCI undertakes an index construction process at an individual market level, which involves: (i) defining the equity universe for each market; (ii) determining the market investable equity universe for each market; (iii) determining market capitalization size segments for each market; (iv) applying index continuity rules for the standard index; and (v) classifying securities under the Global Industry Classification Standard. The index construction methodology differs in some cases depending on whether the relevant market is considered a developed market or an emerging market. The MSCI EAFE Index, the MSCI Singapore Free Index and MSCI USA Index are developed market indices, and the MSCI Taiwan Index and the MSCI Emerging Markets Index are emerging markets indices. All of the MSCI Indices are standard indices, meaning that only securities that would qualify for inclusion in a large cap index or a mid cap index will be included as described below.

#### Defining the Equity Universe

- (i) **Identifying Eligible Equity Securities:** The equity universe initially looks at securities listed in any of the countries in the MSCI global index series, which will be classified as either "developed markets" or "emerging markets". All listed equity securities, including real estate investment trusts and certain income trusts in Canada are eligible for inclusion in the equity universe. Limited partnerships, limited liability companies and business trusts, which are listed in the U.S. and are not structured to be taxed as limited partnerships, are likewise eligible for inclusion in the equity universe. Conversely, mutual funds, exchange traded funds, equity derivatives and most investment trusts are not eligible for inclusion in the equity universe. Preferred shares that exhibit characteristics of equity securities are eligible. Securities for which the Hong Kong Securities and Futures Commission has issued high shareholding concentration notices are not eligible.
- (ii) **Country Classification of Eligible Securities:** Each company and its securities (*i.e.*, share classes) are classified in one and only one country, which allows for a distinctive sorting of each company by its respective country.

#### Determining the Market Investable Equity Universes

A market investable equity universe for a market is derived by (i) identifying eligible listings for each security in the equity universe; and (ii) applying investability screens to individual companies and securities in the equity universe that are classified in that market. A market is generally equivalent to a single country. The global investable equity universe is the aggregation of all market investable equity universes.

- (i) **Identifying Eligible Listings:** A security may have a listing in the country where it is classified (a "local listing") and/or in a different country (a "foreign listing"). A security may be represented by either a local listing or a foreign listing (including a depositary receipt) in the global investable equity universe. A security may be represented by a foreign listing only if the security is classified in a country that meets the foreign listing materiality requirement (as described below), and the security's foreign listing is traded on an eligible stock exchange of a developed market country if the security is classified in a developed market country or, if the security is classified in an emerging market country, an eligible stock exchange of a developed market country or an emerging market country.  
  
In order for a country to meet the foreign listing materiality requirement, the following is determined: all securities represented by a foreign listing that would be included in the country's MSCI Country Investable Market Index if foreign listings were eligible from that country. The aggregate free-float adjusted market capitalization for all such securities should represent at least (i) 5% of the free float-adjusted market capitalization of the relevant MSCI Country Investable Market Index and (ii) 0.05% of the free-float adjusted market capitalization of the MSCI ACWI Investable Market Index. If a country does not meet the foreign listing materiality requirement, then securities in that country may not be represented by a foreign listing in the global investable equity universe.
- (ii) **Applying Investability Screens:** The investability screens used to determine the investable equity universe in each market are:
  - (a) **Equity Universe Minimum Size Requirement:** This investability screen is applied at the company level. In order to be included in a market investable equity universe, a company must have the required minimum full market capitalization. The equity universe minimum size requirement applies to companies in all markets and is derived as follows:

- First, the companies in the developed market equity universe are sorted in descending order of full market capitalization and the cumulative coverage of the free float-adjusted market capitalization of the developed market equity universe is calculated for each company. Each company's free float-adjusted market capitalization is represented by the aggregation of the free float-adjusted market capitalization of the securities of that company in the equity universe.
- Second, when the cumulative free float-adjusted market capitalization coverage of 99% of the sorted equity universe is achieved, by adding each company's free float-adjusted market capitalization in descending order, the full market capitalization of the company that reaches the 99% threshold defines the equity universe minimum size requirement.
- The rank of this company by descending order of full market capitalization within the developed market equity universe is noted, and will be used in determining the equity universe minimum size requirement at the next rebalance.

As of August 2024, the equity universe minimum size requirement was set at US\$383,000,000 for the Developed and Emerging Markets. Companies with a full market capitalization below this level are not included in any market investable equity universe. The equity universe minimum size requirement is reviewed and, if necessary, revised at each quarterly index review, as described below.

- (b) **Equity Universe Minimum Free Float-Adjusted Market Capitalization Requirement:** This investability screen is applied at the individual security level. To be eligible for inclusion in a market investable equity universe, a security must have a free float-adjusted market capitalization equal to or higher than 50% of the equity universe minimum size requirement.
- (c) **Minimum Liquidity Requirement:** This investability screen is applied at the individual security level. To be eligible for inclusion in a market investable equity universe, a security must have at least one eligible listing that has adequate liquidity as measured by its 12-month and 3-month annualized traded value ratio ("ATVR") and 3-month frequency of trading. The ATVR attempts to mitigate the impact of extreme daily trading volumes and takes into account the free float-adjusted market capitalization of securities. A minimum liquidity level of 20% of the 3-month ATVR and 90% of 3-month frequency of trading over the last 4 consecutive quarters, as well as 20% of the 12-month ATVR, are required for inclusion of a security in a market investable equity universe of a developed market. A minimum liquidity level of 15% of the 3-month ATVR and 80% of 3-month frequency of trading over the last 4 consecutive quarters, as well as 15% of the 12-month ATVR, are required for inclusion of a security in a market investable equity universe of an emerging market. Securities in the MSCI China equity universe will not be eligible for inclusion in the MSCI Emerging Markets Index if the security is suspended or has been suspended for 50 consecutive business days or more in the past 12 months.

Only one listing per security may be included in the market investable equity universe. In instances where a security has two or more eligible listings that meet the above liquidity requirements, then the following priority rules are used to determine which listing will be used for potential inclusion of the security in the market investable equity universe:

- (1) Local listing (if the security has two or more local listings, then the listing with the highest 3-month ATVR will be used).
- (2) Foreign listing in the same geographical region (MSCI classifies markets into three main geographical regions: EMEA, Asia Pacific and Americas. If the security has two or more foreign listings in the same geographical region, then the listing with the highest 3-month ATVR will be used).
- (3) Foreign listing in a different geographical region (if the security has two or more foreign listings in a different geographical region, then the listing with the highest 3-month ATVR will be used).

Due to liquidity concerns relating to securities trading at very high stock prices, a security that is currently not a constituent of a MSCI Global Investable Markets Index that is trading at a stock price above US\$10,000 will fail the liquidity screening and will not be included in any market investable equity universe.

- (d) **Global Minimum Foreign Inclusion Factor Requirement:** This investability screen is applied at the individual security level. To determine the free float of a security, MSCI considers the proportion of shares of such security available for purchase in the public equity markets by international investors. In practice, limitations on the investment opportunities for international investors include: strategic stakes in a company held by

private or public shareholders whose investment objective indicates that the shares held are not likely to be available in the market; limits on the proportion of a security's share capital authorized for purchase by non-domestic investors; or other foreign investment restrictions which materially limit the ability of foreign investors to freely invest in a particular equity market, sector or security.

MSCI will then derive a "foreign inclusion factor" for the company that reflects the proportion of shares outstanding that is available for purchase in the public equity markets by international investors. MSCI will then "float-adjust" the weight of each constituent company in an index by the company's foreign inclusion factor.

Once the free float factor has been determined for a security, the security's total market capitalization is then adjusted by such free float factor, resulting in the free float-adjusted market capitalization figure for the security.

- (e) Minimum Length of Trading Requirement: This investability screen is applied at the individual security level. For an initial public offering to be eligible for inclusion in a market investable equity universe, the new issue must have started trading at least three months before the implementation of a quarterly index review. This requirement is applicable to small new issues in all markets. Large initial public offerings are not subject to the minimum length of trading requirement and may be included in a market investable equity universe and a standard index, such as the MSCI Indices, outside of a quarterly index review.
- (f) Minimum Foreign Room Requirement: This investability screen is applied at the individual security level. For a security that is subject to a foreign ownership limit to be eligible for inclusion in a market investable equity universe, the proportion of shares still available to foreign investors relative to the maximum allowed (referred to as "foreign room") must be at least 15%.
- (g) Financial Reporting Requirement: For any companies classified as belonging to the United States, the company must file a Form 10-K/10-Q to be eligible for inclusion in the USA investable equity universe.

#### Determining Market Capitalization Size Segments for Each Market

Once a market investable equity universe is defined, it is segmented into the following size-based indices:

- Investable Market Index (Large Cap + Mid Cap + Small Cap)
- Standard Index (Large Cap + Mid Cap)
- Large Cap Index
- Mid Cap Index
- Small Cap Index

Creating the size segment indices in each market involves the following steps: (i) defining the market coverage target range for each size segment; (ii) determining the global minimum size range for each size segment; (iii) determining the market size segment cutoffs and associated segment number of companies; (iv) assigning companies to the size segments; and (v) applying final size-segment investability requirements. For developed market indices and emerging market indices, the market coverage for a standard index is 85% and 42.5% respectively. As of July 2024, the global minimum size range for a developed market standard index is a full market capitalization of USD 5.52 billion to USD 12.69 billion, and the global minimum size range for an emerging market standard index is a full market capitalization of USD 2.76 billion to USD 6.35 billion.

#### Index Continuity Rules for Standard Indices

In order to achieve index continuity, as well as provide some basic level of diversification within a market index, notwithstanding the effect of other index construction rules, a minimum number of five constituents will be maintained for a developed market standard index and a minimum number of three constituents will be maintained for an emerging market standard index, and involves the following steps:

- If after the application of the index construction methodology, a developed market standard index contains fewer than five securities or an emerging market standard index contains fewer than three securities, then the largest securities by free float-adjusted market capitalization are added to the index in order to reach the minimum number of required constituents.

- At subsequent quarterly index reviews, if the minimum number of securities described above is not met, then after the market investable equity universe is identified, the securities are ranked by free float-adjusted market capitalization, however, in order to increase stability the free float-adjusted market capitalization of the existing index constituents (prior to review) is multiplied by 1.50, and securities are added until the desired minimum number of securities is reached.

#### Classifying Securities under the Global Industry Classification Standard

All securities in the global investable equity universe are assigned to the industry that best describes their business activities. The GICS classification of each security is used by MSCI to construct additional indices.

#### *Calculation Methodologies for the MSCI Indices*

##### Price Return Methodology

The performance of each of the MSCI EAFE Index, the MSCI Singapore Free Index, the MSCI Taiwan Index, the MSCI Emerging Markets Index and MSCI USA Index is a free float weighted average of the U.S. dollar values of their component securities.

Prices used to calculate the component securities are the official exchange closing prices or prices accepted as such in the relevant market. In the case of a market closure, or if a security does not trade on a specific day or during a specific period, MSCI carries the latest available closing price. In the event of a market outage resulting in any component security price to be unavailable, MSCI will generally use the last reported price for such component security for the purpose of performance calculation. If MSCI determines that another price is more appropriate based on the circumstances, an announcement would be sent to clients with the related information. Closing prices are converted into U.S. dollars, as applicable, using the closing spot exchange rates calculated by WM/Refinitiv at 4:00 P.M. London Time.

##### Net Daily Total Return Methodology

The applicable pricing supplement will specify if the underlier for your securities follows the net daily total return methodology. A daily total return index measures the market performance, including price performance discussed under "Price Return Methodology" above and income from regular cash distributions, while a net daily total return index measures the price performance and income from dividends, net of certain withholding taxes. MSCI calculates withholding taxes using the highest applicable withholding tax rate applicable to institutional investors. The current withholding tax rate used by MSCI to calculate the MSCI Singapore Free Index is 0% except for real estate investment trusts, in which case the rate is 10%, and the withholding tax rate used to calculate the MSCI Taiwan Index is 20% except for real estate investment trusts, in which case the rate is 15%. This net income is reinvested among all the constituents in the index and thus makes up part of the total index performance. MSCI's net daily total return methodology reinvests net cash dividends in indices the day the security is quoted ex-dividend, or on the ex-date (converted to U.S. dollars, as applicable). Certain dividends, including special/extraordinary dividends and commemorative dividends, are reinvested in the index if, a day prior to the ex-date, the dividend impact on price is less than 5%. If the impact is 5% or more, the dividend will be reinvested in the index through a price adjustment on the ex-date. A specific price adjustment is always applied for stock dividends that are issued at no cost to the shareholders, an extraordinary capital repayment or a dividend paid in the shares of another company. Cash payments related to corporate events, such as mergers and acquisitions, are considered on a case-by-case basis.

#### *Maintenance of the MSCI Indices*

In order to maintain the representativeness of the MSCI Indices, structural changes to each MSCI Index as a whole may be made by adding or deleting component securities. Currently, such changes in the MSCI Indices may generally only be made on four dates throughout the year: after the close of the last business day of each February, May, August and November.

Each country index is maintained with the objective of reflecting, on a timely basis, the evolution of the underlying equity markets. In maintaining each component country index, emphasis is also placed on its continuity, continuous investability of constituents and replicability of the index and on index stability and minimizing turnover.

MSCI classifies index maintenance in three broad categories. The first consists of ongoing event related changes, such as mergers and acquisitions, which are generally implemented in the country indices in which they occur. The second category consists of light rebalancings, aimed at promptly reflecting other significant market events

under conditions of market stress. The third category consists of quarterly index reviews that systematically re-assess the various dimensions of the equity universe.

Ongoing event-related changes to the country indices are the result of mergers, acquisitions, spin-offs, bankruptcies, reorganizations and other similar corporate events. They can also result from capital reorganizations in the form of rights issues, stock bonus issues, public placements and other similar corporate actions that take place on a continuing basis. MSCI will remove from the index as soon as practicable securities of companies that file for bankruptcy or other protection from their creditors, that are suspended and for which a return to normal business activity and trading is unlikely in the near future, or that fail stock exchange listing requirements with a delisting announcement. Securities may also be considered for early deletion in other significant cases, such as decreases in free float and foreign ownership limits, or when a constituent company acquires or merges with a non-constituent company or spins-off another company. In practice, when a constituent company is involved in a corporate event which results in a significant decrease in the company's free float-adjusted market capitalization or the company decreases its foreign inclusion factor to below 0.15, the securities of that constituent company are considered for early deletion from the indices simultaneously with the event unless, in either case, it is a standard index constituent with a minimum free float-adjusted market capitalization meeting at least two-thirds of 1.8 times one-half of the standard index interim size segment cut-off. Share conversions may also give rise to an early deletion. Changes in number of shares and foreign inclusion factors resulting from primary equity offerings representing at least 5% of the security's pre-event number of shares are implemented as of the close of the first trading day of the new shares, if all necessary information is available at that time. Otherwise, the event is implemented as soon as practicable after the relevant information is made available. MSCI implements pending number of shares and/or free float updates simultaneously with the event, unless the change in number of shares is less than 1% on a post-event number of shares basis, in which case it will be implemented at a subsequent quarterly index review. Changes that do not meet the criteria for implementation at the time of the event as explained above are implemented at a subsequent quarterly index review. Secondary offerings/block sales with sizes representing at least 5% of the security's pre-event number of shares are implemented at the time of the event. All changes resulting from corporate events are announced prior to their implementation, provided all necessary information on the event is available.

MSCI's light rebalancing process aims to ensure that the country indices continue to be an accurate reflection of evolving equity markets during conditions of market stress. This goal is achieved by timely reflecting significant market driven changes that were not captured in each index at the time of their actual occurrence and that should not wait until the quarterly index review due to their importance. MSCI will consider switching to a "light rebalancing" in place of the usual quarterly index review only if one of the following two conditions is met within the last ten business days of the month prior to the announcement date of a quarterly index review (the "market monitoring period"): (1) for any 3 days within the market monitoring period, the MSCI ACWI Index-weighted bid-ask spread breaches 0.19% and the MSCI ACWI Index volatility over the past 10 days breaks 0.55 or (2) there are unexpected full day or partial stock exchange closures impacting 20% of MSCI ACWI Index constituents cumulatively over the market monitoring period. The final decision of whether or not to switch to a "light rebalancing" will be taken by relevant MSCI index committee(s). These light rebalancings may result in additions and deletions of component securities from a country index (or a security being removed from one country listing and represented by a different country listing) and changes in "foreign inclusion factors" and in number of shares. Additions and deletions to component securities may result from: the addition of large companies that did not meet the minimum size criterion for inclusion at the time of their initial public offering or secondary offering; the replacement of companies which are no longer suitable industry representatives; the deletion of securities whose overall free float has fallen to less than 15% and that do not meet specified criteria; the deletion of securities that have become very small or illiquid; and the addition or deletion of securities as a result of other market events. During light rebalancings, foreign inclusion factors and number of shares will be reviewed as discussed below. MSCI has noted that consistency is a factor in maintaining each component country index.

MSCI's quarterly index review is designed to systematically reassess the component securities of the index. During each quarterly index review, the universe of component securities is updated and the global minimum size range for the index is recalculated, which is based on the full market capitalization and the cumulative free float-adjusted market capitalization coverage of each security that is eligible to be included in the index. The following index maintenance activities, among others, are undertaken during each quarterly index review: the list of countries in which securities may be represented by foreign listings is reviewed; the component securities are updated by identifying new equity securities that were not part of the index at the time of the previous quarterly index review; the minimum size requirement for the index is updated and new companies are evaluated relative to

the new minimum size requirement; existing component securities that do not meet the minimum liquidity requirements of the index may be removed (or, with respect to any such security that has other listings, a determination is made as to whether any such listing can be used to represent the security in the market investable universe); changes in "foreign inclusion factors" are implemented (provided the change in free float is greater than 1%, except in cases of correction); and changes in number of shares are updated. During a quarterly index review, component securities may be added or deleted from a country index for a range of reasons, including the reasons discussed with respect to component securities changes during quarterly index reviews as discussed above. However, no changes in foreign inclusion factors are implemented if the change in free float estimate is less than 1%, except in cases of correction. As discussed above, small changes in the number of shares are generally updated at the quarterly index review rather than at the time of the event, provided that the absolute number of shares change is at least 1,000 shares or the relative number of shares change is at least 0.02%. Foreign listings may become eligible to represent securities only from the countries that met the foreign listing materiality requirement at least two quarterly index reviews prior (this requirement is applied only to countries that do not yet include foreign listed securities). Once a country meets the foreign listing materiality requirement at a given quarterly index review, foreign listings will remain eligible for such country even if the foreign listing materiality requirements are not met in the future.

The results of the quarterly index reviews are announced at least two weeks in advance of their effective implementation dates, which are generally set at the close of the last business day of February, May, August and November.

Index maintenance also includes monitoring and completing adjustments for share changes, stock splits, stock dividends, and stock price adjustments due to company restructurings or spin-offs as well as deleting constituents that enter ineligible alert boards.

These guidelines and the policies implementing the guidelines are the responsibility of, and, ultimately, subject to adjustment by, MSCI.

*License Agreement between MSCI Inc. ("MSCI") and GS Finance Corp.*

The MSCI indices are the exclusive property of MSCI. MSCI and the MSCI index names are service mark(s) of MSCI or its affiliates and have been licensed for use for certain purposes by GS Finance Corp. Securities referred to herein are not sponsored, endorsed, or promoted by MSCI, and MSCI bears no liability with respect to any such securities. No purchaser, seller or holder of securities, or any other person or entity, should use or refer to any MSCI trade name, trademark or service mark to sponsor, endorse, market or promote securities without first contacting MSCI to determine whether MSCI's permission is required. Under no circumstances may any person or entity claim any affiliation with MSCI without the prior written permission of MSCI.

THE SECURITIES ARE NOT SPONSORED, ENDORSED, SOLD OR PROMOTED BY MSCI, ANY AFFILIATE OF MSCI INC. OR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING ANY MSCI INDEX. THE MSCI INDEXES ARE THE EXCLUSIVE PROPERTY OF MSCI. MSCI AND THE MSCI INDEX NAMES ARE SERVICE MARK(S) OF MSCI OR ITS AFFILIATES AND HAVE BEEN LICENSED FOR USE FOR CERTAIN PURPOSES BY GS FINANCE CORP. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING ANY MSCI INDEX MAKES ANY REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, TO THE OWNERS OF SECURITIES OR ANY MEMBER OF THE PUBLIC REGARDING THE ADVISABILITY OF INVESTING IN FINANCIAL SECURITIES GENERALLY OR IN SECURITIES PARTICULARLY OR THE ABILITY OF ANY MSCI INDEX TO TRACK CORRESPONDING STOCK MARKET PERFORMANCE. MSCI OR ITS AFFILIATES ARE THE LICENSORS OF CERTAIN TRADEMARKS, SERVICE MARKS AND TRADE NAMES AND OF THE MSCI INDEXES WHICH ARE DETERMINED, COMPOSED AND CALCULATED BY MSCI WITHOUT REGARD TO SECURITIES OR THE ISSUER OR OWNER OF SECURITIES. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING ANY MSCI INDEX HAS ANY OBLIGATION TO TAKE THE NEEDS OF THE ISSUERS OR OWNERS OF SECURITIES INTO CONSIDERATION IN DETERMINING, COMPOSING OR CALCULATING THE MSCI INDEXES. NEITHER MSCI, ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING ANY MSCI INDEX IS RESPONSIBLE FOR OR HAS PARTICIPATED IN THE DETERMINATION OF THE TIMING OF, PRICES AT, OR QUANTITIES OF SECURITIES TO BE ISSUED OR IN THE DETERMINATION OR CALCULATION OF THE EQUATION BY WHICH SECURITIES ARE REDEEMABLE FOR CASH. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, THE MAKING OR COMPILING ANY

MSCI INDEX HAS ANY OBLIGATION OR LIABILITY TO THE OWNERS OF SECURITIES IN CONNECTION WITH THE ADMINISTRATION, MARKETING OR OFFERING OF SECURITIES. ALTHOUGH MSCI SHALL OBTAIN INFORMATION FOR INCLUSION IN OR FOR USE IN THE CALCULATION OF THE MSCI INDEXES FROM SOURCES WHICH MSCI CONSIDERS RELIABLE, NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO MAKING OR COMPILING ANY MSCI INDEX WARRANTS OR GUARANTEES THE ORIGINALITY, ACCURACY AND/OR THE COMPLETENESS OF ANY MSCI INDEX OR ANY DATA INCLUDED THEREIN. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING ANY MSCI INDEX MAKES ANY WARRANTY, EXPRESS OR IMPLIED, AS TO RESULTS TO BE OBTAINED BY GS FINANCE CORP., ITS CUSTOMERS OR COUNTERPARTIES, ISSUERS OF UNDERLIER LINKED-SECURITIES, OWNERS OF SECURITIES OR ANY OTHER PERSON OR ENTITY, FROM THE USE OF ANY MSCI INDEX OR ANY DATA INCLUDED THEREIN IN CONNECTION WITH THE RIGHTS LICENSED HEREUNDER OR FOR ANY OTHER USE. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING ANY MSCI INDEX SHALL HAVE ANY LIABILITY FOR ANY ERRORS, OMISSIONS OR INTERRUPTIONS OF OR IN CONNECTION WITH ANY MSCI INDEX OR ANY DATA INCLUDED THEREIN. FURTHER, NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING ANY MSCI INDEX MAKES ANY EXPRESS OR IMPLIED WARRANTIES OF ANY KIND, AND MSCI, ANY OF ITS AFFILIATES AND ANY OTHER PARTY INVOLVED IN, OR RELATED TO MAKING OR COMPILING ANY MSCI INDEX HEREBY EXPRESSLY DISCLAIM ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO ANY MSCI INDEX AND ANY DATA INCLUDED THEREIN. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT SHALL MSCI, ANY OF ITS AFFILIATES OR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING ANY MSCI INDEX HAVE ANY LIABILITY FOR ANY DIRECT, INDIRECT, SPECIAL, PUNITIVE, CONSEQUENTIAL OR ANY OTHER DAMAGES (INCLUDING LOST PROFITS) EVEN IF NOTIFIED OF THE POSSIBILITY OF SUCH DAMAGES.



## MSCI USA Momentum Top 50 Select Index

The MSCI USA Momentum Top 50 Select Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was launched on August 4, 2020 at an initial value of USD 6,078.6053; and
- is maintained by MSCI Inc. (“MSCI”).

The MSCI USA Momentum Top 50 Select Index is designed to measure the performance of an equity momentum strategy applied to the MSCI USA Index. The MSCI USA Index is a free-float adjusted market capitalization weighted index of large- and mid-cap U.S. companies. The MSCI USA Momentum Top 50 Select Index is calculated in U.S. dollars on a price return basis. Additional information about the MSCI USA Momentum Top 50 Select Index (including the top ten constituent stocks and weights and sector weights) is available on the following website: [msci.com/index-methodology](https://msci.com/index-methodology). We are not incorporating by reference the website or any material it includes in this underlier supplement.

For the avoidance of doubt, the momentum scores used by the index are not defined in the same way as those used by the MSCI Momentum Indexes.

### Construction of the MSCI USA Momentum Top 50 Select Index

The MSCI USA Momentum Top 50 Select Index is constructed by selecting the 50 securities from the MSCI USA Index with the highest unwinsorized momentum z-scores subject to certain limitations on turnover, as described below under “Selecting Constituent Securities.” For more information about the MSCI USA Index, see “MSCI USA Index” below.

#### Calculating the Momentum Score

In order to calculate the momentum score for a security, the first step is to calculate the momentum value for the security. The momentum value for a security is determined using the 6-month price momentum of the security by calculating: (a) (i) the *quotient* of (A) the price of the security one month prior to the rebalancing date *divided* by (B) the price of the security seven months prior to the rebalancing date, *minus* (ii) 1, *minus* (b) the local risk-free rate, which is the 3-month Treasury bill rate on the rebalancing date. If the 6-month price momentum for a security is not available, the momentum value for the security is not calculated and the security is not considered for inclusion in the MSCI USA Momentum Top 50 Select Index.

Second, the momentum z-score for the security is calculated. The momentum z-score for a security equals the number of standard deviations the momentum value for the security is from the average momentum value for all of the securities in the MSCI USA Index for which a momentum value can be calculated.

Third, the momentum z-score is then winsorized at +/- 3 in order to minimize outliers, i.e., a momentum z-score above 3 is capped at 3 standard deviations and a momentum z-score below -3 is floored at -3 standard deviations.

Fourth, the final momentum score is then computed from the momentum z-scores as follows:

- (i) If the momentum z-score is *greater than* or *equal to* 0, the final momentum score equals 1 *plus* the momentum z-score; or
- (ii) If the momentum z-score is *less than* 0, the final momentum score equals the *quotient* of (i) 1 *divided* by (ii) the *difference* of 1 *minus* the momentum z-score.

#### Selecting Constituent Securities

At each quarterly index review all existing constituents of the MSCI USA Index are ranked in the descending order of their unwinsorized momentum z-score. If multiple securities have the same unwinsorized momentum z-score, then the security having a higher weight in the MSCI USA Index is given a higher rank for purposes of the MSCI USA Momentum Top 50 Select Index.

The top 25 securities by rank are automatically selected for inclusion in the MSCI USA Momentum Top 50 Select Index. To reduce index turnover and enhance index stability, existing constituents that have a momentum rank between 26 and 75 are then successively added until the number of securities in the MSCI USA Momentum Top

50 Select Index reaches 50. If the number of securities is below 50 after this step, the remaining securities in the MSCI USA Index with the highest momentum rank are added until the number of securities in the MSCI USA Momentum Top 50 Select Index reaches 50.

Weighting Scheme for the MSCI USA Momentum Top 50 Select Index

The weight of each security selected for the MSCI USA Momentum Top 50 Select Index is calculated in three steps.

First, for each security selected for the MSCI USA Momentum Top 50 Select Index, the pro forma weight is calculated as follows: the product of the security's free-float adjusted market capitalization in the MSCI USA Index times the security's momentum score.

Second, these pro forma weights are then normalized to 100.

Third, to avoid concentration, each GICS sector in the MSCI USA Momentum Top 50 Select Index is capped at a 50% weighting, while each issuer is capped at a 5% weighting. The excess weight due to sector capping is allocated to the other sectors in proportion to their weight prior to such capping. The excess weight due to issuer capping is allocated to other issuers within the same sector in proportion to their weight prior to such capping.

**Maintenance of the MSCI USA Momentum Top 50 Select Index**

Quarterly Index Reviews

The MSCI USA Momentum Top 50 Select Index is reviewed on a quarterly basis to coincide with the regular semi-annual and quarterly index reviews of the MSCI USA Index. The changes are implemented as of the close of the last business day of February, May, August and November. The pro forma index is in general announced nine business days before the effective date.

Ongoing Event Related Changes

The general treatment of corporate events in the MSCI USA Momentum Top 50 Select Index aims to minimize turnover outside of index reviews. The methodology aims to appropriately represent an investor's participation in an event based on relevant deal terms and pre-event weighting of the index constituents that are involved. The following section briefly describes the treatment of common corporate events within the MSCI USA Momentum Top 50 Select Index. Further, changes in index market capitalization that occur as a result of corporate event implementation will be offset by a corresponding change in the variable weighting factor of the constituent, which is used to neutralize the impact of the change in index market capitalization on the level of the index. Additionally, the changes made to the MSCI USA Index during its quarterly index reviews (described below) will be neutralized in the MSCI USA Momentum Top 50 Select Index.

No new securities will be added to the MSCI USA Momentum Top 50 Select Index (except where noted below) between index reviews. MSCI USA Index deletions will be reflected simultaneously in the MSCI USA Momentum Top 50 Select Index.

Event Type	Event Details
New additions to the MSCI USA Index	A new security added to the MSCI USA Index (such as IPO and other early inclusions) will not be added to the MSCI USA Momentum Top 50 Select Index.
Spin-Offs	All securities created as a result of the spin-off of an existing MSCI USA Momentum Top 50 Select Index constituent will be added to the MSCI USA Momentum Top 50 Select Index at the time of event implementation. Reevaluation for continued inclusion in the MSCI USA Momentum Top 50 Select Index will occur at the subsequent index review. For mergers and acquisitions, the acquirer's post event weight will account for the proportionate amount of shares involved in deal consideration, while cash proceeds will be invested across the MSCI USA Momentum Top 50 Select Index.
Merger/acquisition	If an existing MSCI USA Momentum Top 50 Select Index constituent is acquired by a security that is not a constituent of the MSCI USA Momentum Top 50 Select Index, the existing constituent will be deleted from the MSCI USA Momentum

Changes in security characteristics

Top 50 Select Index and the acquiring non-constituent will not be added to the MSCI USA Momentum Top 50 Select Index. A security will continue to be a constituent of the MSCI USA Momentum Top 50 Select Index if there are changes in characteristics (country, sector, size segment, etc.). Reevaluation for continued inclusion in the MSCI USA Momentum Top 50 Select Index will occur at the subsequent index review.

**For information about the construction, calculation methodology and maintenance of the MSCI USA Index, please see “—MSCI Indices” above.**

*License Agreement between MSCI Inc. (“MSCI”) and GS Finance Corp.*

The MSCI USA Momentum Top 50 Select Index and the MSCI USA Index are the exclusive property of MSCI. MSCI and the MSCI USA Momentum Top 50 Select Index and the MSCI USA Index are service mark(s) of MSCI or its affiliates and have been licensed for use for certain purposes by GS Finance Corp. Securities referred to herein are not sponsored, endorsed, or promoted by MSCI, and MSCI bears no liability with respect to any such securities. No purchaser, seller or holder of securities, or any other person or entity, should use or refer to any MSCI trade name, trademark or service mark to sponsor, endorse, market or promote securities without first contacting MSCI to determine whether MSCI's permission is required. Under no circumstances may any person or entity claim any affiliation with MSCI without the prior written permission of MSCI.

THE SECURITIES ARE NOT SPONSORED, ENDORSED, SOLD OR PROMOTED BY MSCI, ANY AFFILIATE OF MSCI INC. OR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX. THE MSCI USA MOMENTUM TOP 50 SELECT INDEX AND THE MSCI USA INDEX ARE THE EXCLUSIVE PROPERTY OF MSCI. MSCI AND THE MSCI USA MOMENTUM TOP 50 SELECT INDEX AND THE MSCI USA INDEX ARE SERVICE MARK(S) OF MSCI OR ITS AFFILIATES AND HAVE BEEN LICENSED FOR USE FOR CERTAIN PURPOSES BY GS FINANCE CORP. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX MAKES ANY REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, TO THE OWNERS OF SECURITIES OR ANY MEMBER OF THE PUBLIC REGARDING THE ADVISABILITY OF INVESTING IN FINANCIAL SECURITIES GENERALLY OR IN SECURITIES PARTICULARLY OR THE ABILITY OF THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX TO TRACK CORRESPONDING STOCK MARKET PERFORMANCE. MSCI OR ITS AFFILIATES ARE THE LICENSORS OF CERTAIN TRADEMARKS, SERVICE MARKS AND TRADE NAMES AND OF THE MSCI USA MOMENTUM TOP 50 SELECT INDEX AND THE MSCI USA INDEX WHICH ARE DETERMINED, COMPOSED AND CALCULATED BY MSCI WITHOUT REGARD TO SECURITIES OR THE ISSUER OR OWNER OF SECURITIES. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX HAS ANY OBLIGATION TO TAKE THE NEEDS OF THE ISSUERS OR OWNERS OF SECURITIES INTO CONSIDERATION IN DETERMINING, COMPOSING OR CALCULATING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX AND THE MSCI USA INDEX. NEITHER MSCI, ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX IS RESPONSIBLE FOR OR HAS PARTICIPATED IN THE DETERMINATION OF THE TIMING OF, PRICES AT, OR QUANTITIES OF SECURITIES TO BE ISSUED OR IN THE DETERMINATION OR CALCULATION OF THE EQUATION BY WHICH SECURITIES ARE REDEEMABLE FOR CASH. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, THE MAKING OR COMPILING OF THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX HAS ANY OBLIGATION OR LIABILITY TO THE OWNERS OF SECURITIES IN CONNECTION WITH THE ADMINISTRATION, MARKETING OR OFFERING OF SECURITIES.

ALTHOUGH MSCI SHALL OBTAIN INFORMATION FOR INCLUSION IN OR FOR USE IN THE CALCULATION OF THE MSCI USA MOMENTUM TOP 50 SELECT INDEX AND THE MSCI USA INDEX FROM SOURCES WHICH MSCI CONSIDERS RELIABLE, NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX WARRANTS OR GUARANTEES THE ORIGINALITY, ACCURACY AND/OR THE COMPLETENESS OF THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX OR ANY DATA INCLUDED THEREIN. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY

INVOLVED IN, OR RELATED TO, MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX MAKES ANY WARRANTY, EXPRESS OR IMPLIED, AS TO RESULTS TO BE OBTAINED BY GS FINANCE CORP., ITS CUSTOMERS OR COUNTERPARTIES, ISSUERS OF UNDERLIER LINKED-SECURITIES, OWNERS OF SECURITIES OR ANY OTHER PERSON OR ENTITY, FROM THE USE OF THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX OR ANY DATA INCLUDED THEREIN IN CONNECTION WITH THE RIGHTS LICENSED HEREUNDER OR FOR ANY OTHER USE. NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX SHALL HAVE ANY LIABILITY FOR ANY ERRORS, OMISSIONS OR INTERRUPTIONS OF OR IN CONNECTION WITH THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX OR ANY DATA INCLUDED THEREIN. FURTHER, NEITHER MSCI, ANY OF ITS AFFILIATES NOR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX MAKES ANY EXPRESS OR IMPLIED WARRANTIES OF ANY KIND, AND MSCI, ANY OF ITS AFFILIATES AND ANY OTHER PARTY INVOLVED IN, OR RELATED TO MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX HEREBY EXPRESSLY DISCLAIM ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX AND ANY DATA INCLUDED THEREIN. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT SHALL MSCI, ANY OF ITS AFFILIATES OR ANY OTHER PARTY INVOLVED IN, OR RELATED TO, MAKING OR COMPILING THE MSCI USA MOMENTUM TOP 50 SELECT INDEX OR THE MSCI USA INDEX HAVE ANY LIABILITY FOR ANY DIRECT, INDIRECT, SPECIAL, PUNITIVE, CONSEQUENTIAL OR ANY OTHER DAMAGES (INCLUDING LOST PROFITS) EVEN IF NOTIFIED OF THE POSSIBILITY OF SUCH DAMAGES.

## Nasdaq-100 Futures Excess Return™ Index

The Nasdaq-100 Futures Excess Return™ Index, which we also refer to in this description as the “index”:

- is an equity futures index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of April 1, 2024, with a base value of 100 as of its base date, September 30, 1999; and
- is sponsored by Nasdaq, Inc. (“Nasdaq”).

The Nasdaq-100 Futures Excess Return™ Index is designed to measure the performance of the nearest expiring quarterly E-mini Nasdaq-100 futures contract (symbol: “NQ”) trading on the Chicago Mercantile Exchange (“CME”). E-mini Nasdaq-100 futures contracts are quarterly contracts to buy or sell standardized trading “units”. One trading unit of the E-mini Nasdaq-100 futures contract equals \$20 multiplied by the Nasdaq-100 index (price return version). The Nasdaq-100 Index® is designed to measure the performance of 100 of the largest Nasdaq listed non-financial stocks. The index is calculated in U.S. dollars (\$) on an excess return basis. The index and the Nasdaq-100 Index® are calculated, maintained and published by Nasdaq. Additional information about the index and the Nasdaq-100 Index® (including sector weights) is available on the following websites: <https://indexes.nasdaqomx.com/Index/Overview/NDXNQER> and [indexes.nasdaqomx.com/Index/Overview/NDX](https://indexes.nasdaqomx.com/Index/Overview/NDX). We are not incorporating by reference the websites or any material they include in this underlier supplement.

### Index Construction

The index is constructed from a single E-mini Nasdaq-100 futures contract with a provision for the replacement of the current E-mini Nasdaq-100 futures contract as the contract approaches expiration. On each index calculation day (which is each weekday that is not a day when CME is scheduled to be closed) prior to each roll period start date (defined below), the next E-mini Nasdaq-100 futures contract is determined as the E-mini Nasdaq-100 futures contract that expires in the next calendar quarter (which is approximately three months out). Thus, there will be two E-mini Nasdaq-100 futures contracts (collectively, the components) during a roll period (defined below): the current contract approaching expiration and the next contract expiring in the next calendar quarter that is replacing it. At the conclusion of each roll period, the next contract becomes the current contract.

The roll period is the period over which the Nasdaq-100 Futures Excess Return™ Index rolls exposure from the current E-mini Nasdaq-100 futures contract to the next E-mini Nasdaq-100 futures contract, which is normally the same as the scheduled roll period but may differ due to market disruption events. The scheduled roll period is the period of three index calculation days starting on, and including, each roll period start date. Each roll period start date is the index calculation day that is five index calculation days prior to the third Friday of each March, June, September and December, provided that if such third Friday is a CME holiday, the CME trading day immediately preceding such third Friday.

### Index Calculations

On each index calculation day, the index values are calculated as follows: the *sum* of (i) the index value on the index calculation day immediately preceding such index calculation day *plus* (ii) the *product of* (a) the number of units, at the end of the day, after any adjustment due on that day, of the current E-mini Nasdaq-100 futures contract for the index calculation day immediately preceding such index calculation day *times* (b) its daily settlement price for such index calculation day *minus* its daily settlement price for the index calculation day immediately preceding such index calculation day *plus* (iii) the *product of* (a) the number of units, at the end of the day, after any adjustment due on that day, of the next E-mini Nasdaq-100 futures contract for the index calculation day immediately preceding such index calculation day *times* (b) its daily settlement price for such index calculation day *minus* its daily settlement price for the index calculation day immediately preceding such index calculation day. For any given index calculation day, if the price of a component is not available, then the last available price for such component shall be used.

For each roll day, subject to the occurrence of a market disruption event described below, new units for each component future of the E-mini Nasdaq-100 futures contract are determined. A roll day, in respect of an E-mini Nasdaq-100 futures contract, is an index calculation day in a scheduled roll period that is not an index calculation day on which there is a market disruption event for a component, if the last day of a scheduled roll period is an index calculation day on which there is a market disruption event for a component, the next index calculation day.

On days other than the last roll day, the units of the current E-mini Nasdaq-100 futures contract are determined as follows:

the *quotient* of (i) the index value on such index calculation day *divided by* (ii) the *sum of* (a) the settlement price of the current E-mini Nasdaq-100 futures contract for such index calculation day *plus* (b) the *product of* (1) the settlement price of the next E-mini Nasdaq-100 futures contract for such index calculation day *times* (2) the *quotient of* (x) a sequential counter, starting at 1, for each scheduled rolled day in a roll period *divided by* (y) 3 *minus* a sequential counter, starting at 1, for each scheduled rolled day in a roll period

On the last roll day, the units of the current E-mini Nasdaq-100 futures contract are zero.

For the incoming E-mini Nasdaq-100 futures contract that is entering the index, the units are determined as follows:

the *quotient* of (i) the index value on such index calculation day *divided by* (ii) the *sum of* (a) the *product of* (1) the settlement price of the current E-mini Nasdaq-100 futures contract for such index calculation day *times* (2) the *quotient of* (x) 3 *minus* a sequential counter, starting at 1, for each scheduled rolled day in a roll period *divided by* (y) a sequential counter, starting at 1, for each scheduled rolled day in a roll period *plus* (b) the settlement price of the next E-mini Nasdaq-100 futures contract for such index calculation day

On the last roll day, this simplifies to the *quotient* of (i) the index value on such index calculation day *divided by* (ii) the settlement price of the next E-mini Nasdaq-100 futures contract for such index calculation day

After a roll period, the next E-mini Nasdaq-100 futures contract becomes the current E-mini Nasdaq-100 futures contract.

The Nasdaq-100 Futures Excess Return™ Index is calculated Monday through Friday, except on days when the CME is scheduled to be closed, as published by CME and as may be updated from time to time. The Nasdaq-100 Futures Excess Return™ Index is calculated based on the contract settlement price provided by CME at market close.

#### **Market Disruption Event**

If a market disruption event occurs on a scheduled roll day for a component, then no change of units of that component shall occur on that day. Instead, the change of units for such index calculation day(s) on which there is a market disruption event for a component will take place, in addition to any scheduled change of units, on the next following index calculation day that such market disruption event is no longer occurring and there is no other market disruption event occurring.

A market disruption event is, in respect of a component, the occurrence of one or more of the following events that affects that component and that the index administrator deems to be material to the Nasdaq-100 Futures Excess Return™ Index:

- Trading disruption: Any unscheduled closure of the CME; a material suspension, limitation or disruption of trading on the CME; a failure of the CME to publish the relevant price, level, value or other information; a halt in trading, such as a circuit breaker or other exchange imposed halt; or any other event that materially affects the ability of market participants to trade, effect transactions in, maintain or unwind positions in that component;
- Exchange disruption: Any exchange related event that disrupts or impairs the ability of market participants to effect transactions or obtain market values or price discovery of a component used directly or indirectly in the Nasdaq-100 Futures Excess Return™ Index;
- Price failure: Any event that impairs or prevents the ability of the index administrator to obtain a relevant price, level, rate value or any other information from an exchange or other source necessary, on a timely basis and in a manner acceptable to the index administrator, in order to perform the calculation of the Nasdaq-100 Futures Excess Return™ Index;
- Inaccurate data: The price or value of a component that has been calculated by reference to data that, in the determination of the index administrator, is inaccurate, incomplete and/or does not adequately reflect the true market price or value of such component;

- Force majeure: Any event or circumstance (including, without limitation, a systems failure, natural man-made disaster, act of God, armed conflict, act of terrorism, riot or labor disruption or any similar intervening circumstance, or restrictions due to emergency powers enforce by federal, state or local government agencies), that is beyond the reasonable control of the index administrator and that the index administrator determines, in its sole discretion, affects the index, a component of the index, any input data required to calculate the index, or that prevents the ability of the index administrator to calculate the Nasdaq-100 Futures Excess Return™ Index; and
- General moratorium: The index administrator observes on any day that there has been a declaration of a general moratorium in respect of banking activities in any relevant jurisdiction.

#### *Consequences of a Market Disruption Event*

If a market disruption event occurs or is occurring on an index calculation day that the index administrator determines materially affects the index, the index administrator may:

- Delay the calculation of the Nasdaq-100 Futures Excess Return™ Index and halt the dissemination of the value of the Nasdaq-100 Futures Excess Return™ Index and/or other information relating to the Nasdaq-100 Futures Excess Return™ Index until such time, which may be a subsequent index calculation day, that the index administrator determines that such market disruption event is no longer occurring; or
- Determine a good faith estimate of any affected or missing input data required to calculate the Nasdaq-100 Futures Excess Return™ Index or the value of the Nasdaq-100 Futures Excess Return™ Index for such index calculation day or time for such index calculation day.

#### *Other Adjustments*

Nasdaq may make adjustments in circumstances other than those detailed in the index methodology, but not limited to, adjustments necessary to ensure Nasdaq-100 Futures Excess Return™ Index and/or market integrity. Nasdaq may exercise discretion or expert judgement (other than that which is purely mechanical and, where relevant, implemented in accordance with the index methodology) when the situation calls for the interpretation of data in calculating and maintaining the Nasdaq-100 Futures Excess Return™ Index, including application of corporate actions. The use of expert judgement is overseen by the index governance process and mandates that the discretion or expert judgement would be exercised (i) in good faith and in a commercially reasonable manner and (ii) in such a manner as to ensure, as far as commercially reasonable, consistency in the approach it adopts with regard to the exercise of such discretion or expert judgement.

#### *Index Governance*

All Nasdaq indices are managed by the governance committee structure and have transparent governance, oversight, and accountability procedures for the index determination process.

**For information about the construction, calculation methodology and maintenance of the Nasdaq-100 Index®, please see “—Nasdaq-100 Index®” below.**

License Agreement between Nasdaq and GS Finance Corp.

The Product(s) is not sponsored, endorsed, sold or promoted by Nasdaq or its affiliates (Nasdaq, with its affiliates, are referred to as the “Corporations”). The Corporations have not passed on the legality or suitability of, or the accuracy or adequacy of descriptions and disclosures relating to, the Product(s). The Corporations make no representation or warranty, express or implied to the owners of the Product(s) or any member of the public regarding the advisability of investing in securities generally or in the Product(s) particularly, or the ability of the Nasdaq-100 Futures Excess Return™ Index or the Nasdaq-100 Index® to track general stock market performance. The Corporations' only relationship to GS Finance Corp. (“Licensee”) is in the licensing of the Nasdaq®, the Nasdaq-100 Futures Excess Return™ Index or the Nasdaq-100 Index®, and certain trade names of the Corporations and the use of the Nasdaq-100 Futures Excess Return™ Index or the Nasdaq-100 Index® which is determined, composed and calculated by Nasdaq without regard to Licensee or the Product(s). Nasdaq has no obligation to take the needs of the Licensee or the owners of the Product(s) into consideration in determining, composing or calculating the Nasdaq-100 Futures Excess Return™ Index or the Nasdaq-100 Index®. The Corporations are not responsible for and have not participated in the determination of the timing of, prices at, or quantities of the Product(s) to be issued or in the determination or calculation of the equation by which the

Product(s) is to be converted into cash. The Corporations have no liability in connection with the administration, marketing or trading of the Product(s).

The Corporations do not guarantee the accuracy and/or uninterrupted calculation of the Nasdaq-100 Futures Excess Return™ Index or the Nasdaq-100 Index® or any data included therein. The Corporations make no warranty, express or implied, as to results to be obtained by Licensee, owners of the product(s), or any other person or entity from the use of the Nasdaq-100 Futures Excess Return™ Index or the Nasdaq-100 Index® or any data included therein. The Corporations make no express or implied warranties, and expressly disclaim all warranties of merchantability or fitness for a particular purpose or use with respect to the Nasdaq-100 Index® or any data included therein. Without limiting any of the foregoing, in no event shall the Corporations have any liability for any lost profits or special, incidental, punitive, indirect, or consequential damages, even if notified of the possibility of such damages.



## Nasdaq-100 Index®

The Nasdaq-100 Index®, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a base date of January 31, 1985, with a base value of 125.00, as adjusted; and
- is calculated, maintained and published by Nasdaq, Inc.

The Nasdaq-100 Index® is designed to measure the performance of 100 of the largest Nasdaq listed non-financial stocks. The Nasdaq-100 Index® is a “price return” index and is calculated using a modified market capitalization-weighted methodology. We have derived all information contained in this underlier supplement regarding the Nasdaq-100 Index® from publicly available information. Additional information about the Nasdaq-100 Index® (including the top ten constituent stocks and weights and sector weights) is available on the following website: [indexes.nasdaqomx.com/Index/Overview/NDX](https://indexes.nasdaqomx.com/Index/Overview/NDX). We are not incorporating by reference the website or any material it includes in this underlier supplement.

### Security Eligibility Criteria

To qualify for index inclusion, securities must meet the following Security Eligibility Criteria which are applied as of the reconstitution reference date.

Eligible security types include common stocks, tracking stocks, and American depositary receipts, including New York registry shares. Real estate investment trusts, special purpose acquisition companies and “when-issued” securities are not eligible.

Multiple classes of securities issued by the same company are each eligible, subject to meeting all other security eligibility criteria.

For constituent selection and weighting purposes, the market capitalization of each company is the combined market capitalization of all eligible share classes. Unless otherwise noted, unlisted share classes are ineligible and will not be considered in the calculation of a company’s market capitalization. To be eligible for index inclusion, a company’s primary US listing must be listed exclusively on the Nasdaq Global Select Market or the Nasdaq Global Market. To be eligible, a company must not be classified as being in the financial industry according to the Industry Classification Benchmark, a product of FTSE International Limited that is used under license.

Companies classified as being in the real estate industry, according to the Industry Classification Benchmark, are eligible unless organized as a real estate investment trust.

There is no minimum or maximum market capitalization criterion, although the security selection process is based in part on a ranking of companies by market capitalization. A security must have a three-month average daily traded value of at least \$5 million (USD).

To be eligible for initial index inclusion, a security must have been listed and available for trading on an eligible exchange for at least three full calendar months, not including the month of initial listing. For seasoning purposes, eligible exchanges include Nasdaq (Nasdaq Global Select Market, Nasdaq Global Market, or Nasdaq Capital Market), NYSE, NYSE American and CBOE BZX. Seasoning eligibility is determined as of the constituent selection reference date and includes that month, therefore:

- To be considered for inclusion at the annual December reconstitution, a security must have been listed and available for trading on an eligible exchange no later than the last business day of August, with seasoning occurring over the months of September, October, and November.
- To be considered for inclusion as a replacement, a security must be seasoned by the last day of the month preceding the replacement event. For example, if a replacement event were to occur in July, the required seasoning period would include all of April, May, and June.

The trading history of a special purpose acquisition company prior to its combination with an operating company will not count towards satisfying the seasoning requirement, regardless of whether the special purpose acquisition company is determined to be the acquirer or the target in the transaction.

Any security that is already a member of the Nasdaq-100 Index<sup>®</sup>, including those added as the result of a spin-off event, will be exempt from the seasoning requirement. A security must have a free float of at least 10%.

Companies that have filed for bankruptcy, or equivalent protection from creditors, will not be considered for initial inclusion in the Nasdaq-100 Index<sup>®</sup>.

A company that has entered into a definitive agreement or other arrangement that is expected to make it ineligible will not be considered for initial inclusion in the Nasdaq-100 Index<sup>®</sup>. Such agreements and arrangements include, but are not limited to:

- An agreement to be purchased by another entity or to become privately owned.
- A plan to delist or to transfer to an ineligible exchange.
- A plan to reorganize as an ineligible security type.
- A decision to liquidate or otherwise permanently cease operations.

#### Constituent Selection

A reconstitution is conducted on an annual basis, at which time all eligible companies are ranked based on market capitalization, as of the reconstitution reference date.

The market capitalization of each company is the combined market capitalization of all eligible share classes. For inclusion purposes, the market capitalization of an American depositary receipt will normally be determined based on the depositary shares outstanding, as reported by the depositary banks. This means that a non-US company represented by an American depositary receipt may be considered for inclusion in the Nasdaq-100 Index<sup>®</sup> at less than its full global market capitalization. Notwithstanding the foregoing, an American depositary receipt that serves as a company's primary global listing (i.e., the underlying shares are not listed or available for trading elsewhere) will be considered for inclusion based on its full global market capitalization, in the same manner as a direct listing.

1. Once ranked, companies are selected for index inclusion based on the following order of criteria: The top 75 ranked companies are selected for inclusion in the Nasdaq-100 Index<sup>®</sup>.
2. Any other companies that were members of the Nasdaq-100 Index<sup>®</sup> as of the reconstitution reference date and are ranked within the top 100 ranked companies are also selected for inclusion in the Nasdaq-100 Index<sup>®</sup>.
3. If fewer than 100 companies are selected based on the first two criteria, then the remaining positions will first be filled, in rank order, by companies currently in the Nasdaq-100 Index<sup>®</sup> as of the reconstitution reference date, which are ranked in positions 101-125, as long as they were:
  - a. ranked in the top 100 as of the reference date of the previous reconstitution, or
  - b. added as a replacement since the previous reconstitution, or
  - c. added as the result of a spinoff event since the previous reconstitution.
4. If fewer than 100 companies are selected based on the first three criteria, the remaining positions will be filled, in rank order, by any companies ranked in the top 100 that were not already members of the Nasdaq-100 Index<sup>®</sup> as of the reconstitution reference date.

#### Constituent Weighting

##### *Constituent Weighting Scheme*

The Nasdaq-100 Index<sup>®</sup> employs a modified capitalization weighting scheme.

##### *Constituent Weighting Process*

The quarterly weight process uses company-level weights, which are derived using the price and total shares outstanding ("TSO") of each security, as of the rebalance reference date. For any company represented by more than one eligible share class, the company weight is the combined weight of the eligible securities representing its share classes. All American depositary receipt securities selected for index inclusion will have their weights assigned according to the market capitalization of the depositary shares outstanding, as reported by the depositary banks.

For quarterly rebalances in March, June, and September, index shares for each security are adjusted by the percentage change in that company's TSO since the previous TSO update. Following those adjustments, the resulting company weights are evaluated based on two constraints:

- No company's weight may exceed 24%.
- The aggregate weight of the companies whose weights exceed 4.5% may not exceed 48%.

If neither constraint is violated, then no further adjustments are made, and the quarterly constituent weighting process is complete.

Only in cases where either or both of the constraints above are violated, or when the quarterly rebalance coincides with the annual reconstitution (i.e., December), quarterly weight adjustments are made according to a two-stage adjustment process described below. This process uses the price and TSO of each security, as of the rebalance reference date, to derive the initial company-level weights.

**Stage 1 adjustment.** If no company's initial weight exceeds 24% of the Nasdaq-100 Index<sup>®</sup>, initial weights are used as Stage 1 weights without adjustment. Otherwise, initial weights are adjusted such that no company's weight may exceed 20% of the Nasdaq-100 Index<sup>®</sup>.

**Stage 2 adjustment.** If the aggregate weight of the companies whose Stage 1 weights exceed 4.5% does not exceed 48%, Stage 1 weights are used as the final weights. Otherwise, Stage 1 weights are adjusted such that:

- The aggregate weight of the companies whose Stage 1 weights exceeded 4.5% is set to 40%.
- Companies with Stage 1 weights below 4.5% may also have their weights adjusted to preserve the initial rank order of all companies.

If the two-stage process results in a violation of the weighting constraints as previously detailed in the this section, then the process is repeated until the company weights meet the constraints.

#### *Annual Weight Adjustment*

The annual reconstitution employs an additional two-stage weight adjustment using security-level constraints. For any company with more than one eligible share class, the securities representing those share classes are considered separately.

Final security weights from the quarterly weight adjustment are used as the initial security weights for the annual weight adjustment process.

**Stage 1 adjustment.** If no security's initial weight exceeds 15%, initial weights are used as Stage 1 weights. Otherwise, initial weights are adjusted such that no security's weight may exceed 14% of the Nasdaq-100 Index<sup>®</sup>.

**Stage 2 adjustment.** If the aggregate weight of the securities with the five largest Stage 1 weights does not exceed 40%, Stage 1 weights are used as final weights. Otherwise, Stage 1 weights are adjusted such that:

- The aggregate weight of the securities with the five largest Stage 1 weights is set to 38.5%.
- In order to preserve the initial rank order of the securities, the final index weight of any security outside the five largest will be capped at the lesser of 4.4% or the weight of the fifth largest security.

If the two-stage process results in a violation of the weighting constraints as previously detailed in the this section, then the process is repeated until the security weights meet the constraints.

#### *Nasdaq-100 Index<sup>®</sup> Calculation*

The discussion below describes the "price return" calculation of the Nasdaq-100 Index<sup>®</sup>. As compared to the gross total return or net total return versions of the Nasdaq-100 Index<sup>®</sup>, the price return version is ordinarily calculated without regard to ordinary cash dividends on the Nasdaq-100 Index<sup>®</sup> stocks. However, all Nasdaq-100 Index<sup>®</sup> calculations reflect special cash dividends.

The Nasdaq-100 Index<sup>®</sup> is a modified market capitalization-weighted index. The value of the Nasdaq-100 Index<sup>®</sup> equals the Nasdaq-100 Index<sup>®</sup> market value divided by the Nasdaq-100 Index<sup>®</sup> divisor. The overall Nasdaq-100 Index<sup>®</sup> market value is the aggregate of each Nasdaq-100 Index<sup>®</sup> stock's market value, as may be adjusted for any corporate actions. A Nasdaq-100 Index<sup>®</sup> stock's market value is determined by multiplying the last sale price by the number of shares of the index security included in the Nasdaq-100 Index<sup>®</sup>. In other words, the value of the

Nasdaq-100 Index® is equal to (i) the sum of the products of (a) the index shares of each of the Nasdaq-100 Index® stocks multiplied by (b) each such stock's last sale price (adjusted for corporate actions, if any), divided by (ii) the divisor of the Nasdaq-100 Index®.

The price return Nasdaq-100 Index® divisor is calculated as the ratio of (i) the start of day market value of the Nasdaq-100 Index® divided by (ii) the previous day Nasdaq-100 Index® value.

If an index security does not trade on the relevant Nasdaq exchange on a given day or the relevant Nasdaq exchange has not opened for trading, the previous index calculation day's closing price for index security (adjusted for corporate actions occurring prior to market open on the current day, if any) is used. If an index security is halted during the trading day, the most recent last sale price is used until trading resumes. For securities where the Nasdaq Stock Market is the relevant Nasdaq exchange, the last sale price may be the Nasdaq Official Closing Price when it is closed.

Index Calendar

Reconstitution Frequency	Annually
Rebalance Frequency	Quarterly
Reconstitution Reference Dates	Last trading day of November
Reconstitution Announcement Dates	After the close on the second Friday in December
Reconstitution Effective Dates	At market open on the first trading day following the third Friday in December
Rebalance Reference Dates	Last trading day of February, May, August, and November, respectively
Rebalance Announcement Dates	After the close on the second Friday in March, June, September, and December
Rebalance Effective Dates	At market open on the first trading day following the third Friday in March, June, September, and December

A special rebalance may be triggered, if either of the following weighting restrictions are violated, based on end-of-day values:

- No company's weight may exceed 24%.
- The aggregate weight of the companies whose weights exceed 4.5% may not exceed 48%.

Notice of a special rebalance, including the effective date and reference date, will be published in advance through the normal channels, and will follow the quarterly update process described in the constituent weighting section.

The Nasdaq-100 Index® is calculated Monday through Friday, except on days when the US markets are closed.

The Nasdaq-100 Index® is calculated during the trading day based on the last sale price and are disseminated once per second from 09:30:01 to 17:16:00 ET. The closing value of the Nasdaq-100 Index® may change up until 17:15:00 ET due to corrections to the last sale price of the index securities.

Index Maintenance

Deletion Policy

If, at any time, it is determined that an index security is ineligible for continued inclusion, it will be removed as soon as practicable. Advanced notice of an index security deletion, including the effective date, will be announced through the normal channels. Criteria for security removal include, but are not limited to:

- Delisting or transferring to an ineligible exchange.
- Reorganizing as an ineligible security type (e.g., a real estate investment trust).
- Reclassification as a financial company, according to the ICB.

- Involvement in a merger, acquisition, or other major corporate event that would make continued inclusion impossible, impractical, or inappropriate.
- Failure to maintain a weight of at least 0.10% for two consecutive month ends. Any security that fails to maintain a weight of at least 0.10% for two consecutive month-ends will be replaced, subject to the availability of a replacement security with a larger market capitalization. If no such security is available, the incumbent security will remain in the Nasdaq-100 Index<sup>®</sup> until a suitable replacement can be identified. If its weight increases to above 0.10% before a suitable replacement security is designated, then the incumbent security will not be replaced. This situation will be evaluated at the end of each calendar month.
- For a security added to the Nasdaq-100 Index<sup>®</sup> as the result of a spin-off event, failure to establish a weight of at least 0.10% at the end of its second day of regular-way trading as an index member.
- Declaring bankruptcy, liquidating, or otherwise permanently ceasing operations.

In circumstances where it is not possible to provide sufficient advanced notification of the removal event and/or the identity of a replacement, the security being removed may be persisted in the Nasdaq-100 Index<sup>®</sup> at its last sale price, or at an appropriate "deal price", until the effective date of the replacement company's entry into the Nasdaq-100 Index<sup>®</sup>. In such cases, a temporary placeholder security may be utilized, and will be denoted by adding a dollar sign to the beginning and end of the security's ticker symbol.

Securities that are added to the Nasdaq-100 Index<sup>®</sup> as the result of a spin-off event are normally maintained in the Nasdaq-100 Index<sup>®</sup>, subject to the removal criteria specified above. Those that are not immediately removed may be removed at a later date to protect the integrity of the Nasdaq-100 Index<sup>®</sup>, for example, if a spun-off security demonstrates liquidity characteristics that diverge materially from the security eligibility criteria.

#### Replacement Policy

Other than at the index reconstitution, except for spin-offs, additions to the Nasdaq-100 Index<sup>®</sup> occur only when there is a deletion that requires replacement. The company with the largest market capitalization that meets all eligibility criteria as of the prior month-end, and which is not already an index member, will replace the deleted company.

For companies represented by more than one share class, the company will only be considered deleted when all its share classes have been removed from the Nasdaq-100 Index<sup>®</sup>. If a security is removed, but other securities representing the same company remain in the Nasdaq-100 Index<sup>®</sup>, a replacement event will not be triggered.

A security that was added to the Nasdaq-100 Index<sup>®</sup> as the result of a spin-off event, and then removed before the next reconstitution, will not be replaced.

For pending deletions set to occur soon after a reconstitution and/or rebalance effective date, the removal may be accelerated to occur in conjunction with the reconstitution and/or rebalance event.

#### Corporate Actions

In the periods between scheduled index reconstitution and rebalancing events, individual index securities may be subject to a variety of corporate actions and events that require maintenance and adjustments to the Nasdaq-100 Index<sup>®</sup>.

At the quarterly rebalancing, no changes are made to the Nasdaq-100 Index<sup>®</sup> from the previous month end until the quarterly share change effective date, with the exception of corporate actions with an ex-date.

#### *Special Cash Dividends*

A special cash dividend is a cash payment by the issuer of the index security to shareholders that the issuer does not consider to be part of its regular dividend paying cycle. A dividend is considered special in the Nasdaq-100 Index<sup>®</sup> if the information provided by the vendor or the index exchange indicates that the dividend is special. Other nomenclature for a special dividend may include but not be limited to extra, extraordinary, non-recurring, one-time, unusual, etc.

The start of day price of the index security is adjusted downward for the amount of the special cash dividend with no adjustment to the index shares resulting in a change to the divisor.

### *Return of Capital*

A return of capital is a cash distribution paid from the company's capital surplus rather than its net income or retained earnings. For the purposes of index calculation, Nasdaq will determine the treatment (regular vs. special) of each return of capital event based on whether the payment fits with the company's regular pattern of dividend payments, or if the payment appears to be extraordinary in nature.

### *Liquidation Distributions*

A liquidation distribution, sometimes referred to as a "liquidating dividend" is a cash distribution made by an issuer in conjunction with the dissolution of its business. Bankruptcy liquidations rarely result in liquidation payments to equity shareholders. Voluntary liquidations, on the other hand, will generally produce one or more liquidation payment events. For the purposes of index calculation, Nasdaq treats liquidation distributions in the same manner as special dividends.

### *Stock Split / Stock Dividend / Bonus Issue*

A stock split, stock dividend and bonus issue are similar transactions which generally result in no change to the market capitalization of the security. They essentially imply the same event and the only difference is in the way the terms are quoted. A stock split or bonus issue is quoted in terms of shares received to shares held and stock dividends are quoted in percentages. This event increases the index shares of the index security based on an adjustment factor, while simultaneously reducing its per share price by applying a corresponding inverse adjustment factor, such that the weight of the index security remains similar before and after the event resulting in no change or a minimal change to the divisor.

### *Cash and Stock Dividend*

An issuer of a security may pay a cash and stock dividend on the same security on the same date. In this case, the cash dividend is processed in the Nasdaq-100 Index® before the stock dividend unless otherwise indicated.

### *Optional Dividend*

An issuer of a security may permit the shareholder to choose between receiving a dividend in cash or stock. In this case, the adjustment is made to the index security in the manner the dividend is announced.

### *Reverse Stock Split / Consolidation*

A reverse split generally results in no change to the market capitalization of the security. Reverse splits are quoted in terms of shares received to shares held. This event decreases the number of index shares of the index security based on an adjustment factor while simultaneously increasing its per share price by applying a corresponding inverse adjustment factor, such that the weight of the index security remains similar before and after the event resulting in no change or a minimal change to the divisor.

### *Rights Offering / Issue*

An issuer may offer to existing shareholders the right to participate in a new issuance of shares in proportion to each shareholder's existing holdings of the security at a set price (the subscription price) during a subscription period. Shareholders are allotted rights in accordance with the ratio set by the company. The rights may trade for a certain period of time during the subscription period, allowing shareholders the opportunity to sell their rights in the market. Failure to subscribe to the rights prior to the end of the subscription period will result in their expiration and the shareholders forfeiture of the opportunity to purchase new shares under the rights issuance.

Renounceable rights offering: The rights issued to an existing shareholder are transferable in the open market and are able to be sold separately from the shares to other investors during the life of the right. Renounceable rights are referred to as "transferable" or "tradable".

Non-renounceable rights offering: The rights issued to an existing shareholder cannot be traded. Shareholders must either subscribe to the rights or they lapse upon expiration of the subscription period.

Whether the rights offering is renounceable or non-renounceable, if the distribution is of the same index security, the price and index shares are adjusted if the rights have a subscription price on an equivalent per share basis that is less than its last sale price (in-the money) of the index security. The price is adjusted downward for the value of the right.

The index shares are increased to reflect the full exercise of the rights offering. The number of additional index shares is determined by multiplying the number of rights issued per index security by the current number of index shares, then dividing that product by the number of rights required to purchase one new index security. This results in a divisor adjustment.

If the rights have a subscription price on an equivalent per share basis that is greater than the last sale price (out of the money) of the index security on the day before the ex-distribution date, no adjustment will be made to the price or index shares of the index security, even if the offering is underwritten or otherwise guaranteed in some way. If the distribution is not available to all shareholders, then no adjustment is made to either the price or index shares of the index security.

#### *Stock Distribution of Another Security*

An issuer may distribute shares of another pre-existing publicly traded company to its own shareholders. These events are often announced as “in specie”, “in kind”, or “spinoff” distributions. Such events generally do not result in the issuance of new shares or the formation of a new corporate entity, and may not fall within the traditional definition of a spinoff. Nevertheless, regardless of the terminology used to announce the event, this distribution will be handled as a “spin-off” as described below.

In cases where the distributed security is already a member of the Nasdaq-100 Index®, its index shares will be increased, on the effective date, to reflect the value of the distribution.

#### *Spin-offs*

A spin-off (also known as a de-merger) occurs when the issuer of an equity security (the parent) “spins off” a business it owns into a separate new issuer (the spinco). Shares of the spinco are distributed to the shareholders of the parent, on a pro-rata basis, at a ratio established by the parent. Any spinco which does not meet the traditional definition of a security, or is not expected to be publicly listed, may be disregarded by the Nasdaq-100 Index®. Spinco securities will be added to the Nasdaq-100 Index® as their parent security on the effective date. Index shares of the spinco are calculated by multiplying the index shares of the parent times the spinoff ratio. If the parent security’s listing exchange applies a price adjustment to the parent security, the spinco security will be assigned an initial price consistent with that amount, adjusted according to the spinoff ratio. If no price adjustment is applied to the parent, the spinco will be assigned a price of zero. In any case, including events involving multiple spinco(s), the total value of the parent and spinco(s) reflected within the Nasdaq-100 Index® at the start-of-day on the effective date will be equal to the value of the parent security at the prior end-of-day. Resulting divisor changes, if any, are not expected to be meaningful. Passive investors should not expect to take any action at the time the spinoff event becomes effective.

Once the spinoff event has been completed, the spinco will be evaluated for continued inclusion in the Nasdaq-100 Index®. By default, the security will remain in the Nasdaq-100 Index® until at least the next scheduled reconstitution, unless there is a specific reason for immediate disqualification. Regardless of the reason(s) for disqualification, a disqualified spinco will be held in the Nasdaq-100 Index® until regular-way trading is established, and removed only after sufficient advanced notice is provided through the normal communication channels.

A disqualified spinco is normally removed at the last sale price of the day prior to the announced removal date. There is no adjustment to the index shares of the parent. This will not result in a divisor adjustment.

#### *Tracking Stocks*

A separate line of stock which is issued for the purpose of “tracking” the financial performance of a particular business line, division or subsidiary of a company is often referred to as a “tracking stock.” The pro-rata distribution of a newly issued tracking stock to existing shareholders of the “parent” company is handled in accordance with the guidelines for spin-offs. A similar distribution of a pre-existing tracking stock is handled as a stock distribution of another security.

#### *Mergers & Acquisitions (M&A)*

A merger/acquisition is the combination of two (or more) companies into one larger company, involving an exchange of stock and/or cash payment to the shareholders of the acquired company.

If the issuer of the index security is the company being acquired, the index security is removed the day following the shareholder vote or the expected expiration of the tender offer, provided the acquisition is not contested. In

the event the acquisition is contested, the deletion occurs once results have been received that indicate the acquisition will likely be successful. If the approval is by written consent, then the removal occurs as soon as reasonably practical thereafter.

When the acquiring company is an index security, it may incur an increase in its index shares if the acquisition involves an exchange of stock as payment.

#### *Additions / Deletions*

The addition or deletion of a security will generally result in a divisor change. Index securities are added or removed from the Nasdaq-100 Index<sup>®</sup> at their last sale price on the day prior to the effective date of the change.

#### *Halted Securities*

If an index security, at the time of its removal from the Nasdaq-100 Index<sup>®</sup>, is halted from trading on its index exchange and its current last sale price cannot readily be determined, the index security may, at Nasdaq's discretion, be removed at a price of 0.00000001 ("zero price"). This price is applied to the index security after the close of all the trading markets in the Nasdaq-100 Index<sup>®</sup> but prior to the time the official closing value of the Nasdaq-100 Index<sup>®</sup> is disseminated.

#### *Index Share and TSO Changes*

A security's index shares may change as a result of events other than those corporate actions/events noted above. If a change in TSO arising from other corporate events is greater than or equal to 10%, an adjustment to index shares is made as soon as practicable after being sufficiently verified. If the change in TSO is less than 10%, then all such changes are accumulated and made effective at one time on a quarterly basis after the close of trading on the third Friday in each of March, June, September and December. The index shares are adjusted by the same percentage amount by which the TSO has changed.

#### *Bankruptcy*

In the event that an existing index constituent files for bankruptcy or equivalent protection from creditors, affected securities will be removed from their respective indexes, on a best-efforts basis, as soon as practicable after Nasdaq becomes aware of the filing.

If the index constituent is still available for trading on its primary exchange, it is removed from the Nasdaq-100 Index<sup>®</sup> at the security's last trading price. If the security is no longer trading per its primary exchange, the constituent may be removed at an OTC price, if judged reliable. When no sufficiently reliable price exists, the security is removed at a price of zero.

#### *Sanctions*

Generally, Nasdaq Indices will approach the treatment of sanctions through the lens of United States, United Kingdom, and/or European Union based investors. Most sanctions can be thought of as being either comprehensive or selective:

Comprehensive sanctions programs are geographically oriented, and often apply broad-based financial restrictions on entire countries. Examples include Cuba, North Korea, Iran, and Syria. Companies in countries targeted by comprehensive sanctions are not eligible for inclusion in the Nasdaq-100 Index<sup>®</sup>.

Other sanctions programs are more selective, and target specific companies and individuals regardless of their locations. Nasdaq consults multiple sources in order to identify and interpret relevant sanctions on a best-efforts basis.

Because different sanctions programs include a variety of evolving restrictions and requirements, sanctions generally require a case-by-case review. Any resulting index adjustments, if necessary, will be made at the sole discretion of the Nasdaq Index Management Committee.

#### *Other Adjustments*

Nasdaq may make adjustments in circumstances other than those detailed in the index methodology, but not limited to adjustments necessary to ensure Nasdaq-100 Index<sup>®</sup> and/or market integrity. Nasdaq may exercise discretion or expert judgement (other than that which is purely mechanical and, where relevant, implemented in accordance with the index methodology) when the situation calls for the interpretation of data in calculating and maintaining the Nasdaq-100 Index<sup>®</sup>, including application of corporate actions. The use of expert judgement is



overseen by the index governance process and mandates that the discretion or expert judgement would be exercised (i) in good faith and in a commercially reasonable manner and (ii) in such a manner as to ensure, as far as commercially reasonable, consistency in the approach it adopts with regard to the exercise of such discretion or expert judgement.

#### Index Governance

All Nasdaq Indexes are managed by the governance committee structure and have transparent governance, oversight, and accountability procedures for the index determination process.

#### License Agreement between Nasdaq, Inc. and GS Finance Corp.

The Product(s) is not sponsored, endorsed, sold or promoted by Nasdaq, Inc. or its affiliates (Nasdaq, with its affiliates, are referred to as the "Corporations"). The Corporations have not passed on the legality or suitability of, or the accuracy or adequacy of descriptions and disclosures relating to, the Product(s). The Corporations make no representation or warranty, express or implied to the owners of the Product(s) or any member of the public regarding the advisability of investing in securities generally or in the Product(s) particularly, or the ability of the Nasdaq-100<sup>®</sup> Index to track general stock market performance. The Corporations' only relationship to GS Finance Corp. ("Licensee") is in the licensing of the Nasdaq<sup>®</sup>, Nasdaq-100 Index<sup>®</sup>, and certain trade names of the Corporations and the use of the Nasdaq-100 Index<sup>®</sup> which is determined, composed and calculated by Nasdaq without regard to Licensee or the Product(s). Nasdaq has no obligation to take the needs of the Licensee or the owners of the Product(s) into consideration in determining, composing or calculating the Nasdaq-100 Index<sup>®</sup>. The Corporations are not responsible for and have not participated in the determination of the timing of, prices at, or quantities of the Product(s) to be issued or in the determination or calculation of the equation by which the Product(s) is to be converted into cash. The Corporations have no liability in connection with the administration, marketing or trading of the Product(s).

The Corporations do not guarantee the accuracy and/or uninterrupted calculation of Nasdaq-100 Index<sup>®</sup> or any data included therein. The Corporations make no warranty, express or implied, as to results to be obtained by Licensee, owners of the product(s), or any other person or entity from the use of the Nasdaq-100 Index<sup>®</sup> or any data included therein. The Corporations make no express or implied warranties, and expressly disclaim all warranties of merchantability or fitness for a particular purpose or use with respect to the Nasdaq-100 Index<sup>®</sup> or any data included therein. Without limiting any of the foregoing, in no event shall the Corporations have any liability for any lost profits or special, incidental, punitive, indirect, or consequential damages, even if notified of the possibility of such damages.

## Nasdaq-100 Technology Sector Index

The Nasdaq-100 Technology Sector Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a base date of February 22, 2006, with a base value of 1000.00, as adjusted; and
- is calculated, maintained and published by Nasdaq, Inc.

The Nasdaq-100 Technology Sector Index is designed to measure the performance of the technology companies in the Nasdaq-100 Index<sup>®</sup>. The Nasdaq-100 Index<sup>®</sup> is designed to measure the performance of 100 of the largest Nasdaq listed non-financial stocks. Each issuer of a stock in the Nasdaq-100 Technology Sector Index is classified as a Technology company according to the Industry Classification Benchmark (ICB). The Nasdaq-100 Technology Sector Index is a “price return” index and is an equal weighted index. We have derived all information contained in this underlier supplement regarding the Nasdaq-100 Technology Sector Index from publicly available information. Additional information about the Nasdaq-100 Technology Sector Index (including the top ten constituent stocks and weights and sector weights) is available on the following website: [indexes.nasdaqomx.com/Index/Overview/NDXT](http://indexes.nasdaqomx.com/Index/Overview/NDXT). We are not incorporating by reference the website or any material it includes in this underlier supplement.

### Security Eligibility Criteria

In order to be eligible for the Nasdaq-100 Technology Sector Index, a security must be included in the Nasdaq-100 Index<sup>®</sup>. A company must be classified as a Technology company (any company classified under the Technology Industry) according to the ICB.

### Index Calendar

The Nasdaq-100 Technology Sector Index follows the same reconstitution and rebalance schedule as the Nasdaq-100 Index<sup>®</sup>.

### Constituent Selection

All securities that meet the security eligibility criteria are included in the Nasdaq-100 Technology Sector Index.

### Constituent Weighting

#### *Constituent Weighting Scheme*

The Nasdaq-100 Technology Sector Index is an equal-weighted index.

#### *Constituent Weighting Process*

The Nasdaq-100 Technology Sector Index is rebalanced quarterly such that all issuers within the Nasdaq-100 Technology Sector Index have an equal index market value. For issuers represented by multiple securities, the index market values are equally apportioned across their respective index securities. Index shares are calculated by dividing each index security's resulting index market value by its last sale price.

### Nasdaq-100 Technology Sector Index Calculation

The discussion below describes the “price return” calculation of the Nasdaq-100 Technology Sector Index. The applicable pricing supplement will describe the calculation if the underlier for your securities is not the price return calculation. As compared to the gross total return or net total return versions of the Nasdaq-100 Technology Sector Index, the price return version is ordinarily calculated without regard to ordinary cash dividends on the Nasdaq-100 Technology Sector Index stocks. However, all Nasdaq-100 Technology Sector Index calculations reflect special cash dividends.

The Nasdaq-100 Technology Sector Index is an equal weighted index. The value of the Nasdaq-100 Technology Sector Index equals the Nasdaq-100 Technology Sector Index market value divided by the Nasdaq-100 Technology Sector Index divisor. The overall Nasdaq-100 Technology Sector Index market value is the aggregate of each Nasdaq-100 Technology Sector Index stock's market value, adjusted by the Nasdaq-100 Technology Sector Index stock's equal-weighting factor used to assign an equal weight at the previous rebalancing, as may be adjusted for any corporate actions. A Nasdaq-100 Technology Sector Index stock's market value is determined by multiplying the last sale price by the number of shares of the index security included in the Nasdaq-100 Index<sup>®</sup>. In other words, the value of the Nasdaq-100 Technology Sector Index is equal to (i) the sum of the products of (a)

the index shares of each of the Nasdaq-100 Technology Sector Index stocks multiplied by (b) each such stock's last sale price (adjusted for corporate actions, if any) multiplied by (c) such stock's equal weighting factor, divided by (ii) the divisor of the Nasdaq-100 Technology Sector Index.

The price return Nasdaq-100 Technology Sector Index divisor is calculated as the ratio of (i) the start of day market value of the Nasdaq-100 Technology Sector Index divided by (ii) the previous day Nasdaq-100 Technology Sector Index value.

If an index security does not trade on the relevant Nasdaq exchange on a given day or the relevant Nasdaq exchange has not opened for trading, the previous index calculation day's closing price for index security (adjusted for corporate actions occurring prior to market open on the current day, if any) is used. If an index security is halted during the trading day, the most recent last sale price is used until trading resumes. For securities where the Nasdaq Stock Market is the relevant Nasdaq exchange, the last sale price may be the Nasdaq Official Closing Price when it is closed.

#### **Index Maintenance**

##### ***Deletion Policy***

If a component of the Nasdaq-100 Technology Sector Index is removed from the Nasdaq-100 Index® for any reason, it is also removed from the Nasdaq-100 Technology Sector Index at the same time.

##### ***Replacement Policy***

When a component of the Nasdaq-100 Index® that is classified as Technology according to ICB is removed from the Nasdaq-100 Index®, it is also removed from the Nasdaq-100 Technology Sector Index and as such, if the replacement company being added to the Nasdaq-100 Index® is classified as Technology according to ICB, it is added to the Nasdaq-100 Technology Sector Index and will assume the weight of the removed company on the index effective date.

When a component of the Nasdaq-100 Index® that is not classified as Technology according to ICB is removed and the replacement company being added to the Nasdaq-100 Index® is classified as Technology according to ICB, the replacement company is considered for addition to the Nasdaq-100 Technology Sector Index at the next quarterly rebalance.

When a component of the Nasdaq-100 Index® that is classified as Technology according to ICB is removed from the Nasdaq-100 Index® and the replacement company being added to the Nasdaq-100 Index® is not classified as Technology according to ICB, the company is removed from the Nasdaq-100 Technology Sector Index and the divisor of the Nasdaq-100 Technology Sector Index is adjusted to ensure index continuity.

##### ***Additions Policy***

If a security is added to the Nasdaq-100 Index for any reason, it may be added to the Nasdaq-100 Technology Sector Index at the same time.

##### ***Corporate Actions***

In the interim periods between scheduled index reconstitution and rebalance events, individual index securities may be the subject to a variety of corporate actions and events that require maintenance and adjustments to the Nasdaq-100 Technology Sector Index.

##### ***Special Cash Dividends***

A special cash dividend is a cash payment by the issuer of the index security to shareholders that the issuer does not consider to be part of its regular dividend paying cycle. A dividend is considered special in the Nasdaq-100 Technology Sector Index if the information provided by the vendor or the index exchange indicates that the dividend is special. Other nomenclature for a special dividend may include but not be limited to extra, extraordinary, non-recurring, one-time, unusual, etc.

The start of day price of the index security is adjusted downward for the amount of the special cash dividend and a corresponding adjustment is made to the index shares such that the market value of the security does not change, or changes only minimally resulting in no change or a minimal change to the divisor.

##### ***Return of Capital***

A return of capital is a cash distribution paid from the company's capital surplus rather than its net income or retained earnings. For the purposes of index calculation, Nasdaq will determine the treatment (regular vs. special)

of each return of capital event based on whether the payment fits with the company's regular pattern of dividend payments, or if the payment appears to be extraordinary in nature.

#### *Liquidation Distributions*

A liquidation distribution, sometimes referred to as a "liquidating dividend" is a cash distribution made by an issuer in conjunction with the dissolution of its business. Bankruptcy liquidations rarely result in liquidation payments to equity shareholders. Voluntary liquidations, on the other hand, will generally produce one or more liquidation payment events. For the purposes of index calculation, Nasdaq treats liquidation distributions in the same manner as special dividends.

#### *Stock Split / Stock Dividend / Bonus Issue*

A stock split, stock dividend and bonus issue are similar transactions which generally result in no change to the market capitalization of the security. They essentially imply the same event and the only difference is in the way the terms are quoted. A stock split or bonus issue is quoted in terms of shares received to shares held and stock dividends are quoted in percentages. This event increases the index shares of the index security based on an adjustment factor, while simultaneously reducing its per share price by applying a corresponding inverse adjustment factor, such that the weight of the index security remains similar before and after the event resulting in no change or a minimal change to the divisor.

#### *Cash and Stock Dividend*

An issuer of a security may pay a cash and stock dividend on the same security on the same date. In this case, the cash dividend is processed in the Nasdaq-100 Technology Sector Index before the stock dividend unless otherwise indicated.

#### *Optional Dividend*

An issuer of a security may permit the shareholder to choose between receiving a dividend in cash or stock. In this case, the adjustment is made to the index security in the manner the dividend is announced.

#### *Reverse Stock Split / Consolidation*

A reverse split generally results in no change to the market capitalization of the security. Reverse splits are quoted in terms of shares received to shares held. This event decreases the number of index shares of the index security based on an adjustment factor while simultaneously increasing its per share price by applying a corresponding inverse adjustment factor, such that the weight of the index security remains similar before and after the event resulting in no change or a minimal change to the divisor.

#### *Rights Offering / Issue*

An issuer may offer to existing shareholders the right to participate in a new issuance of shares in proportion to each shareholder's existing holdings of the security at a set price (the subscription price) during a subscription period. Shareholders are allotted rights in accordance with the ratio set by the company. The rights may trade for a certain period of time during the subscription period, allowing shareholders the opportunity to sell their rights in the market. Failure to subscribe to the rights prior to the end of the subscription period will result in their expiration and the shareholders forfeiture of the opportunity to purchase new shares under the rights issuance.

Renounceable rights offering: The rights issued to an existing shareholder are transferable in the open market and are able to be sold separately from the shares to other investors during the life of the right. Renounceable rights are referred to as "transferable" or "tradable".

Non-renounceable rights offering: The rights issued to an existing shareholder cannot be traded. Shareholders must either subscribe to the rights or they lapse upon expiration of the subscription period.

Whether the rights offering is renounceable or non-renounceable, if the distribution is of the same index security, the price and index shares are adjusted if the rights have a subscription price on an equivalent per share basis that is less than its last sale price (in-the money) of the index security. The price is adjusted downward for the value of the right.

The index shares are increased by applying a corresponding inverse adjustment factor, such that the weight of the security remains similar before and after the event resulting in no change or a minimal change to the divisor.

If the rights have a subscription price on an equivalent per share basis that is greater than the last sale price (out of the money) of the index security on the day before the ex-distribution date, no adjustment will be made to the price or index shares of the index security, even if the offering is underwritten or otherwise guaranteed in some

way. If the distribution is not available to all shareholders, then no adjustment is made to either the price or index shares of the index security.

#### *Stock Distribution of Another Security*

An issuer may distribute shares of another pre-existing publicly traded company to its own shareholders. These events are often announced as “in specie”, “in kind”, or “spinoff” distributions. Such events generally do not result in the issuance of new shares or the formation of a new corporate entity, and may not fall within the traditional definition of a spinoff. Nevertheless, regardless of the terminology used to announce the event, this distribution will be handled as a “spin-off” as described below.

In cases where the distributed security is already a member of the Nasdaq-100 Technology Sector Index, its index shares will be increased, on the effective date, to reflect the value of the distribution.

#### *Spin-offs*

A spin-off (also known as a de-merger) occurs when the issuer of an equity security (the parent) “spins off” a business it owns into a separate new issuer (the spinco). Shares of the spinco are distributed to the shareholders of the parent, on a pro-rata basis, at a ratio established by the parent. Any spinco which does not meet the traditional definition of a security, or is not expected to be publicly listed, may be disregarded by the Nasdaq-100 Technology Sector Index. Spinco securities will be added to the Nasdaq-100 Technology Sector Index as their parent security on the effective date. Index shares of the spinco are calculated by multiplying the index shares of the parent times the spinoff ratio. If the parent security’s listing exchange applies a price adjustment to the parent security, the spinco security will be assigned an initial price consistent with that amount, adjusted according to the spinoff ratio. If no price adjustment is applied to the parent, the spinco will be assigned a price of zero. In any case, including events involving multiple spinco(s), the total value of the parent and spinco(s) reflected within the Nasdaq-100 Technology Sector Index at the start-of-day on the effective date will be equal to the value of the parent security at the prior end-of-day. Resulting divisor changes, if any, are not expected to be meaningful. Passive investors should not expect to take any action at the time the spinoff event becomes effective.

Once the spinoff event has been completed, the spinco will be evaluated for continued inclusion in the Nasdaq-100 Technology Sector Index. By default, the security will remain in the Nasdaq-100 Technology Sector Index until at least the next scheduled reconstitution, unless there is a specific reason for immediate disqualification. Regardless of the reason(s) for disqualification, a disqualified spinco will be held in the Nasdaq-100 Technology Sector Index until regular-way trading is established, and removed only after sufficient advanced notice is provided through the normal communication channels.

A disqualified spinco is normally removed at the last sale price of the day prior to the announced removal date. The index shares of the parent are increased in order to absorb the weight of the removed security. Resulting divisor changes, if any, are not expected to be meaningful.

If a spinco is retained, the Nasdaq-100 Technology Sector Index will not be rebalanced to restore equal weighting until the next scheduled rebalancing or reconstitution event.

In addition, to alleviate liquidity and capacity concerns, spinco securities that do not meet minimum size and/or liquidity requirements may be removed from the Nasdaq-100 Technology Sector Index as part of the next rebalance event in order to protect the integrity of the Nasdaq-100 Technology Sector Index.

#### *Tracking Stocks*

A separate line of stock which is issued for the purpose of “tracking” the financial performance of a particular business line, division or subsidiary of a company is often referred to as a “tracking stock.” The pro-rata distribution of a newly issued tracking stock to existing shareholders of the “parent” company is handled in accordance with the guidelines for spin-offs. A similar distribution of a pre-existing tracking stock is handled as a stock distribution of another security.

#### *Mergers & Acquisitions (M&A)*

A merger/acquisition is the combination of two (or more) companies into one larger company, involving an exchange of stock and/or cash payment to the shareholders of the acquired company.

If the issuer of the index security is the company being acquired, the index security is removed the day following the shareholder vote or the expected expiration of the tender offer, provided the acquisition is not contested. In the event the acquisition is contested, the deletion occurs once results have been received that indicate the

acquisition will likely be successful. If the approval is by written consent, then the removal occurs as soon as reasonably practical thereafter.

When the acquiring company is an index security no increase in index shares will occur.

#### *Additions / Deletions*

The deletion and simultaneous addition at other than the index evaluation where the Nasdaq-100 Technology Sector Index will not result in a divisor change as the addition will assume the weight of the deletion. Securities are added or removed from the Nasdaq-100 Technology Sector Index at their last sale price on the day prior to the effective date of the change.

If an index security, at the time of its removal from the Nasdaq-100 Technology Sector Index, is halted from trading on its index exchange and its current last sale price cannot readily be determined, the index security may, at Nasdaq's discretion, be removed at a price of 0.00000001 ("zero price"). This price is applied to the index security after the close of all the trading markets in the Nasdaq-100 Technology Sector Index but prior to the time the official closing value of the Nasdaq-100 Technology Sector Index is disseminated.

#### *Index Share Adjustments*

Other than as a direct result of corporate actions, the Nasdaq-100 Technology Sector Index does not normally experience share adjustments between scheduled index rebalance and reconstitution events.

#### *Bankruptcy*

In the event that an existing index constituent files for bankruptcy or equivalent protection from creditors, affected securities will be removed from their respective indexes, on a best-efforts basis, as soon as practicable after Nasdaq becomes aware of the filing.

If the index constituent is still available for trading on its primary exchange, it is removed from the Nasdaq-100 Technology Sector Index at the security's last trading price. If the security is no longer trading per its primary exchange, the constituent may be removed at an OTC price, if judged reliable. When no sufficiently reliable price exists, the security is removed at a price of zero.

#### *Sanctions*

Generally, Nasdaq Indices will approach the treatment of sanctions through the lens of United States, United Kingdom, and/or European Union based investors. Most sanctions can be thought of as being either comprehensive or selective:

Comprehensive sanctions programs are geographically oriented, and often apply broad-based financial restrictions on entire countries. Examples include Cuba, North Korea, Iran, and Syria. Companies in countries targeted by comprehensive sanctions are not eligible for inclusion in the Nasdaq-100 Technology Sector Index.

Other sanctions programs are more selective, and target specific companies and individuals regardless of their locations. Nasdaq consults multiple sources in order to identify and interpret relevant sanctions on a best-efforts basis.

Because different sanctions programs include a variety of evolving restrictions and requirements, sanctions generally require a case-by-case review. Any resulting index adjustments, if necessary, will be made at the sole discretion of the Nasdaq Index Management Committee.

#### *Other Adjustments*

Nasdaq may make adjustments in circumstances other than those detailed in the index methodology, but not limited to adjustments necessary to ensure Nasdaq-100 Technology Sector Index and/or market integrity. Nasdaq may exercise discretion or expert judgement (other than that which is purely mechanical and, where relevant, implemented in accordance with the index methodology) when the situation calls for the interpretation of data in calculating and maintaining the Nasdaq-100 Technology Sector Index, including application of corporate actions. The use of expert judgement is overseen by the index governance process and mandates that the discretion or expert judgement would be exercised (i) in good faith and in a commercially reasonable manner and (ii) in such a manner as to ensure, as far as commercially reasonable, consistency in the approach it adopts with regard to the exercise of such discretion or expert judgement.

## Index Governance

The Nasdaq Index Management Committee approves all new index methodologies. This committee is comprised of full-time professional members of Nasdaq. The committee meets regularly, and reviews items including, but not limited to, pending corporate actions that may affect index constituents, statistics comparing the composition of the name of our index to the market, companies that are being considered as candidates for addition to the name of our index, and any significant market events.

## Discretionary Adjustment

The index methodology was created by Nasdaq to achieve the aforementioned objective of measuring the underlying purpose of the Nasdaq-100 Technology Sector Index. Any deviations from the index methodology are made in the sole judgment and discretion of Nasdaq so that the Nasdaq-100 Technology Sector Index continues to achieve its objective.

**For information about the construction, calculation methodology and maintenance of the Nasdaq-100 Index<sup>®</sup>, please see “—Nasdaq-100 Index<sup>®</sup>” above.**

*License Agreement between Nasdaq, Inc. and GS Finance Corp.*

The Product(s) is not sponsored, endorsed, sold or promoted by Nasdaq, Inc. or its affiliates (Nasdaq, with its affiliates, are referred to as the “Corporations”). The Corporations have not passed on the legality or suitability of, or the accuracy or adequacy of descriptions and disclosures relating to, the Product(s). The Corporations make no representation or warranty, express or implied to the owners of the Product(s) or any member of the public regarding the advisability of investing in securities generally or in the Product(s) particularly, or the ability of the Nasdaq-100 Technology Sector Index to track general stock market performance. The Corporations' only relationship to GS Finance Corp. (“Licensee”) is in the licensing of the Nasdaq<sup>®</sup>, the Nasdaq-100 Technology Sector Index, Nasdaq-100 Index<sup>®</sup>, and certain trade names of the Corporations and the use of the Nasdaq-100 Index<sup>®</sup> which is determined, composed and calculated by Nasdaq without regard to Licensee or the Product(s). Nasdaq has no obligation to take the needs of the Licensee or the owners of the Product(s) into consideration in determining, composing or calculating the Nasdaq-100 Technology Sector Index or the Nasdaq-100 Index<sup>®</sup>. The Corporations are not responsible for and have not participated in the determination of the timing of, prices at, or quantities of the Product(s) to be issued or in the determination or calculation of the equation by which the Product(s) is to be converted into cash. The Corporations have no liability in connection with the administration, marketing or trading of the Product(s).

The Corporations do not guarantee the accuracy and/or uninterrupted calculation of Nasdaq-100 Index<sup>®</sup> or any data included therein. The Corporations make no warranty, express or implied, as to results to be obtained by Licensee, owners of the product(s), or any other person or entity from the use of the Nasdaq-100 Technology Sector Index or the Nasdaq-100 Index<sup>®</sup> or any data included therein. The Corporations make no express or implied warranties, and expressly disclaim all warranties of merchantability or fitness for a particular purpose or use with respect to the Nasdaq-100 Index<sup>®</sup> or any data included therein. Without limiting any of the foregoing, in no event shall the Corporations have any liability for any lost profits or special, incidental, punitive, indirect, or consequential damages, even if notified of the possibility of such damages.

## Nikkei 225

The Nikkei Stock Average, more commonly known as the Nikkei 225:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first published on September 7, 1950 and was originally calculated by the Tokyo Stock Exchange but has been calculated by Nikkei Inc. since 1970; and
- is calculated, published and disseminated daily by Nikkei Inc.

The Nikkei 225 is comprised of 225 highly liquid stocks of the Tokyo Stock Exchange Prime Market and aims to maintain long-term continuity and reflect changes in industry structure. The real-time price return Japanese yen value of the Nikkei 225 is reported by Bloomberg under the ticker symbol “NKY”. According to Nikkei Inc., the Nikkei 225 has been widely followed throughout its history as a barometer of the Japanese equity markets and the Japanese economy following World War II. Additional information about the Nikkei 225 (including the top ten constituent stocks and weights and sector weights) can be found on Nikkei Inc.’s website at: [indexes.nikkei.co.jp/en/nkave](https://indexes.nikkei.co.jp/en/nkave). We are not incorporating by reference the website or any material it includes in this document. Nikkei Inc. is under no obligation to continue to publish the Nikkei 225 and may discontinue the Nikkei 225 at any time as further described below.

Prior to April 2022, constituent stocks were selected from the Tokyo Stock Exchange first section.

### Construction of the Nikkei 225

In order to be eligible for the Nikkei 225, a stock must be an ordinary share of a domestic company listed on the Tokyo Stock Exchange Prime Market. Non-ordinary shares such as exchange-traded funds, real estate investment trusts, preferred stock, preferred securities and tracking stocks are not eligible. The constituents of the Nikkei 225 are reviewed twice a year at the end of January and July (the “semi-annual review”) and changes are typically implemented on the first trading day of April and October, respectively. The maximum number of constituent changes that may be made pursuant to the semi-annual review is 3. However, a constituent change due to a corporate reorganization near the time of the semi-annual review is not counted toward the maximum number of 3 constituent changes. The semi-annual review focuses on 1) a stock’s liquidity in the market and 2) industry sector balance. The purpose of the semi-annual review is to maintain market representativeness of the constituents.

First, Nikkei Inc. assesses the liquidity of all eligible stocks by considering two factors: trading value of the preceding 5 years and magnitude of price fluctuation by trading value of the preceding 5 years. Magnitude of price fluctuation by trading value is calculated as the quotient of (1) the quotient of (i) the stock’s high price divided by (ii) such stock’s low price divided by (2) such stock’s trading value. After performing the liquidity assessment, the stocks are then ranked in descending order of liquidity and the top 450 stocks constitute the “high liquidity group” and remain eligible for inclusion in the Nikkei 225. Any current constituents falling outside of the high liquidity group (ranked 451 or lower based on liquidity) are deleted from the Nikkei 225. Of those stocks in the high liquidity group, the top 75 with the highest liquidity and not already a constituent are added to the Nikkei 225.

Second, the 450 stocks within the high liquidity group are categorized into the six industrial sectors: technology, financials, consumer goods, industrial materials, capital goods/others and transportation/utilities. Once the number of stocks in each sector is determined, such number is divided in half to determine the target number of stocks from each sector that shall constitute the 225 constituents in the Nikkei 225. If any of the sectors are over-represented at that stage (i.e., there are a greater number of actual constituents in the Nikkei 225 for the sector relative to the target number of stocks for such sector), current constituents in the Nikkei 225 are deleted in order of ascending liquidity so those constituents with the lowest liquidity are removed from the Nikkei 225 until the overage is corrected. If any of the sectors are under-represented (i.e., there are a lesser number of actual constituents in the Nikkei 225 for the sector relative to the target number of stocks for such sector), non-constituent stocks within the high liquidity group are added in order of descending liquidity so those stocks with the highest liquidity are added to the Nikkei 225 until the shortage is corrected. This process is performed to achieve a group of 225 constituents that reflect the intended sector balance.

### Calculation of the Nikkei 225

The Nikkei 225 is a weighted price average index in which the level of the Nikkei 225 is calculated as the *quotient* of (i) the *sum* of all constituents’ adjusted stock prices *divided* by (ii) the divisor (as described below). A constituent’s adjusted stock price is equal to the *product* of (i) the stock’s price *times* (ii) the price adjustment



factor of such stock. For a constituent to which a capping ratio is applied, the price adjustment factor will be replaced by the capped price adjustment factor (as described below). The Nikkei 225 level is rounded to the nearest hundredth and is calculated and published every 5 seconds beginning at 9 am (Tokyo time) daily.

The stock price used in the calculation is selected by the following priority order of the prices in the auction trading of the Tokyo Stock Exchange: (1) special quote, sequential trade quote or temporary quote, (2) traded price and (3) base price. If the special quote, sequential trade quote or temporary quote is used for the calculation, the price will be used until the next valid price is applied, even if the quote is canceled. The traded price includes the traded price in the closing auction. The base price is obtained based on the priority order of the ex-rights theoretical price, the latest special quote price, sequential trade quote price or temporary quote, and the latest traded price up to the preceding day. In most cases, the price used for the calculation of the closing level of the Nikkei 225 on the preceding day becomes the base price. In the case of a stock that is trading ex-rights (e.g., after a stock split) for the first time on that day, however, Nikkei Inc. calculates an ex-rights theoretical price based on the price used for calculation on the preceding day and the appropriate adjustment to reflect the change in the stock. Nikkei Inc. does not adjust for dividends in calculating the Nikkei 225.

The price adjustment factor of a stock to be added to the Nikkei 225 shall be 1, unless the price of such stock is greater than 1% of the sum of the adjusted price of each stock included in the Nikkei 225. If the price of such stock (as determined during the semi-annual review at the end of January and July) exceeds this threshold, the price adjustment factor shall be the highest 0.1 interval from 0.1 through 0.9 that adjusts the price of such stock so that it does not exceed 1% of the sum of the adjusted price of each stock included in the Nikkei 225. The price adjustment factor for a stock is determined at the semi-annual review.

The price adjustment factor of an index constituent will be revised in the case of a large scale stock split (or reverse split). In such event, the price adjustment factor is revised to keep the price level of the constituent unchanged. However, since the price adjustment factor is determined only to one digit after the decimal point, an adjustment to the price adjustment factor could result in a fraction. If such revision to the price adjustment factor is less than 0.1, the price adjustment factor will be set as 0.1 and the remainder of the price differential will be adjusted by the divisor (see below). Revision to the price adjustment factor of an index constituent as a result of a large scale stock split (or reverse split) will be announced at least 5 business days before the effective date.

#### *Capping Ratio*

A capping ratio is a number which is used to temporarily decrease the weight of a constituent when such weight exceeds the weight cap threshold (12% at the semi-annual review in October 2022 and will be reduced to 11% and 10% at the semi-annual reviews in October 2023 and October 2024, respectively). For a constituent to which a capping ratio is applied, the constituent's adjusted stock price is equal to the *product* of (i) the stock's price *times* (ii) the capped price adjustment factor of such stock. The capped price adjustment factor of a stock is equal to the *product* of (i) the price adjustment factor of such stock *times* (ii) the capping ratio of such stock, rounded to the nearest 0.1.

The capping ratio is applied, revised, or cancelled as stipulated below.

- If, at a semi-annual review, the weight of a constituent to which any capping ratio is not yet applied exceeds the weight cap threshold, a capping ratio of 0.9 shall be applied on the effective date of the constituent change resulting from the semi-annual review. If a capping ratio was already applied to such constituent, the capping ratio will be decreased by 0.1. However, if no change is observed in the capped price adjustment factor after the application of the new capping ratio, the capping ratio will be decreased further until there is a change in the capped price adjustment factor.
- If, at a semi-annual review, the weight of a constituent to which a capped price adjustment factor is applied is below 5%, the capping ratio will be increased by 0.1 on the effective date of the constituent change resulting from the semi-annual review. However, if no change is observed in the capped price adjustment factor after the application of the new capping ratio, the capping ratio will be increased further until there is a change in the capped price adjustment factor. If the new capping ratio after the increase is 1, the capping ratio will be canceled.
- In the case of a large scale split or reverse split of a constituent to which the capped price adjustment factor is applied, if the price adjustment factor is adjusted by the ratio of the split or reverse split, the capping ratio may be revised so that the new capped price adjustment factor does not change the weight of the constituent. For such a constituent, the capping ratio may have fractions after 0.1 and may be increased or decreased by the number other than 0.1 in the next revision of the capping ratio.

- In principle, the capping ratio is applied, revised, or cancelled on the effective date of the constituent change resulting from the semi-annual review. However, depending on the liquidity of the constituent, changes in the capping ratio may be implemented in two or more steps.

#### *Divisor Adjustments*

As noted above, the Nikkei 225 is calculated as an adjusted price average index, where the weight is based on the price adjustment factor. The divisor is intended to maintain continuity of the Nikkei 225 and is the denominator of the fraction used to calculate the average. The divisor was initially the number of constituents, but has been adjusted over time to reflect changes in the constituents and to maintain the continuity of the index.

When constituents are changed, the sum of stock prices (the numerator of the fraction prior to adjustment) changes based upon the prices of additions and deletions to the Nikkei 225. Therefore, in order to maintain index continuity over time, the divisor is recalculated for the following events, except in the case of certain large scale splits and reverse splits, as discussed above: (i) changes in the constituents; (ii) corporate actions such as splits, reverse splits and paid-in capital increases; and (iii) capping ratio application, revision, cancellation or raising the price adjustment factor to the planned value for a stock whose price adjustment factor was one-half of the planned value.

The divisor for the next business day is calculated as the *product* of (i) the current day's divisor *times* (ii) the *quotient* of (a) the *sum* of the base prices for the next business day's constituents *divided* by (b) the *aggregate* of the closing price of each of the current day's constituents used to calculate the Nikkei 225 level for the current day *times* the price adjustment factor of such constituent for the current day. For purposes of calculating the divisor, the base price for the next business day's constituents will be equal to the *product* of (i) the base price for the next business day *times* (ii) the price adjustment factor for the next business day. For constituents to which a capping ratio has been applied, the capped price adjustment factor is used to adjust the price instead of the price adjustment factor.

The divisor is published on Nikkei Inc.'s website on each Tokyo Stock Exchange trading day and is rounded to the nearest one hundred-millionth. For additional information about the divisor, as well as calculation examples of divisor changes, please see the index guide on Nikkei Inc.'s website.

#### *Maintenance of the Nikkei 225*

#### *Extraordinary Replacement*

In addition to additions and deletions of constituents resulting from the semi-annual review, changes to index constituents may also be made as a result of certain extraordinary events. Stocks designated by the Tokyo Stock Exchange as a "security to be delisted" or "securities on alert," stocks affected by corporate restructuring (including mergers, share exchanges and share transfers), or stocks transferred to the Tokyo Stock Exchange market other than the Prime will be deleted from the Nikkei 225. Constituents that are designated by the Tokyo Stock Exchange as "a security under supervision" will remain constituents of the Nikkei 225 at the time of designation. However, Nikkei may replace such a constituent with a pre-announcement when it is highly inappropriate to keep the stock as a constituent, e.g. when the probability of delisting is extremely high.

If a constituent has been deleted from the Nikkei 225 based on an event described above, a stock will be added to replace the deleted constituent by selecting the highest liquidity stock in the same sector as the deleted constituent from the high liquidity group determined during the last semi-annual review. However, if a deletion is scheduled close to an semi-annual review, additional stocks may be selected as part of the applicable semi-annual review process. Additionally, if there are multiple deletions in a short period of time not close to a scheduled semi-annual review, the standard semi-annual review process assessing liquidity and sector balance will be followed to select new constituents rather than referring to the last semi-annual review list.

#### *Special Rules for Additions Resulting from Other Corporate Actions*

Notwithstanding the process above, the following procedures may be applied in certain cases of corporate restructuring. Application of these special rules is determined for each particular case. Where (i) a constituent is merged and delisted or (ii) a newly established listed parent company receives its shares by transfer or exchange from another constituent, the delisted stock may be replaced by the successor company's stock if it becomes listed on the Tokyo Stock Exchange Prime Market. In the case of spin-offs where multiple companies remain listed on the Tokyo Stock Exchange Prime Market, the stock of the company that succeeds to the major operations of the former company will become a constituent of the Nikkei 225.

Except for constituent changes resulting from the semi-annual review and from the circumstances described above under “Extraordinary Replacement” and “Special Rules for Additions Resulting from Other Corporate Actions”, there is no process for adding new constituents to the Nikkei 225. After consultation with academics and market professionals, Nikkei Inc. decides and announces the list of deletions and additions. As discussed above under “Calculation of the Nikkei 225”, the divisor is adjusted accordingly to maintain continuity when constituents are added or deleted from the Nikkei 225. Deletions and additions to the Nikkei 225 resulting from either the semi-annual review or extraordinary events are generally effective on the same day in an effort to maintain the number of constituents at 225. However, when necessary, additions may be made after the deletions take effect and during the interim period, the Nikkei 225 may be calculated with less than 225 constituents. For example, when a constituent is delisted by share exchange or transfer and the succeeding company such as the newly formed parent company or an unlisted company becomes the parent by receiving the shares of the delisted company and listing its shares in a short period of time.

#### *Changes to the Nikkei 225 Methodology*

Although the Nikkei 225 is calculated and maintained in accordance with the information provided in the methodology maintained on Nikkei Inc.’s website, Nikkei Inc. has discretion to take measures it deems appropriate upon the occurrence of events which are not covered in the methodology or in circumstances where it is difficult to continue to calculate the Nikkei 225 using the rules described in such methodology.

#### *License Agreement between Nikkei Inc. and GS Finance Corp.*

Goldman Sachs has entered into a non-exclusive license agreement with Nikkei Inc. (“NKI”) whereby GS Finance Corp., in exchange for a fee, will be permitted to use the Nikkei 225 in connection with the offer and sale of your security. Any intellectual property rights relating to the Nikkei 225 belong to NKI. Goldman Sachs is not affiliated with NKI; the only relationship between NKI and Goldman Sachs is the licensing of the use of the Nikkei 225 and trademarks relating to the Nikkei 225.

NKI is under no obligation to continue the calculation and dissemination of the Nikkei 225. Your security is not sponsored, endorsed, sold or otherwise promoted by NKI. No inference should be drawn from the information contained herein that NKI makes any representation or warranty, express or implied, to us or any holder of your security or any member of the public regarding the advisability of investing in securities generally or in your security in particular or the ability of the Nikkei 225 to track generally stock market performance.

NKI determines, composes and calculates the Nikkei 225 without regard to your security. NKI has no obligation to take into account your interest, or that of anyone else having an interest, in your security in determining, composing or calculating the Nikkei 225 or any successor index. NKI is not responsible for and has not participated in the determination of the terms, prices or amount of your security and will not be responsible for or participate in any determination or calculation regarding the principal amount of your security payable at the stated maturity date. NKI has no obligation or liability in connection with the administration, marketing or trading of your security.

Neither NKI nor any of its affiliates accepts any responsibility for the calculation, maintenance or publication of the Nikkei 225. NKI disclaims all responsibility for any errors or omissions in the calculation and dissemination of the Nikkei 225 or the manner in which the Nikkei 225 is applied in determining the level of the Nikkei 225 or any amount payable upon maturity of your security.

NKI DOES NOT GUARANTEE THE ACCURACY OR THE COMPLETENESS OF THE NIKKEI 225 OR ANY DATA INCLUDED IN THE NIKKEI 225. NKI ASSUMES NO LIABILITY FOR ANY ERRORS OR OMISSIONS.

**Russell 2000® Futures Excess Return Index**

The Russell 2000® Futures Excess Return Index, which we also refer to in this description as the “index”:

- is an equity futures index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of May 20, 2024, with a base value of 100 as of its base date, September 16, 2011; and
- is sponsored by FTSE Russell (“FTSE Russell”).

The Russell 2000® Futures Excess Return Index measures the performance of the first nearby E-mini Russell 2000 futures contract (symbol: “RTY”) trading on the Chicago Mercantile Exchange (“CME”). E-mini Russell 2000 futures contracts are quarterly contracts to buy or sell standardized trading “units”. One trading unit of E-mini Russell 2000 futures contracts equals \$50 multiplied by the Russell 2000® Index (price return version). The Russell 2000® Index measures the composite price performance of stocks of 2,000 companies incorporated in the U.S., its territories and certain “benefit-driven incorporation countries” and is designed to track the performance of the small capitalization segment of the U.S. equity market. The index is calculated in U.S. dollars (\$) on an excess return basis. The index and the Russell 2000® Index are calculated, maintained and published by FTSE Russell. Additional information about the index and the Russell 2000® Index (including sector weights) is available on the following websites: [lseg.com/en/ftse-russell/indices/russell-futures](https://www.ftserussell.com/en/ftse-russell/indices/russell-futures) and [lseg.com/en/ftse-russell/indices/russell-us#t-russell-2000](https://www.ftserussell.com/en/ftse-russell/indices/russell-us#t-russell-2000). We are not incorporating by reference the websites or any material they include in this underlier supplement.

**Roll Methodology**

The index is constructed from a single E-mini Russell 2000 futures contract. When the first nearby E-mini Russell 2000 futures contract approaches expiration, it is replaced by the second nearby E-mini Russell 2000 futures contract. This process is referred to as “rolling”.

Rolling is conducted over three business days every March, June, September and December and commences five business days prior to the last trade date of the first nearby E-mini Russell 2000 futures contract. For example, if the last trade date of the first nearby E-mini Russell 2000 future is on the 3rd Friday of the month, the roll period will commence on the second Friday of the month, five business days before. This is referred to as the “roll period”.

On each business day of the roll period, a proportion of the index weight in the first nearby E-mini Russell 2000 futures contract is rolled into the second nearby E-mini Russell 2000 futures contract at the daily settlement price of the respective futures contracts. The closing weights on each day in the roll period are as follows:

Roll day	Weights (at close)	
	First nearby futures contract	Second nearby futures contract
1	2/3	1/3
2	1/3	2/3
3	0	1

**Market Disruption Events**

If a market disruption event occurs on the last business day of the scheduled roll period, the roll on such a business day shall not be postponed. If a market disruption event occurs on any business day during the scheduled roll period that is not the last business day of the scheduled roll period, then the portion of the roll shall be postponed to the first roll business day immediately following such business day as per above.

If, on any business day, a market disruption event occurs or is occurring that MerQube (the “index calculation agent”) determines, in its sole discretion, materially affects the Russell 2000® Futures Excess Return Index, the index calculation agent may:

- use the last available closing futures value to calculate and publish the closing index level; and/or
- defer or suspend the calculation and publication of the closing index level and any other information relating to the Russell 2000® Futures Excess Return Index until the next business day on which such market disruption event has ceased.

If a market disruption event has occurred, resulting in the index calculation agent exercising its discretion as described above, the index calculation agent will inform FTSE Russell of the decision as soon after calculation and dissemination of the index value on that day as possible.

A market disruption event means, with respect to the index, the occurrence of one or more of the following events if, in the discretion of the index calculation agent, such event is material:

- the index calculation agent observes on any business day that there has been a declaration of a general moratorium in respect of banking activities in any relevant jurisdiction;
- the occurrence of an event that makes it impossible or not reasonably practicable on any business day for the index calculation agent to obtain the value of any futures contract, or any other price or necessary information for purposes of calculating the index value in a manner acceptable to the index calculation agent;
- the administrator of the underlying futures contract fails to announce or publish the level of such futures contract on a business day on which the level of such futures contract was scheduled to be announced or published;
- the occurrence or existence of a lack of, or material decline in, the liquidity in the market for trading of any underlying futures contract on any business day;
- a force majeure event; or any event that disrupts or impairs (as determined by the index calculation agent acting in a reasonable manner) the ability of market participants in general to establish, maintain or unwind transactions in, or obtain market values for, futures, forwards, options, swaps or other over-the-counter derivative transactions indirectly included in and/or that may be used for hedging any futures contract; or
- a suspension, disruption, absence or material limitation imposed on trading by the relevant exchanges (or related exchanges(s)) or observed in any related over-the-counter market(s) or otherwise and whether by reason of movements in price exceeding limits permitted by the relevant exchange(s) or related exchange(s) or otherwise in the futures, forwards, options, swaps or other over-the-counter derivative transactions indirectly included in and/or that may be used for hedging the Russell 2000<sup>®</sup> Futures Excess Return Index.

#### *Index Calculation*

The index is calculated on each day on which the CME is open for trading. The index value of the index on any given index business day will be calculated as the *product* of: (i) the value of the index as of the preceding business day and (ii) the daily return of the futures contract.

On any business day (other than during the roll period), the daily return of a futures contract is calculated as the official daily settlement price of the futures contract quoted by the exchange divided by the settlement price on the preceding business day.

During the roll period, the calculation of the daily return will reflect the price of the second nearby futures contract into which the first nearby futures contract is gradually rolled.

**For information about the construction, calculation methodology and maintenance of the Russell 2000<sup>®</sup> Index, please see “—Russell 2000<sup>®</sup> Index” below.**

*License Agreement between Frank Russell Company (doing business as FTSE Russell) and GS Finance Corp.*

Frank Russell Company doing business as FTSE Russell (“Russell”) and Goldman Sachs International have entered into a non-exclusive license agreement, granting GS Finance Corp., in exchange for a fee, permission to use the Russell 2000<sup>®</sup> Futures Excess Return Index or the Russell 2000<sup>®</sup> Index in connection with the offer and sale of the securities. GS Finance Corp. is not affiliated with Russell; the only relationship between Russell and GS Finance Corp. is the licensing of the use of the Russell 2000<sup>®</sup> Futures Excess Return Index or the Russell 2000<sup>®</sup> Index (a trademark of Russell) and trademarks relating to the Russell 2000<sup>®</sup> Futures Excess Return Index or the Russell 2000<sup>®</sup> Index.

GS Finance Corp. does not accept any responsibility for the calculation, maintenance or publication of the Russell 2000<sup>®</sup> Futures Excess Return Index or Russell 2000<sup>®</sup> Index or any successor index.

The securities (the “Product”) has been developed solely by Goldman Sachs. The “Product” is not in any way connected to or sponsored, endorsed, sold or promoted by the London Stock Exchange Group plc and its group undertakings (collectively, the “LSE Group”). FTSE Russell is a trading name of certain of the LSE Group companies.

All rights in the Russell 2000® Futures Excess Return Index (the “Index”) vest in the relevant LSE Group company which owns the Index. “FTSE®” “Russell®”, “FTSE Russell®” are trade mark(s) of the relevant LSE Group company and are used by any other LSE Group company under license.

The Index is calculated by or on behalf of FTSE International Limited or its affiliate, agent or partner. The LSE Group does not accept any liability whatsoever to any person arising out of (a) the use of, reliance on or any error in the Index or (b) investment in or operation of the Product. The LSE Group makes no claim, prediction, warranty or representation either as to the results to be obtained from the Product or the suitability of the Index for the purpose to which it is being put by Goldman Sachs.

## Russell 2000® Index

The Russell 2000® Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first launched in 1984 based on an initial value of 100 as of December 31, 1978; and
- is sponsored by FTSE Russell (“FTSE Russell”)

The Russell 2000® Index measures the composite price performance of stocks of 2,000 companies in the U.S. equity market. It is generally considered to be a “small-cap” index. Additional information about the Russell 2000® Index (including the top ten constituent stocks and sector weights) is available on the following website: [ftse.com/analytics/factsheets/Home/Search#](https://ftse.com/analytics/factsheets/Home/Search#). We are not incorporating by reference the website or any material it includes in this underlier supplement.

The Russell 2000® Index includes approximately 2,000 of the smallest securities that form the Russell 3000® Index. The Russell 3000® Index is comprised of the 3,000 largest U.S. companies, or 98% based on market capitalization, of the investable U.S. equity market. The Russell 2000® Index is designed to track the performance of the small capitalization segment of the U.S. equity market.

### *Selection of Constituent Stocks of the Russell 2000® Index*

The Russell 2000® Index is a sub-index of the Russell 3000® Index. To be eligible for inclusion in the Russell 3000® Index, and, consequently, the Russell 2000® Index, a company's stocks must be listed on the rank day and FTSE Russell must have access to documentation verifying the company's eligibility for inclusion. The rank day occurs on the last business day of April with membership eligibility determined using public information available on the rank day and market capitalizations calculated at market close. Eligible initial public offerings (“IPOs”) are added to Russell U.S. Indices quarterly, based on total market capitalization rankings within the market-adjusted capitalization breaks established during the most recent reconstitution. To be added to any Russell U.S. index during a quarter outside of reconstitution, IPOs must meet additional eligibility criteria.

A company is included in the U.S. equity markets and is eligible for inclusion in the Russell 3000® Index, and consequently, the Russell 2000® Index, if that company incorporates in the U.S., has its headquarters in the U.S. and also trades with the highest liquidity in the U.S. If a company does not satisfy all of the above criteria, it can still be included in the U.S. equity market if any one of the following home country indicators is in the United States: (i) country of incorporation, (ii) country of headquarters and (iii) country in which the company trades with the highest liquidity (as defined by a two-year average daily dollar trading volume from all exchanges within the country), and the primary location of that company's assets or its revenue, based on an average of two years of assets or revenues data, is also in the United States. In addition, if there is insufficient information to assign a company to the U.S. equity markets based on its assets or revenue, the company may nonetheless be assigned to the U.S. equity markets if the headquarters of the company is located in the United States or if the headquarters of the company is located in certain “benefit-driven incorporation countries”, or “BDIs”, and that company's most liquid stock exchange is in the United States. The BDI countries are Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bonaire, British Virgin Islands, Cayman Islands, Channel Islands, Cook Islands, Curaçao, Faroe Islands, Gibraltar, Guernsey, Isle of Man, Jersey, Liberia, Marshall Islands, Panama, Saba, Sint Eustatius, Sint Maarten and Turks and Caicos Islands. A U.S.-listed company is not eligible for inclusion within the U.S. equity market if it has been classified by FTSE Russell as a China N share on the rank date of the index reconstitution. A company will be considered a China N share if the following criteria are satisfied: (i) the company is incorporated outside of mainland China, (ii) the company is listed on the NYSE, the Nasdaq or the NYSE American (formerly the NYSE MKT), (iii) the company has a headquarter or principal executive office or its establishment in mainland China, with the majority of its revenue or assets derived from the People's Republic of China, and (iv) the company is controlled by a mainland Chinese entity, company or individual (if the shareholder background cannot be determined with publicly available information, FTSE Russell will consider whether the establishment and origin of the company are in mainland China and whether the company is headquartered in mainland China). An existing China N Share which fails one or more of the following criteria will cease to be classified as a China N share: (i) the company is no longer incorporated outside the People's Republic of China, (ii) the company is no longer listed on the NYSE, the Nasdaq exchange, or the NYSE American, (iii) the percentages of revenue and assets derived from the People's Republic of China have both fallen below 45 percent, or (iv) the company is acquired/a controlling stake is held by a non-Mainland Chinese state entity, company or individual. Only asset and revenue data from the most recent annual report is considered

when evaluating whether a company should be classified a China N share (i.e., there will be no two year averaging). ADRs and ADSs are not eligible for inclusion in the Russell 2000® Index.

In addition, all securities eligible for inclusion in the Russell 3000® Index, and consequently, the Russell 2000® Index, must trade on an eligible exchange (CBOE (formerly BATS), NYSE, NYSE American (formerly NYSE MKT), NYSE Arca and Nasdaq).

#### *Exclusions from the Russell 2000® Index*

FTSE Russell specifically excludes the following companies and securities from the Russell 2000® Index: (i) preferred and convertible preferred stock, redeemable shares, participating preferred stock, warrants, rights, depository receipts, installment receipts and trust receipts; (ii) royalty trusts, U.S. limited liability companies, closed-end investment companies, companies that are required to report Acquired Fund Fees and Expenses (as defined by the SEC), including business development companies, blank check companies, special-purpose acquisition companies and limited partnerships; (iii) companies with a total market capitalization less than \$30 million; (iv) companies with only a small portion of their shares available in the free-float as defined by FTSE Russell (companies with less than an absolute 5% of shares available); (v) bulletin board, pink sheets or over-the-counter traded securities, including securities for which prices are displayed on the FINRA ADF; (vi) real estate investment trusts and publicly traded partnerships that generate, or have historically generated, unrelated business taxable income and have not taken steps to block their unrelated business taxable income to equity holders; and (vii) companies with less than 5% of the company's voting rights in the hands of unrestricted shareholders.

#### *Initial List of Eligible Securities*

The primary criterion FTSE Russell uses to determine the initial list of securities eligible for the Russell 3000® Index and, consequently, the Russell 2000® Index, is total market capitalization, which is calculated by multiplying the total outstanding shares for a company by the market price as of the rank day for those securities being considered at annual reconstitution. IPOs may be added between constitutions as noted below. All common stock share classes are combined in determining a company's total shares outstanding. If multiple share classes have been combined, the number of total shares outstanding will be multiplied by the primary exchange close price and used to determine the company's total market capitalization. In cases where the common stock share classes act independently of each other (e.g., tracking stocks), each class is considered for inclusion separately. Stocks must have a closing price at or above \$1.00 on their primary exchange or an eligible secondary exchange on the last trading day of May of each year to be eligible for inclusion in the Russell 2000® Index. In order to reduce unnecessary turnover, if an existing member's closing price is less than \$1.00 on the rank day, it will be considered eligible if the average of the daily closing prices from their primary exchange during the 30 days prior to the rank day is equal to or greater than \$1.00. If an existing member does not trade on the rank day, it must price at \$1.00 or above on another eligible U.S. exchange to remain eligible.

#### *Multiple Share Classes*

If an eligible company trades under multiple share classes or if a company distributes shares of an additional share class to its existing shareholders through a mandatory corporate action, each share class will be reviewed independently for inclusion. Share classes in addition to the primary vehicle (the pricing vehicle) that have a total market capitalization larger than \$30 million, an average daily dollar trading value that exceeds that of the global median, and a float of 5% or greater of shares available in the free-float as defined by FTSE Russell are eligible for inclusion.

The pricing vehicle will generally be designated as the share class with the highest two-year trading volume as of the rank day. In the absence of two years' worth of data, all available data will be used for this calculation. If the difference between trading volumes for each share class is less than 20%, the share class with the most available shares outstanding will be used as the pricing vehicle. At least 100 day trading volume is necessary to consider the class as a pricing vehicle for existing members. New members will be analyzed on all available data, even if that data is for less than 100 days.

#### *Annual Reconstitution*

The Russell 2000® Index is reconstituted annually by FTSE Russell to reflect changes in the marketplace. The list of companies is ranked based on total market capitalization on the last trading day in May, with the actual reconstitution occurring on the fourth Friday of June each year. A full calendar for reconstitution is published each spring.



A company's total shares are multiplied by the primary exchange close price of the pricing vehicle and used to determine the company's total market capitalization for the purpose of ranking of companies and determination of index membership. If no volume exists on the primary exchange on the rank day, the last trade price from an eligible secondary exchange will be used where volume exists (using the lowest trade price above \$1.00 if multiple secondary markets exist). The company's rank will be determined based on the cumulative market capitalization. As of the June 2016 reconstitution, any share class not qualifying for eligibility independently will not be aggregated with the pricing vehicle within the available shares calculation.

For mergers and spin-offs that are effective between the rank day and the business day immediately before the index lock down takes effect ahead of the annual reconstitution in June, the market capitalizations of the impacted securities are recalculated and membership is reevaluated as of the effective date of the corporate action. For corporate events that occur during the reconstitution lock down period (which takes effect from the open on the first day of the lock down period onwards), market capitalizations and memberships will not be reevaluated. Non index members that have been considered ineligible as of rank day will not be reevaluated in the event of a subsequent corporate action that occurs between rank day and the reconstitution effective date.

#### *Index Calculation and Capitalization Adjustments*

As a capitalization-weighted index, the Russell 2000® Index reflects changes in the capitalization, or market value, of the index stocks relative to the capitalization on a base date. This discussion describes the "price return" calculation of the Russell 2000® Index. The applicable pricing supplement will describe the calculation if the underlier for your securities is not the price return calculation. The current Russell 2000® Index value is the compounded result of the cumulative daily (or monthly) return percentages, where the starting value of the Russell 2000® Index is equal to the base value (100) and base date (December 31, 1978). Returns between any two dates can then be derived by dividing the ending period index value ( $IV_1$ ) by the beginning period ( $IV_0$ ) index value, so that the return equals  $[(IV_1 / IV_0) - 1] * 100$ .

Constituent stocks of the index are weighted in the Russell 2000® Index by their free-float market capitalization, which is calculated by multiplying the primary closing price by the number of free-float shares. Free-float shares are shares that are available to the public for purchase as determined by FTSE Russell. Adjustments to shares are reviewed quarterly (including at reconstitution) and for major corporate actions such as mergers. Total shares and adjustments for available shares are based on information recorded in SEC corporate filings.

The following are excluded from free float: shares directly owned by state, regional, municipal and local governments (excluding shares held by independently managed pension schemes for governments); shares held by directors, senior executives and managers of the company, and by their family and direct relations, and by companies with which they are affiliated; shares held within employee share plans; shares held by public companies or by non-listed subsidiaries of public companies; shares held by sovereign wealth funds, founders, promoters, former directors, founding venture capital and private equity firms, private companies, individuals (including employees) and shares held by several holders acting in concert where the holding is 10% or greater of the total number of shares in issue; all shares where the holder is subject to a lock-up clause (for the duration of that clause, after which free float changes resulting from the expiry of a lock-up will be implemented at the next quarterly review subject to the lock-up expiry date occurring on or prior to the share and float change information cut-off date); shares held by an investor, investment company or an investment fund that is actively participating in the management of a company or is holding shares for publicly announced strategic reasons, or has successfully placed a current member to the board of directors of a company; and shares that are subject to ongoing contractual agreements (such as swaps) where they would ordinarily be treated as restricted. In addition, while portfolio holdings such as pension funds, insurance funds or investment companies will generally not be considered as restricted from free float, where a single portfolio holding is 30% or greater it will be regarded as strategic and therefore restricted (and will remain restricted until the holding falls below 30%).

#### *Corporate Actions Affecting the Index*

FTSE Russell adjusts the Russell 2000® Index on a daily basis in response to certain corporate actions and events. Therefore, a company's membership in the Russell 2000® Index and its weight in the Russell 2000® Index can be impacted by these corporate actions. The adjustment is applied based on sources of public information, including press releases and Securities and Exchange Commission filings. Prior to the completion of a corporate action or event, FTSE Russell estimates the effective date. FTSE Russell will then adjust the anticipated effective date based on public information until the date is considered final. Depending on the time on a given day that an action is determined to be final, FTSE Russell will generally either (1) apply the action before the open on the ex-date or (2) apply the action after providing appropriate notice. If FTSE Russell has confirmed the completion of a corporate action, scheduled to become effective subsequent to a rebalance, the event may be implemented in

conjunction with the rebalance to limit turnover, provided appropriate notice can be given. FTSE Russell applies the following methodology guidelines when adjusting the Russell 2000® Index in response to corporate actions and events:

**“No Replacement” Rule** — Securities that are deleted from the Russell 2000® Index between reconstitution dates, for any reason (e.g., mergers, acquisitions or other similar corporate activity) are not replaced. Thus, the number of securities in the Russell 2000® Index over the past year will fluctuate according to corporate activity.

#### ***Mergers and Acquisitions***

Adjustments due to mergers and acquisitions are applied to the Russell 2000® Index after the action is determined to be final. In the event that a constituent is being acquired for cash or is delisted subsequent to an index review, such constituent will be removed from the Russell 2000® Index in conjunction with the index review, assuming that the action is determined to be final and a minimum of two days' notice can be provided.

**Between constituents:** When mergers and acquisitions take place between companies that are both constituents of a Russell index for cash, the target company is deleted from the Russell 2000® Index at the last traded price. When mergers and acquisitions take place between companies that are both constituents of a Russell index for stock, the target company is deleted from the Russell 2000® Index and the shares of the acquiring stock are increased according to the offer terms. When mergers and acquisitions take place between companies that are both constituents of a Russell index for cash or stock or a combination thereof, the target company is deleted from the Russell 2000® Index and the shares of the acquiring company are simultaneously increased per the merger terms.

**Between a constituent and a non-constituent:** If the target company is a member of the Russell 2000® Index, it is deleted from the Russell 2000® Index and the acquiring company will be included initially in the Russell 2000® Index provided it is eligible in all other respects at the time of the merger, regardless of previous eligibility screenings. If the acquiring company is deemed eligible it will be added to the Russell 2000® Index on the effective date and the opening price will be calculated using the offer terms. When the target company is a FTSE Russell Universe member, the shares of the member acquiring company will be updated to reflect the merger. Any share update will be made giving appropriate notice.

Given sufficient market hours after the confirmation of a merger or acquisition, FTSE Russell effects the action after the close on the last day of trading of the target company, or at an appropriate time once the transaction has been deemed to be final.

**Rights Offerings** — Rights offered to shareholders are reflected in the Russell 2000® Index only if the subscription price of the rights is at a discount to the market price of the stock. Provided that FTSE Russell has been alerted to the rights offer prior to the ex-date, it will adjust the price of the stock for the value of the rights and increased shares according to the terms of the offering before the open on the ex-date.

**Spin-offs** — If the spin-off entity meets the eligibility requirements for the Russell 2000® Index, the spin-off entity will be added to the Russell 2000® Index on the ex-date of the distribution. The spin-off entity will be retained in the Russell 2000® Index until the next annual reconstitution, when it will be evaluated for inclusion. If the spin-off entity does not meet the eligibility requirements for the Russell 2000® Index, the spin-off entity will be added to the Russell 2000® Index on the ex-date of the distribution. It will remain in the Russell 2000® Index until listing and settlement and then deleted at market price with notice.

**Initial Public Offerings** — Eligible IPOs are added to the Russell 2000® Index based on total market capitalization ranking within the market-adjusted capitalization breaks established at the most recent annual reconstitution.

An IPO of additional share classes will be considered for eligibility and must meet the same eligibility criteria for all other multiple share classes. If at the time of the IPO the additional share class does not meet the eligibility criteria for separate index membership, it will not be added to the Russell 2000® Index and will subsequently be reviewed for index membership during the next annual reconstitution.

Once IPO additions have been announced, an IPO may be added to the Russell 2000® Index prior to the previously announced schedule, if a corporate action has deemed this to be appropriate and notice can be provided (e.g. an index member automatically receives shares via a stock distribution into a projected IPO add).

**Tender Offers** — A company acquired as a result of a tender offer is removed when (i) (a) the bidder's shareholding has reached at least 90%; (b) shareholders have validly tendered and the shares have been irrevocably accepted for payment; and (c) all pertinent offer conditions have been reasonably met and the acquirer has not explicitly stated that it does not intend to acquire the remaining shares; (ii) there is reason to believe that the remaining free float is under 5% based on information available at the time; or (iii) following

completion of the offer the acquirer has stated intent to finalize the acquisition via a short-form merger, squeeze-out, top-up option or any other compulsory mechanism.

Where the conditions for index deletion are not met, FTSE Russell may implement a free float change based on the reported acceptance results at the expiration of the initial, subsequent or final offer period where (i) the minimum acceptance level as stipulated by the acquirer is met; (ii) shareholders have validly tendered and the shares have been irrevocably accepted for payment; (iii) all pertinent offer conditions have been reasonably met and (iv) the change to the current float factor is greater than 3%. FTSE Russell uses the published results of the offer to determine the new free float of the target company. If no information is published in conjunction with the results from which FTSE Russell can determine which shareholders have and have not tendered, the free float change will reflect the total shares now owned by the acquiring company. A minimum T+2 notice period of the change is generally provided. Any subsequent disclosure on the updated shareholder structure will be reviewed during the quarterly review cycle. If the offer includes a stock consideration, the acquiring company's shares will be increased proportionate to the free float change of the target company. If the target company's free float change is greater than 3%, the associated change to the acquiring company's shares will be implemented regardless of size. Additionally, if the change to the target company is less than 3%, then no change will be implemented to the target or the acquiring company at the time of the event, regardless of any change to the acquiring company's shares. The target company will then be deleted as a second-step, if the conditions for deletion are achieved at the expiration of a subsequent offer period.

In the event that a tender offer results in an additional listed and active "tendered" line prior to the tendered shares being accepted and exchanged for settlement, FTSE Russell will generally evaluate the following factors to determine whether to switch to the tendered line: (i) the objective of the offer is to fully acquire and delist the target company (and FTSE Russell is not aware of any obstacles designed to prevent this objective; e.g. there are no major shareholders who have publicly disclosed that they will not be tendering); (ii) the offer is deemed to be successful (i.e. the minimum acceptance threshold has been achieved); (iii) more than 50% of the shares subject to the offer have been tendered; (iv) there is an additional tender offer period to provide a window for index users to tender into the tendered shares' line; and (v) there are outstanding regulatory or other substantive hurdles preventing the transaction completing immediately at the conclusion of the tender offer, with the results not expected to be known for some time. Index implementation will generally occur immediately after the opening of the additional offer period (with the provision of appropriate notice) – with an informative notice published announcing the change, to supplement the information within the applicable tracker files. In the event that the tendered line is halted prior to index implementation, its close price will be updated to reflect the deal terms until implementation. In the event that the prerequisites for deletion are not achieved and the target company is retained within the Russell 2000® Index at a reduced weight, the tendered line will be removed at deal terms (if no active market) with the ordinary line being re-added at a reduced weight at its last close price.

In exceptional circumstances, any review changes due to be effective for the companies involved in a tender offer may be retracted if FTSE Russell becomes aware of a tender offer which is due to complete on or around the effective date of such index review changes. Such exceptional circumstances may include undue price pressure being placed on the companies involved, or if proceeding with the review changes would compromise the replicability of the Russell 2000® Index.

**Delisted and Suspended Stocks** — A constituent will be deleted if it is delisted from all eligible exchanges. A constituent will be deleted if FTSE Russell becomes aware (in the country of assigned nationality) that the stock has become bankrupt, has filed for bankruptcy protection, enters into administration or receivership, commenced accelerated safeguarding procedures, is insolvent or is liquidated (or local equivalents); or has filed for delisting and no regulatory or shareholder approvals are outstanding, converts into an ineligible corporate structure or where evidence of a change in circumstances makes it ineligible for index inclusion. If, however, FTSE Russell becomes aware that a constituent is suspended, index treatment will be determined as follows:

- unless the circumstances regarding deletions set forth below apply, a constituent will continue to be included in the Russell 2000® Index for a period of up to 20 business days at its last traded price;
- if a constituent continues to be suspended at the end of that 20 business day period (the suspension period), it will be subject to review. FTSE Russell will take into account the stated reasons for the suspension. These reasons may include announcements made by the company regarding a pending acquisition or restructuring, and any stated intentions regarding a date for the resumption of trading. If following review, a decision is taken to remove the constituent, FTSE Russell will provide notice of 20 business days (the notice period) that it intends to remove the constituent, at zero value, at the conclusion of the notice period. If the security has not resumed trading at the conclusion of the notice period, it will be removed with two days' notice. If during

the notice period further details are disclosed as to the reason for a company's suspension, those reasons (and any possible resumption of trade date) will be taken into account when determining if the company should remain on notice;

- if a suspended constituent resumes trading on or before the last business day of the notice period, the deletion notice will be rescinded and the constituent will be retained in the Russell 2000® Index. However, where the constituent resumes trading after the 40th business day of suspension, the constituent will continue to be removed from the Russell 2000® Index as previously announced but in these circumstance the deletion will be implemented at market value unless there are barriers that render a market value irreproducible. In this event, the company will continue to be removed at zero;
- if the notice period expires in the week preceding an index review, the company will be removed in conjunction with the index review;
- in certain limited circumstances where the index weight of the constituent is significant and FTSE Russell determines that a market-related value can be established for the suspended constituent, for example because similar company securities continue to trade, deletion may take place at the market-related value instead. In such circumstances, FTSE Russell will set out its rationale for the proposed treatment of the constituent at the end of the suspension period. The company would then be removed at that value at the end of the notice period;
- subject to the second following paragraph, if a constituent has been removed from the Russell 2000® Index and trading is subsequently restored, the constituent will only be reconsidered for inclusion after a period of 12 months from its deletion. For the purposes of index eligibility it will be treated as a new issue.

For example, if FTSE Russell becomes aware that a U.S. company has filed for Chapter 7 bankruptcy, Chapter 11 bankruptcy protection, a receiver is appointed, has filed for delisting under a Form 25, or a liquidation plan is filed, it will be removed from the Russell 2000® Index with notice. If a constituent is removed pursuant to this rule and is not trading and there is no express confirmation that shareholders will receive a fixed cash amount per share held, FTSE Russell will remove the stock at a nominal price of \$0.0001. If a price on an ineligible market (e.g. OTC) is available, the constituent may be removed using this price.

A company emerging from bankruptcy protection or insolvency will be reconsidered for index inclusion at the next annual reconstitution (i.e., there will be no 12 month exclusion).

A constituent will be deleted if FTSE Russell becomes aware that the price of the constituent has reached its minimum permissible trade price. The constituent will be removed from the Russell 2000® Index in conjunction with the next index review subject to it still being at the minimum permissible trade price at the start of the quarterly review lock down period. The stock will only be reconsidered for index eligibility after a period of 12 months from its deletion. For purposes of index eligibility it will be evaluated as a new issue.

**Stock Distributions and distributions in specie**— A price adjustment for stock distributions is applied on the ex-date of the distribution. Where FTSE Russell is able to value a distribution in specie prior to the ex-date, a price adjustment is made to the company paying the dividend at the open on the ex-date. If no valuation of the distribution exists prior to the ex-date, no price adjustment is applied. Where the company whose holders are receiving the distribution is an index member, its shares will be increased according to the terms of the distribution. If such company is not an index member, the distributed shares will be added to the Russell 2000® Index until they have been settled and have listed, at which point they will be removed at the last traded price giving appropriate notice.

**Special Cash Dividends** — If a constituent pays out a special cash dividend, the price of the stock is adjusted to deduct the dividend amount before the open on the ex-date. No adjustment for regular cash dividends is made in the price return calculation of the Russell 2000® Index.

**Updates to Shares Outstanding and Free Float** — FTSE Russell reviews the Russell 2000® Index quarterly for updates to shares outstanding and to free floats used in calculating the Russell 2000® Index. The changes are implemented quarterly in March, June, September and December after the close on the third Friday of such month. The June reconstitution will be implemented on the fourth Friday of June.

In March, September and December shares outstanding and free floats are updated to reflect (i) cumulative share changes greater than 1%, (ii) for constituents with a free float less than or equal to 15%, cumulative free float changes greater than 1%, and (iii) for constituents with a free float greater than 15%, cumulative free float changes greater than 3%. Updates to shares outstanding and free floats will be implemented each June regardless of size (i.e., the percentage change thresholds above will not be applied). FTSE Russell implements

the June updates using data sourced primarily from the companies' publicly available information filed with the Securities and Exchange Commission.

Outside of the quarterly update cycle, outstanding shares and free float will be updated with at least two days' notice if prompted by primary or secondary offerings if (i) there is a USD \$1 billion investable market capitalization change related to a primary/secondary offering measured by multiplying the change to index shares by the subscription price or (ii) there is a resultant 5% change in index shares related to a primary or secondary offering and a USD \$250 million investable market capitalization change measured by multiplying the change to index shares by the subscription price. The pricing date will serve as the trigger for implementation; i.e. once FTSE Russell is aware that an offering has priced, the update will be implemented with two days' notice from market close (contingent on the thresholds described above being triggered). If discovery of the pricing date occurs more than two days after the pricing date, the update will be deferred until the next quarterly review.

In exceptional circumstances, FTSE Russell may defer implementation until after the new shares are listed and with the provision of two days' notice. An offering may be deemed exceptional if implementation prior to the listing of the new shares may cause undue price pressure on the company, or if proceeding with the changes may compromise the replicability of the index.

If a company distributes shares of an additional share class to its existing shareholders through a mandatory corporate action, the additional share class will be evaluated for separate index membership. The new share class will be deemed eligible if the market capitalization of the distributed shares meets the minimum size requirement (the market capitalization of the smallest member of the Russell 3000E Index from the previous rebalance as adjusted for performance to date). If the additional share class is not eligible at the time of distribution, it will not be added to the Russell 2000® Index.

*License Agreement between Frank Russell Company (doing business as FTSE Russell) and GS Finance Corp.*

Frank Russell Company doing business as FTSE Russell ("Russell") and Goldman Sachs International have entered into a non-exclusive license agreement, granting GS Finance Corp., in exchange for a fee, permission to use the Russell 2000® Index in connection with the offer and sale of the securities. GS Finance Corp. is not affiliated with Russell; the only relationship between Russell and GS Finance Corp. is the licensing of the use of the Russell 2000® Index (a trademark of Russell) and trademarks relating to the Russell 2000® Index.

GS Finance Corp. does not accept any responsibility for the calculation, maintenance or publication of the Russell 2000® Index or any successor index.

The securities are not sponsored, endorsed, sold or promoted by Russell. Russell makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the Russell 2000® Index to track general stock market performance or a segment of the same. Russell's publication of the Russell 2000® Index in no way suggests or implies an opinion by Russell as to the advisability of investment in any or all of the securities upon which the Russell 2000® Index is based. Russell's only relationship to GS Finance Corp. is the licensing of certain trademarks and trade names of Russell and of the Russell 2000® Index which is determined, composed and calculated by Russell without regard to GS Finance Corp. or the securities. Russell is not responsible for and has not reviewed the securities nor any associated literature or publications and Russell makes no representation or warranty express or implied as to their accuracy or completeness, or otherwise. Russell reserves the right, at any time and without notice, to alter, amend, terminate or in any way change the Russell 2000® Index. Russell has no obligation or liability in connection with the administration, marketing or trading of the securities.

RUSSELL DOES NOT GUARANTEE THE ACCURACY AND/OR THE COMPLETENESS OF THE RUSSELL 2000® INDEX OR ANY DATA INCLUDED THEREIN AND RUSSELL SHALL HAVE NO LIABILITY FOR ANY ERRORS, OMISSIONS, OR INTERRUPTIONS THEREIN. RUSSELL MAKES NO WARRANTY, EXPRESS OR IMPLIED, AS TO RESULTS TO BE OBTAINED BY GS FINANCE CORP., INVESTORS, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE RUSSELL 2000® INDEX OR ANY DATA INCLUDED THEREIN. RUSSELL MAKES NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE WITH RESPECT TO THE RUSSELL 2000® INDEX OR ANY DATA INCLUDED THEREIN. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT SHALL RUSSELL HAVE ANY LIABILITY FOR ANY SPECIAL, PUNITIVE, INDIRECT, OR CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS), EVEN IF NOTIFIED OF THE POSSIBILITY OF SUCH DAMAGES.

## Russell 2000® Value Index

The Russell 2000® Value Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first launched in 1993 based on an initial value of 1,000 as of May 31, 1993; and
- is sponsored by FTSE Russell (“FTSE Russell”)

The Russell 2000® Value Index is sponsored by FTSE Russell (“Russell”) and is a sub-index of the Russell 2000® Index. The Russell 2000® Value Index is generally considered to be a “small-cap” U.S. equity index and is predominantly comprised of value stocks, meaning stocks issued by companies thought to be undervalued by the market relative to comparable companies. Additional information about the Russell 2000® Value Index (including the top ten constituent stocks and sector weights) is available on the following website: [ftse.com/analytics/factsheets/Home/Search#](http://ftse.com/analytics/factsheets/Home/Search#). We are not incorporating by reference the website or any material it includes in this underlier supplement.

The Russell 2000® Index includes approximately 2,000 of the smallest securities that form the Russell 3000® Index. The Russell 3000® Index is comprised of the 3,000 largest U.S. companies, or 98% based on market capitalization, of the investable U.S. equity market. The Russell 2000® Index is designed to track the performance of the small capitalization segment of the U.S. equity market.

### *Selection of Constituent Stocks of the Russell 2000® Value Index*

The Russell 2000® Value Index is a sub-index of the Russell 2000® Index, which is a sub-index of the Russell 3000® Index. To be eligible for inclusion in the Russell 3000® Index and the Russell 2000® Index, and, consequently, the Russell 2000® Value Index, a company’s stocks must be listed on the rank day and FTSE Russell must have access to documentation verifying the company’s eligibility for inclusion. The rank day occurs on the last business day of April with membership eligibility determined using public information available on the rank day and market capitalizations calculated at market close. Eligible initial public offerings (“IPOs”) are added to Russell U.S. Indices quarterly, based on total market capitalization rankings within the market-adjusted capitalization breaks established during the most recent reconstitution. To be added to any Russell U.S. index during a quarter outside of reconstitution, IPOs must meet additional eligibility criteria.

A company is included in the U.S. equity markets and is eligible for inclusion in the Russell 3000® Index and the Russell 2000® Index, and consequently, the Russell 2000® Value Index, if that company incorporates in the U.S., has its headquarters in the U.S. and also trades with the highest liquidity in the U.S. If a company does not satisfy all of the above criteria, it can still be included in the U.S. equity market if any one of the following home country indicators is in the United States: (i) country of incorporation, (ii) country of headquarters and (iii) country in which the company trades with the highest liquidity (as defined by a two-year average daily dollar trading volume from all exchanges within the country), and the primary location of that company’s assets or its revenue, based on an average of two years of assets or revenues data, is also in the United States. In addition, if there is insufficient information to assign a company to the U.S. equity markets based on its assets or revenue, the company may nonetheless be assigned to the U.S. equity markets if the headquarters of the company is located in the United States or if the headquarters of the company is located in certain “benefit-driven incorporation countries”, or “BDIs”, and that company’s most liquid stock exchange is in the United States. The BDI countries are Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bonaire, British Virgin Islands, Cayman Islands, Channel Islands, Cook Islands, Curaçao, Faroe Islands, Gibraltar, Guernsey, Isle of Man, Jersey, Liberia, Marshall Islands, Panama, Saba, Sint Eustatius, Sint Maarten and Turks and Caicos Islands. A U.S.-listed company is not eligible for inclusion within the U.S. equity market if it has been classified by FTSE Russell as a China N share on the rank date of the index reconstitution. A company will be considered a China N share if the following criteria are satisfied: (i) the company is incorporated outside of mainland China, (ii) the company is listed on the NYSE, the Nasdaq or the NYSE American (formerly the NYSE MKT), (iii) the company has a headquarter or principal executive office or its establishment in mainland China, with the majority of its revenue or assets derived from the People’s Republic of China, and (iv) the company is controlled by a mainland Chinese entity, company or individual (if the shareholder background cannot be determined with publicly available information, FTSE Russell will consider whether the establishment and origin of the company are in mainland China and whether the company is headquartered in mainland China). An existing China N Share which fails one

or more of the following criteria will cease to be classified as a China N share: (i) the company is no longer incorporated outside the People's Republic of China, (ii) the company is no longer listed on the NYSE, the Nasdaq exchange, or the NYSE American, (iii) the percentages of revenue and assets derived from the People's Republic of China have both fallen below 45 percent, or (iv) the company is acquired/a controlling stake is held by a non-Mainland Chinese state entity, company or individual. Only asset and revenue data from the most recent annual report is considered when evaluating whether a company should be classified a China N share (i.e., there will be no two year averaging). ADRs and ADSs are not eligible for inclusion in the Russell 3000® Index or the Russell 2000® Index, or consequently, the Russell 2000® Value Index.

In addition, all securities eligible for inclusion in the Russell 3000® Index or the Russell 2000® Index, and consequently, the Russell 2000® Value Index, must trade on an eligible exchange (CBOE (formerly BATS), NYSE, NYSE American (formerly NYSE MKT), NYSE Arca and Nasdaq).

#### *Exclusions from the Russell 2000® Value Index*

FTSE Russell specifically excludes the following companies and securities from the Russell 3000® Index and the Russell 2000® Index, and consequently, the Russell 2000® Value Index: (i) preferred and convertible preferred stock, redeemable shares, participating preferred stock, warrants, rights, depositary receipts, installment receipts and trust receipts; (ii) royalty trusts, U.S. limited liability companies, closed-end investment companies, companies that are required to report Acquired Fund Fees and Expenses (as defined by the SEC), including business development companies, blank check companies, special-purpose acquisition companies and limited partnerships; (iii) companies with a total market capitalization less than \$30 million; (iv) companies with only a small portion of their shares available in the free-float as defined by FTSE Russell (companies with less than an absolute 5% of shares available); (v) bulletin board, pink sheets or over-the-counter traded securities, including securities for which prices are displayed on the FINRA ADF; (vi) real estate investment trusts and publicly traded partnerships that generate, or have historically generated, unrelated business taxable income and have not taken steps to block their unrelated business taxable income to equity holders; and (vii) companies with less than 5% of the company's voting rights in the hands of unrestricted shareholders.

#### *Initial List of Eligible Securities*

The primary criterion FTSE Russell uses to determine the initial list of securities eligible for the Russell 3000® Index and the Russell 2000® Index and, consequently, the Russell 2000® Value Index, is total market capitalization, which is calculated by multiplying the total outstanding shares for a company by the market price as of the rank day for those securities being considered at annual reconstitution. IPOs may be added between constitutions as noted below. All common stock share classes are combined in determining a company's total shares outstanding. If multiple share classes have been combined, the number of total shares outstanding will be multiplied by the primary exchange close price and used to determine the company's total market capitalization. In cases where the common stock share classes act independently of each other (e.g., tracking stocks), each class is considered for inclusion separately. Stocks must have a closing price at or above \$1.00 on their primary exchange or an eligible secondary exchange on the last trading day of May of each year to be eligible for inclusion in the Russell 3000® Index and the Russell 2000® Index, and consequently, the Russell 2000® Value Index. In order to reduce unnecessary turnover, if an existing member's closing price is less than \$1.00 on the rank day, it will be considered eligible if the average of the daily closing prices from their primary exchange during the 30 days prior to the rank day is equal to or greater than \$1.00. If an existing member does not trade on the rank day, it must price at \$1.00 or above on another eligible U.S. exchange to remain eligible.

#### *Multiple Share Classes*

If an eligible company trades under multiple share classes or if a company distributes shares of an additional share class to its existing shareholders through a mandatory corporate action, each share class will be reviewed independently for inclusion. Share classes in addition to the primary vehicle (the pricing vehicle) that have a total market capitalization larger than \$30 million, an average daily dollar trading value that exceeds that of the global median, and a float of 5% or greater of shares available in the free-float as defined by FTSE Russell are eligible for inclusion.

The pricing vehicle will generally be designated as the share class with the highest two-year trading volume as of the rank day. In the absence of two years' worth of data, all available data will be used for this calculation. If the difference between trading volumes for each share class is less than 20%, the share class with the most available shares outstanding will be used as the pricing vehicle. At least 100 day trading volume is necessary to consider the class as a pricing vehicle for existing members. New members will be analyzed on all available data, even if that data is for less than 100 days.

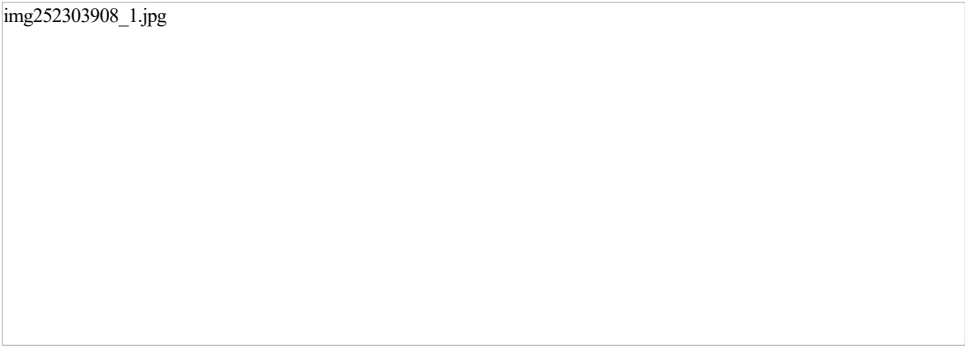
*Determining Style*

Russell uses a “non-linear probability” method to determine whether a stock included in the Russell 2000® Index is included in the Russell 2000® Value Index, the Russell 2000® Growth Index, or both. The term “probability” is used to indicate the degree of certainty that a stock belongs in one of those indexes.

Russell uses three variables to determine whether a stock exhibits growth characteristics, value characteristics, or both. One variable—book-to-price ratio—is used to represent a stock’s value characteristics, while two variables—I/B/E/S forecast medium-term growth (2 year) and sales per share historical growth (5 year)—are used to represent a stock’s growth characteristics. Stocks included in the Russell 2000® Index are given a ranking for each variable and these rankings are converted to standardized units, where the value variable represents 50% of the score and the two growth variables represent the remaining 50%. They are then combined to produce a composite value score (“CVS”). Stocks included in the Russell 2000® Index are then ranked by their CVS, and a probability algorithm is applied to the CVS distribution to assign growth and value weights or “probabilities” to each stock. In general, a stock with a higher CVS is considered a value stock, a stock with a lower CVS is considered a growth stock and a stock with a CVS in the middle range is considered to have both growth and value characteristics.

*Description of non-linear probability algorithm*

Stock A, in Figure 1, is a security with 20% of its available shares assigned to the Russell 2000® Value Index and the remaining 80% assigned to the Russell 2000® Growth Index. The growth and value probabilities will always sum to 100%. Hence, the sum of a stock’s market capitalization in the Russell 2000® Value Index and the Russell 2000® Growth Index will always equal its market capitalization in the Russell 2000® Index.



In Figure 1, the quartile breaks are calculated such that approximately 25% of the available market capitalization lies in each quartile. Stocks at the median are divided 50% in the Russell 2000® Value Index and 50% in the Russell 2000® Growth Index. Stocks below the first quartile are 100% in the Russell 2000® Growth Index. Stocks above the third quartile are 100% in the Russell 2000® Value Index. Stocks falling between the first and third quartile breaks are in both the Russell 2000® Value Index and the Russell 2000® Growth Index to varying degrees depending on how far they are above or below the median and how close they are to the first or third quartile breaks, subject to the 5% rule and the banding rule, as described below.

*5% rule*

If a stock’s initial weight is more than 95% in either the Russell 2000® Value Index or the Russell 2000® Growth Index, Russell increases its weight to 100% in that index and removes the stock altogether from the other index. As a result of the 5% rule, roughly 70% of the available market capitalization of the Russell 2000® Index is classified as all-growth or all-value. The remaining 30% of stocks have some portion of their market capitalization allocated to the Russell 2000® Value Index and the Russell 2000® Growth Index, depending on their relative distance from the median value score.

*Banding rule*

In an effort to mitigate unnecessary turnover, Russell implements a banding methodology at the CVS level. If (i) a company’s CVS change from the previous year is less than plus or minus 0.10 and (ii) the company remains in the Russell 2000® Index, then the CVS will not be updated during the next reconstitution process. Keeping the CVS static for these companies does not mean the probability (value/growth) will remain unchanged in all cases



due to the relation of a CVS score to the overall index. In the past, this banding methodology has reduced turnover caused by smaller, less meaningful movements while continuing to allow the larger, more meaningful changes to occur.

#### *Market capitalization*

The market capitalization of the Russell 2000® Value Index may not equal 50% of the Russell 2000® Index because asymmetry in the capitalization distributions within the second and third quartiles may result in a skewed distribution of CVS. When CVS is normally distributed, each of the Russell 2000® Value Index and the Russell 2000® Growth Index will equal 50% of the Russell 2000® Index.

#### *Missing values, negative values, or low coverage*

Stocks with missing or negative values for their book-to-price ratio, missing values for I/B/E/S medium-term growth (2 year) (negative I/B/E/S medium-term growth is valid), or missing sales per share historical growth (5 year) (6 years of quarterly numbers are required), are allocated by using the mean value score of (i) the Russell Global Sectors industry, subsector, or sector group (for the June 2020 rebalance) and (ii) the ICB official sector scheme (for new additions/IPOs starting after the June 2020 rebalance and for the June 2021 rebalance and going forward) into which the company falls in the Russell 2000® Index. Each missing (or in the case of book-to-price ratio, negative) variable is substituted with the mean value score of the industry, subsector or sector group independently. An industry must have five members or the substitution reverts to the subsector, and so forth to the sector. In addition, a weighted value score is calculated for securities with low analyst coverage for I/B/E/S medium-term growth. For securities with coverage by a single analyst, 2/3 of the industry, subsector, or sector group value score is weighted with 1/3 the security's independent value score. For those securities with coverage by 2 analysts, 2/3 of the independent security's value score is used and only 1/3 of the industry, subsector, or sector group is weighted. For those securities with at least three analysts contributing to the I/B/E/S medium-term growth variable, 100% of the independent security's value score is used.

#### *Annual Reconstitution*

The Russell 2000® Index and the Russell 2000® Value Index are reconstituted annually by FTSE Russell to reflect changes in the marketplace. The list of companies is ranked based on total market capitalization on the last trading day in May, with the actual reconstitution occurring on the fourth Friday of June each year. A full calendar for reconstitution is published each spring.

A company's total shares are multiplied by the primary exchange close price of the pricing vehicle and used to determine the company's total market capitalization for the purpose of ranking of companies and determination of index membership. If no volume exists on the primary exchange on the rank day, the last trade price from an eligible secondary exchange will be used where volume exists (using the lowest trade price above \$1.00 if multiple secondary markets exist). The company's rank will be determined based on the cumulative market capitalization. As of the June 2016 reconstitution, any share class not qualifying for eligibility independently will not be aggregated with the pricing vehicle within the available shares calculation.

For mergers and spin-offs that are effective between the rank day and the business day immediately before the index lock down takes effect ahead of the annual reconstitution in June, the market capitalizations of the impacted securities are recalculated and membership is reevaluated as of the effective date of the corporate action. For corporate events that occur during the reconstitution lock down period (which takes effect from the open on the first day of the lock down period onwards), market capitalizations and memberships will not be reevaluated. Non-index members that have been considered ineligible as of rank day will not be reevaluated in the event of a subsequent corporate action that occurs between rank day and the reconstitution effective date.

#### *Index Calculation and Capitalization Adjustments*

As a capitalization-weighted index, the Russell 2000® Value Index reflects changes in the capitalization, or market value, of the index stocks relative to the capitalization on a base date. This discussion describes the "price return" calculation of the Russell 2000® Value Index. The applicable pricing supplement will describe the calculation if the underlier for your securities is not the price return calculation. The current Russell 2000® Value Index value is the compounded result of the cumulative daily (or monthly) return percentages, where the starting value of the Russell 2000® Value Index is equal to the base value (1,000) and base date (May 31, 1993). Returns between any two dates can then be derived by dividing the ending period index value (IV1) by the beginning period (IV0) index value, so that the return equals  $[(IV1 / IV0) - 1] * 100$ . To calculate the index value, the market values of the index stocks are added together to arrive at the total market capitalization of the index. The market value of an index stock is equal to the product of (i) the price of such stock times (ii) the number of available shares times (iii)

the stock's value weight or "probability". The last sale prices will be used for exchange traded and Nasdaq stocks. In the event of a market disruption resulting in any index stock price being unavailable, Russell will generally use the last reported price for such index stock to calculate the index.

The weight of a stock included in the Russell 2000® Value Index is equal to its weight in the Russell 2000® Index multiplied by its value weight or "probability." Constituent stocks of the Russell 2000® Index are weighted in the Russell 2000® Index by their free-float market capitalization, which is calculated by multiplying the primary closing price by the number of free-float shares. Free-float shares are shares that are available to the public for purchase as determined by FTSE Russell. Adjustments to shares are reviewed quarterly (including at reconstitution) and for major corporate actions such as mergers. Total shares and adjustments for available shares are based on information recorded in SEC corporate filings.

The following are excluded from free float: shares directly owned by state, regional, municipal and local governments (excluding shares held by independently managed pension schemes for governments); shares held by directors, senior executives and managers of the company, and by their family and direct relations, and by companies with which they are affiliated; shares held within employee share plans; shares held by public companies or by non-listed subsidiaries of public companies; shares held by sovereign wealth funds, founders, promoters, former directors, founding venture capital and private equity firms, private companies, individuals (including employees) where the holding is 10% or greater of the total number of shares in issue; all shares where the holder is subject to a lock-up clause (for the duration of that clause, after which free float changes resulting from the expiry of a lock-up will be implemented at the next quarterly review subject to the lock-up expiry date occurring on or prior to the share and float change information cut-off date); shares held by an investor, investment company or an investment fund that is actively participating in the management of a company or is holding shares for publicly announced strategic reasons, or has successfully placed a current member to the board of directors of a company; and shares that are subject to ongoing contractual agreements (such as swaps) where they would ordinarily be treated as restricted. In addition, while portfolio holdings such as pension funds, insurance funds or investment companies will generally not be considered as restricted from free float, where a single portfolio holding is 30% or greater it will be regarded as strategic and therefore restricted (and will remain restricted until the holding falls below 30%).

#### *Corporate Actions Affecting the Russell 2000® Value Index*

FTSE Russell adjusts the Russell 2000® Value Index on a daily basis in response to certain corporate actions and events. Therefore, a company's membership in the Russell 2000® Value Index and its weight in the Russell 2000® Value Index can be impacted by these corporate actions. The adjustment is applied based on sources of public information, including press releases and Securities and Exchange Commission filings. Prior to the completion of a corporate action or event, FTSE Russell estimates the effective date. FTSE Russell will then adjust the anticipated effective date based on public information until the date is considered final. Depending on the time on a given day that an action is determined to be final, FTSE Russell will generally either (1) apply the action before the open on the ex-date or (2) apply the action after providing appropriate notice. If FTSE Russell has confirmed the completion of a corporate action, scheduled to become effective subsequent to a rebalance, the event may be implemented in conjunction with the rebalance to limit turnover, provided appropriate notice can be given. FTSE Russell applies the following methodology guidelines when adjusting the Russell 2000® Value Index in response to corporate actions and events:

**"No Replacement" Rule** — Securities that are deleted from the Russell 2000® Value Index between reconstitution dates, for any reason (e.g., mergers, acquisitions or other similar corporate activity) are not replaced. Thus, the number of securities in the Russell 2000® Value Index over the past year will fluctuate according to corporate activity.

#### *Mergers and Acquisitions*

Adjustments due to mergers and acquisitions are applied to the Russell 2000® Value Index after the action is determined to be final. In the event that a constituent is being acquired for cash or is delisted subsequent to an index review, such constituent will be removed from the Russell 2000® Value Index in conjunction with the index review, assuming that the action is determined to be final and a minimum of two days' notice can be provided.

**Between constituents:** When mergers and acquisitions take place between companies that are both constituents of a Russell index for cash, the target company is deleted from the Russell 2000® Value Index at the last traded price. When mergers and acquisitions take place between companies that are both constituents of a Russell index for stock, the target company is deleted from the Russell 2000® Value Index and the shares of the acquiring stock are increased according to the offer terms. When mergers and acquisitions take place between companies

that are both constituents of a Russell index for cash or stock or a combination thereof, the target company is deleted from the Russell 2000® Value Index and the shares of the acquiring company are simultaneously increased per the merger terms.

**Between a constituent and a non-constituent:** If the target company is a member of the Russell 2000® Value Index, it is deleted from the Russell 2000® Value Index and the acquiring company will be included initially in the Russell 2000® Value Index provided it is eligible in all other respects at the time of the merger, regardless of previous eligibility screenings. If the acquiring company is deemed eligible it will be added to the Russell 2000® Value Index on the effective date and the opening price will be calculated using the offer terms. When the target company is a FTSE Russell Universe member, the shares of the member acquiring company will be updated to reflect the merger. Any share update will be made giving appropriate notice.

Given sufficient market hours after the confirmation of a merger or acquisition, FTSE Russell effects the action after the close on the last day of trading of the target company, or at an appropriate time once the transaction has been deemed to be final.

**Rights Offerings** — Rights offered to shareholders are reflected in the Russell 2000® Value Index only if the subscription price of the rights is at a discount to the market price of the stock. Provided that FTSE Russell has been alerted to the rights offer prior to the ex-date, it will adjust the price of the stock for the value of the rights and increased shares according to the terms of the offering before the open on the ex-date.

**Spin-offs** — If the spin-off entity meets the eligibility requirements for the Russell 2000® Index, the spin-off entity will be added to the Russell 2000® Value Index on the ex-date of the distribution. The spin-off entity will be retained in the Russell 2000® Value Index until the next annual reconstitution, when it will be evaluated for inclusion. If the spin-off entity does not meet the eligibility requirements for the Russell 2000® Value Index, the spin-off entity will be added to the Russell 2000® Value Index on the ex-date of the distribution. It will remain in the Russell 2000® Value Index until listing and settlement and then deleted at market price with notice.

**Initial Public Offerings** — Eligible IPOs are added to the Russell 2000® Index based on total market capitalization ranking within the market-adjusted capitalization breaks established at the most recent annual reconstitution. Any IPO that is added to the Russell 2000® Index will also be added to the Russell 2000® Value Index or the Russell 2000® Growth Index, as applicable, based on its industry's average style probability established at the latest reconstitution.

An IPO of additional share classes will be considered for eligibility and must meet the same eligibility criteria for all other multiple share classes. If at the time of the IPO the additional share class does not meet the eligibility criteria for separate index membership, it will not be added to the Russell 2000® Value Index and will subsequently be reviewed for index membership during the next annual reconstitution.

Once IPO additions have been announced, an IPO may be added to the Russell 2000® Value Index prior to the previously announced schedule, if a corporate action has deemed this to be appropriate and notice can be provided (e.g. an index member automatically receives shares via a stock distribution into a projected IPO add).

**Tender Offers** — A company acquired as a result of a tender offer is removed when (i) (a) the bidder's shareholding has reached at least 90%; (b) shareholders have validly tendered and the shares have been irrevocably accepted for payment; and (c) all pertinent offer conditions have been reasonably met and the acquirer has not explicitly stated that it does not intend to acquire the remaining shares; (ii) there is reason to believe that the remaining free float is under 5% based on information available at the time; or (iii) following completion of the offer the acquirer has stated intent to finalize the acquisition via a short-form merger, squeeze-out, top-up option or any other compulsory mechanism.

Where the conditions for index deletion are not met, FTSE Russell may implement a free float change based on the reported acceptance results at the expiration of the initial, subsequent or final offer period where (i) the minimum acceptance level as stipulated by the acquiror is met; (ii) shareholders have validly tendered and the shares have been irrevocably accepted for payment; (iii) all pertinent offer conditions have been reasonably met and (iv) the change to the current float factor is greater than 3%. FTSE Russell uses the published results of the offer to determine the new free float of the target company. If no information is published in conjunction with the results from which FTSE Russell can determine which shareholders have and have not tendered, the free float change will reflect the total shares now owned by the acquiring company. A minimum T+2 notice period of the change is generally provided. Any subsequent disclosure on the updated shareholder structure will be reviewed during the quarterly review cycle. If the offer includes a stock consideration, the acquiring company's shares will be increased proportionate to the free float change of the target company. If the target company's free float change is greater than 3%, the associated change to the acquiring company's shares will be implemented

regardless of size. Additionally, if the change to the target company is less than 3%, then no change will be implemented to the target or the acquiring company at the time of the event, regardless of any change to the acquiring company's shares. The target company will then be deleted as a second-step, if the conditions for deletion are achieved at the expiration of a subsequent offer period.

In the event that a tender offer results in an additional listed and active "tendered" line prior to the tendered shares being accepted and exchanged for settlement, FTSE Russell will generally evaluate the following factors to determine whether to switch to the tendered line: (i) the objective of the offer is to fully acquire and delist the target company (and FTSE Russell is not aware of any obstacles designed to prevent this objective; e.g. there are no major shareholders who have publicly disclosed that they will not be tendering); (ii) the offer is deemed to be successful (i.e. the minimum acceptance threshold has been achieved); (iii) more than 50% of the shares subject to the offer have been tendered; (iv) there is an additional tender offer period to provide a window for index users to tender into the tendered shares' line; and (v) there are outstanding regulatory or other substantive hurdles preventing the transaction completing immediately at the conclusion of the tender offer, with the results not expected to be known for some time. Index implementation will generally occur immediately after the opening of the additional offer period (with the provision of appropriate notice) – with an informative notice published announcing the change, to supplement the information within the applicable tracker files. In the event that the tendered line is halted prior to index implementation, its close price will be updated to reflect the deal terms until implementation. In the event that the prerequisites for deletion are not achieved and the target company is retained within the Russell 2000® Value Index at a reduced weight, the tendered line will be removed at deal terms (if no active market) with the ordinary line being re-added at a reduced weight at its last close price. In exceptional circumstances, any review changes due to be effective for the companies involved in a tender offer may be retracted if FTSE Russell becomes aware of a tender offer which is due to complete on or around the effective date of such index review changes. Such exceptional circumstances may include undue price pressure being placed on the companies involved, or if proceeding with the review changes would compromise the replicability of the Russell 2000® Value Index.

**Delisted and Suspended Stocks** — A constituent will be deleted if it is delisted from all eligible exchanges. A constituent will be deleted if FTSE Russell becomes aware (in the country of assigned nationality) that the stock has become bankrupt, has filed for bankruptcy protection, enters into administration or receivership, commenced accelerated safeguarding procedures, is insolvent or is liquidated (or local equivalents); or has filed for delisting and no regulatory or shareholder approvals are outstanding, converts into an ineligible corporate structure or where evidence of a change in circumstances makes it ineligible for index inclusion. If, however, FTSE Russell becomes aware that a constituent is suspended, index treatment will be determined as follows:

- unless the circumstances regarding deletions set forth below apply, a constituent will continue to be included in the Russell 2000® Value Index for a period of up to 20 business days at its last traded price;
- if a constituent continues to be suspended at the end of that 20 business day period (the suspension period), it will be subject to review. FTSE Russell will take into account the stated reasons for the suspension. These reasons may include announcements made by the company regarding a pending acquisition or restructuring, and any stated intentions regarding a date for the resumption of trading. If following review, a decision is taken to remove the constituent, FTSE Russell will provide notice of 20 business days (the notice period) that it intends to remove the constituent, at zero value, at the conclusion of the notice period. If the security has not resumed trading at the conclusion of the notice period, it will be removed with two days' notice. If during the notice period further details are disclosed as to the reason for a company's suspension, those reasons (and any possible resumption of trade date) will be taken into account when determining if the company should remain on notice;
- if a suspended constituent resumes trading on or before the last business day of the notice period, the deletion notice will be rescinded and the constituent will be retained in the Russell 2000® Value Index. However, where the constituent resumes trading after the 40th business day of suspension, the constituent will continue to be removed from the Russell 2000® Value Index as previously announced but in these circumstance the deletion will be implemented at market value unless there are barriers that render a market value irreplicable. In this event, the company will continue to be removed at zero;
- if the notice period expires in the week preceding an index review, the company will be removed in conjunction with the index review;
- in certain limited circumstances where the index weight of the constituent is significant and FTSE Russell determines that a market-related value can be established for the suspended constituent, for example because similar company securities continue to trade, deletion may take place at the market-related value

instead. In such circumstances, FTSE Russell will set out its rationale for the proposed treatment of the constituent at the end of the suspension period. The company would then be removed at that value at the end of the notice period;

- subject to the second following paragraph, if a constituent has been removed from the Russell 2000® Value Index and trading is subsequently restored, the constituent will only be reconsidered for inclusion after a period of 12 months from its deletion. For the purposes of index eligibility it will be treated as a new issue.

For example, if FTSE Russell becomes aware that a U.S. company has filed for Chapter 7 bankruptcy, Chapter 11 bankruptcy protection, a receiver is appointed, has filed for delisting under a Form 25, or a liquidation plan is filed, it will be removed from the Russell 2000® Value Index with notice. If a constituent is removed pursuant to this rule and is not trading and there is no express confirmation that shareholders will receive a fixed cash amount per share held, FTSE Russell will remove the stock at a nominal price of \$0.0001. If a price on an ineligible market (e.g. OTC) is available, the constituent may be removed using this price.

A company emerging from bankruptcy protection or insolvency will be reconsidered for index inclusion at the next annual reconstitution (i.e., there will be no 12 month exclusion).

A constituent will be deleted if FTSE Russell becomes aware that the price of the constituent has reached its minimum permissible trade price. The constituent will be removed from the Russell 2000® Index in conjunction with the next index review subject to it still being at the minimum permissible trade price at the start of the quarterly review lock down period. The stock will only be reconsidered for index eligibility after a period of 12 months from its deletion. For purposes of index eligibility it will be evaluated as a new issue.

**Stock Distributions and distributions in specie**— A price adjustment for stock distributions is applied on the ex-date of the distribution. Where FTSE Russell is able to value a distribution in specie prior to the ex-date, a price adjustment is made to the company paying the dividend at the open on the ex-date. If no valuation of the distribution exists prior to the ex-date, no price adjustment is applied. Where the company whose holders are receiving the distribution is an index member, its shares will be increased according to the terms of the distribution. If such company is not an index member, the distributed shares will be added to the Russell 2000® Value Index until they have been settled and have listed, at which point they will be removed at the last traded price giving appropriate notice.

**Special Cash Dividends** — If a constituent pays out a special cash dividend, the price of the stock is adjusted to deduct the dividend amount before the open on the ex-date. No adjustment for regular cash dividends is made in the price return calculation of the Russell 2000® Value Index.

**Updates to Shares Outstanding and Free Float** — FTSE Russell reviews the Russell 2000® Value Index quarterly for updates to shares outstanding and to free floats used in calculating the Russell 2000® Value Index. The changes are implemented quarterly in March, June, September and December after the close on the third Friday of such month. The June reconstitution will be implemented on the fourth Friday of June.

In March, September and December shares outstanding and free floats are updated to reflect (i) cumulative share changes greater than 1%, (ii) for constituents with a free float less than or equal to 15%, cumulative free float changes greater than 1%, and (iii) for constituents with a free float greater than 15%, cumulative free float changes greater than 3%. Updates to shares outstanding and free floats will be implemented each June regardless of size (i.e., the percentage change thresholds above will not be applied). FTSE Russell implements the June updates using data sourced primarily from the companies' publicly available information filed with the Securities and Exchange Commission.

Outside of the quarterly update cycle, outstanding shares and free float will be updated with at least two days' notice if prompted by primary or secondary offerings if (i) there is a USD \$1 billion investable market capitalization change related to a primary/secondary offering measured by multiplying the change to index shares by the subscription price or (ii) there is a resultant 5% change in index shares related to a primary or secondary offering and a USD \$250 million investable market capitalization change measured by multiplying the change to index shares by the subscription price. The pricing date will serve as the trigger for implementation; i.e. once FTSE Russell is aware that an offering has priced, the update will be implemented with two days' notice from market close (contingent on the thresholds described above being triggered). If discovery of the pricing date occurs more than two days after the pricing date, the update will be deferred until the next quarterly review.

In exceptional circumstances, FTSE Russell may defer implementation until after the new shares are listed and with the provision of two days' notice. An offering may be deemed exceptional if implementation prior to the listing

of the new shares may cause undue price pressure on the company, or if proceeding with the changes may compromise the replicability of the index.

If a company distributes shares of an additional share class to its existing shareholders through a mandatory corporate action, the additional share class will be evaluated for separate index membership. The new share class will be deemed eligible if the market capitalization of the distributed shares meets the minimum size requirement (the market capitalization of the smallest member of the Russell 3000E Index from the previous rebalance as adjusted for performance to date). If the additional share class is not eligible at the time of distribution, it will not be added to the Russell 2000® Value Index.

*License Agreement between Frank Russell Company (doing business as FTSE Russell) and GS Finance Corp.*

Frank Russell Company doing business as FTSE Russell ("Russell") and Goldman Sachs International have entered into a non-exclusive license agreement, granting GS Finance Corp., in exchange for a fee, permission to use the Russell 2000® Value Index in connection with the offer and sale of the securities. GS Finance Corp. is not affiliated with Russell; the only relationship between Russell and GS Finance Corp. is the licensing of the use of the Russell 2000® Value Index (a trademark of Russell) and trademarks relating to the Russell 2000® Value Index.

GS Finance Corp. does not accept any responsibility for the calculation, maintenance or publication of the Russell 2000® Value Index or any successor index.

The securities are not sponsored, endorsed, sold or promoted by Russell. Russell makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the Russell 2000® Index to track general stock market performance or a segment of the same. Russell's publication of the Russell 2000® Value Index in no way suggests or implies an opinion by Russell as to the advisability of investment in any or all of the securities upon which the Russell 2000® Value Index is based. Russell's only relationship to GS Finance Corp. is the licensing of certain trademarks and trade names of Russell and of the Russell 2000® Value Index which is determined, composed and calculated by Russell without regard to GS Finance Corp. or the securities. Russell is not responsible for and has not reviewed the securities nor any associated literature or publications and Russell makes no representation or warranty express or implied as to their accuracy or completeness, or otherwise. Russell reserves the right, at any time and without notice, to alter, amend, terminate or in any way change the Russell 2000® Index. Russell has no obligation or liability in connection with the administration, marketing or trading of the securities.

RUSSELL DOES NOT GUARANTEE THE ACCURACY AND/OR THE COMPLETENESS OF THE RUSSELL 2000® VALUE INDEX OR ANY DATA INCLUDED THEREIN AND RUSSELL SHALL HAVE NO LIABILITY FOR ANY ERRORS, OMISSIONS, OR INTERRUPTIONS THEREIN. RUSSELL MAKES NO WARRANTY, EXPRESS OR IMPLIED, AS TO RESULTS TO BE OBTAINED BY GS FINANCE CORP., INVESTORS, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE RUSSELL 2000® VALUE INDEX OR ANY DATA INCLUDED THEREIN. RUSSELL MAKES NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE WITH RESPECT TO THE RUSSELL 2000® VALUE INDEX OR ANY DATA INCLUDED THEREIN. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT SHALL RUSSELL HAVE ANY LIABILITY FOR ANY SPECIAL, PUNITIVE, INDIRECT, OR CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS), EVEN IF NOTIFIED OF THE POSSIBILITY OF SUCH DAMAGES.

## S&P/ASX 200 Index

The S&P/ASX 200 Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first launched in 1979 by the Australian Securities Exchange and was acquired and re-launched by its current index sponsor on April 3, 2000; and
- is sponsored, calculated, published and disseminated by S&P Dow Jones Indices LLC, a part of McGraw Hill Financial (“S&P”).

The S&P/ASX 200 Index includes 200 of the largest and most liquid stocks listed on the Australian Securities Exchange, which we refer to as the ASX, by float-adjusted market capitalization. As discussed below, the S&P/ASX 200 Index is not limited solely to companies having their primary operations or headquarters in Australia or to companies having their primary listing on the ASX. All ordinary and preferred shares (if such preferred shares are not of a fixed income nature) listed on the ASX, including secondary listings, are eligible for the S&P/ASX 200 Index. Hybrid stocks such as convertible stocks, bonds, warrants, preferred stock that provides a guaranteed fixed return and listed investment companies are not eligible for inclusion. Stocks that are currently the target of an acquisition are ineligible for inclusion or promotion to the S&P/ASX 200 Index. Additional information about the S&P/ASX 200 Index (including the top ten constituent stocks, sector weights and country weights) is available on the following websites: [spglobal.com/spdji/en/indices/equity/sp-asx-200](http://spglobal.com/spdji/en/indices/equity/sp-asx-200) and [spglobal.com](http://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

The S&P/ASX 200 Index is intended to provide exposure to the largest 200 eligible securities that are listed on the ASX by float-adjusted market capitalization. Constituent companies for the S&P/ASX 200 Index are chosen based on market capitalization, public float and liquidity. All index-eligible securities that have their primary or secondary listing on the ASX are included in the initial selection of stocks from which the 200 index stocks may be selected.

The float-adjusted market capitalization of companies is determined based on the daily average market capitalization over the last six months. The security’s price history over the last six months, adjusted for price-adjusting corporate actions, the latest available shares on issue and the investable weight factor, which we refer to as the IWF, are the factors relevant to the calculation of daily average market capitalization. The IWF is a variable that is primarily used to determine the available float of a security for ASX listed securities.

### *Number of Shares*

When considering the index eligibility of securities for inclusion or promotion into S&P/ASX indices, the number of index securities under consideration is based upon the latest available ASX quoted securities. For domestic securities (companies incorporated in Australia and traded on the ASX, companies incorporated overseas but exclusively listed on the ASX and companies incorporated overseas and traded on other markets but most of its trading activity is on the ASX), this figure is purely based upon the latest available data from the ASX.

Foreign-domiciled securities may quote the total number of securities on the ASX that is representative of their global equity capital; whereas other foreign-domiciled securities may quote securities on the ASX on a partial basis that represents their Australian equity capital. In order to overcome this inconsistency, S&P will quote the number of index securities that are represented by CHESS Depositary Interests (CDIs) for a foreign entity. When CDIs are not issued, S&P will use the total securities held on the Australian register (CHESS and, where supplied, the issuer sponsored register). This quoted number for a foreign entity is representative of the Australian equity capital, thereby allowing the S&P/ASX 200 Index to be reflective of the Australian market.

The number of CDIs or shares of a foreign entity quoted on the ASX can experience more volatility than is typically the case for ordinary shares on issue. Therefore, an average number on issue will be applied over a three-month period. For CDIs that have been on issue for less than three months, the available history is applied. For CDIs included in the S&P/ASX 200 Index due to a corporate action (e.g., a spin-off), the shares outstanding are reviewed at the following rebalance once a three-month average is available. Where CDI information is not supplied to the ASX by the company or the company’s share register, estimates for Australian equity capital will be drawn from CHESS data and, ultimately, registry-sourced data.

### *IWF*

The S&P/ASX 200 Index is float-adjusted, meaning that the share counts used in calculating the S&P/ASX 200 Index reflect only those shares available to investors rather than all of a company’s outstanding shares. S&P

seeks to exclude shares held by certain shareholders concerned with the control of a company, a group that generally includes the following: officers and directors and related individuals whose holdings are publicly disclosed; private equity, venture capital and special equity firms; asset managers and insurance companies with direct board of directors representation; shares held by another publicly traded company; holders of restricted shares; company-sponsored employee share plans or trusts, defined contribution plans/savings and investment plans; foundations or family trusts associated with the company; government entities at all levels except government retirement or pension funds; sovereign wealth funds; and any individual person listed as a 5% or greater stakeholder in a company as reported in regulatory filings (collectively, "control holders"). To this end, S&P excludes all share-holdings (other than depository banks; pension funds, including government pension and retirement funds; mutual funds, exchange traded fund providers, investment funds, hedge funds and asset managers that do not have direct board of director representation, including: stakeholders who may have the right to appoint a board of directors member but choose not to do so, stakeholders who have exercised a right to appoint a board of directors observer even if that observer is employed by the stakeholder, and stakeholders who have exercised a right to appoint an independent director who is not employed by the stakeholder; investment funds of insurance companies; and independent foundations not associated with the company) with a position greater than 5% of the outstanding shares of a company from the float-adjusted share count to be used in index calculations.

The exclusion is accomplished by calculating an investable weight factor (IWF) for each stock that is included in the S&P/ASX 200 Index as follows:

$$\text{IWF} = (\text{available float shares})/(\text{total shares outstanding})$$

where available float shares is defined as total shares outstanding less shares held by strategic holders. In most cases, an IWF is reported to the nearest one percentage point. For companies with multiple share class lines, a separate IWF is calculated for each share class line.

For traditional IPOs, the IWF is generally calculated using the total shares offered (excluding overallotment options) for that share class, divided by the total shares outstanding for the same share class post-IPO.

For IPO direct placement listings on ex-U.S. exchanges, the IWF is calculated using the number of shares listed after excluding the strategic/controlling shareholders.

For direct placement listings on U.S. exchanges, the IWF is calculated using the total registered shares as announced in official documents, subtracting out all control holders and then dividing that result by the total shares outstanding for that share class post IPO.

A company must have a minimum IWF of 0.3 to be eligible for index inclusion, however an IWF at or above that level is not necessary for ongoing index membership.

The IWF for foreign domiciled securities in the S&P/ASX 200 Index is typically set to 1.

IWFs are reviewed annually as part of the September quarterly rebalancing. In addition to the annual IWF review, certain events may warrant an intra-quarter or quarterly IWF update.

#### Liquidity Test

Only stocks that are regularly traded are eligible for inclusion. Eligible stocks are considered for index inclusion based on their stock median liquidity (median daily value traded divided by its average float-adjusted market capitalization for the last six months) relative to the market capitalization weighted average of the stock median liquidities of the 500 companies of the All Ordinaries index, another member of the S&P/ASX index family.

#### Index Maintenance

S&P rebalances the S&P/ASX 200 Index constituents quarterly to ensure adequate market capitalization and liquidity. The reference date used for the trading data is the second to last Friday of the month prior to the rebalancing. Quarterly review changes take effect after the market close on the third Friday of March, June, September and December. Eligible stocks are considered for index inclusion based on their float-adjusted market capitalization rank relative to the stated quota of 200 securities. For example, a stock that is currently in the S&P/ASX 300 and is ranked at 175, based on float-adjusted market capitalization, within the universe of eligible securities may be considered for inclusion into the S&P/ASX 200 Index, provided that liquidity hurdles are met. Stocks that fail the relative liquidation criteria are typically removed from the float-adjusted market capitalization rankings.

In order to limit the level of index turnover, eligible non-constituent securities will generally only be considered for index inclusion once a current constituent stock is excluded due to a sufficiently low rank and/or liquidity, based



on the float-adjusted market capitalization. Potential index inclusions and exclusions need to satisfy buffer requirements in terms of the rank of the stock relative to a given index. In order to be added to the S&P/ASX 200 Index, a stock must be ranked 179th or higher, and in order to be deleted from the S&P/ASX 200 Index, a stock must be ranked 221st or lower. The buffers are established to limit the level of index turnover that may take place at each quarterly rebalancing. The buffers serve as guidelines for arriving at any potential constituent changes to the S&P/ASX 200 Index, however, these rules can be by-passed when circumstances warrant.

Intra-rebalancing index additions are generally only made if a vacancy is created by an index deletion. Index additions are made according to float-adjusted market capitalization and liquidity. The reference date used to determine the index replacement is determined on a case by case basis and taken closer to the time of the event that triggered the vacancy. An initial public offering is added to the S&P/ASX 200 Index only when an appropriate vacancy occurs and is subject to proven liquidity for at least eight weeks. An exception may be made for extraordinary large offerings where sizeable trading volumes justify index inclusion.

Deletions can occur between index rebalancing dates due to acquisitions, mergers and spin-offs or due to suspension or bankruptcies. The decision to remove a stock from the S&P/ASX 200 Index will be made once there is sufficient evidence that the transaction will be completed. Stocks that are removed due to merger and acquisition (M&A) activity are removed from the S&P/ASX 200 Index at the closing price of the security on the deletion date for cash-only offers. Otherwise the best available price in the market is used.

Share numbers for all index constituents are updated quarterly and are rounded to the nearest thousand.

Share updates for foreign-domiciled securities will take place at each quarterly rebalancing. The update to the number of index shares will only take place when the 3-month average of CDIs or the total securities held in the Australian branch of the issuer sponsored register (where supplied) and in CHESS, on the rebalancing reference date, differs from the current index shares by 5% or more. Where CDI information is not supplied to the ASX by the company or the company's share register, estimates for Australian equity capital will be drawn from CHESS data and, ultimately, registry-sourced data.

#### Intra-Quarter Changes to the Number of Shares of a Constituent

Changes as a result of mandatory events, such as mergers or acquisition driven share/IWF changes, stock splits and mandatory distributions are not subject to a minimum threshold for implementation and are implemented when the transaction occurs. At S&P's discretion, however, de minimis merger and acquisition changes may be accumulated and implemented with the updates made with the quarterly share updates as described below. Material share/IWF changes resulting from certain non-mandatory corporate actions follow the accelerated implementation rule.

#### Material Share/IWF Changes – Accelerated Implementation Rule

1. Public offerings. Public offerings of new company-issued shares and/or existing shares offered by selling shareholders, including block sales and spot secondaries, will be eligible for accelerated implementation treatment if the size of the event meets the materiality threshold criteria:

- (a) at least US \$150 million, and
- (b) at least 5% of the pre-event total shares.

In addition to the materiality threshold, public offerings must satisfy the following conditions:

- be underwritten.
- have a publicly available prospectus, offering document, or prospectus summary filed with the relevant authorities.
- have a publicly available confirmation from an official source that the offering has been completed.

For public offerings that involve a concurrent combination of new company shares and existing shares offered by selling shareholders, both events are implemented if either of the public offerings or the total underwritten public offering represents at least 5% of total shares and US \$150 million. Any concurrent share repurchase by the affected company will also be included in the implementation.

2. Dutch Auctions, self-tender offer buybacks, and split-off exchange offers. These non-mandatory corporate action types will be eligible for accelerated implementation treatment regardless of size once the final results are publicly announced and verified by S&P.

For companies with multiple share class lines, the criteria specified above apply to each individual multiple share class line rather than total company shares.

Accelerated implementation for events less than US \$1 billion includes an adjustment to the company's IWF only to the extent that such an IWF change helps the new float share total mimic the shares available in the offering. To minimize unnecessary turnover, these IWF changes do not need to meet any minimum threshold requirement for implementation. Any IWF change resulting in an IWF of 0.96 or greater is rounded up to 1.00 at the subsequent annual IWF review.

For accelerated implementation of at least US \$1 billion, S&P applies the share change, and any resulting IWF change, using the latest share and ownership information publicly available at the time of the announcement, even if the offering size is below the 5% threshold. This exception ensures that very large events are recognized in a timely manner using the latest available information. Any IWF change resulting in an IWF of 0.96 or greater is rounded up to 1.00.

#### Market Specific Accelerated Implementation Rules

Non-fully paid or non-fully settled offerings, such as subscription receipts forward sales agreements, are ineligible for accelerated implementation. Share updates resulting from completion of subscription receipts terms, or the settlement of forward sale agreements, are updated at a future quarterly rebalancing.

#### Announcement Policy

For Australian stocks, S&P provides two (2) business days' notice from the day the Appendix 2A (ASX Listing Rules – Application for Quotation of Securities) is filed. If the Appendix 2A is filed at or after the end of the day, accelerated changes will be implemented at the earliest on the next trading day.

#### Non-Material Share/IWF Changes – Quarterly Implementation

All non-mandatory events not covered or implemented via the accelerated implementation rule (including but not limited to private placements, acquisition of private companies, and conversion of non-index share lines) are reviewed quarterly, effective after the close of the third Friday of the third month in each calendar quarter and as per below.

#### Share Updates

At each quarterly review, shares outstanding are updated to the latest available information as of the rebalancing reference date.

#### IWF Updates

At the quarterly review, IWF changes are only made if there is a share change of at least 5% of total current shares outstanding and if the adjusted IWF absolute change is at least 5, with IWF adjustments limited to the extent necessary to help reflect the corresponding share change.

For quarterly share change events, unless there is explicit information stating that the new shares are not available to the market, shares are generally considered to be available to all investors and reflected in the IWF. Events such as conversion of derivative securities, acquisitions of private companies, or acquisitions of non-index companies that do not trade on a major exchange are generally implemented as described above.

Other than the situations described above, please note that IWF changes are only made at the annual IWF review.

#### Rebalancing Guidelines – Share/IWF Reference Date & Freeze Period

A reference date, after the market close five weeks prior to the third Friday in March, June, September and December, is the cutoff for publicly available information used for quarterly shares outstanding and IWF changes. All shares outstanding and ownership information contained in public filings and/or official sources dates on or before the reference date are included in that quarter's update. In addition, there is a freeze period on a quarterly basis for any changes that result from the accelerated implementation rules. The freeze period begins after the market close on the Tuesday prior to the second Friday of each rebalancing month (i.e. March, June, September, and December) and ends after the market close on the third Friday of the rebalancing month. Pro-forma files for float-adjusted market capitalization indices are generally released after the market close on the first Friday, two weeks prior to the rebalancing effective date. For illustration purposes, if rebalancing pro-forma files are scheduled to be released on Friday, March 5, the share/IWF freeze period will begin after the close of trading on Tuesday, March 9 and will end after the close of trading the following Friday, March 19 (i.e. the third Friday of the rebalancing month).

During the share/IWF freeze period shares and IWFs are not changed and the accelerated implementation rule is suspended, except for mandatory corporate action events (such as merger activity, stock splits, and rights

offerings). The suspension includes all changes that qualify for accelerated implementation and would typically be announced or effective during the share/IWF freeze period. At the end of the freeze period all suspended changes will be announced on the third Friday of the rebalancing month and implemented five business days after the quarterly rebalancing effective date. For these non-mandatory events, S&P uses shares and IWF data as of the upcoming rebalancing effective date to calculate the size of the event and in turn assess if the event qualifies the accelerated implementation rule.

*Index Calculation*

The S&P/ASX 200 Index is calculated using a base-weighted aggregate methodology. The value of the S&P/ASX 200 Index on any day for which an index value is published is determined by a fraction, the numerator of which is the *sum* for all index stocks of the products of the price of each stock in the S&P/ASX 200 Index *times* the number of shares of such stock included in the S&P/ASX 200 Index *times* that stock's IWF, and the denominator of which is the divisor, which is described more fully below.

In order to prevent the value of the S&P/ASX 200 Index from changing due to corporate actions, all corporate actions may require S&P to make an index or divisor adjustment. This helps maintain the value of the S&P/ASX 200 Index and ensures that the movement of the S&P/ASX 200 Index does not reflect the corporate actions of the individual companies that comprise the S&P/ASX 200 Index.

The table below summarizes the types of index adjustments and indicates whether the corporate action will require a divisor adjustment:

Corporate Action	Treatment
Company addition/deletion	<u>Addition</u> Companies are added at the float market capitalization weight. The net change to the index market capitalization causes a divisor adjustment. <u>Deletion</u> The weights of all stocks in the index will proportionally change. Relative weights will stay the same. The index divisor will change due to the net change in the index market capitalization
Change in shares outstanding	Increasing (decreasing) the shares outstanding increases (decreases) the market capitalization of the index. The change to the index market capitalization causes a divisor adjustment.
Split/reverse split	Shares outstanding are adjusted by split ratio. Stock price is adjusted by split ratio. There is no change to the index market capitalization and no divisor adjustment.
Spin-off	The spin-off is added to the index on the ex-date at a price of zero. The spin-off index shares are based on the spin-off ratio. On the ex-date the spin-off will have the same attributes as its parent company, and will remain in the index for at least one trading day. As a result, there will be no change to the index divisor on the ex-date. If the spin-off is ineligible for continued inclusion, it will be removed after the ex-date. The weight of the spin-off being deleted is reinvested across all the index components proportionally such that the relative weights of all index components are unchanged. The net change in index market capitalization will cause a divisor change.
Change in IWF	Increasing (decreasing) the IWF increases (decreases) the market capitalization of the index. A net change to the index market capitalization causes a divisor adjustment.
Ordinary dividend	When a company pays an ordinary cash dividend, the index does not make any adjustments to the price or shares of the stock. As a result there are no divisor adjustments to the index.
Special dividend	The stock price is adjusted by the amount of the dividend. The net change to the index market capitalization causes a divisor adjustment
Rights offering	All rights offerings that are in the money on the ex-date are applied under the assumption the rights are fully subscribed. The stock price is adjusted by the value of the rights and the shares outstanding are increased by the rights ratio. The net change in market capitalization causes a divisor adjustment.

### *Recalculation Policy*

S&P reserves the right to recalculate and republish the S&P/ASX 200 Index at its discretion in the event one of the following issues has occurred: (1) incorrect or revised closing price of one or more constituent securities; (2) missed or misapplied corporate event; (3) incorrect application of an index methodology; (4) late announcement of a corporate event; or (5) incorrect calculation or data entry error. The decision to recalculate the S&P/ASX 200 Index is made at the discretion of the index manager and/or index committee, as further discussed below. The potential market impact or disruption resulting from a recalculation is considered when making any such decision. In the event of an incorrect closing price, a missed or misapplied corporate action, a late announcement of a corporate event, or an incorrect calculation or data entry error that is discovered within two trading days of its occurrence, generally the S&P/ASX 200 Index is calculated. In the event any such event is discovered beyond the two trading day period, the index committee shall decide whether the S&P/ASX 200 Index should be recalculated. In the event of an incorrect application of the methodology that results in the incorrect composition and/or weighting of index constituents, the index committee shall determine whether or not to recalculate the S&P/ASX 200 Index following specified guidelines. In the event that the S&P/ASX 200 Index is recalculated, it shall be done within a reasonable timeframe following the detection and review of the issue.

### *Calculations and Pricing Disruptions*

Prices used to calculate the S&P/ASX 200 Index are obtained from ICE and Refinitiv. If the relevant exchange suffers a failure or interruption, real-time calculations are halted until the exchange confirms that trading and price dissemination has resumed.

If the interruption is not resolved before the market close and the exchange publishes a list of closing prices, those prices are used to calculate the closing value of the S&P/ASX 200 Index. If no list is published, the last trade for each security before the interruption is used to calculate the closing value of the S&P/ASX 200 Index. If no trades were reported for a security, the previous close adjusted for corporate actions is used for index calculation.

In extreme circumstances, S&P may decide to delay index adjustments or not publish the S&P/ASX 200 Index.

### *Unexpected Exchange Closures*

An unexpected market/exchange closure occurs when a market/exchange fully or partially fails to open or trading is temporarily halted. This can apply to a single exchange or to a market as a whole, when all of the primary exchanges are closed and/or not trading. Unexpected market/exchange closures are usually due to unforeseen circumstances, such as natural disasters, inclement weather, outages, or other events.

In the event of an unexpected exchange closure, S&P uses the following guidelines:

- (i) If an unexpected exchange closure occurs prior to the open of trading and it is indicated that trading will not open for a given day, S&P will treat the day as an unscheduled market holiday.
- (ii) If a market disruption occurs intraday, S&P will wait for the impacted exchange to publish a list of closing prices, which will then be used to calculate the closing index values. If no list is published, the last trade for each security before the interruption is used to calculate the index closing value. If no trades were reported for a security, the previous closing price, adjusted for corporate actions, is used for index calculation.

### *License Agreement between S&P Dow Jones Indices LLC and GS Finance Corp.*

The "S&P/ASX 200" is a product of S&P Dow Jones Indices LLC or its affiliates ("SPDJI") and ASX Operations Pty Ltd, and has been licensed for use by GS Finance Corp. ("Licensee"). Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC ("S&P") and Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones"). ASX 200 is a registered trademark of ASX Operations Pty Ltd. The trademarks have been licensed to SPDJI and have been sublicensed for use for certain purposes by Licensee. Licensee's Product(s) are not sponsored, endorsed, sold or promoted by SPDJI, Dow Jones, S&P, any of their respective affiliates (collectively, "S&P Dow Jones Indices") or ASX Operations Pty Ltd. Neither S&P Dow Jones Indices nor ASX Operations Pty Ltd make any representation or warranty, express or implied, to the owners of the Licensee's Product(s) or any member of the public regarding the advisability of investing in securities generally or in Licensee's Product(s) particularly or the ability of the S&P/ASX 200 to track general market performance. S&P Dow Jones Indices and ASX Operations Pty Ltd only relationship to Licensee with respect to the S&P/ASX 200 is the licensing of the Index and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The S&P/ASX 200 is determined, composed and

calculated by S&P Dow Jones Indices ASX Operations Pty Ltd. without regard to Licensee or the Licensee's Product(s). S&P Dow Jones Indices and ASX Operations Pty Ltd. have no obligation to take the needs of Licensee or the owners of Licensee's Product(s) into consideration in determining, composing or calculating the S&P/ASX 200. Neither S&P Dow Jones Indices nor ASX Operations Pty Ltd. are responsible for and have not participated in the determination of the prices, and amount of Licensee's Product(s) or the timing of the issuance or sale of Licensee's Product(s) or in the determination or calculation of the equation by which Licensee's Product(s) is to be converted into cash, surrendered or redeemed, as the case may be. S&P Dow Jones Indices and ASX Operations Pty Ltd. have no obligation or liability in connection with the administration, marketing or trading of Licensee's Product(s). There is no assurance that investment products based on the S&P/ASX 200 will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

NEITHER S&P DOW JONES INDICES NOR THIRD PARTY LICENSOR GUARANTEES THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE S&P/ASX 200 OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO, ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES AND ASX OPERATIONS PTY LTD. SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES AND ASX OPERATIONS PTY LTD. MAKES NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY LICENSEE, OWNERS OF THE LICENSEE'S PRODUCT(S), OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE S&P/ASX 200 OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES OR ASX OPERATIONS PTY LTD. BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES INCLUDING BUT NOT LIMITED TO, LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN

ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND LICENSEE, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

## S&P 500® Daily Risk Control 5% USD Excess Return Index

The S&P 500® Daily Risk Control 5% USD Excess Return Index (the "Excess Return index"):

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of September 10, 2009, with a base value of 100 as of its base date, February 5, 1990; and
- is sponsored by S&P Dow Jones Indices LLC ("S&P").

The Excess Return index is the excess return version of the S&P 500® Daily Risk Control 5% USD Total Return Index (the "Risk Control index"), meaning that the Excess Return index is designed to measure the return on a hypothetical investment in the Risk Control index borrowed at a rate of the Secured Overnight Financing Rate (SOFR) *plus* 0.02963%. Any percentage increase in the Risk Control index will be offset by a rate of SOFR *plus* 0.02963%.

**Prior to December 20, 2021, the Excess Return index measured the return on a hypothetical investment in the Risk Control index borrowed at the overnight U.S. dollar LIBOR rate.**

The Risk Control index is intended to provide investors with exposure to the S&P 500® Total Return Index (the "Total Return index") subject to a risk control strategy that dynamically increases or decreases the exposure to the Total Return index in an attempt to achieve a 5% volatility target. The Risk Control index's exposure to the Total Return index can be greater than, less than or equal to 100%. Exposure in excess of 100% is achieved by hypothetically borrowing cash at a rate of SOFR *plus* 0.02963%. Exposure of less than 100% is achieved by hypothetically selling some of the exposure to the Total Return index, which results in a hypothetical cash position that accrues interest at the rate of SOFR *plus* 0.02963%. Notwithstanding that the title of each of the Excess Return index and the Risk Control index includes the phrase "Risk Control", the Excess Return index and the Risk Control index may decrease significantly more or increase significantly less than the Total Return index.

**Prior to December 20, 2021, the Risk Control index's exposure in excess of 100% was achieved by hypothetically borrowing cash at a rate of overnight U.S. dollar LIBOR. Exposure of less than 100% was achieved by hypothetically selling some of the exposure to the Total Return index, which resulted in a hypothetical cash position that accrued interest at the overnight U.S. dollar LIBOR rate.**

**As a result, extremely limited historical information regarding the performance of the Excess Return Index and the Risk Control index subsequent to their discontinued use of overnight U.S. dollar LIBOR is available, which may make it difficult for you to make an informed decision with respect to an investment in the securities.**

The Total Return index is a total return-based calculation of the S&P 500® Index. The S&P 500® Index includes a representative sample of 500 companies in leading industries of the U.S. economy.

The Excess Return index, the Risk Control index, the Total Return index and the S&P 500® Index are calculated, maintained and published by S&P Dow Jones Indices LLC ("S&P"). Additional information about the Excess Return index, the Risk Control index, the Total Return index, and the S&P 500® Index (including sector weights) is available on the following websites: [spglobal.com/spdji/en/indices/strategy/sp-500-daily-risk-control-5-index](https://spglobal.com/spdji/en/indices/strategy/sp-500-daily-risk-control-5-index), [spglobal.com/spdji/en/indices/equity/sp-500](https://spglobal.com/spdji/en/indices/equity/sp-500) and [spglobal.com](https://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

## S&P 500® Daily Risk Control 5% USD Excess Return Index

The Excess Return index is the excess return version of the Risk Control index. The Excess Return index is designed to measure the return on a hypothetical investment in the Risk Control index that is made with borrowed funds. Borrowing costs are assessed at a rate of SOFR *plus* 0.02963%. Such costs will reduce any positive index return and will increase any negative index return. The level of the Excess Return index on an index calculation day ("T") is equal to the *product* of (a) the level of the Excess Return index on the previous index calculation day ("T – 1") *multiplied by* (b) (i) the return of the Risk Control index on the Excess Return index calculation day ("T") *minus* (ii) the borrowing costs.

## S&P 500® Daily Risk Control 5% USD Total Return Index

The Risk Control index is designed to measure the return on a hypothetical investment in the Total Return index that dynamically increases or decreases its exposure to the Total Return index in an attempt to achieve a 5% volatility target (the “volatility target”). While the Risk Control index is designed to achieve a stable level of volatility, there can be no assurance that the Risk Control index will achieve this goal.

The return on the Risk Control index consists of two components: (1) the exposure to the Total Return index, which may be greater than (but not greater than 150%), less than (as low as zero) or equal to 100% of the daily return of the Total Return index, and (2) an interest cost or gain. An exposure greater than 100% of the daily return of the Total Return index is a leveraged position where the exposure to the Total Return index is increased by hypothetically borrowing cash (and paying interest on such cash as described below) and investing such cash in the Total Return index. An exposure less than 100% of the daily return of the Total Return index is a deleveraged position where the exposure to the Total Return index is decreased by hypothetically selling some of the exposure, which results in a hypothetical cash position that accrues interest. An exposure equal to 100% of the daily return of the Total Return index has the same daily return as the Total Return index. Interest cost accrues on the amount of any hypothetical borrowed cash and interest gain accrues on the amount of any hypothetical cash position. The rate of SOFR *plus* 0.02963% is used to calculate the interest cost or gain. The Excess Return index sponsor may use other successor interest rates if SOFR is unavailable, and a 360-day year is assumed for the interest calculations in accordance with U.S. banking practices.

Each Risk Control index calculation day (“T”), the Excess Return index sponsor calculates the “leverage factor”, which determines whether the exposure to the Total Return index should be greater than, less than or equal to 100% of the daily return of the Total Return index for the following Risk Control index calculation day (“T + 1”). The leverage factor is a ratio of the target volatility level (of 5%) to the “realized volatility” (as defined below) for the second preceding Risk Control index calculation day (“T - 2”), subject to a maximum leverage factor of 150% and a minimum leverage factor of 0%. For example, if on the second preceding Risk Control index calculation day the realized volatility were equal to 4%, on the Risk Control index calculation day the leverage factor would be equal to 125% (5% divided by 4%) and on the following Risk Control index calculation day the Risk Control index would be exposed to 125% of the daily return of the Total Return index.

Although the Risk Control index is rebalanced at the close of each Risk Control index calculation day, because of how the leverage factor is calculated, there is a lag of two Risk Control index calculation days between the calculation of the leverage factor and the rebalancing of the Risk Control index in accordance with that leverage factor. Therefore, on any given Risk Control index calculation day, the leverage factor that determined the Risk Control index's exposure to the Total Return index for such Risk Control index calculation day was based on the realized volatility of the Total Return index from two Risk Control index calculation days prior.

“Realized volatility” is a measurement of variations in the historical daily returns of the Total Return index. Realized volatility is calculated as the greater of short-term volatility and long-term volatility. Both short-term volatility and long-term volatility are calculated based on the historical daily returns over the same time period (from the day that is two Risk Control index calculation days before the inception date (September 10, 2009) of the Risk Control index to the day that is two Risk Control index calculation days before the current Risk Control index calculation day) and both apply and gradually increase a discount that gradually reduces the significance of a given historical daily return as it moves farther into the past. However, short-term volatility applies a larger discount than does long-term volatility. The discount for short-term volatility is slightly more than double the discount for long-term volatility. As a result, the 10 most recent Risk Control index calculation days account for approximately 50% of the weighting when determining short-term volatility, while the 23 most recent Risk Control index calculation days account for approximately 50% of the weighting when determining long-term volatility. **The short-term realized volatility calculation and the long-term realized volatility calculations differ only in that the long-term volatility calculation places 50% of the calculation weighting on an additional 13 days.**

When the volatility of the Total Return index increases (or decreases), short-term volatility will increase (or decrease) more quickly than long-term volatility. Because realized volatility is the greater of short-term volatility and long-term volatility, realized volatility will increase quickly when volatility increases, which will quickly reduce exposure to the Total Return index. Conversely, because realized volatility is the greater of short-term volatility and long-term volatility, realized volatility will decrease slowly when volatility decreases, which in turn will gradually increase exposure to the Total Return index.

If realized volatility is less than the volatility target, the leverage factor will be greater than one and the exposure to the daily return of the Total Return index will be greater than 100%. As a result, interest costs will be incurred for the exposure greater than 100% at the rate of SOFR *plus* 0.02963%. For example, if the realized volatility is 4%, the leverage factor will be 125% (i.e., 5 divided by 4 = 125%). In this case, the Risk Control index would be exposed to 125% of the daily return of the Total Return index, and interest cost will be assessed for the 25% exposure above 100%. If realized volatility is greater than the volatility target, the leverage factor will be less than one and the exposure to the daily return of the Total Return index will be less than 100%. As a result, exposure will be moved to the cash position, which will accrue interest at the rate of SOFR *plus* 0.02963%. For example, if the realized volatility is 6%, the leverage factor will be approximately 83% (i.e., 5 divided by 6 = approximately 83%). In this case, the Risk Control index would be exposed to approximately 83% of the daily return of the Total Return index, plus the interest gain on the 17% of exposure that is moved to the cash position. If realized volatility is equal to the volatility target, the leverage factor will be equal to one and exposure to the daily return of the Total Return index will be equal to 100% and there will be no interest cost or gain.

***Typically, a portion of the Risk Control index's exposure has been to the hypothetical cash position.***

#### Total Return Index

The Total Return index is a total return-based calculation of the S&P 500® Index. The total return construction reflects both movements in stock prices and the reinvestment of dividend income. The Total Return index represents the total return earned in a portfolio that tracks the S&P 500® Index and reinvests dividend income in the overall index, not in the specific stock paying the dividend.

The total return construction builds the Total Return index from the price return version of the S&P 500® Index but accounts for daily total dividend returns. The first step is to calculate the total dividend paid on a given day and convert that figure into price index points. A total daily dividend amount is calculated as the aggregate of, for each of the stocks in the S&P 500® Index, the *product* of (a) the number of shares of such stock *times* (b) the dividend per share paid for such stock. This calculation is performed for each trading day. The dividend per share for a stock is generally zero except for four times a year when it goes ex-dividend for the quarterly dividend payment. Some stocks included in the S&P 500® Index do not pay dividends and this amount always remains zero. Ordinary cash dividends are applied on the ex-dividend date in calculating the total return index. The Total Return index reflects both ordinary and special cash dividends. "Special dividends" are those dividends that are outside of the normal payment pattern established historically by the issuing company. These may be described by the company as "special," "extra," "year-end" or "return of capital." Whether a dividend is funded from operating earnings or from other sources of cash does not affect the determination of whether it is ordinary or special. S&P Dow Jones Indices will generally consider the third consecutive instance of a non-ordinary dividend (in terms of timing, not amount) to be ordinary for index calculation purposes as a third consecutive instance will now be considered to be part of the normal payment pattern established by the company. As discussed under "The S&P 500® Index" below, special dividends are treated as corporate actions with offsetting price and divisor adjustments.

The total daily dividend amount calculated above is converted to index points by dividing such amount by the divisor for the price return version of the S&P 500® Index. The daily total return for the Total Return index is then determined by calculating the *result of* (a) the *quotient* of (i) the *sum* of (1) the level of the price return version of the S&P 500® Index on that day *plus* (2) the index points reflecting the total daily dividend amount on such day *divided by* (ii) the level of the price return version of the S&P 500® Index for the previous day *minus* (b) one. The daily total return is used to update the Total Return index level from one day to the next by calculating the *product* of (a) the level of the Total Return index from the previous day *times* (b) the *sum* of (i) one *plus* (ii) the daily total return for the given day.

**For information about the construction, calculation methodology and maintenance of the S&P 500® Index, please see "— The S&P 500® Index" below.**

*License Agreement between S&P and GS Finance Corp.*

The S&P 500® Daily Risk Control 5% USD Excess Return Index, the S&P 500® Daily Risk Control 5% USD Total Return Index, the S&P 500® Total Return Index and the S&P 500® Index are products of S&P Dow Jones Indices LLC, and have been licensed for use by GS Finance Corp. ("Goldman"). Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC; Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones") and these trademarks have been licensed for use by S&P



Dow Jones Indices LLC and sublicensed for certain purposes by Goldman. Goldman's securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, Standard & Poor's Financial Services LLC or any of their respective affiliates (collectively, "S&P Dow Jones Indices"). S&P Dow Jones Indices makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the S&P 500® Daily Risk Control 5% USD Excess Return Index, the S&P 500® Daily Risk Control 5% USD Total Return Index, the S&P 500® Total Return Index or the S&P 500® Index to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the S&P 500® Daily Risk Control 5% USD Excess Return Index, the S&P 500® Daily Risk Control 5% USD Total Return Index, the S&P 500® Total Return Index and the S&P 500® Index is the licensing of these indices and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The S&P 500® Daily Risk Control 5% USD Excess Return Index, the S&P 500® Daily Risk Control 5% USD Total Return Index, the S&P 500® Total Return Index and the S&P 500® Index are determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the S&P 500® Daily Risk Control 5% USD Excess Return Index, the S&P 500® Daily Risk Control 5% USD Total Return Index, the S&P 500® Total Return Index or the S&P 500® Index. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the S&P 500® Daily Risk Control 5% USD Excess Return Index, the S&P 500® Daily Risk Control 5% USD Total Return Index, the S&P 500® Total Return Index or the S&P 500® Index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

S&P DOW JONES INDICES DOES NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE S&P 500® DAILY RISK CONTROL 5% USD EXCESS RETURN INDEX, THE S&P 500® DAILY RISK CONTROL 5% USD TOTAL RETURN INDEX, THE S&P 500® TOTAL RETURN INDEX OR THE S&P 500® INDEX OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE S&P 500® DAILY RISK CONTROL 5% USD EXCESS RETURN INDEX, THE S&P 500® DAILY RISK CONTROL 5% USD TOTAL RETURN INDEX, THE S&P 500® TOTAL RETURN INDEX OR S&P 500® INDEX OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES

### S&P 500® Daily Risk Control 10% USD Excess Return Index

The S&P 500® Daily Risk Control 10% USD Excess Return Index (the “Excess Return index”):

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of May 13, 2009, with a base value of 100 as of its base date, December 31, 1990; and
- is sponsored by S&P Dow Jones Indices LLC (“S&P”).

The Excess Return index is the excess return version of the S&P 500® Daily Risk Control 10% USD Total Return Index (the “Risk Control index”), meaning that the Excess Return index is designed to measure the return on a hypothetical investment in the Risk Control index borrowed at a rate of the Secured Overnight Financing Rate (SOFR) plus 0.02963%.

Any percentage increase in the Risk Control index will be offset by a rate of SOFR *plus* 0.02963%.

**Prior to December 20, 2021, the Excess Return index measured the return on a hypothetical investment in the Risk Control index borrowed at the overnight U.S. dollar LIBOR rate.**

The Risk Control index is intended to provide investors with exposure to the S&P 500® Total Return Index (the “Total Return index”) subject to a risk control strategy that dynamically increases or decreases the exposure to the Total Return index in an attempt to achieve a 10% volatility target. The Risk Control index’s exposure to the Total Return index can be greater than, less than or equal to 100%. Exposure in excess of 100% is achieved by hypothetically borrowing cash at a rate of SOFR plus 0.02963%. Exposure of less than 100% is achieved by hypothetically selling some of the exposure to the Total Return index, which results in a hypothetical cash position that accrues interest at the rate of SOFR plus 0.02963%. Notwithstanding that the title of each of the Excess Return index and the Risk Control index includes the phrase “Risk Control”, the Excess Return index and the Risk Control index may decrease significantly more or increase significantly less than the Total Return index.

**Prior to December 20, 2021, the Risk Control index’s exposure in excess of 100% was achieved by hypothetically borrowing cash at a rate of overnight U.S. dollar LIBOR. Exposure of less than 100% was achieved by hypothetically selling some of the exposure to the Total Return index, which resulted in a hypothetical cash position that accrued interest at the overnight U.S. dollar LIBOR rate.**

**As a result, extremely limited historical information regarding the performance of the Excess Return Index and the Risk Control index subsequent to their discontinued use of overnight U.S. dollar LIBOR is available, which may make it difficult for you to make an informed decision with respect to an investment in the securities.**

The Total Return index is a total return-based calculation of the S&P 500® Index. The S&P 500® Index includes a representative sample of 500 companies in leading industries of the U.S. economy.

The Excess Return index, the Risk Control index, the Total Return index and the S&P 500® Index are calculated, maintained and published by S&P Dow Jones Indices LLC (“S&P”). Additional information about the Excess Return index, the Risk Control index, the Total Return index, and the S&P 500® Index (including sector weights) is available on the following websites: [spglobal.com/spdji/en/indices/strategy/sp-500-daily-risk-control-10-index](https://spglobal.com/spdji/en/indices/strategy/sp-500-daily-risk-control-10-index), [spglobal.com/spdji/en/indices/equity/sp-500](https://spglobal.com/spdji/en/indices/equity/sp-500) and [spglobal.com](https://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

### S&P 500® Daily Risk Control 10% USD Excess Return Index

The Excess Return index is the excess return version of the Risk Control index. The Excess Return index is designed to measure the return on a hypothetical investment in the Risk Control index that is made with borrowed funds. Borrowing costs are assessed at a rate of SOFR plus 0.02963%. Such costs will reduce any positive index return and will increase any negative index return. The level of the Excess Return index on an index calculation day (“T”) is equal to the *product* of (a) the level of the Excess Return index on the previous index calculation day (“T – 1”) *multiplied by* (b) (i) the return of the Risk Control index on the Excess Return index calculation day (“T”) *minus* (ii) the borrowing costs.

### S&P 500® Daily Risk Control 10% USD Total Return Index

The Risk Control index is designed to measure the return on a hypothetical investment in the Total Return index that dynamically increases or decreases its exposure to the Total Return index in an attempt to achieve a 10% volatility target (the “volatility target”). While the Risk Control index is designed to achieve a stable level of volatility, there can be no assurance that the Risk Control index will achieve this goal.

The return on the Risk Control index consists of two components: (1) the exposure to the Total Return index, which may be greater than (but not greater than 150%), less than (as low as zero) or equal to 100% of the daily return of the Total Return index, and (2) an interest cost or gain. An exposure greater than 100% of the daily return of the Total Return index is a leveraged position where the exposure to the Total Return index is increased by hypothetically borrowing cash (and paying interest on such cash as described below) and investing such cash in the Total Return index. An exposure less than 100% of the daily return of the Total Return index is a deleveraged position where the exposure to the Total Return index is decreased by hypothetically selling some of the exposure, which results in a hypothetical cash position that accrues interest. An exposure equal to 100% of the daily return of the Total Return index has the same daily return as the Total Return index. Interest cost accrues on the amount of any hypothetical borrowed cash and interest gain accrues on the amount of any hypothetical cash position. The rate of SOFR plus 0.02963% is used to calculate the interest cost or gain. The Excess Return index sponsor may use other successor interest rates if SOFR is unavailable, and a 360-day year is assumed for the interest calculations in accordance with U.S. banking practices.

Each Risk Control index calculation day ("T"), the Excess Return index sponsor calculates the "leverage factor", which determines whether the exposure to the Total Return index should be greater than, less than or equal to 100% of the daily return of the Total Return index for the following Risk Control index calculation day ("T + 1"). The leverage factor is a ratio of the target volatility level (of 10%) to the "realized volatility" (as defined below) for the second preceding Risk Control index calculation day ("T - 2"), subject to a maximum leverage factor of 150% and a minimum leverage factor of 0%. For example, if on the second preceding Risk Control index calculation day the realized volatility were equal to 8%, on the Risk Control index calculation day the leverage factor would be equal to 125% (10% divided by 8%) and on the following Risk Control index calculation day the Risk Control index would be exposed to 125% of the daily return of the Total Return index.

Although the Risk Control index is rebalanced at the close of each Risk Control index calculation day, because of how the leverage factor is calculated, there is a lag of two Risk Control index calculation days between the calculation of the leverage factor and the rebalancing of the Risk Control index in accordance with that leverage factor. Therefore, on any given Risk Control index calculation day, the leverage factor that determined the Risk Control index's exposure to the Total Return index for such Risk Control index calculation day was based on the realized volatility of the Total Return index from two Risk Control index calculation days prior.

"Realized volatility" is a measurement of variations in the historical daily returns of the Total Return index. Realized volatility is calculated as the greater of short-term volatility and long-term volatility. Both short-term volatility and long-term volatility are calculated based on the historical daily returns over the same time period (from the day that is two Risk Control index calculation days before the inception date (May 13, 2009) of the Risk Control index to the day that is two Risk Control index calculation days before the current Risk Control index calculation day) and both apply and gradually increase a discount that gradually reduces the significance of a given historical daily return as it moves farther into the past. However, short-term volatility applies a larger discount than does long-term volatility. The discount for short-term volatility is slightly more than double the discount for long-term volatility. As a result, the 10 most recent Risk Control index calculation days account for approximately 50% of the weighting when determining short-term volatility, while the 23 most recent Risk Control index calculation days account for approximately 50% of the weighting when determining long-term volatility. **The short-term realized volatility calculation and the long-term realized volatility calculations differ only in that the long-term volatility calculation places 50% of the calculation weighting on an additional 13 days.**

When the volatility of the Total Return index increases (or decreases), short-term volatility will increase (or decrease) more quickly than long-term volatility. Because realized volatility is the greater of short-term volatility and long-term volatility, realized volatility will increase quickly when volatility increases, which will quickly reduce exposure to the Total Return index. Conversely, because realized volatility is the greater of short-term volatility and long-term volatility, realized volatility will decrease slowly when volatility decreases, which in turn will gradually increase exposure to the Total Return index.

If realized volatility is less than the volatility target, the leverage factor will be greater than one and the exposure to the daily return of the Total Return index will be greater than 100%. As a result, interest costs will be incurred for the exposure greater than 100% at the rate of SOFR plus 0.02963%. For example, if the realized volatility is 8%, the leverage factor will be 125% (i.e., 10 divided by 8 = 125%). In this case, the Risk Control index would be exposed to 125% of the daily return of the Total Return index, and interest cost will be assessed for the 25% exposure above 100%. If realized volatility is greater than the volatility target, the leverage factor will be less than one and the exposure to the daily return of the Total Return index will be less than 100%. As a result, exposure will be moved to the cash position, which will accrue interest at the rate of SOFR plus 0.02963%. For example, if the realized volatility is 12%, the leverage factor will be approximately 83% (i.e., 10 divided by 12 = approximately

83%). In this case, the Risk Control index would be exposed to approximately 83% of the daily return of the Total Return index, plus the interest gain on the 17% of exposure that is moved to the cash position. If realized volatility is equal to the volatility target, the leverage factor will be equal to one and exposure to the daily return of the Total Return index will be equal to 100% and there will be no interest cost or gain.

**Typically, a portion of the Risk Control index's exposure has been to the hypothetical cash position.**

#### Total Return Index

The Total Return index is a total return-based calculation of the S&P 500® Index. The total return construction reflects both movements in stock prices and the reinvestment of dividend income. The Total Return index represents the total return earned in a portfolio that tracks the S&P 500® Index and reinvests dividend income in the overall index, not in the specific stock paying the dividend.

The total return construction builds the Total Return index from the price return version of the S&P 500® Index but accounts for daily total dividend returns. The first step is to calculate the total dividend paid on a given day and convert that figure into price index points. A total daily dividend amount is calculated as the aggregate of, for each of the stocks in the S&P 500® Index, the *product* of (a) the number of shares of such stock *times* (b) the dividend per share paid for such stock. This calculation is performed for each trading day. The dividend per share for a stock is generally zero except for four times a year when it goes ex-dividend for the quarterly dividend payment. Some stocks included in the S&P 500® Index do not pay dividends and this amount always remains zero. Ordinary cash dividends are applied on the ex-dividend date in calculating the total return index. The Total Return index reflects both ordinary and special cash dividends. "Special dividends" are those dividends that are outside of the normal payment pattern established historically by the issuing company. These may be described by the company as "special," "extra," "year-end" or "return of capital." Whether a dividend is funded from operating earnings or from other sources of cash does not affect the determination of whether it is ordinary or special. S&P Dow Jones Indices will generally consider the third consecutive instance of a non-ordinary dividend (in terms of timing, not amount) to be ordinary for index calculation purposes as a third consecutive instance will now be considered to be part of the normal payment pattern established by the company. As discussed under "The S&P 500® Index" below, special dividends are treated as corporate actions with offsetting price and divisor adjustments.

The total daily dividend amount calculated above is converted to index points by dividing such amount by the divisor for the price return version of the S&P 500® Index. The daily total return for the Total Return index is then determined by calculating the *result of* (a) the *quotient* of (i) the *sum* of (1) the level of the price return version of the S&P 500® Index on that day *plus* (2) the index points reflecting the total daily dividend amount on such day *divided by* (ii) the level of the price return version of the S&P 500® Index for the previous day *minus* (b) one. The daily total return is used to update the Total Return index level from one day to the next by calculating the *product* of (a) the level of the Total Return index from the previous day *times* (b) the *sum* of (i) one *plus* (ii) the daily total return for the given day.

**For information about the construction, calculation methodology and maintenance of the S&P 500® Index, please see "— The S&P 500® Index" below.**

#### License Agreement between S&P and GS Finance Corp.

The S&P 500® Daily Risk Control 10% USD Excess Return Index, the S&P 500® Daily Risk Control 10% USD Total Return Index, the S&P 500® Total Return Index and the S&P 500® Index are products of S&P Dow Jones Indices LLC, and have been licensed for use by GS Finance Corp. ("Goldman"). Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC; Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones") and these trademarks have been licensed for use by S&P Dow Jones Indices LLC and sublicensed for certain purposes by Goldman. Goldman's securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, Standard & Poor's Financial Services LLC or any of their respective affiliates (collectively, "S&P Dow Jones Indices"). S&P Dow Jones Indices makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the S&P 500® Daily Risk Control 10% USD Excess Return Index, the S&P 500® Daily Risk Control 10% USD Total Return Index, the S&P 500® Total Return Index or the S&P 500® Index to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the S&P 500® Daily Risk Control 10% USD Excess Return Index, the S&P 500® Daily Risk Control 10% USD Total Return Index, the S&P 500® Total Return Index and the S&P 500® Index is the licensing of these indices and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The S&P 500® Daily Risk Control 10% USD Excess Return Index, the S&P 500® Daily Risk Control 10% USD Total Return Index, the S&P 500® Total Return Index

and the S&P 500® Index are determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the S&P 500® Daily Risk Control 10% USD Excess Return Index, the S&P 500® Daily Risk Control 10% USD Total Return Index, the S&P 500® Total Return Index or the S&P 500® Index. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the S&P 500® Daily Risk Control 10% USD Excess Return Index, the S&P 500® Daily Risk Control 10% USD Total Return Index, the S&P 500® Total Return Index or the S&P 500® Index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

S&P DOW JONES INDICES DOES NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE S&P 500® Daily Risk Control 10% USD Excess Return Index, the S&P 500® Daily Risk Control 10% USD Total Return Index, the S&P 500® Total Return Index or the S&P 500® INDEX OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE S&P 500® Daily Risk Control 10% USD Excess Return Index, the S&P 500® Daily Risk Control 10% USD Total Return Index, the S&P 500® Total Return Index or S&P 500® INDEX OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

## S&P 500® Futures Excess Return Index

The S&P 500® Futures Excess Return Index, which we also refer to in this description as the “index”:

- is an equity futures index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of August 11, 2010, with a base value of 100 as of its base date, September 9, 1997; and
- is sponsored by S&P Dow Jones Indices LLC (“S&P”).

The S&P 500® Futures Excess Return Index measures the performance of the nearest maturing quarterly E-mini S&P 500 futures contract trading on the Chicago Mercantile Exchange (“CME”). E-mini S&P 500 futures contracts are quarterly contracts to buy or sell standardized trading “units”. One trading unit of the E-mini S&P 500 futures contracts equals \$50 multiplied by the S&P 500® Index (price return version). The S&P 500® Index includes a representative sample of 500 companies in leading industries of the U.S. economy. The index is calculated in U.S. dollars (\$) on an excess return basis. The index and the S&P 500® Index are calculated, maintained and published by S&P. Additional information about the index and the S&P 500® Index (including sector weights) is available on the following websites: [spglobal.com/spdji/en/indices/strategy/sp-500-futures-index](http://spglobal.com/spdji/en/indices/strategy/sp-500-futures-index), [spglobal.com/spdji/en/indices/equity/sp-500](http://spglobal.com/spdji/en/indices/equity/sp-500) and [spglobal.com](http://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

### *Calculation of the Index*

The index is constructed from the front-month E-mini S&P 500 futures contract and includes a provision for the replacement of the current E-mini S&P 500 futures contract as the contract approaches maturity (also referred to as “rolling” or “the roll”). This replacement occurs over a one-day rolling period every March, June, September, and December, effective after the close of trading five business days preceding the last trading date of the E-mini S&P 500 futures contract.

The index is calculated from the price change of the underlying E-mini S&P 500 futures contract. The level of the index on a trading date is calculated as follows: the *product* of (i) the level of the index on the preceding business day, which is any date on which the index is calculated, *multiplied by* (ii) one *plus* the contract daily return (described below) on such date.

On each trading date, the contract daily return is calculated as the *result* of (i) the *quotient* of (a) the daily contract reference price (the official closing price per futures contract, as designated by the relevant exchange) on such date *divided by* (b) the daily contract reference price on the immediately preceding trading date.

### *Index Committee*

An index committee maintains the index. The index committee may revise index policy covering rules for including currencies, the timing of rebalancing or other matters. The index sponsor considers information about changes to its indices and related matters to be potentially market moving and material. Therefore, all index committee discussions are confidential.

The index committee reserves the right to make exceptions when applying the methodology if the need arises. In any scenario where the treatment differs from the general rules, notice will be provided, whenever possible.

In addition to the daily governance and maintenance of the index methodology, at least once within any 12-month period, the index committee reviews the methodology to ensure the index continues to achieve the stated objective, and that the data and methodology remain effective.

### *Recalculation Policy*

The index sponsor may recalculate the index if settlement prices are amended or there is a deviation from what is stated in the index methodology. If amended settlement prices due to vendor errors or exchange updates are discovered within two business days of its occurrence, the index manager may, at their discretion, recalculate the index without involving the index committee. In the event any such recalculation event is discovered beyond such two business day period, the index committee shall decide whether the index should be recalculated. Errors identified prior to the next day open are corrected and the indices are reposted. Other errors are reviewed by the

index committee, which is responsible for determining which actions should be taken. Errors due to index sponsor data entry errors, methodology misapplication or other similar errors are reviewed by the index committee. The index committee then determines whether the index is impacted by such error(s) to an extent that it should be recalculated and reposted.

#### *Unexpected Exchange Closures*

An unexpected exchange closure occurs when an exchange fully or partially fails to open or trading is temporarily halted. If an exchange fails to open due to unforeseen circumstances, such as natural disasters, inclement weather, outages, or other events, the index uses the prior day's settlement prices. In situations where an exchange is forced to close early due to unforeseen events, such as computer or electric power failures, weather conditions, or other events, the index sponsor calculates the settlement price of the index based on (i) the settlement prices published by the exchange, or (ii) if no settlement price is available, the index committee determines the course of action and notifies clients accordingly.

**For information about the construction, calculation methodology and maintenance of the S&P 500® Index, please see “— The S&P 500® Index” below.**

#### *License Agreement between S&P and GS Finance Corp.*

The S&P 500® Futures Excess Return Index, the S&P 500® Futures Index and the S&P 500® Index are products of S&P Dow Jones Indices LLC, and have been licensed for use by GS Finance Corp. (“Goldman”). Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC; Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC (“Dow Jones”) and these trademarks have been licensed for use by S&P Dow Jones Indices LLC and sublicensed for certain purposes by Goldman. Goldman's securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, Standard & Poor's Financial Services LLC or any of their respective affiliates (collectively, “S&P Dow Jones Indices”). S&P Dow Jones Indices makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the S&P 500® Futures Excess Return Index, the S&P 500® Futures Index or the S&P 500® Index to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the S&P 500® Futures Excess Return Index, the S&P 500® Futures Index and the S&P 500® Index is the licensing of these indices and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The S&P 500® Futures Excess Return Index, the S&P 500® Futures Index and the S&P 500® Index are determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the S&P 500® Futures Excess Return Index, the S&P 500® Futures Index or the S&P 500® Index. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the S&P 500® Futures Excess Return Index, the S&P 500® Futures Index or the S&P 500® Index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

S&P DOW JONES INDICES DOES NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE S&P 500® FUTURES EXCESS RETURN INDEX, THE S&P 500® FUTURES INDEX OR THE S&P 500® INDEX OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE S&P 500® FUTURES EXCESS RETURN INDEX, THE S&P 500® FUTURES INDEX OR THE S&P 500® INDEX OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE

LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.



### **S&P 500® Futures Volatility Plus Daily Risk Control Index**

The S&P 500® Futures Volatility Plus Daily Risk Control Index, which we also refer to in this description as the “index”:

- is an equity futures index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of April 25, 2022, with a base value of 100 as of its base date, February 4, 1998; and
- is sponsored by S&P Dow Jones Indices LLC (“S&P”).

The S&P 500® Futures Volatility Plus Daily Risk Control Index is designed to provide leveraged exposure to the S&P 500® Futures Excess Return Index based on a dynamic volatility target. The amount of leverage can change on each index calculation day, and a leverage factor is calculated in order to determine the applicable amount of leveraged exposure, with a minimum exposure of 100% (meaning that there is no leveraged exposure to the S&P 500® Futures Excess Return Index) and a maximum exposure of 200%. The leverage factor is calculated by dividing (i) the applicable realized volatility of the S&P 500® Futures Excess Return Index plus 10% by (ii) the applicable realized volatility of the S&P 500® Futures Excess Return Index. The sum of the applicable realized volatility of the S&P 500® Futures Excess Return Index plus 10% is referred to as the dynamic volatility target. The realized volatility of the S&P 500® Futures Excess Return Index is described further under “Construction of the S&P 500® Futures Volatility Plus Daily Risk Control Index” below. While the S&P 500® Futures Volatility Plus Daily Risk Control Index is designed to achieve a dynamic volatility target, there can be no assurance that the S&P 500® Futures Volatility Plus Daily Risk Control Index will achieve this goal. The S&P 500® Futures Excess Return Index measures the performance of the nearest maturing quarterly E-mini S&P 500 futures contract trading on the Chicago Mercantile Exchange. The S&P 500® Index includes a representative sample of 500 companies in leading industries of the U.S. economy. The S&P 500® Futures Volatility Plus Daily Risk Control Index, the S&P 500® Futures Excess Return Index and the S&P 500® Index are calculated, maintained and published by S&P Dow Jones Indices LLC (“S&P”). Additional information about the S&P 500® Futures Volatility Plus Daily Risk Control Index, the S&P 500® Futures Excess Return Index and the S&P 500® Index (including sector weights) is available on the following websites: [spglobal.com/spdji/en/indices/strategy/sp-500-futures-volatility-plus-daily-risk-control-index](https://spglobal.com/spdji/en/indices/strategy/sp-500-futures-volatility-plus-daily-risk-control-index), [spglobal.com/spdji/en/indices/strategy/sp-500-futures-index/#overview](https://spglobal.com/spdji/en/indices/strategy/sp-500-futures-index/#overview), [spglobal.com/spdji/en/indices/equity/sp-500](https://spglobal.com/spdji/en/indices/equity/sp-500) and [spglobal.com](https://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

### **Construction of the S&P 500® Futures Volatility Plus Daily Risk Control Index**

The return on the S&P 500® Futures Volatility Plus Daily Risk Control Index consists of leveraged exposure to the S&P 500® Futures Excess Return Index. The S&P 500® Futures Volatility Plus Daily Risk Control Index adjusts exposure to the S&P 500® Futures Excess Return Index based on a leverage factor that changes based on the realized volatility of the S&P 500® Futures Excess Return Index, subject to a minimum leverage factor (or exposure) of 100% and a maximum leverage factor (or exposure) of 200%. An exposure equal to 100% of the daily return of the S&P 500® Futures Excess Return Index has the same daily return as the S&P 500® Futures Excess Return Index. An exposure greater than 100% of the daily return of the S&P 500® Futures Excess Return Index is a leveraged position where the exposure to the S&P 500® Futures Excess Return Index is increased, meaning that any increase in the level of the S&P 500® Futures Excess Return Index will result in a larger increase in the level of the S&P 500® Futures Volatility Plus Daily Risk Control Index and any decrease in the level of the S&P 500® Futures Excess Return Index will result in a larger decrease in the level of the S&P 500® Futures Volatility Plus Daily Risk Control Index. In practice, the leverage factor will always be greater than 100%.

#### ***Calculation of the Leverage Factor***

Each index calculation day (“T”), the index sponsor calculates the leverage factor, which determines what the exposure to the S&P 500® Futures Excess Return Index will be for the following index calculation day (“T + 1”). The leverage factor is a ratio of the dynamic volatility target (i.e., the sum of (i) the realized volatility of the S&P 500® Futures Excess Return Index for the second preceding index calculation day (“T - 2”) *plus* (ii) 10%) to the realized volatility of the S&P 500® Futures Excess Return Index for the second preceding index calculation day (T - 2), subject to a minimum leverage factor of 100% and a maximum leverage factor of 200%. For example, if on

the second preceding index calculation day (T - 2) the realized volatility was equal to 20%, on the index calculation day (T) the leverage factor would be equal to 150% (the *quotient of (i) the sum of 20% plus 10% divided by (ii) 20%*) and on the following index calculation day (T + 1) the S&P 500® Futures Volatility Plus Daily Risk Control Index would be exposed to 150% of the daily return of the S&P 500® Futures Excess Return Index.

For example, if the leverage factor calculated on an index calculation day (T) is equal to 150% and the level of the S&P 500® Futures Excess Return Index on the following index calculation day (T + 1) increases by 10% from the level of the S&P 500® Futures Excess Return Index on the index calculation day (T), the level of the S&P 500® Futures Volatility Plus Daily Risk Control Index on the following index calculation day (T + 1) would increase by 15% (150% *times* 10%). Conversely, if the leverage factor calculated on an index calculation day (T) is equal to 150% and the level of the S&P 500® Futures Excess Return Index on the following index calculation day (T + 1) decreases by 10% from the level of the S&P 500® Futures Excess Return Index on index calculation day (T), the level of the S&P 500® Futures Volatility Plus Daily Risk Control Index on the following index calculation day (T + 1) would decrease by 15% (150% *times* -10%). **Accordingly, the leverage factor has the effect of magnifying any increases or decreases in the level of the S&P 500® Futures Excess Return Index.**

Although the leverage factor is calculated at the close of each index calculation day (on index calculation day (T)), because of how the leverage factor is calculated, there is a lag of two index calculation days between the measurement of realized volatility of the S&P 500® Futures Excess Return Index (which is done on index calculation day (T - 2)) and the calculation of the leverage factor (on index calculation day (T)). Therefore, the leverage factor used to calculate the level of the S&P 500® Futures Volatility Plus Daily Risk Control Index on index calculation day (T + 1) will be based on the realized volatility of the S&P 500® Futures Excess Return Index measured three index calculation days prior to index calculation day (T + 1). Due to this lag and the fact that realized volatility can fluctuate significantly during this period, and even during a single day, the leverage factor used to calculate the S&P 500® Futures Volatility Plus Daily Risk Control Index on index calculation day (T + 1) will not reflect the most current measurement of realized volatility. As a result, the S&P 500® Futures Volatility Plus Daily Risk Control Index may have greater exposure to the S&P 500® Futures Excess Return Index when the level of the S&P 500® Futures Excess Return Index is decreasing than it would have had if the leverage factor were calculated based on a more current measurement of realized volatility. See “Additional Risk Factors Specific to the Securities — The Volatility Plus Index Will Not Reflect the Most Current Volatility of the Underlying Index”.

#### *Calculation of Realized Volatility of the S&P 500® Futures Excess Return Index*

“Realized volatility” is a measurement of variations in the historical daily returns of the S&P 500® Futures Excess Return Index. Realized volatility is calculated as the average of short-term volatility and long-term volatility. Both short-term volatility and long-term volatility are calculated based on the historical daily returns over the same time period (from the day that is two index calculation days before the base date (February 5, 1998) of the S&P 500® Futures Volatility Plus Daily Risk Control Index to the day that is two index calculation days before the current index calculation day) and both apply and gradually increase a discount that gradually reduces the significance of a given historical daily return as it moves farther into the past. However, short-term volatility applies a larger discount than does long-term volatility. The discount for short-term volatility is slightly more than double the discount for long-term volatility.

When the volatility of the S&P 500® Futures Excess Return Index increases (or decreases), short-term volatility will increase (or decrease) more quickly than long-term volatility.

**For information about the construction, calculation methodology and maintenance of the S&P 500® Futures Excess Return Index and the S&P 500® Index, please see “— The S&P 500® Futures Excess Return Index” above and “— The S&P 500® Index” below, respectively.**

#### *License Agreement between S&P and GS Finance Corp.*

The S&P 500® Futures Volatility Plus Daily Risk Control Index, the S&P 500® Futures Excess Return Index, the S&P 500® Futures Index and the S&P 500® Index are products of S&P Dow Jones Indices LLC, and have been licensed for use by GS Finance Corp. (“Goldman”). Standard & Poor’s® and S&P® are registered trademarks of Standard & Poor’s Financial Services LLC; Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC (“Dow Jones”) and these trademarks have been licensed for use by S&P Dow Jones Indices LLC and sublicensed for certain purposes by Goldman. Goldman’s securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, Standard & Poor’s Financial Services LLC or any of their respective affiliates (collectively, “S&P Dow Jones Indices”). S&P Dow Jones Indices makes no representation or

warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the S&P 500<sup>®</sup> Futures Volatility Plus Daily Risk Control Index, the S&P 500<sup>®</sup> Futures Excess Return Index, the S&P 500<sup>®</sup> Futures Index or the S&P 500<sup>®</sup> Index to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the S&P 500<sup>®</sup> Futures Volatility Plus Daily Risk Control Index, the S&P 500<sup>®</sup> Futures Excess Return Index, the S&P 500<sup>®</sup> Futures Index and the S&P 500<sup>®</sup> Index is the licensing of these indices and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The S&P 500<sup>®</sup> Futures Volatility Plus Daily Risk Control Index, the S&P 500<sup>®</sup> Futures Excess Return Index, the S&P 500<sup>®</sup> Futures Index and the S&P 500<sup>®</sup> Index are determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the S&P 500<sup>®</sup> Futures Volatility Plus Daily Risk Control Index, the S&P 500<sup>®</sup> Futures Excess Return Index, the S&P 500<sup>®</sup> Futures Index or the S&P 500<sup>®</sup> Index. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the S&P 500<sup>®</sup> Futures Volatility Plus Daily Risk Control Index, the S&P 500<sup>®</sup> Futures Excess Return Index, the S&P 500<sup>®</sup> Futures Index or the S&P 500<sup>®</sup> Index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

S&P DOW JONES INDICES DOES NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE S&P 500<sup>®</sup> FUTURES VOLATILITY PLUS DAILY RISK CONTROL INDEX, THE S&P 500<sup>®</sup> FUTURES EXCESS RETURN INDEX, THE S&P 500<sup>®</sup> FUTURES INDEX OR THE S&P 500<sup>®</sup> INDEX OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE S&P 500<sup>®</sup> FUTURES VOLATILITY PLUS DAILY RISK CONTROL INDEX, THE S&P 500<sup>®</sup> FUTURES EXCESS RETURN INDEX, THE S&P 500<sup>®</sup> FUTURES INDEX OR THE S&P 500<sup>®</sup> INDEX OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

## S&P 500® Index

The S&P 500® Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first launched on March 4, 1957 based on an initial value of 10 from 1941-1943; and
- is sponsored by S&P Dow Jones Indices LLC (“S&P”).

The S&P 500® Index includes a representative sample of 500 companies in leading industries of the U.S. economy. The 500 companies are not the 500 largest companies listed on the NYSE and not all 500 companies are listed on the NYSE. S&P chooses companies for inclusion in the S&P 500® Index with an aim of achieving a distribution by broad industry groupings that approximates the distribution of these groupings in the common stock population of the U.S. domiciled equity market. Although the S&P 500® Index contains 500 constituent companies, at any one time it may contain greater than 500 constituent trading lines since some companies included in the S&P 500® Index prior to July 31, 2017 may be represented by multiple share class lines in the S&P 500® Index. The S&P 500® Index is calculated, maintained and published by S&P and is part of the S&P Dow Jones Indices family of indices. Additional information about the S&P 500® Index (including the sector weights) is available on the following websites: [spglobal.com/spdji/en/indices/equity/sp-500](http://spglobal.com/spdji/en/indices/equity/sp-500) and [spglobal.com](http://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

S&P intends for the S&P 500® Index to provide a performance benchmark for the large-cap U.S. domiciled equity markets. Constituent changes are made on an as-needed basis and there is no schedule for constituent reviews. Index additions and deletions are announced with at least three business days advance notice. Less than three business days' notice may be given at the discretion of the S&P Index Committee. Relevant criteria for additions to the S&P 500® Index that are employed by S&P include: the company proposed for addition should have an unadjusted company market capitalization of \$18.0 billion or more and a security level float-adjusted market capitalization of at least 50% of such threshold (for spin-offs, eligibility is determined using when-issued prices, if available); the float-adjusted liquidity ratio of the stock (defined as the annual dollar value traded divided by the float-adjusted market capitalization) should be greater than or equal to 0.75 at the time of the addition to the S&P 500® Index and the stock should trade a minimum of 250,000 shares in each of the six months leading up to the evaluation date (current constituents have no minimum requirement), where the annual dollar value traded is calculated as the average closing price multiplied by the historical volume over the 365 calendar days prior to the evaluation date (reduced to the available trading period for IPOs, spin-offs or public companies considered to be U.S. domiciled for index purposes that do not have 365 calendar days of trading history on a U.S. exchange); the company must be a U.S.-domiciled company (characterized as a company that satisfies U.S. Securities Exchange Act's periodic reporting obligations by filing certain required forms for domestic issuers (e.g., Form 10-K annual reports, Form 10-Q quarterly reports and Form 8-K current reports, among others) and with a primary listing of the common stock on the NYSE, NYSE Arca, NYSE American (formerly NYSE MKT), Nasdaq Global Select Market, Nasdaq Global Market, Nasdaq Capital Market, Cboe BZX (formerly Bats BZX), Cboe BYX (formerly Bats BYX), Cboe EDGA (formerly Bats EDGA) or Cboe EDGX (formerly Bats EDGX) (each, an “eligible exchange”)); the proposed constituent has an investable weight factor (“IWF”) of 10% or more; the inclusion of the company will contribute to sector balance in the S&P 500® Index relative to sector balance in the market in the relevant market capitalization range; financial viability (the sum of the most recent four consecutive quarters' Generally Accepted Accounting Principles (GAAP) earnings (net income excluding discontinued operations) should be positive as should the most recent quarter); and, for IPOs, the company must be traded on an eligible exchange for at least twelve months (for former SPACs, S&P considers the de-SPAC transaction to be an event equivalent to an IPO, and 12 months of trading post the de-SPAC event are required before a former SPAC can be considered for inclusion in the S&P 500® Index; spin-offs or in-specie distributions from existing constituents do not need to be traded on an eligible exchange for twelve months prior to their inclusion in the S&P 500® Index). In addition, constituents of the S&P MidCap 400® Index and the S&P SmallCap 600® Index can be added to the S&P 500® Index provided they meet the unadjusted company level market capitalization eligibility criteria for the S&P 500® Index. Migrations from the S&P MidCap 400® Index or the S&P SmallCap 600® Index do not need to meet the financial viability, liquidity, or 50% of the S&P 500® Index's unadjusted company level minimum market capitalization threshold criteria. Further, constituents of the S&P Total Market Index Ex S&P Composite 1500 (which includes all eligible U.S. common equities except for those included in the S&P 500® Index, the S&P MidCap 400® Index and the S&P SmallCap 600® Index) that acquire a constituent of the S&P 500® Index, the S&P MidCap 400® Index or the S&P SmallCap 600® Index that do not fully meet all of the eligibility criteria may still be added to the S&P 500® Index at the discretion of the Index Committee if the merger consideration includes

the acquiring company issuing stock to target company shareholders, and the Index Committee determines that the addition could minimize turnover and enhance the representativeness of the S&P 500® Index as a market benchmark. Certain types of organizational structures and securities are always excluded, including, but not limited to, business development companies (BDCs), limited partnerships, master limited partnerships, limited liability companies (LLCs), OTC bulletin board issues, closed-end funds, ETFs, ETNs, royalty trusts, tracking stocks, special purpose acquisition companies (SPACs), preferred stock and convertible preferred stock, unit trusts, equity warrants, convertible bonds, investment trusts, rights and American depositary receipts (ADRs). Stocks are deleted from the S&P 500® Index when they are involved in mergers, acquisitions or significant restructurings such that they no longer meet the inclusion criteria, and when they substantially violate one or more of the addition criteria. Stocks that are delisted or moved to the pink sheets or the bulletin board are removed, and those that experience a trading halt may be retained or removed in S&P's discretion. S&P evaluates additions and deletions with a view to maintaining S&P 500® Index continuity.

For constituents included in the S&P 500® Index prior to July 31, 2017, all publicly listed multiple share class lines are included separately in the S&P 500® Index, subject to, in the case of any such share class line, that share class line satisfying the liquidity and float criteria discussed above and subject to certain exceptions. It is possible that one listed share class line of a company may be included in the S&P 500® Index while a second listed share class line of the same company is excluded. For companies that issue a second publicly traded share class to index share class holders, the newly issued share class line is considered for inclusion if the event is mandatory and the market capitalization of the distributed class is not considered to be de minimis.

As of July 31, 2017, companies with multiple share class lines are no longer eligible for inclusion in the S&P 500® Index. Only common shares are considered when determining whether a company has a multiple share class structure. Constituents of the S&P 500® Index prior to July 31, 2017 with multiple share class lines will be grandfathered in and continue to be included in the S&P 500® Index. If an S&P 500® Index constituent reorganizes into a multiple share class line structure, that company will be reviewed for continued inclusion in the S&P 500® Index at the discretion of the S&P Index Committee.

#### *Calculation of the S&P 500® Index*

The S&P 500® Index is calculated using a base-weighted aggregative methodology. This discussion describes the "price return" calculation of the S&P 500® Index. The applicable pricing supplement will describe the calculation if the underlier for your securities is not the price return calculation. The value of the S&P 500® Index on any day for which an index value is published is determined by a fraction, the numerator of which is the aggregate of the market price of each stock in the S&P 500® Index *times* the number of shares of such stock included in the S&P 500® Index, and the denominator of which is the divisor, which is described more fully below. The "market value" of any index stock is the *product* of the market price per share of that stock *times* the number of the then-outstanding shares of such index stock that are then included in the S&P 500® Index.

The S&P 500® Index is also sometimes called a "base-weighted aggregative index" because of its use of a divisor. The "divisor" is a value calculated by S&P that is intended to maintain conformity in index values over time and is adjusted for all changes in the index stocks' share capital after the "base date" as described below. The level of the S&P 500® Index reflects the total market value of all index stocks relative to the index's base date of 1941-43.

In addition, the S&P 500® Index is float-adjusted, meaning that the share counts used in calculating the S&P 500® Index reflect only those shares available to investors rather than all of a company's outstanding shares. S&P seeks to exclude shares held by long-term, strategic shareholders concerned with the control of a company, a group that generally includes the following: officers and directors and related individuals whose holdings are publicly disclosed, private equity, venture capital, special equity firms, asset managers and insurance companies with board of director representation, publicly traded companies that hold shares in another company, holders of restricted shares (except for shares held as part of a lock-up agreement), company-sponsored employee share plans/trusts, defined contribution plans/savings, investment plans, foundations or family trusts associated with the company, government entities at all levels (except government retirement or pension funds), sovereign wealth funds and any individual person listed as a 5% or greater stakeholder in a company as reported in regulatory filings (collectively, "strategic holders"). To this end, S&P excludes all share-holdings (other than depositary banks, pension funds (including government pension and retirement funds), mutual funds, exchange traded fund providers, investment funds, hedge funds, asset managers that do not have direct board of director representation (including stakeholders who may have the right to appoint a board of director member but choose not to do so, stakeholders who have exercised a right to appoint a board of director "observer" even if that observer is employed by the stakeholder and stakeholders who have exercised a right to appoint an independent director who is not employed by the stakeholder), investment funds of insurance companies and independent foundations

not associated with the company) with a position greater than 5% of the outstanding shares of a company from the float-adjusted share count to be used in S&P 500® Index calculations.

The exclusion is accomplished by calculating an IWF for each stock that is part of the numerator of the float-adjusted index fraction described above:

$$\text{IWF} = (\text{available float shares})/(\text{total shares outstanding})$$

where available float shares is defined as total shares outstanding less shares held by strategic holders. In most cases, an IWF is reported to the nearest one percentage point. For companies with multiple share class lines, a separate IWF is calculated for each share class line.

#### *Maintenance of the S&P 500® Index*

In order to keep the S&P 500® Index comparable over time S&P engages in an index maintenance process. The S&P 500® Index maintenance process involves changing the constituents as discussed above, and also involves maintaining quality assurance processes and procedures, adjusting the number of shares used to calculate the S&P 500® Index, monitoring and completing the adjustments for company additions and deletions, adjusting for stock splits and stock dividends and adjusting for other corporate actions. In addition to its daily governance of indices and maintenance of the S&P 500® Index methodology, at least once within any 12 month period, the S&P Index Committee reviews the S&P 500® Index methodology to ensure the S&P 500® Index continues to achieve the stated objective, and that the data and methodology remain effective. The S&P Index Committee may at times consult with investors, market participants, security issuers included in or potentially included in the S&P 500® Index, or investment and financial experts.

#### *Divisor Adjustments*

The two types of adjustments primarily used by S&P are divisor adjustments and adjustments to the number of shares (including float adjustments) used to calculate the S&P 500® Index. Set forth below under "*Adjustments for Corporate Actions*" is a table of certain corporate events and their resulting effect on the divisor and the share count. If a corporate event requires an adjustment to the divisor, that event has the effect of altering the market value of the affected index stock and consequently of altering the aggregate market value of the index stocks following the event. In order that the level of the S&P 500® Index not be affected by the altered market value (which could be an increase or decrease) of the affected index stock, S&P generally derives a new divisor by dividing the post-event market value of the index stocks by the pre-event index value, which has the effect of reducing the S&P 500® Index's post-event value to the pre-event level.

#### *Changes to the Number of Shares of a Constituent*

The index maintenance process also involves tracking the changes in the number of shares included for each of the index companies. Changes as a result of mandatory events, such as mergers or acquisition driven share/IWF changes, stock splits and mandatory distributions are not subject to a minimum threshold for implementation and are implemented when the transaction occurs. At S&P's discretion, however, de minimis merger and acquisition changes may be accumulated and implemented with the updates made with the quarterly share updates as described below. Material share/IWF changes resulting from certain non-mandatory corporate actions follow the accelerated implementation rule. Non-material share/IWF changes are implemented quarterly.

#### *Material Share/IWF Changes – Accelerated Implementation Rule*

1. Public offerings. Public offerings of new company-issued shares and/or existing shares offered by selling shareholders, including block sales and spot secondaries, will be eligible for accelerated implementation treatment if the size of the event meets the materiality threshold criteria:

- (a) at least US \$150 million, and
- (b) at least 5% of the pre-event total shares.

In addition to the materiality threshold, public offerings must satisfy the following conditions:

- be underwritten.
- have a publicly available prospectus, offering document, or prospectus summary filed with the relevant authorities.
- have a publicly available confirmation from an official source that the offering has been completed.

For public offerings that involve a concurrent combination of new company shares and existing shares offered by selling shareholders, both events are implemented if either of the public offerings or the total underwritten public

offering represents at least 5% of total shares and US \$150 million. Any concurrent share repurchase by the affected company will also be included in the implementation.

2. Dutch Auctions, self-tender offer buybacks, and split-off exchange offers. These non-mandatory corporate action types will be eligible for accelerated implementation treatment regardless of size once the final results are publicly announced and verified by S&P.

For companies with multiple share class lines, the criteria specified above apply to each individual multiple share class line rather than total company shares.

Accelerated implementation for events less than US \$1 billion includes an adjustment to the company's IWF only to the extent that such an IWF change helps the new float share total mimic the shares available in the offering. To minimize unnecessary turnover, these IWF changes do not need to meet any minimum threshold requirement for implementation. Any IWF change resulting in an IWF of 0.96 or greater is rounded up to 1.00 at the subsequent annual IWF review.

For accelerated implementation of at least US \$1 billion, S&P applies the share change, and any resulting IWF change, using the latest share and ownership information publicly available at the time of the announcement, even if the offering size is below the 5% threshold. This exception ensures that very large events are recognized in a timely manner using the latest available information. Any IWF change resulting in an IWF of 0.96 or greater is rounded up to 1.00.

#### Market Specific Accelerated Implementation Rules

Non-fully paid or non-fully settled offerings, such as subscription receipts forward sales agreements, are ineligible for accelerated implementation. Share updates resulting from completion of subscription receipts terms, or the settlement of forward sale agreements, are updated at a future quarterly rebalancing.

#### Announcement Policy

For accelerated implementation, S&P provides two (2) business days' notice for all non-U.S. listed stocks and U.S. listed depositary receipts, and one (1) business days' notice for all non-depositary receipt U.S. listed stocks.

#### Non-Material Share/IWF Changes – Quarterly Implementation

All non-mandatory events not covered or implemented via the accelerated implementation rule (including but not limited to private placements, acquisition of private companies, and conversion of non-index share lines) are reviewed quarterly, effective after the close of the third Friday of the third month in each calendar quarter and as per below.

#### Share Updates

At each quarterly review, shares outstanding are updated to the latest available information as of the rebalancing reference date.

#### IWF Updates

At the quarterly review, IWF changes are only made if there is a share change of at least 5% of total current shares outstanding and if the adjusted IWF absolute change is at least 5, with IWF adjustments limited to the extent necessary to help reflect the corresponding share change.

For quarterly share change events, unless there is explicit information stating that the new shares are not available to the market, shares are generally considered to be available to all investors and reflected in the IWF. Events such as conversion of derivative securities, acquisitions of private companies, or acquisitions of non-index companies that do not trade on a major exchange are generally implemented as described above.

Other than the situations described above, please note that IWF changes are only made at the annual IWF review.

#### Rebalancing Guidelines – Share/IWF Reference Date & Freeze Period

A reference date, after the market close five weeks prior to the third Friday in March, June, September, and December, is the cutoff for publicly available information used for quarterly shares outstanding and IWF changes. All shares outstanding and ownership information contained in public filings and/or official sources dated on or before the reference date are included in that quarter's update. In addition, there is a freeze period on a quarterly basis for any changes that result from the accelerated implementation rules.

Pro-forma files for float-adjusted market capitalization indices are generally released after the market close on the first Friday, two weeks prior to the rebalancing effective date. Pro-forma files for capped and alternatively

weighted indices are generally released after the market close on the second Friday, one week prior to the rebalancing effective date. For illustration purposes, if rebalancing pro-forma files are scheduled to be released on Friday, March 5, the share/IWF freeze period will begin after the close of trading on Tuesday, March 9 and will end after the close of trading the following Friday, March 19 (i.e. the third Friday of the rebalancing month).

During the share/IWF freeze period, shares and IWFs are not changed and the accelerated implementation rule is suspended, except for mandatory corporate action events (such as merger activity, stock splits, and rights offerings). The suspension includes all changes that qualify for accelerated implementation and would typically be announced or effective during the share/IWF freeze period. At the end of the freeze period all suspended changes will be announced on the third Friday of the rebalancing month and implemented five business days after the quarterly rebalancing effective date. For these non-mandatory events, S&P uses shares and IWF data as of the upcoming rebalancing effective date to calculate the size of the event and in turn assess if the event qualifies the accelerated implementation rule.

Adjustments for Corporate Actions

There is a large range of corporate actions that may affect companies included in the S&P 500® Index. Certain corporate actions require S&P to recalculate the share count or the float adjustment or to make an adjustment to the divisor to prevent the value of the S&P 500® Index from changing as a result of the corporate action. This helps ensure that the movement of the S&P 500® Index does not reflect the corporate actions of individual companies in the S&P 500® Index.

Spin-Offs

As a general policy, a spin-off security is added to the S&P 500® Index on the ex-date at a price of zero (with no divisor adjustment) and will remain in the S&P 500® Index for at least one trading day. The spin-off security will remain in the S&P 500® Index if it meets all eligibility criteria. If the spin-off security is determined ineligible to remain in the S&P 500® Index, it will generally be removed after at least one day of regular way trading (with a divisor adjustment). The weight of the spin-off being deleted is reinvested across all the index components proportionately such that the relative weights of all index components are unchanged. The net change in index market capitalization will cause a divisor change.

Companies that are spun off from a constituent of the S&P 500® Index do not need to meet the eligibility criteria for new constituents, but they should be considered U.S. domiciled for index purposes. At the discretion of the Index Committee, a spin-off company may be retained in the S&P 500® Index if the Index Committee determines it has a total market capitalization representative of the S&P 500® Index. If the spin-off company's estimated market capitalization is below the minimum unadjusted company market capitalization for the S&P 500® Index but there are other constituent companies in the S&P 500® Index that have a significantly lower total market capitalization than the spin-off company, the Index Committee may decide to retain the spin-off company in the S&P 500® Index.

Several additional types of corporate actions, and their related treatment, are listed in the table below.

Corporate Action	Treatment
Company addition/deletion	<u>Addition</u>
	Companies are added at the float market capitalization weight. The net change to the index market capitalization causes a divisor adjustment.
	<u>Deletion</u>
Change in shares outstanding	The weights of all stocks in the index will proportionally change. Relative weights will stay the same. The index divisor will change due to the net change in the index market capitalization
	Increasing (decreasing) the shares outstanding increases (decreases) the market capitalization of the index. The change to the index market capitalization causes a divisor adjustment.
Split/reverse split	Shares outstanding are adjusted by split ratio. Stock price is adjusted by split ratio. There is no change to the index market capitalization and no divisor adjustment.
Change in IWF	Increasing (decreasing) the IWF increases (decreases) the market capitalization of the index. A net change to the index market capitalization causes a divisor adjustment.



Ordinary dividend	When a company pays an ordinary cash dividend, the index does not make any adjustments to the price or shares of the stock. As a result there are no divisor adjustments to the index.
Special dividend	The stock price is adjusted by the amount of the dividend. The net change to the index market capitalization causes a divisor adjustment
Rights offering	All rights offerings that are in the money on the ex-date are applied under the assumption the rights are fully subscribed. The stock price is adjusted by the value of the rights and the shares outstanding are increased by the rights ratio. The net change in market capitalization causes a divisor adjustment.

Any company that is removed from the S&P 500® Index, the S&P MidCap 400® Index or the S&P SmallCap 600® Index must wait a minimum of one year from its removal date before being reconsidered as a replacement candidate for the S&P 500® Index.

*Recalculation Policy*

S&P reserves the right to recalculate and republish the S&P 500® Index at its discretion in the event one of the following issues has occurred: (1) incorrect or revised closing price of one or more constituent securities; (2) missed or misapplied corporate action; (3) incorrect application of an index methodology; (4) late announcement of a corporate action; or (5) incorrect calculation or data entry error. The decision to recalculate the S&P 500® Index is made at the discretion of the index manager and/or index committee, as further discussed below. The potential market impact or disruption resulting from a recalculation is considered when making any such decision. In the event of an incorrect closing price, a missed or misapplied corporate action, a late announcement of a corporate action, or an incorrect calculation or data entry error that is discovered within two trading days of its occurrence, generally the S&P 500® Index is recalculated. In the event any such event is discovered beyond the two trading day period, the index committee shall decide whether the S&P 500® Index should be recalculated. In the event of an incorrect application of the methodology that results in the incorrect composition and/or weighting of index constituents, the index committee shall determine whether or not to recalculate the S&P 500® Index following specified guidelines. In the event that the S&P 500® Index is recalculated, it shall be done within a reasonable timeframe following the detection and review of the issue.

*Calculations and Pricing Disruptions*

Closing levels for the S&P 500® Index are calculated by S&P based on the closing price of the individual constituents of the S&P 500® Index as set by their primary exchange. Closing prices are received by S&P from one of its third party vendors and verified by comparing them with prices from an alternative vendor. The vendors receive the closing price from the primary exchanges. Real-time intraday prices are calculated similarly without a second verification. Official end-of-day calculations are based on each stock's primary market closing price. Prices used for the calculation of real time index values are based on the "Consolidated Tape". The Consolidated Tape is an aggregation of trades for each constituent over all regional exchanges and trading venues and includes the primary exchange. If there is a failure or interruption on one or more exchanges, real-time calculations will continue as long as the "Consolidated Tape" is operational.

If an interruption is not resolved prior to the market close, official closing prices will be determined by following the hierarchy set out in NYSE Rule 123C. A notice is published on the S&P website at spglobal.com indicating any changes to the prices used in S&P 500® Index calculations. In extreme circumstances, S&P may decide to delay index adjustments or not publish the S&P 500® Index. Real-time indices are not restated.

*Unexpected Exchange Closures*

An unexpected market/exchange closure occurs when a market/exchange fully or partially fails to open or trading is temporarily halted. This can apply to a single exchange or to a market as a whole, when all of the primary exchanges are closed and/or not trading. Unexpected market/exchange closures are usually due to unforeseen circumstances, such as natural disasters, inclement weather, outages, or other events.

To a large degree, S&P is dependent on the exchanges to provide guidance in the event of an unexpected exchange closure. S&P's decision making is dependent on exchange guidance regarding pricing and mandatory corporate actions.

NYSE Rule 123C provides closing contingency procedures for determining an official closing price for listed securities if the exchange is unable to conduct a closing transaction in one or more securities due to a system or technical issue.

3:00 PM ET is the deadline for an exchange to determine its plan of action regarding an outage scenario. As such, S&P also uses 3:00 PM ET as the cutoff.

If all major exchanges fail to open or unexpectedly halt trading intraday due to unforeseen circumstances, S&P will take the following actions:

**Market Disruption Prior to Open of Trading:**

- (i) If all exchanges indicate that trading will not open for a given day, S&P will treat the day as an unscheduled market holiday. The decision will be communicated to clients as soon as possible through the normal channels. Indices containing multiple markets will be calculated as normal, provided that at least one market is open that day. Indices which only contain closed markets will not be calculated.
- (ii) If exchanges indicate that trading, although delayed, will open for a given day, S&P will begin index calculation when the exchanges open.

**Market Disruption Intraday:**

- (i) If exchanges indicate that trading will not resume for a given day, the S&P 500<sup>®</sup> Index level will be calculated using prices determined by the exchanges based on NYSE Rule 123C. Intraday S&P 500<sup>®</sup> Index values will continue to use the last traded composite price until the primary exchange publishes official closing prices.

***License Agreement between S&P and GS Finance Corp.***

The S&P 500<sup>®</sup> Index is a product of S&P Dow Jones Indices LLC, and has been licensed for use by GS Finance Corp. ("Goldman"). Standard & Poor's<sup>®</sup> and S&P<sup>®</sup> are registered trademarks of Standard & Poor's Financial Services LLC; Dow Jones<sup>®</sup> is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones") and these trademarks have been licensed for use by S&P Dow Jones Indices LLC and sublicensed for certain purposes by Goldman. Goldman's securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, Standard & Poor's Financial Services LLC or any of their respective affiliates (collectively, "S&P Dow Jones Indices"). S&P Dow Jones Indices makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the S&P 500<sup>®</sup> Index to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the S&P 500<sup>®</sup> Index is the licensing of the S&P 500<sup>®</sup> Index and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The S&P 500<sup>®</sup> Index is determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the S&P 500<sup>®</sup> Index. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the S&P 500<sup>®</sup> Index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

S&P DOW JONES INDICES DOES NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE S&P 500<sup>®</sup> INDEX OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE S&P 500<sup>®</sup> INDEX OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

S&P 500® Value Index

The S&P 500® Value Index, which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of May 30, 1992, with a base value of 291.12 as of its base date, June 30, 1995; and
- is sponsored by S&P Dow Jones Indices LLC (“S&P”).

The S&P 500® Value Index is a capped market capitalization weighted index designed to measure the performance of companies included in the S&P 500® Index that are fully or partially categorized as value stocks, as determined by style scores calculated for each security included in the S&P 500® Index. The S&P 500 Index includes a representative sample of 500 companies in leading industries of the U.S. economy. Generally, value stocks are stocks that exhibit relatively strong value characteristics (determined by reference to (1) book-value-to-price ratio, (2) earnings-to-price ratio and (3) sales-to-price ratio) and relatively weak growth characteristics (determined by reference to (1) three-year change in earnings-per-share growth (excluding extra items) over price per share, (2) three-year sales-per-share growth rate and (3) momentum (12-month percentage price change)). Stocks that are fully characterized as value stocks have 100% of their float-adjusted market capitalization in the S&P 500 Index assigned to the index. Stocks that are partially characterized as value stocks have a portion of their float-adjusted market capitalization in the S&P 500 Index assigned to the index. Stocks that are fully characterized as growth stocks are excluded from the index. The index and the S&P 500® Index are calculated, maintained and published by S&P. Additional information about the S&P 500® Value Index (including the sector weights) is available on the following websites: [spglobal.com/spdji/en/indices/equity/sp-500-value](http://spglobal.com/spdji/en/indices/equity/sp-500-value) and [spglobal.com](http://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

Construction of the S&P 500® Value Index

To be eligible for inclusion in the S&P 500® Value Index, a stock must be a constituent of the S&P 500® Index. For more information about the S&P 500® Index, see “S&P 500® Index” above.

Style Factors

S&P uses the following growth factors and value factors to measure growth and value for each constituent in the eligible universe:

Growth Factors		Value Factors
three-year net change in earnings-per-share (excluding extra items) over current price	book-value-to-price ratio	
three-year sales-per-share growth rate	earnings-to-price ratio	
momentum (12-month percentage price change)	sales-to-price ratio	

When earnings from three years prior are not available, the two-year change in earnings per share (excluding extra items) over price per share is used. When earnings from two years prior are not available, the one-year change in earnings per share (excluding extra items) over price per share is used. If earnings from one year prior are not available, set the factor to zero.

When sales from three years prior are not available, then two-year sales per share growth rate is used. When sales from two years prior are not available, then one-year sales per share growth rate is used. When sales from one year prior are not available, set the factor to zero. If the starting value is less than zero, the style factor is multiplied by a factor of negative 1.

When there is not enough trading history to calculate 12-month momentum, then momentum is calculated from the stock’s listing date.

When the book value to price ratio, earnings to price ratio, or sales to price ratio is not available, the factor is set to zero.

### *Style Scores*

Once a year, raw values for each of the above factors are calculated for each company in the eligible universe. These raw values are first winsorized to the 90th percentile (generally speaking, winsorization is a process to limit the impact of extreme values) and then standardized by dividing the difference between each company's raw score and the mean of the entire set by the standard deviation of the entire set. A growth score for each company is computed as the average of the standardized values of the three growth factors. Similarly, a value score for each company is computed as the average of the standardized values of the three value factors.

At the end of this step each company has a growth score and a value score, with growth and value being measured along separate dimensions (i.e., scales).

### *Establishing Style Baskets*

Companies within the eligible universe are ranked based on growth and value scores. A company with a high growth score would have a higher growth rank, while a company with a low value score would have a lower value rank. For example, the S&P 500® Index constituent with the highest value score would have a value rank of 1, while the constituent with the lowest value score would have a value rank of 500.

The companies within the eligible universe are then sorted in ascending order of the ratio growth rank/value rank. The companies at the top of the list have a higher growth rank (or high growth score) and a lower value rank (or low value score) and, therefore, exhibit pure growth characteristics. The companies at the top of the list, comprising 33% of the float-adjusted market capitalization of the S&P 500® Index, are assigned to the growth basket (fully categorized as growth stocks).

The companies at the bottom of the list have a higher value rank (or high value score) and a lower growth rank (or low growth score) and, therefore, exhibit pure value characteristics. The companies at the bottom of the list, comprising 33% of the float-adjusted market capitalization of the S&P 500® Index, are assigned to the value basket (fully categorized as value stocks).

The companies in the middle 34% of the list are assigned to the blended basket (partially categorized as growth stocks and partially characterized as value stocks).

### *Creating the Growth and Value Indices*

S&P divides the complete float-adjusted market capitalization of the S&P 500® Index approximately equally into the S&P 500® Growth Index and the S&P 500® Value Index while limiting the number of stocks that overlap across both. 100% of a company's float-adjusted market capitalization fully categorized as a growth stock is assigned to the S&P 500® Growth Index, and 100% of a company's float-adjusted market capitalization fully categorized as a value stock is assigned to the S&P 500® Value Index. The float-adjusted market capitalization of a company in the middle 34% is distributed between the S&P 500® Growth Index and the S&P 500® Value Index based on its distance from the average growth score of companies fully categorized as growth stocks and the average value score of companies fully categorized as value stocks. In particular, the percentage of a company's float-adjusted market capitalization in the S&P 500® Index that is allocated to the S&P 500® Value Index will be equal to (a) its distance from the average growth score of companies fully categorized as growth stocks divided by (b) the sum of (i) its distance from the average growth score of companies fully categorized as growth stocks plus (ii) its distance from the average value score of companies fully categorized as value stocks. Further, to avoid very small fractions of a stock's market capitalization being in the index, (x) if the calculated percentage is greater than or equal to 80%, 100% will be allocated to the S&P 500® Value Index, and (y) if the calculated percentage is less than 20%, 0% will be allocated to the S&P 500® Value Index.

After the conclusion of the rebalancing, the total float-adjusted market capitalization of the S&P 500® Index will be approximately equally divided between the S&P 500® Value Index and the S&P 500® Growth Index. However, no mathematical procedure is employed to force an equal distribution since price movements of constituent stocks would result in inequality immediately following any reconstitution.

#### *Calculation of the S&P 500® Value Index*

**The S&P 500® Value Index is calculated as the index market value divided by the divisor using the divisor methodology used in all S&P's equity indices, including the S&P 500® Index. See "S&P 500® Index" above for more information.**

#### *Constituent Weighting*

For capping purposes, the S&P 500® Value Index rebalances quarterly after the close of business on the third Friday of March, June, September, and December using the following procedures:

1. With prices reflected on the rebalancing reference date (the Wednesday prior to the first Friday of March, June, September, and December), adjusted for any applicable corporate actions, and membership, shares outstanding, investable weight factors (IWFs), and growth/value factor as of the rebalancing effective date, weight each company by style adjusted float-adjusted market capitalization.
2. If any company weighs more than 24% cap the company's weight at 23%, which allows for a 2% buffer.
3. Proportionally redistribute any excess weight to all uncapped companies within the S&P 500® Value Index. The process continues iteratively until no company breaches the 23% weight cap.
4. The aggregate weight of companies with weights greater than 4.8% cannot exceed 50% of the total index weight.
5. If the rule in step 4 is breached, rank all companies in descending order by weight and reduce the weight of the smallest company whose weight is greater than 4.8% that causes the step 4 breach to 4.5%. Continue the process iteratively until step 4 is satisfied.
6. Assign index share amounts to each constituent to arrive at the weights calculated above.
7. If, on the third to last business day of March, June, September, or December, a company has an index weight greater than 24%, or the sum of the companies with weights greater than 4.8% exceeds 50%, a secondary reweighting is triggered with the rebalancing effective date after the close of the last business day of the month with any applicable reweighting changes appearing in daily proforma and corporate action files starting on the second to last business day of the month. The secondary reweighting uses the closing prices as of the third to last business day of March, June, September, or December, and membership, shares outstanding, IWFs and growth/value factor as of the rebalancing effective date.

#### *Maintenance of the S&P 500® Value Index*

The S&P 500® Value Index rebalances annually, effective after the close on the third Friday of December. The reference date to calculate style scores is after the close of the last trading date of the previous month. Style scores and growth and value midpoint averages are reset only at the December rebalancing.

If a constituent of the index is dropped from the S&P 500® Index, it will also be removed from the index.

With respect to spin-offs, index membership follows the S&P 500® Index and a child stock (i.e., a spin-off stock) is assigned the same float market-capitalization weight in the index as the parent stock.

Other changes to the index are made on an as-needed basis, following the guidelines of the S&P 500® Index. See "S&P 500® Index" above for more information.

#### *License Agreement between S&P and GS Finance Corp.*

The S&P 500® Value Index is a product of S&P Dow Jones Indices LLC, and has been licensed for use by GS Finance Corp. ("Goldman"). Standard & Poor's® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC; Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones") and these trademarks have been licensed for use by S&P Dow Jones Indices LLC and sublicensed for certain purposes by Goldman. Goldman's securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, Standard & Poor's Financial Services LLC or any of their respective affiliates (collectively, "S&P Dow Jones Indices"). S&P Dow Jones Indices makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the S&P 500® Value Index to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the S&P 500® Value

Index is the licensing of the S&P 500® Value Index and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The S&P 500® Value Index is determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the S&P 500® Value Index. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the S&P 500® Value Index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

S&P DOW JONES INDICES DOES NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE S&P 500® VALUE INDEX OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE S&P 500® VALUE INDEX OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

## S&P 500® Volatility Plus Daily Risk Control Index

The S&P 500® Volatility Plus Daily Risk Control Index (the “index”):

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of March 21, 2022, with a base value of 100 as of its base date, December 31, 1991; and
- is sponsored by S&P Dow Jones Indices LLC (“S&P”).

The S&P 500® Volatility Plus Daily Risk Control Index is designed to provide leveraged exposure to the S&P 500® Index based on a dynamic volatility target. The amount of leverage can change on each index calculation day, and a leverage factor is calculated in order to determine the applicable amount of leveraged exposure, with a minimum exposure of 100% (meaning that there is no leveraged exposure to the S&P 500® Index) and a maximum exposure of 200%. The leverage factor is calculated by dividing (i) the applicable realized volatility of the S&P 500® Index plus 10% by (ii) the applicable realized volatility of the S&P 500® Index. The sum of the applicable realized volatility of the S&P 500® Index plus 10% is referred to as the dynamic volatility target. The realized volatility of the S&P 500® Index is described further under “Construction of the S&P 500® Volatility Plus Daily Risk Control Index” below. While the S&P 500® Volatility Plus Daily Risk Control Index is designed to achieve a dynamic volatility target, there can be no assurance that the S&P 500® Volatility Plus Daily Risk Control Index will achieve this goal. The S&P 500® Index includes a representative sample of 500 companies in leading industries of the U.S. economy. The S&P 500® Volatility Plus Daily Risk Control Index and the S&P 500® Index are calculated, maintained and published by S&P Dow Jones Indices LLC (“S&P”). Additional information about the S&P 500® Volatility Plus Daily Risk Control Index and the S&P 500® Index (including sector weights) is available on the following websites: [spglobal.com/spdji/en/indices/strategy/sp-500-volatility-plus-daily-risk-control-index/#overview](https://spglobal.com/spdji/en/indices/strategy/sp-500-volatility-plus-daily-risk-control-index/#overview), [spglobal.com/spdji/en/indices/equity/sp-500](https://spglobal.com/spdji/en/indices/equity/sp-500) and [spglobal.com](https://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

### Construction of the S&P 500® Volatility Plus Daily Risk Control Index

The return on the S&P 500® Volatility Plus Daily Risk Control Index consists of leveraged exposure to the S&P 500® Index. The S&P 500® Volatility Plus Daily Risk Control Index adjusts exposure to the S&P 500® Index based on a leverage factor that changes based on the realized volatility of the S&P 500® Index, subject to a minimum leverage factor (or exposure) of 100% and a maximum leverage factor (or exposure) of 200%. An exposure equal to 100% of the daily return of the S&P 500® Index has the same daily return as the S&P 500® Index. An exposure greater than 100% of the daily return of the S&P 500® Index is a leveraged position where the exposure to the S&P 500® Index is increased, meaning that any increase in the level of the S&P 500® Index will result in a larger increase in the level of the S&P 500® Volatility Plus Daily Risk Control Index and any decrease in the level of the S&P 500® Index will result in a larger decrease in the level of the S&P 500® Volatility Plus Daily Risk Control Index. In practice, the leverage factor will always be greater than 100%.

#### Calculation of the Leverage Factor

Each index calculation day (“T”), the index sponsor calculates the leverage factor, which determines what the exposure to the S&P 500® Index will be for the following index calculation day (“T + 1”). The leverage factor is a ratio of the dynamic volatility target (i.e., the sum of (i) the realized volatility of the S&P 500® Index for the second preceding index calculation day (“T - 2”) *plus* (ii) 10%) to the realized volatility of the S&P 500® Index for the second preceding index calculation day (T - 2), subject to a minimum leverage factor of 100% and a maximum leverage factor of 200%. For example, if on the second preceding index calculation day (T - 2) the realized volatility was equal to 20%, on the index calculation day (T) the leverage factor would be equal to 150% (the *quotient* of (i) the *sum* of 20% *plus* 10% *divided by* (ii) 20%) and on the following index calculation day (T + 1) the S&P 500® Volatility Plus Daily Risk Control Index would be exposed to 150% of the daily return of the S&P 500® Index.

For example, if the leverage factor calculated on an index calculation day (T) is equal to 150% and the level of the S&P 500® Index on the following index calculation day (T + 1) increases by 10% from the level of the S&P 500® Index on the index calculation day (T), the level of the S&P 500® Volatility Plus Daily Risk Control Index on the following index calculation day (T + 1) would increase by 15% (150% *times* 10%). Conversely, if the leverage factor calculated on an index calculation day (T) is equal to 150% and the level of the S&P 500® Index on the following index calculation day (T + 1) decreases by 10% from the level of the S&P 500® Index on index

calculation day (T), the level of the S&P 500® Volatility Plus Daily Risk Control Index on the following index calculation day (T + 1) would decrease by 15% (150% *times* -10%). **Accordingly, the leverage factor has the effect of magnifying any increases or decreases in the level of the S&P 500® Index.**

Although the leverage factor is calculated at the close of each index calculation day (on index calculation day (T)), because of how the leverage factor is calculated, there is a lag of two index calculation days between the measurement of realized volatility of the S&P 500® Index (which is done on index calculation day (T - 2)) and the calculation of the leverage factor (on index calculation day (T)). Therefore, the leverage factor used to calculate the level of the S&P 500® Volatility Plus Daily Risk Control Index on index calculation day (T + 1) will be based on the realized volatility of the S&P 500® Index measured three index calculation days prior to index calculation day (T + 1). Due to this lag and the fact that realized volatility can fluctuate significantly during this period, and even during a single day, the leverage factor used to calculate the S&P 500® Volatility Plus Daily Risk Control Index on index calculation day (T + 1) will not reflect the most current measurement of realized volatility. As a result, the S&P 500® Volatility Plus Daily Risk Control Index may have greater exposure to the S&P 500® Index when the level of the S&P 500® Index is decreasing than it would have had if the leverage factor were calculated based on a more current measurement of realized volatility. See “Additional Risk Factors Specific to the Securities — The Volatility Plus Index Will Not Reflect the Most Current Volatility of the Underlying Index”.

#### *Calculation of Realized Volatility of the S&P 500® Index*

“Realized volatility” is a measurement of variations in the historical daily returns of the S&P 500® Index. Realized volatility is calculated as the average of short-term volatility and long-term volatility. Both short-term volatility and long-term volatility are calculated based on the historical daily returns over the same time period (from the day that is two index calculation days before the base date (December 31, 1991) of the S&P 500® Volatility Plus Daily Risk Control Index to the day that is two index calculation days before the current index calculation day) and both apply and gradually increase a discount that gradually reduces the significance of a given historical daily return as it moves farther into the past. However, short-term volatility applies a larger discount than does long-term volatility. The discount for short-term volatility is slightly more than double the discount for long-term volatility.

When the volatility of the S&P 500® Index increases (or decreases), short-term volatility will increase (or decrease) more quickly than long-term volatility.

**For information about the construction, calculation methodology and maintenance of the S&P 500® Index, please see “— The S&P 500® Index” above.**

#### *License Agreement between S&P and GS Finance Corp.*

The S&P 500® Volatility Plus Daily Risk Control Index and the S&P 500® Index are products of S&P Dow Jones Indices LLC, and have been licensed for use by GS Finance Corp. (“Goldman”). Standard & Poor’s® and S&P® are registered trademarks of Standard & Poor’s Financial Services LLC; Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC (“Dow Jones”) and these trademarks have been licensed for use by S&P Dow Jones Indices LLC and sublicensed for certain purposes by Goldman. Goldman’s securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, Standard & Poor’s Financial Services LLC or any of their respective affiliates (collectively, “S&P Dow Jones Indices”). S&P Dow Jones Indices makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the S&P 500® Volatility Plus Daily Risk Control Index or the S&P 500® Index to track general market performance. S&P Dow Jones Indices’ only relationship to Goldman with respect to the S&P 500® Volatility Plus Daily Risk Control Index and the S&P 500® Index is the licensing of these indices and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The S&P 500® Volatility Plus Daily Risk Control Index and the S&P 500® Index are determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the S&P 500® Volatility Plus Daily Risk Control Index or the S&P 500® Index. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the S&P 500® Volatility Plus Daily Risk Control Index or the S&P 500® Index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.



S&P DOW JONES INDICES DOES NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE S&P 500® VOLATILITY PLUS DAILY RISK CONTROL INDEX, OR THE S&P 500® INDEX OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE S&P 500® VOLATILITY PLUS DAILY RISK CONTROL INDEX OR S&P 500® INDEX OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

## S&P MidCap 400® Index

The S&P MidCap 400® Index, which we also refer to herein as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- has a launch date of June 19, 1991, with a base value of 100 as of its base date, June 28, 1991; and
- is sponsored by S&P Dow Jones Indices LLC (“S&P”).

The S&P MidCap 400® Index includes a representative sample of 400 mid-sized companies in various industries of the U.S. economy. S&P Dow Jones Indices LLC (“S&P”) chooses companies for inclusion in the S&P MidCap 400® Index with an aim of achieving a distribution by broad industry groupings that approximates the distribution of these groupings in the common stock population of mid-size companies in the U.S. domiciled equity market. Although the S&P MidCap 400® Index contains 400 constituent companies, at any one time it may contain greater than 400 constituent trading lines since some companies included in the S&P MidCap 400® Index prior to July 31, 2017 may be represented by multiple share class lines in the S&P MidCap 400® Index. The S&P MidCap 400® Index is calculated, maintained and published by S&P and is part of the S&P Dow Jones Indices family of indices. Additional information about the S&P MidCap 400® Index (including the sector weights) is available on the following websites: [spglobal.com/spdji/en/indices/equity/sp-400](http://spglobal.com/spdji/en/indices/equity/sp-400) and [spglobal.com](http://spglobal.com). We are not incorporating by reference the websites or any material they include in this underlier supplement.

The S&P MidCap 400® Index is intended to reflect the risk and return characteristics of the broader universe of mid-sized firms in the U.S. domiciled equity markets. Index additions and deletions are announced with at least three business days advance notice. Less than three business days' notice may be given at the discretion of the S&P Index Committee. Constituent changes are generally announced one to five business days prior to the change. Relevant criteria for additions to the S&P MidCap 400® Index that are employed by S&P include: the company proposed for addition should have an unadjusted company market capitalization of between \$6.7 billion and \$18.0 billion and a security level float-adjusted market capitalization of at least 50% of such threshold (but the constituents are not the 400 largest companies in the NYSE in that range and not all 400 companies are listed on such exchange; for spin-offs, eligibility is determined using when-issued prices, if available); the float-adjusted liquidity ratio of the stock (defined as the annual dollar value traded divided by the float-adjusted market capitalization) should be greater than or equal to 0.75 at the time of the addition to the S&P MidCap 400® Index and the stock should trade a minimum of 250,000 shares in each of the six months leading up to the evaluation date (current constituents have no minimum requirement), where the annual dollar value traded is calculated as the average closing price multiplied by the historical volume over the 365 calendar days prior to the evaluation date (reduced to the available trading period for IPOs, spin-offs or public companies considered to be U.S. domiciled for index purposes that do not have 365 calendar days of trading history on a U.S. exchange); the company must be a U.S.-domiciled company (characterized as a company that satisfies U.S. Securities Exchange Act's periodic reporting obligations by filing certain required forms for domestic issuers (e.g., Form 10-K annual reports, Form 10-Q quarterly reports and Form 8-K current reports, among others) and with a primary listing of the common stock on the NYSE, NYSE Arca, NYSE American (formerly NYSE MKT), Nasdaq Global Select Market, Nasdaq Global Market, Nasdaq Capital Market, Cboe BZX (formerly Bats BZX), Cboe BYX (formerly Bats BYX), Cboe EDGA (formerly Bats EDGA) or Cboe EDGX (formerly Bats EDGX) (each, an “eligible exchange”)), the proposed constituent has an investable weight factor (“IWF”) of 10% or more, the inclusion of the company will contribute to sector balance in the S&P MidCap 400® Index relative to sector balance in the market in the relevant market capitalization range; financial viability (the sum of the most recent four consecutive quarters' Generally Accepted Accounting Principles (GAAP) earnings (net income excluding discontinued operations) should be positive as should the most recent quarter; and, for IPOs, the company must be traded on an eligible exchange for at least twelve months (for former SPACs, S&P considers the de-SPAC transaction to be an event equivalent to an IPO, and 12 months of trading post the de-SPAC event are required before a former SPAC can be considered for inclusion in the S&P MidCap 400® Index; spin-offs or in-specie distributions from existing constituents do not need to be traded on an eligible exchange for twelve months prior to their inclusion in the S&P MidCap 400® Index). In addition, constituents of the S&P 500® Index and the S&P SmallCap 600® Index can be added to the S&P MidCap 400® Index provided they meet the unadjusted company level market capitalization eligibility criteria for the S&P MidCap 400® Index. Migrations from the S&P 500® Index or the S&P SmallCap 600® Index do not need to meet the financial viability, liquidity, or 50% of the S&P MidCap 400® Index's unadjusted company level minimum market capitalization threshold criteria. Further, constituents of the S&P Total

Market Index Ex S&P Composite 1500 (which includes all eligible U.S. common equities except for those included in the S&P 500® Index, the S&P MidCap 400® Index and the S&P SmallCap 600® Index) that acquire a constituent of the S&P 500® Index, the S&P MidCap 400® Index or the S&P SmallCap 600® Index that do not fully meet all of the eligibility criteria may still be added to the S&P MidCap 400® Index at the discretion of the Index Committee if the merger consideration includes the acquiring company issuing stock to target company shareholders, and the Index Committee determines that the addition could minimize turnover and enhance the representativeness of the S&P MidCap 400® Index as a market benchmark. Certain types of organizational structures and securities are always excluded, including, but not limited to, business development companies (BDCs), limited partnerships, master limited partnerships, limited liability companies (LLCs) OTC bulletin board issues, closed-end funds, ETFs, ETNs, royalty trusts, tracking stocks, special purpose acquisition companies (SPACs), preferred stock and convertible preferred stock, unit trusts, equity warrants, convertible bonds, investment trusts, rights and American depositary receipts ("ADRs"). Stocks are deleted from the S&P MidCap 400® Index when they are involved in mergers, acquisitions or significant restructurings such that they no longer meet the inclusion criteria, and when they substantially violate one or more of the addition criteria. Stocks that are delisted or moved to the pink sheets or the bulletin board are removed and those that experience a trading halt may be retained or removed in S&P's discretion. S&P evaluates additions and deletions with a view to maintaining S&P MidCap 400® Index continuity.

For constituents included in the S&P MidCap 400® Index prior to July 31, 2017, all publicly listed multiple share class lines are included separately in the S&P MidCap 400® Index, subject to, in the case of any such share class line, that share class line satisfying the liquidity and float criteria discussed above and subject to certain exceptions. It is possible that one listed share class line of a company may be included in the S&P MidCap 400® Index while a second listed share class line of the same company is excluded. For companies that issue a second publicly traded share class to index share class holders, the newly issued share class line is considered for inclusion if the event is mandatory and the market capitalization of the distributed class is not considered to be de minimis.

As of July 31, 2017, companies with multiple share class lines are no longer eligible for inclusion in the S&P MidCap 400® Index. Only common shares are considered when determining whether a company has a multiple share class structure. Constituents of the S&P MidCap 400® Index prior to July 31, 2017 with multiple share class lines will be grandfathered in and continue to be included in the S&P MidCap 400® Index. If an S&P MidCap 400® Index constituent reorganizes into a multiple share class line structure, that company will be reviewed for continued inclusion in the S&P MidCap 400® Index at the discretion of the S&P Index Committee.

#### *Calculation of the S&P MidCap 400® Index*

The S&P MidCap 400® Index is calculated using a base-weighted aggregative methodology. This discussion describes the "price return" calculation of the S&P MidCap 400® Index. The applicable pricing supplement will describe the calculation if the underlier for your securities is not the price return calculation. The value of the S&P MidCap 400® Index on any day for which an index value is published is determined by a fraction, the numerator of which is the aggregate of the market price of each stock in the S&P MidCap 400® Index times the number of shares of such stock included in the S&P MidCap 400® Index, and the denominator of which is the divisor, which is described more fully below. The "market value" of any index stock is the *product* of the market price per share of that stock *times* the number of the then-outstanding shares of such index stock that are then included in the S&P MidCap 400® Index.

The S&P MidCap 400® Index is also sometimes called a "base-weighted aggregative index" because of its use of a divisor. The "divisor" is a value calculated by S&P that is intended to maintain conformity in index values over time and is adjusted for all changes in the index stocks' share capital after the "base date" as described below. The level of the S&P MidCap 400® Index reflects the total market value of all index stocks relative to the S&P MidCap 400® Index's base date of June 28, 1991.

In addition, the S&P MidCap 400® Index is float-adjusted, meaning that the share counts used in calculating the S&P MidCap 400® Index reflect only those shares available to investors rather than all of a company's outstanding shares. S&P seeks to exclude shares held by long-term, strategic shareholders concerned with the control of a company, a group that generally includes the following: officers and directors and related individuals whose holdings are publicly disclosed, private equity, venture capital, special equity firms, asset managers and insurance companies with board of director representation, publicly traded companies that hold shares in another company, holders of restricted shares (except for shares held as part of a lock-up agreement), company-sponsored employee share plans/trusts, defined contribution plans/savings, investment plans, foundations or family trusts associated with the company, government entities at all levels (except government retirement or pension funds), sovereign wealth funds and any individual person listed as a 5% or greater stakeholder in a company as reported

in regulatory filings (collectively, “strategic holders”). To this end, S&P excludes all share-holdings (other than depositary banks, pension funds (including government pension and retirement funds), mutual funds, exchange traded fund providers, investment funds, hedge funds, asset managers that do not have direct board of director representation (including stakeholders who may have the right to appoint a board of director member but choose not to do so, stakeholders who have exercised a right to appoint a board of director “observer” even if that observer is employed by the stakeholder and stakeholders who have exercised a right to appoint an independent director who is not employed by the stakeholder), investment funds of insurance companies and independent foundations not associated with the company) with a position greater than 5% of the outstanding shares of a company from the float-adjusted share count to be used in S&P MidCap 400® Index calculations.

The exclusion is accomplished by calculating an “IWF” for each stock that is part of the numerator of the float-adjusted index fraction described above:

$$\text{IWF} = (\text{available float shares}) / (\text{total shares outstanding})$$

where available float shares is defined as total shares outstanding less shares held by strategic holders. In most cases, an IWF is reported to the nearest one percentage point. For companies with multiple share class lines, a separate IWF is calculated for each share class line.

#### *Maintenance of the S&P MidCap 400® Index*

In order to keep the S&P MidCap 400® Index comparable over time S&P engages in an index maintenance process. The S&P MidCap 400® Index maintenance process involves changing the constituents as discussed above, and also involves maintaining quality assurance processes and procedures, adjusting the number of shares used to calculate the S&P MidCap 400® Index, monitoring and completing the adjustments for company additions and deletions, adjusting for stock splits and stock dividends and adjusting for other corporate actions. In addition to its daily governance of indices and maintenance of the index methodology, at least once within any 12 month period, the S&P Index Committee reviews the index methodology to ensure the S&P MidCap 400® Index continues to achieve the stated objective, and that the data and methodology remain effective. The S&P Index Committee may at times consult with investors, market participants, security issuers included in or potentially included in the S&P MidCap 400® Index, or investment and financial experts.

#### *Divisor Adjustments*

The two types of adjustments primarily used by S&P are divisor adjustments and adjustments to the number of shares (including float adjustments) used to calculate the S&P MidCap 400® Index. Set forth below is a table of certain corporate events and their resulting effect on the divisor and the share count. If a corporate event requires an adjustment to the divisor, that event has the effect of altering the market value of the affected index stock and consequently of altering the aggregate market value of the index stocks following the event. In order that the level of the S&P MidCap 400® Index not be affected by the altered market value (which could be an increase or decrease) of the affected index stock, S&P generally derives a new divisor by dividing the post-event market value of the index stocks by the pre-event index value, which has the effect of reducing the S&P MidCap 400® Index's post-event value to the pre-event level.

#### *Changes to the Number of Shares of a Constituent*

The index maintenance process also involves tracking the changes in the number of shares included for each of the index companies. Changes as a result of mandatory events, such as mergers or acquisition driven share/IWF changes, stock splits and mandatory distributions are not subject to a minimum threshold for implementation and are implemented when the transaction occurs. At S&P's discretion, however, de minimis merger and acquisition changes may be accumulated and implemented with the updates made with the quarterly share updates as described below. Material share/IWF changes resulting from certain non-mandatory corporate actions follow the accelerated implementation rule. Non-material share/IWF changes are implemented quarterly.

#### *Material Share/IWF Changes – Accelerated Implementation Rule*

1. Public offerings. Public offerings of new company-issued shares and/or existing shares offered by selling shareholders, including block sales and spot secondaries, will be eligible for accelerated implementation treatment if the size of the event meets the materiality threshold criteria:

- (a) at least US \$150 million, and
- (b) at least 5% of the pre-event total shares.

In addition to the materiality threshold, public offerings must satisfy the following conditions:

- be underwritten.

- have a publicly available prospectus, offering document, or prospectus summary filed with the relevant authorities.
- have a publicly available confirmation from an official source that the offering has been completed.

For public offerings that involve a concurrent combination of new company shares and existing shares offered by selling shareholders, both events are implemented if either of the public offerings or the total underwritten public offering represents at least 5% of total shares and US \$150 million. Any concurrent share repurchase by the affected company will also be included in the implementation.

2. Dutch Auctions, self-tender offer buybacks, and split-off exchange offers. These non-mandatory corporate action types will be eligible for accelerated implementation treatment regardless of size once the final results are publicly announced and verified by S&P.

For companies with multiple share class lines, the criteria specified above apply to each individual multiple share class line rather than total company shares.

Accelerated implementation for events less than US \$1 billion includes an adjustment to the company's IWF only to the extent that such an IWF change helps the new float share total mimic the shares available in the offering. To minimize unnecessary turnover, these IWF changes do not need to meet any minimum threshold requirement for implementation. Any IWF change resulting in an IWF of 0.96 or greater is rounded up to 1.00 at the subsequent annual IWF review.

For accelerated implementation of at least US \$1 billion, S&P applies the share change, and any resulting IWF change, using the latest share and ownership information publicly available at the time of the announcement, even if the offering size is below the 5% threshold. This exception ensures that very large events are recognized in a timely manner using the latest available information. Any IWF change resulting in an IWF of 0.96 or greater is rounded up to 1.00.

#### Market Specific Accelerated Implementation Rules

Non-fully paid or non-fully settled offerings, such as subscription receipts forward sales agreements, are ineligible for accelerated implementation. Share updates resulting from completion of subscription receipts terms, or the settlement of forward sale agreements, are updated at a future quarterly rebalancing.

#### Announcement Policy

For accelerated implementation, S&P provides two (2) business days' notice for all non-U.S. listed stocks and U.S. listed depositary receipts, and one (1) business days' notice for all non-depositary receipt U.S. listed stocks.

#### Non-Material Share/IWF Changes – Quarterly Implementation

All non-mandatory events not covered or implemented via the accelerated implementation rule (including but not limited to private placements, acquisition of private companies, and conversion of non-index share lines) are reviewed quarterly, effective after the close of the third Friday of the third month in each calendar quarter and as per below.

#### Share Updates

At each quarterly review, shares outstanding are updated to the latest available information as of the rebalancing reference date.

#### IWF Updates

At the quarterly review, IWF changes are only made if there is a share change of at least 5% of total current shares outstanding and if the adjusted IWF absolute change is at least 5, with IWF adjustments limited to the extent necessary to help reflect the corresponding share change.

For quarterly share change events, unless there is explicit information stating that the new shares are not available to the market, shares are generally considered to be available to all investors and reflected in the IWF. Events such as conversion of derivative securities, acquisitions of private companies, or acquisitions of non-index companies that do not trade on a major exchange are generally implemented as described above.

Other than the situations described above, please note that IWF changes are only made at the annual IWF review.

#### Rebalancing Guidelines – Share/IWF Reference Date & Freeze Period

A reference date, after the market close five weeks prior to the third Friday in March, June, September, and December, is the cutoff for publicly available information used for quarterly shares outstanding and IWF changes.

All shares outstanding and ownership information contained in public filings and/or official sources dated on or before the reference date are included in that quarter's update. In addition, there is a freeze period on a quarterly basis for any changes that result from the accelerated implementation rules.

Pro-forma files for float-adjusted market capitalization indices are generally released after the market close on the first Friday, two weeks prior to the rebalancing effective date. Pro-forma files for capped and alternatively weighted indices are generally released after the market close on the second Friday, one week prior to the rebalancing effective date. For illustration purposes, if rebalancing pro-forma files are scheduled to be released on Friday, March 15, the share/IWF freeze period will begin after the close of trading on Tuesday, March 9 and will end after the close of trading the following Friday, March 19 (i.e. the third Friday of the rebalancing month).

During the share/IWF freeze period, shares and IWFs are not changed and the accelerated implementation rule is suspended, except for mandatory corporate action events (such as merger activity, stock splits, and rights offerings). The suspension includes all changes that qualify for accelerated implementation and would typically be announced or effective during the share/IWF freeze period. At the end of the freeze period all suspended changes will be announced on the third Friday of the rebalancing month and implemented five business days after the quarterly rebalancing effective date. For these non-mandatory events, S&P uses shares and IWF data as of the upcoming rebalancing effective date to calculate the size of the event and in turn assess if the event qualifies the accelerated implementation rule.

Adjustments for Corporate Actions

There is a large range of corporate actions that may affect companies included in the S&P MidCap 400® Index. Certain corporate actions require S&P to recalculate the share count or the float adjustment or to make an adjustment to the divisor to prevent the value of the S&P MidCap 400® Index from changing as a result of the corporate action. This helps ensure that the movement of the S&P MidCap 400® Index does not reflect the corporate actions of individual companies in the S&P MidCap 400® Index.

Spin-Offs

As a general policy, a spin-off security is added to the S&P MidCap 400® Index on the ex-date at a price of zero (with no divisor adjustment) and will remain in the S&P MidCap 400® Index for at least one trading day. The spin-off security will remain in the S&P MidCap 400® Index if it meets all eligibility criteria. If the spin-off security is determined ineligible to remain in the S&P MidCap 400® Index, it will generally be removed after at least one day of regular way trading (with a divisor adjustment). The weight of the spin-off being deleted is reinvested across all the index components proportionately such that the relative weights of all index components are unchanged. The net change in index market capitalization will cause a divisor change.

Companies that are spun off from a constituent of the S&P MidCap 400® Index do not need to meet the eligibility criteria for new constituents, but they should be considered U.S. domiciled for index purposes. At the discretion of the Index Committee, a spin-off company may be retained in the S&P MidCap 400® Index if the Index Committee determines it has a total market capitalization representative of the S&P MidCap 400® Index. If the spin-off company's estimated market capitalization is below the minimum unadjusted company market capitalization for the S&P MidCap 400® Index but there are other constituent companies in the S&P MidCap 400® Index that have a significantly lower total market capitalization than the spin-off company, the Index Committee may decide to retain the spin-off company in the S&P MidCap 400® Index.

Several additional types of corporate actions, and their related treatment, are listed in the table below.

Corporate Action	Treatment
Company addition/deletion	<u>Addition</u>
	Companies are added at the float market capitalization weight. The net change to the index market capitalization causes a divisor adjustment.
Change in shares outstanding	<u>Deletion</u>
	The weights of all stocks in the index will proportionally change. Relative weights will stay the same. The index divisor will change due to the net change in the index market capitalization
	Increasing (decreasing) the shares outstanding increases (decreases) the market capitalization of the index. The change to the index market capitalization causes a divisor adjustment.

Split/reverse split	Shares outstanding are adjusted by split ratio. Stock price is adjusted by split ratio. There is no change to the index market capitalization and no divisor adjustment.
Change in IWF	Increasing (decreasing) the IWF increases (decreases) the market capitalization of the index. A net change to the index market capitalization causes a divisor adjustment.
Ordinary dividend	When a company pays an ordinary cash dividend, the index does not make any adjustments to the price or shares of the stock. As a result there are no divisor adjustments to the index.
Special dividend	The stock price is adjusted by the amount of the dividend. The net change to the index market capitalization causes a divisor adjustment
Rights offering	All rights offerings that are in the money on the ex-date are applied under the assumption the rights are fully subscribed. The stock price is adjusted by the value of the rights and the shares outstanding are increased by the rights ratio. The net change in market capitalization causes a divisor adjustment.

Any company that is removed from the S&P 500® Index, the S&P MidCap 400® Index or the S&P SmallCap 600® Index must wait a minimum of one year from its removal date before being reconsidered as a replacement candidate for the S&P MidCap 400® Index.

*Recalculation Policy*

S&P reserves the right to recalculate and republish the S&P MidCap 400® Index at its discretion in the event one of the following issues has occurred: (1) incorrect or revised closing price of one or more constituent securities; (2) missed or misapplied corporate action; (3) incorrect application of an index methodology; (4) late announcement of a corporate action; or (5) incorrect calculation or data entry error. The decision to recalculate the S&P MidCap 400® Index is made at the discretion of the index manager and/or index committee, as further discussed below. The potential market impact or disruption resulting from a recalculation is considered when making any such decision. In the event of an incorrect closing price, a missed or misapplied corporate action, a late announcement of a corporate event, or an incorrect calculation or data entry error that is discovered within two trading days of its occurrence, generally the S&P MidCap 400® Index is recalculated. In the event any such event is discovered beyond the two trading day period, the index committee shall decide whether the S&P MidCap 400® Index should be recalculated. In the event of an incorrect application of the methodology that results in the incorrect composition and/or weighting of index constituents, the index committee shall determine whether or not to recalculate the S&P MidCap 400® Index following specified guidelines. In the event that the S&P MidCap 400® Index is recalculated, it shall be done within a reasonable timeframe following the detection and review of the issue.

*Calculations and Pricing Disruptions*

Closing levels for the S&P MidCap 400® Index are calculated by S&P based on the closing price of the individual constituents of the S&P MidCap 400® Index as set by their primary exchange. Closing prices are received by S&P from one of its third party vendors and verified by comparing them with prices from an alternative vendor. The vendors receive the closing price from the primary exchanges. Real-time intraday prices are calculated similarly without a second verification. Official end-of-day calculations are based on each stock's primary market closing price. Prices used for the calculation of real time index values are based on the "Consolidated Tape". The Consolidated Tape is an aggregation of trades for each constituent over all regional exchanges and trading venues and includes the primary exchange. If there is a failure or interruption on one or more exchanges, real-time calculations will continue as long as the "Consolidated Tape" is operational.

If an interruption is not resolved prior to the market close, official closing prices will be determined by following the hierarchy set out in NYSE Rule 123C. A notice is published on the S&P website at spglobal.com indicating any changes to the prices used in S&P MidCap 400® Index calculations. In extreme circumstances, S&P may decide to delay index adjustments or not publish the S&P MidCap 400® Index. Real-time indices are not restated.

*Unexpected Exchange Closures*

An unexpected market/exchange closure occurs when a market/exchange fully or partially fails to open or trading is temporarily halted. This can apply to a single exchange or to a market as a whole, when all of the primary

exchanges are closed and/or not trading. Unexpected market/exchange closures are usually due to unforeseen circumstances, such as natural disasters, inclement weather, outages, or other events.

To a large degree, S&P is dependent on the exchanges to provide guidance in the event of an unexpected exchange closure. S&P's decision making is dependent on exchange guidance regarding pricing and mandatory corporate actions.

NYSE Rule 123C provides closing contingency procedures for determining an official closing price for listed securities if the exchange is unable to conduct a closing transaction in one or more securities due to a system or technical issue.

3:00 PM ET is the deadline for an exchange to determine its plan of action regarding an outage scenario. As such, S&P also uses 3:00 PM ET as the cutoff.

If all major exchanges fail to open or unexpectedly halt trading intraday due to unforeseen circumstances, S&P will take the following actions:

Market Disruption Prior to Open of Trading:

- (i) If all exchanges indicate that trading will not open for a given day, S&P will treat the day as an unscheduled market holiday. The decision will be communicated to clients as soon as possible through the normal channels. Indices containing multiple markets will be calculated as normal, provided that at least one market is open that day. Indices which only contain closed markets will not be calculated.
- (ii) If exchanges indicate that trading, although delayed, will open for a given day, S&P will begin index calculation when the exchanges open.

Market Disruption Intraday:

- (i) If exchanges indicate that trading will not resume for a given day, the S&P MidCap 400<sup>®</sup> Index level will be calculated using prices determined by the exchanges based on NYSE Rule 123C. Intraday S&P MidCap 400<sup>®</sup> Index values will continue to use the last traded composite price until the primary exchange publishes official closing prices.

*License Agreement between S&P and GS Finance Corp.*

The S&P MidCap 400<sup>®</sup> Index is a product of S&P Dow Jones Indices LLC, and has been licensed for use by GS Finance Corp. ("Goldman"). Standard & Poor's<sup>®</sup> and S&P<sup>®</sup> are registered trademarks of Standard & Poor's Financial Services LLC; Dow Jones<sup>®</sup> is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones") and these trademarks have been licensed for use by S&P Dow Jones Indices LLC and sublicensed for certain purposes by Goldman. Goldman's securities are not sponsored, endorsed, sold or promoted by S&P Dow Jones Indices LLC, Dow Jones, Standard & Poor's Financial Services LLC or any of their respective affiliates (collectively, "S&P Dow Jones Indices"). S&P Dow Jones Indices makes no representation or warranty, express or implied, to the owners of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities particularly or the ability of the S&P MidCap 400<sup>®</sup> Index to track general market performance. S&P Dow Jones Indices' only relationship to Goldman with respect to the S&P MidCap 400<sup>®</sup> Index is the licensing of the S&P MidCap 400<sup>®</sup> Index and certain trademarks, service marks and/or trade names of S&P Dow Jones Indices and/or its licensors. The S&P MidCap 400<sup>®</sup> Index is determined, composed and calculated by S&P Dow Jones Indices without regard to Goldman or the securities. S&P Dow Jones Indices have no obligation to take the needs of Goldman or the owners of the securities into consideration in determining, composing or calculating the S&P MidCap 400<sup>®</sup> Index. S&P Dow Jones Indices are not responsible for and have not participated in the determination of the prices, and amount of the securities or the timing of the issuance or sale of the securities or in the determination or calculation of the equation by which the securities are to be converted into cash. S&P Dow Jones Indices have no obligation or liability in connection with the administration, marketing or trading of the securities. There is no assurance that investment products based on the S&P MidCap 400<sup>®</sup> Index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

S&P DOW JONES INDICES DOES NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE S&P MIDCAP 400<sup>®</sup> INDEX OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL



WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY GOLDMAN, OWNERS OF THE SECURITIES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE S&P MIDCAP 400® INDEX OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND GOLDMAN, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

## Swiss Market Index

The Swiss Market Index (SMI®), which we also refer to in this description as the “index”:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first launched with a base level of 1,500 as of June 30, 1988; and
- is sponsored, calculated, published and disseminated by SIX Group Ltd., certain of its subsidiaries, and the Management Committee of the SIX Swiss Exchange (the “Exchange”).

The Swiss Market Index is a price return float-adjusted market capitalization-weighted index of the 20 largest stocks traded on the SIX Swiss Exchange. The Swiss Market Index represents more than 75% of the free-float market capitalization of the entire Swiss market. Additional information about the Swiss Market Index (including the top ten constituent stocks and weights and sector weights) is available on the following website: [six-group.com/en/products-services/the-swiss-stock-exchange/market-data/indices/equity-indices/smi.html](http://six-group.com/en/products-services/the-swiss-stock-exchange/market-data/indices/equity-indices/smi.html). We are not incorporating by reference the website or any material it includes in this underlier supplement.

### *Swiss Market Index Composition and Selection Criteria*

The Swiss Market Index is comprised of the 20 highest ranked stocks traded on the SIX Swiss Exchange that have a free float of 20% or more and that are not investment companies. The equity universe is largely Swiss domestic companies, although in some cases foreign issuers with a primary listing on the SIX Swiss Exchange that submit to certain reporting requirements or investment companies that do not hold any shares of any company that has a primary listing on the SIX Swiss Exchange may be included.

The ranking of each security is determined by a combination of the following criteria:

- average free-float market capitalization over the last 12 months (compared to the capitalization of the Swiss Performance Index, which serves as a benchmark for the overall Swiss equity market and as the index universe for the Swiss Market Index), and
- cumulative on order book turnover over the last 12 months (compared to the total turnover of the Swiss Performance Index).

Each of these two factors is assigned a 50% weighting in ranking the stocks eligible for the Swiss Market Index.

The Swiss Market Index is reconstituted annually after prior notice of at least two months on the third Friday in September after the close of trading. For companies that were listed during the last 12 months, the cumulated on order book turnover generally excludes the first five trading days in the calculation. The ordinary index reconstitution is based on data from the previous July 1 through June 30. Provisional interim selection (ranking) lists based on the average free-float market capitalization and cumulative on order book turnover over the last 12 months are also published at the cut off dates March 31, September 30 and December 31.

The 18 securities with the highest rank are selected for inclusion in the Swiss Market Index. In order to reduce turnover, a buffer is used for securities ranked 19 to 22. From the securities ranked 19 to 22, those which are currently already in the Swiss Market Index are included with priority. After that, new components are added from the buffer until the Swiss Market Index has 20 components.

If a company has primary listings on several exchanges and less than 50% of that company's total turnover is generated on the SIX Swiss Exchange, it will not be included in the Swiss Market Index unless it satisfies an additional liquidity criteria. For this purpose, at the ordinary index review in September, all index components of the Swiss Performance Index are ranked in descending order according to their cumulative order book turnover of the last 12 months relative to the total turnover of the Swiss Performance Index. Such a security must rank at least 18 or better in terms of the cumulated on order book turnover over the past 12 months and if it ranks 23 or lower it will be automatically excluded from the Swiss Market Index (i.e., without considering its free float).

### *Maintenance of the Swiss Market Index*

**Constituent Changes.** In the case of major market changes as a result of corporate actions, the Management Committee of SIX Swiss Exchange can decide at the request of the Index Commission that a security should be admitted to the Swiss Market Index outside of the annual review period as long as it clearly fulfills the criteria for inclusion. For the same reasons, a security can also be excluded if the requirements for admission to the Swiss Market Index are no longer fulfilled. Extraordinary exclusions and respective additions into the Swiss Market Index are implemented after a notification period of usually five trading days. Extraordinary inclusions into the Swiss

Market Index take place after a three-month period on a quarterly basis after the close of trading on the third Friday of March, June, September and December (for example, a security listed on or before the fifth trading day prior to the end of November cannot be included until the following March). In case of a planned delisting, the exclusion of an index component is made, if possible, on the next ordinary index review. However, if the delisting would be effective before the ordinary index review, the component is excluded from the index on the effective date of the delisting. If the index component no longer meets the criteria for remaining in the index due to a pending acquisition, it may be removed ahead of time. If a delisting has been confirmed, it will be removed from the Swiss Market Index at the next upcoming ordinary quarterly adjustment date (March, June, September and December) with a notice period of at least five days. However, if the delisting would be effective before the ordinary index review, the security is excluded from the Swiss Market Index on the effective date of the delisting. If a delisted company is removed before the ordinary index review, it will be replaced by the best ranked candidate on the selection list which is not yet part of the Swiss Market Index in order to maintain 20 components.

**Capped Weightings and Intra-Quarter Breaches.** The weight of any index constituent that exceeds a weight of 18% within the Swiss Market Index is reduced to that value at each ordinary quarterly adjustment date by applying a capping factor to the calculation of such constituent's free float market capitalization. A constituent's number of shares and free float figure are used to determine its capping factor. The excess weight (the difference of the original weight minus the capped weight) is distributed proportionally across the other index constituents. The constituents are also capped at 18% as soon as two index constituents exceed a weight of 20% (an "intra-quarter breach"). If an intra-quarter breach is detected at the close of trading, the new capping factors become effective after the close of trading on the following trading day. The weights of the largest components are therefore set again to 18% effective after the close of the following trading day. If an issuer is represented in the Swiss Market Index by more than one security, their free float market capitalization is cumulated for the calculation of the capping factors.

**Number of Shares and Free Float.** The securities included in the Swiss Market Index are weighted according to their free float. This means that shares deemed to be in fixed ownership are deducted from the market capitalization of that company. The free float is calculated on the basis of outstanding shares. Issued and outstanding share capital is, as a rule, the total share capital that has been fully subscribed and fully or partially paid in and registered in the Commercial Register. Not counting as issued and outstanding share capital are the authorized capital and the conditional capital of a company. The free float is calculated on the basis of listed shares only. If a company offers several different categories of listed participation rights, each is treated separately for the purposes of index calculation.

Fundamentally deemed to be shares held in fixed ownership are shares held by individual persons or groups of persons in companies and that reach or exceed the threshold of 5%. Shares held by individual persons and groups of persons bound by a shareholders' agreement which is binding for more than 5% of the listed shares or who, according to publicly known facts, have a long-term interest in the company are also deemed to be in fixed ownership.

For the calculation of the number of shares in firm hands, the Exchange may also use other sources than the reports submitted to it. In particular, the Exchange may rely on information from issuer surveys conducted by itself.

In general, shares held by administrators, trustees, investment fund companies, pension funds and investment companies are counted as free-float. The Exchange classifies at its own discretion persons and groups of persons who, because of their area of activity or the absence of important information, cannot be clearly assigned.

The free-float rule applies only to bearer shares and registered shares. Capital issued in the form of participation certificates ("Partizipationsscheine") and bonus certificates ("Genussscheine") is taken into full account in calculating the Swiss Market Index because it does not confer voting rights.

The number of securities in the Swiss Market Index and the free-float factors are adjusted after the close of trading on four adjustment dates per year, the third Friday of March, June, September and December. Such changes are provisionally pre-announced at least one month before the effective date, although the index sponsor reserves the right to take account of recent changes up to five trading days before the effective date.

In order to avoid frequent slight changes to the weighting and to maintain the stability of the Swiss Market Index, any extraordinary change of the total number of outstanding securities or the free float will only result in an extraordinary adjustment if it exceeds 10% and 5% respectively, occurs from one trading to the next and is in

conjunction with a corporate action. Such adjustment is effective considering a notice period of two days. The effective date is based on available information.

*Calculation of the Swiss Market Index*

The index sponsor calculates the Swiss Market Index using the “Laspeyres formula,” with a weighted arithmetic mean of a defined number of securities issues. The formula for calculating the index value can be expressed as follows:

**Swiss Market Index = Free Float Market Capitalization of the SMI® / Divisor**

The “free float market capitalization of the SMI®” is equal to the sum of the product of the last-paid price, the number of shares, the free float factor, the capping factor and, if a foreign stock is included, the current CHF exchange rate as of the time the index value is being calculated. The index value is calculated in real time and is updated whenever a trade is made in a component stock. Where any index component stock price is unavailable on any trading day, the index sponsor will use the last reported price for such component stock. Only prices from the Exchange’s electronic order book are used in calculating the Swiss Market Index.

*Divisor Value and Adjustments*

The divisor is a technical number used to calculate the Swiss Market Index and is adjusted to reflect changes in market capitalization due to corporate events.

Below are common corporate events and their impact on the divisor of the Swiss Market Index.

Event	Divisor Change?
Regular cash dividend	No
Stock split	No
Rights issue	If the rights issue is used to raise capital, the divisor increases. If the rights issue is used to return capital, the divisor decreases.

*Merger and Acquisition activities*

Mergers and acquisitions are corporate actions that go along with a change to the ownership structure of one or more companies. This can result in the disappearance of the involved companies (delisting) and in the creation of a new company (merger) or in the integration of one company into the other (acquisition). Therefore, the corporate action may lead to a new listing or to a delisting which results in an adjustment of the index composition. In both cases a change in the number of shares or the free float factor are to be considered which result in a change of the components weight.

*Spinoff*

A spinoff occurs when a company sells parts of its business into a new company and lists its shares. The shares of the newly formed company are distributed equally to the shareholders of the existing company. Therefore, the spin-off is generally treated as an extraordinary payment. However, no market price is available on the ex-date of the spinoff. In order to obtain such a market price, the spun off company is added to the Swiss Market Index with a reference price during the ex-day. The opening price will be 0. The instrument is added to the Swiss Market Index at the ex-date with a price of 0. The adjustments to market value are made on the first trading day following the ex-date with the closing price of the same.

*License Agreement between SIX Swiss Exchange and GS Finance Corp.*

SIX Swiss Exchange AG (“SIX Swiss Exchange”) and its licensors (“Licensors”) have no relationship to GS Finance Corp., other than the licensing of the SMI® and the related trademarks for use in connection with the offered securities.

SIX Swiss Exchange and its Licensors do not:

- sponsor, endorse, sell or promote the offered securities.
- recommend that any person invest in the offered securities or any other securities.

- have any responsibility or liability for or make any decisions about the timing, amount or pricing of the offered securities.
- have any responsibility or liability for the administration, management or marketing of the offered securities.
- consider the needs of the offered securities or the owners of the offered securities in determining, composing or calculating the SMI<sup>®</sup> or have any obligation to do so.

SIX Swiss Exchange and its Licensors give no warranty, and exclude any liability (whether in negligence or otherwise), in connection with the offered securities or their performance.

SIX Swiss Exchange does not assume any contractual relationship with the purchasers of the offered securities or any other third parties.

Specifically, SIX Swiss Exchange and its Licensors do not give any warranty, express or implied, and exclude any liability for:

- The results to be obtained by the offered securities, the owner of the offered securities or any other person in connection with the use of the SMI<sup>®</sup> and the data included in the SMI<sup>®</sup>;
- The accuracy, timeliness, and completeness of the SMI<sup>®</sup> and its data;
- The merchantability and the fitness for a particular purpose or use of the SMI<sup>®</sup> and its data;
- The performance of the offered securities generally.

SIX Swiss Exchange and its Licensors give no warranty and exclude any liability, for any errors, omissions or interruptions in the SMI<sup>®</sup> or its data;

Under no circumstances will SIX Swiss Exchange or its Licensors be liable (whether in negligence or otherwise) for any lost profits or indirect, punitive, special or consequential damages or losses, arising as a result of such errors, omissions or interruptions in the SMI<sup>®</sup> or its data or generally in relation to the offered securities, even in circumstances where SIX Swiss Exchange or its Licensors are aware that such loss or damage may occur.

The licensing Agreement between GS Finance Corp. and SIX Swiss Exchange is solely for their benefit and not for the benefit of the owners of the offered securities or any other third parties.

TOPIX

TOPIX (also referred to herein as the “index”), also known as the Tokyo Stock Price Index:

- is an equity index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- was first launched on July 1, 1969 with a base level of 100 as of January 4, 1968; and
- is sponsored, calculated published and disseminated by JPX Market Innovation & Research, Inc., which we refer to as JPXI.

TOPIX is a free-float adjusted market capitalization weighted index comprised of domestic common stocks listed on the Tokyo Stock Exchange (TSE) covering an extensive portion of the Japanese stock market. On April 4, 2022, JPXI began revisions to TOPIX in conjunction with the restructuring of the TSE into three new market segments: the Prime Market, Standard Market or Growth Market. Revisions to TOPIX will be carried out in stages from October 2022 to January 2025. Prior to April 4, 2022, TOPIX was comprised of all domestic common stocks listed on the First Section of the TSE. At that time, domestic stocks admitted to the TSE were assigned either to the TSE First Section, TSE Second Section, TSE Mothers or JASDAQ (Standard and Growth). Additional information about TOPIX (including the top ten constituent stocks and weights and sector weights) is available on the following website: [jpx.co.jp/english/markets/indices/topix/](http://jpx.co.jp/english/markets/indices/topix/). We are not incorporating by reference the website or any material it includes in this underlier supplement.

TOPIX Composition and Maintenance

As of April 4, 2022, TOPIX was comprised of all domestic common stocks listed on the TSE First Section as of April 1, 2022 (the business day before the TSE market restructuring), excluding certain types of securities such as subscription warrant securities and preferred equity contribution securities. During the period from April 4, 2022 to January 31, 2025, constituent revisions will be carried out in stages as described further below.

TOPIX Calculation

TOPIX is a free-float adjusted market capitalization weighted index, which reflects movements in the market capitalization as measured from a base index value of 100 set on the base date of January 4, 1968. The discussion below describes the “price return” calculation of TOPIX. The applicable pricing supplement will describe the calculation of TOPIX if the underlier for your securities is not the price return calculation.

JPXI calculates TOPIX by *multiplying* the base index value of 100 by the *quotient* of the current free-float-adjusted market value *divided* by the base market value. The resulting value is not expressed in Japanese yen but presented as a number of points, rounded to the nearest one hundredth. The formula for calculating TOPIX value can be expressed as follows:

Index value =

Base index value of 100 ×

Current free-float-adjusted market value

Base market value

The current free-float-adjusted market value is the sum of the products of the price times the number of free-float-adjusted shares for each constituent stock.

The number of free-float-adjusted shares for this calculation is the total number of listed shares multiplied by free-float weight multiplied by the cap-adjustment ratio. The total number of listed shares used for this purpose is usually the same as the number of actual listed shares. However, in some cases these numbers will differ as a consequence of the index methodology. For instance, in the case of a stock split, the number of listed shares will increase on the additional listing date after the stock split becomes effective; on the other hand, the number of listed shares for index calculation purposes will increase on the ex-rights date.

Free-float weight is the weight of listed shares deemed to be available for trading in the market, and is determined and calculated by JPXI for each constituent stock. It is calculated by *subtracting* the *quotient* of non-free-float shares *divided by* listed shares *from* one. Free-float weight is reviewed in order to reflect the latest distribution of share ownership. JPXI estimates non-free-float shares using published materials such as securities reports, and generally deems shares held by the top ten major shareholders (with certain exceptions), treasury stocks, shares held by members of the issuer’s board of directors to be unavailable for trading in the market and shares held by other listed companies for investment purposes other than pure investment. JPXI may deem other shares to be

unavailable for trading in the market. Securities deemed to be held by individuals indicated in the section of the state of corporate governance, etc. in the securities report will not be included in the estimation of non-free-float shares. The timing of the yearly free-float-weight review is different according to the settlement terms of listed companies. In addition to the yearly review, extraordinary reviews may be conducted for events JPXI expects will significantly affect the free-float weight. These include third-party allotment, when preferred shares are converted or subscription warrants are exercised, as well as in the event of a demerger, merger/stock-swap, take-over bid and other events JPXI judges deem will significantly affect free-float weight.

The upper weighting limit for any one constituent of TOPIX is 10%. If an issue's weight calculated by free-float adjusted market capitalization as of the last business day of every August is over the upper limit, a cap-adjustment ratio for adjustment of weight will be applied to said issue on the last business day of October. Even if the weight again exceeds the upper limit due to stock price movements or other reasons, the cap-adjustment ratio will not be changed until the last business day of the next October.

In the event of any increase or decrease in the current free-float-adjusted market value due to causes other than fluctuations in the stock market, such as public offerings, adjustments are made by JPXI to the base market value in order to maintain the continuity of TOPIX.

The adjusted base market value will equal the old base market value *multiplied* by the *quotient* of the free-float-adjusted market value on the business day before the adjustment date *plus* or *minus*, as applicable, the adjustment amount *divided* by the free-float-adjusted market value on the business day before the adjustment date.

The adjustment amount for the foregoing calculation will be an amount equal to the *product* of the change (the absolute value of the increase or decrease) in the number of shares used for index calculations *times* the price of the shares used for adjustment.

*Weighting Adjustments by Tradable Share Market Capitalization Criteria (only applicable from April 4, 2022 through January 31, 2025)*

(i) Designation of "phased weighting reduction constituents"

- Of the constituents as of April 1, 2022, those that fall under both the following (a) and (b) will be designated as "phased weighting reduction constituents":
  - (a) First decision: The constituent's tradable share market capitalization is less than JPY 10 billion as of the "Notice on Whether the Listed Company is Meeting the Continued Listing Criteria for New Market Segments", which has a base date of June 30, 2021, and
  - (b) Second decision: The constituent's tradeable share market capitalization is less than JPY 10 billion at the end of the reporting period following the reporting period used in decision (a).
- Any constituent applying for listing on the First Section through an initial listing (excluding technical listings) or section transfer after the "first set of revisions pertaining to cash equity market restructuring" were implemented on November 1, 2020 will not be subject to designation as a phased weighting reduction constituent based on tradable share market capitalization.

(ii) Adjustment to the weighting of phased weighting reduction constituents

- The weighting of phased weighting reduction constituents will be reduced in 10 stages on the last business day of every quarter starting on the last business day of October 2022 (October 31, 2022), and these constituents will be removed from the index on the last business day of January 2025.
- Said adjustments to the weighting of phased weighting reduction constituents will be calculated by multiplying the free-float weight by the transition factor (which will decrease from 1.0 to 0 in increments of 0.1)
- In order to check whether there have been changes to the tradeable share market capitalization of each phased weighting reduction constituent, a re-evaluation will be conducted, using tradable share market capitalization as of the end of the reporting period following the reporting period used for the second decision in (i)(b). If the tradable share market capitalization of a constituent has reached JPY 10 billion or more but the annual traded value ratio of said constituent has not reached 0.2 at this point, the transition factor will no longer decrease as of the fifth stage (it will stay at 0.6, the same as the fourth stage). If the tradable share market capitalization and the annual traded value ratio of a constituent have reached JPY 10 billion or more and 0.2 or more respectively at this point, the transition factor shall be increased to 1 in

increments of 0.1 from the fifth stage and said constituent will be removed from the list of phased weighting reduction constituents. The traded value ratio used for the re-evaluation in (ii) is calculated using the sum of monthly traded value ratios from September 2022 to August 2023. The monthly traded value ratio shall be calculated as follows: (Median of daily traded value in trading sessions at TSE *multiplied by* the number of business days in the month) *divided by* the free-float adjusted market capitalization as of the last business day of the month before the transition factor was applied.

#### Transition Schedule

Transition Stage	Index Revision Date	Transition Factor
1st	Last business day of October 2022	x0.9
2nd	Last business day of January 2023	x0.8
3rd	Last business day of April 2023	x0.7
4th	Last business day of July 2023	x0.6
	Re-evaluation	
5th	Last business day of October 2023	x0.5
6th	Last business day of January 2024	x0.4
7th	Last business day of April 2024	x0.3
8th	Last business day of July 2024	x0.2
9th	Last business day of October 2024	x0.1
10th (removed from TOPIX)	Last business day of January 2025	x0

#### Non-Periodic Removal

- Constituents which are delisted (excluding cases where the stock lists on another TSE market immediately), designated as securities to be delisted or designated as securities on special alert shall be removed
- If a constituent is designated as a security on special alert as of the day of transition to the new market structure (April 4, 2022), said constituent will be removed from TOPIX on the last business day of April 2022

#### Non-Periodic Inclusion

- Stocks which carry out initial listings (excluding technical listings) on or transfer to the Prime Market will be included in TOPIX on the last business day of the month following the month containing the listing date or transfer date.
- In the event a constituent of TOPIX is delisted due to a stock transfer, stock swap, merger for creating a new company or demerger, and the newly created, surviving or succeeding company is listed without delay, JPXI will add the new company to the index.
- In the event a constituent of TOPIX is delisted due to a stock swap or absorption-type merger, in which the surviving company or the parent company holding all shares of the constituent company is not a constituent of TOPIX, then JPXI will add the surviving company or the parent company to the index.
- For issues that are removed from the index due to designation as securities on special alert, but have had said designation cancelled as of the last business day of August 2023, if the company meets the same criteria as for the re-evaluation in "Adjustment to the weighting of phased weighting reduction constituents" above (i.e., tradeable share market capitalization of JPY 10 billion or more and annual traded value ratio of 0.2 or more), said company shall be added to TOPIX on the last business day of October 2023.



*Dates of Constituent Inclusion and Removal*

	<b>Event</b>	<b>Adjustment Date</b>	<b>Stock Price Used for Adjustment</b>
<b>Addition</b>	A company is to be newly listed on the Prime Market	Last business day of the month after such listing	Stock price at the end of trading on the business day before adjustment date
<b>Addition</b>	New listing of a newly formed company resulting from a corporate consolidation, stock transfer, stock swap, merger for creating a new company or demerger that results in a TOPIX constituent being delisted and the new company being included in TOPIX.	New listing date. If the initial listing date falls on a holiday, it will be the following business day	Base price
<b>Addition</b>	Delisting of a TOPIX constituent due to a stock swap or an absorption-type merger with a surviving stock that is not a TOPIX constituent, and the surviving stock is included in TOPIX	Delisting date	Stock price at the end of trading on the business day before adjustment date
<b>Addition</b>	A company is to be transferred to the Prime Market	Last business day of the month after such change	Stock price at the end of trading on the business day before adjustment date
<b>Deletion</b>	New listing of a newly formed company resulting from a corporate consolidation, stock transfer, stock swap, merger for creating a new company or demerger that results in a TOPIX constituent being delisted and the new company being included in TOPIX.	Listing date of the newly formed company (normally two business days following delisting date)	Stock price at the end of trading on the business day before the delisting date. The stock price at the end of trading on the business day before the delisting date is used to calculate TOPIX for the period from the delisting date to the removal date.
<b>Deletion</b>	A constituent is to be delisted due to a reason other than as described in the preceding scenario	Delisting date	Stock price at the end of trading on the business day before adjustment date
<b>Deletion</b>	A constituent's securities are designated to be delisted or designated as a security on special alert	Four business days after designation. If the designation date falls on a holiday, it will be the next business day.	Stock price at the end of trading on the business day before adjustment date

Changes in the number of shares and the price of the shares for adjustments to the base market value will be made as described in the table below.

### Change in the Number of Shares

Event	Adjustment Date	Stock Price Used for Adjustment
Change of free-float weight	Date of change	Stock price at the end of trading on the business day before adjustment date
Public offering	Additional listing date (day after payment date). If listing date falls on a holiday, it will be the next business day	Stock price at the end of trading on the business day before adjustment date
Allocation of new shares to a third party	Five business days after additional listing date (two business days after payment date)	Stock price at the end of trading on the business day before adjustment date
Capital increase through allotment to shareholders	Ex-rights date	Payment price per share
Exercise of subscription warrants	Last business day of the month following exercise	Stock price at the end of trading on the business day before adjustment date
Conversion of preferred shares	Last business day of the month following conversion	Stock price at the end of trading on the business day before adjustment date
Cancellation of treasury stock	Last business day of the month following cancellation	Stock price at the end of trading on the business day before adjustment date
Merger or stock swaps between a non-surviving constituent and another constituent	Delisting date of the non-surviving constituent	Stock price at the end of trading on the business day before adjustment date
Merger or stock swaps other than that described above (including the share delivery where the share delivery subsidiary is an unlisted company)	Listing change date (effective date)	Stock price at the end of trading on the business day before adjustment date
Rights offering (limited to case where the allotted subscription warrant securities are listed; the case where the allotted subscription warrant securities are not listed is treated as "Exercise of subscription warrants")	Ex-rights date	Payment price per share
Offering for sale of shares held by the Government of Japan (Nippon Telegraph, Telephone and Japan Tobacco and Japan Post Holdings only)	Date determined by JPXI (generally the delivery date)	Stock price at the end of trading on the business day before adjustment date
Demerger (absorption-type)	Listing change date (the effective date)	Stock price at the end of trading on the business day before adjustment date
Other adjustments	Last business day of the month in which the information appears in "Sho-ho" (TSE Notice) or the last business day of the following month	Stock price at the end of trading on the business day before adjustment date

No adjustments will be made to the base market value in the case of a stock split, reverse stock split, or gratis allotment of shares (limited to cases where treasury stock is allotted).

Retroactive adjustments will not be made to revise the figures of the index that have already been calculated and disseminated even if issuing companies file amendments on previously released information.

### *Market Disruption*

If trading in a certain constituent is halted, JPXI regards the constituent's share price for purposes of calculating TOPIX to be unchanged. Where an event that is not specified in the rules of TOPIX occurs, or if JPXI decides that it is impossible to use its existing methods to calculate TOPIX, JPXI may use an alternate method of index calculation as it deems valid.

### *License Agreement between JPXI and GS Finance Corp.*

GS Finance Corp. expects to enter into a license agreement with JPXI, in exchange for a fee, whereby GS Finance Corp. will be permitted to use TOPIX in connection with the offer and sale of the securities. Except for stock holdings our affiliates may have in JPXI, we are not affiliated with JPXI; the only relationship between JPXI and GS Finance Corp. is the licensing of the use of TOPIX and trademarks relating to TOPIX.

The securities are not sponsored, endorsed or promoted by JPXI. No inference should be drawn from the information contained in this underlier supplement that JPXI makes any representation or warranty, implied or express, to GS Finance Corp., any holder of the securities or any member of the public regarding the advisability of investing in securities generally or in the securities in particular or the ability of TOPIX to track general stock market performance.

JPXI determines, composes and calculates TOPIX without regard to the securities. JPXI has no obligation to take into account your interest, or that of anyone else having an interest, in the securities in determining, composing or calculating TOPIX. JPXI is not responsible for and has not participated in the determination of the terms, prices or amount of the securities and will not be responsible for or participate in any determination or calculation regarding the principal amount of the securities payable at the stated maturity date or upon redemption. JPXI has no obligation or liability in connection with the administration, marketing or trading of the securities.

Neither GS Finance Corp. nor any of its affiliates accepts any responsibility for the calculation, maintenance or publication of TOPIX or any successor index. JPXI disclaims all responsibility for any errors or omissions in the calculation and dissemination of TOPIX or the manner in which TOPIX is applied in determining any initial index level or final index level or any amount payable upon maturity or redemption of the securities.

TOPIX Index Value and TOPIX Marks are subject to the proprietary rights owned by JPXI and JPXI owns all rights and know-how relating to TOPIX such as calculation, publication and use of TOPIX Index Value and relating to TOPIX Marks. JPXI shall reserve the rights to change the methods of calculation or publication, to cease the calculation or publication of TOPIX Index Value or to change TOPIX Marks or cease the use thereof. JPXI makes no warranty or representation whatsoever, either as to the results stemmed from the use of TOPIX Index Value and TOPIX Marks or as to the figure at which TOPIX Index Value stands on any particular day. JPXI gives no assurance regarding accuracy or completeness of TOPIX Index Value and data contained therein. Further, JPXI shall not be liable for the miscalculation, incorrect publication, delayed or interrupted publication of TOPIX Index Value. No securities are in any way sponsored, endorsed or promoted by JPXI. JPXI shall not bear any obligation to give an explanation of the securities or an advice on investments to any purchaser of the securities or to the public. JPXI neither selects specific stocks or groups thereof nor takes into account any needs of the issuing company or any purchaser of the securities, for calculation of TOPIX Index Value. Including but not limited to the foregoing, JPXI shall not be responsible for any damage resulting from the issue and sale of the securities.

## **Non-Seasonally Adjusted U.S. City Average All Items Consumer Price Index for All Urban Consumers**

The non-seasonally adjusted U.S. City Average All Items Consumer Price Index for All Urban Consumers, which we also refer to in this description as the “CPI”:

- is a consumer price index, and therefore cannot be invested in directly;
- does not file reports with the SEC because it is not an issuer;
- is reported monthly by the Bureau of Labor Statistics of the U.S. Department of Labor (“BLS”).

The CPI is a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services, including food, clothing, shelter, fuels, transportation, doctors’ and dentists’ services, drugs and other goods and services that people buy for day-to-day living. The BLS sets the average CPI level for the base reference period - the 36-month period covering 1982, 1983 and 1984 - equal to 100, and then measures changes in relation to that figure. The CPI for a particular month is published during the following month.

In calculating the CPI, price changes for the various items are averaged together with weights that represent their importance in the spending of urban households in the United States. The contents of the market basket of goods and services and the weights assigned to the various items are updated periodically by the BLS to take into account changes in consumer buying habits or shifts in population distribution or demographics.

Additional information about the CPI is available on the following website: [bls.gov/cpi/](https://bls.gov/cpi/). We are not incorporating by reference the website or any material it includes in this underlier supplement.

### ***Whose buying habits does the CPI reflect?***

The CPI reflects spending patterns for each of two population groups: all urban consumers and urban wage earners and clerical workers. The all urban consumer group represents over 90 percent of the total U.S. population. It is based on the expenditures of almost all residents of urban or metropolitan areas, including professionals, the self-employed, the unemployed, and retired people, as well as urban wage earners and clerical workers. Not included in the CPI are the spending patterns of people living in rural nonmetropolitan areas, those in farm households, people in the Armed Forces, and those in institutions, such as prisons and mental hospitals.

### ***What goods and services are covered by the CPI?***

The CPI represents all goods and services purchased for consumption by all urban consumers. The market basket of consumer goods and services is developed from detailed expenditure information provided by families and individuals on what they actually bought. The BLS classifies all expenditure items into more than 200 categories, arranged into eight major groups. Major groups and examples of categories in each are as follows:

- Food and beverages: breakfast cereal, milk, coffee, chicken, wine, full service meals and snacks;
- Housing: rent of primary residence, owners' equivalent rent, utilities and bedroom furniture;
- Apparel: men's shirts and sweaters, women's dresses, baby clothes, shoes and jewelry;
- Transportation: new vehicles, airline fares, gasoline and motor vehicle insurance;
- Medical care: prescription drugs, medical equipment and supplies, physicians' services, eyeglasses and eye care and hospital services;
- Recreation: televisions, toys, pets and pet products, sports equipment and park and museum admissions;
- Education and communication: college tuition, postage, telephone services, computer software and accessories; and
- Other goods and services: tobacco and smoking products, haircuts and other personal services and funeral expenses.

Also included within these major groups are various government-charged user fees, such as water and sewerage charges, auto registration fees, and vehicle tolls. In addition, the CPI includes taxes (such as sales and excise taxes) that are directly associated with the prices of specific goods and services. However, the CPI excludes taxes (such as income and Social Security taxes) not directly associated with the purchase of consumer goods and services. The CPI also does not include investment items, such as stocks, bonds, real estate, and life

insurance because these items relate to savings, and not to day-to-day consumption expenses. For each of the item categories, using scientific statistical procedures, the BLS has chosen samples of several hundred specific items within selected business establishments frequented by consumers to represent the thousands of varieties available in the marketplace.

#### ***How is price data collected and reviewed?***

Each month, BLS data collectors visit (in person or on the web) or call thousands of retail stores, service establishments, rental units, and doctors' offices, all over the United States, to obtain information on the prices of the thousands of items used to track and measure price changes in the CPI. These data collectors record the prices of about 80,000 items each month, representing a scientifically selected sample of the prices paid by consumers for goods and services purchased. During each call or visit, the economic assistant collects price data on a specific good or service that was precisely defined during an earlier visit. If the selected item is available, the economic assistant records its price. If the selected item is no longer available, or if there have been changes in the quality or quantity of the good or service since the last time prices were collected, the data collector selects a new item or records the quality change in the current item. Data on prices for goods and services are collected each month in 75 urban areas across the country from about 6,000 housing units and approximately 22,000 retail establishments, which include department stores, supermarkets, hospitals, filling stations, and other types of stores and service establishments. All taxes directly associated with the purchase and use of items are included in the CPI. Data on rents are collected from about 50,000 landlords or tenants. Prices of fuels and a few other items are obtained every month in all 75 locations. Prices of most other commodities and services are collected every month in the three largest geographic areas and every other month in other areas.

The recorded information is sent to the national office of BLS, where specialists who have detailed knowledge about the particular goods or services priced review the data. These specialists check the data for accuracy and consistency, and make any necessary corrections or adjustments, which can range from an adjustment for a change in the size or quantity of a packaged item, to more complex adjustments based upon statistical analysis of the value of an item's features or quality. Thus, commodity specialists strive to prevent changes in the quality of items from affecting the CPI's measurement of price change.

#### ***How is the CPI calculated?***

The CPI is a product of a series of interrelated samples. First, using data from the U.S. Census, the BLS selects the urban areas from which data on prices are collected. Next, a sample of data from the Consumer Expenditure Survey identifies the places where households purchase various types of goods and services, forming the basis for the CPI's outlet sample. Also using data from the Consumer Expenditure Survey, the BLS statisticians assign quotes in the CPI item categories to specific outlets. A specific item is then chosen for selection using a process which bases the probability of selection for an item on the share the item composes within the outlet's revenue in that item category.

Recorded price changes are weighted by the importance of the item in the spending patterns of the appropriate population group. The combination of carefully selected geographic areas, retail establishments, commodities and services, and associated weight, gives a weighted measurement of price change for all items in all outlets, in all areas priced for the CPI.

In calculating the CPI, price changes for the various items in each location are averaged together based on their weights, which represent their importance in the spending of the appropriate population group. Local data are then aggregated to obtain a U.S. city average and converted to a CPI to show price changes for the United States as a whole. The level of the CPI is considered final when released.

#### ***Will the CPI be updated or revised?***

The CPI is subject to revision by the BLS. For example, the BLS revises the CPI to account for significant changes in consumer buying habits or shifts in population distribution or demographics. In addition, the census conducted every 10 years by the U.S. Census Bureau provides information that enables the BLS to reselect a new geographic sample that accurately reflects the current population distribution and other demographic factors. Also, as a matter of policy, the BLS researches statistical methods to apply to the calculation of the CPI. Thus, even between major revisions, further update or revisions to the CPI are made.

#### ***Is the CPI adjusted for seasonal changes?***

The CPI is not adjusted to remove the effect of seasonal influences — those which occur at the same time and in about the same magnitude every year. Among these influences are price movements resulting from changing

weather conditions, production cycles, changeovers of models, and holidays. Accordingly, it may be difficult to tell whether changes in the CPI between any two months reflect changing economic conditions or only normal seasonal patterns.

***What are some of the limitations of the CPI?***

The CPI may not be applicable to all population groups. For example, the CPI is designed to measure inflation for the U.S. urban population and thus may not accurately reflect the experience of people living in rural areas. Also, the CPI does not produce official estimates for the rate of inflation experienced by subgroups of the population, such as the elderly or the poor.

Another limitation is that the CPI cannot be used to measure differences in price levels or living costs between one area and another as it measures only time-to-time changes in each area. A higher index for one area does not necessarily mean that prices are higher there than in another area with a lower index. Instead, it means that prices have risen faster in the area with the higher index calculated from the two areas' common reference period. Additionally, the CPI is a conditional cost-of-living measure; it does not attempt to measure everything that affects living standards. Factors such as social and environmental changes and changes in income taxes are beyond the definitional scope of the CPI and are excluded.

The CPI is a measure of prices based on a sample of items, and therefore differs somewhat from what the results would be if the actual records of all retail purchases by everyone in the index population could be used to compile the CPI. These estimating or sampling errors are limitations in the accuracy of the CPI, not mistakes in calculating the CPI. The BLS calculates and publishes estimates of the 1-month, 2-month, 6-month and 12-month percent change standard errors annually for the CPI.

Furthermore, non-sampling errors occur from a variety of sources. Unlike sampling errors, they can cause persistent bias in measurements of the CPI. Non-sampling errors are caused by problems of price data collection, logistical lags in conducting surveys, difficulties in defining basic concepts and their operational implementation, and difficulties in handling the problems of quality change. Non-sampling errors can be far more hazardous to the accuracy of a price index than sampling errors.

We have not authorized anyone to provide any information or to make any representations other than those contained in or incorporated by reference in this underlier supplement no. 42, the accompanying prospectus supplement or the accompanying prospectus. We take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may provide. This underlier supplement no. 42 is an offer to sell only the securities offered hereby, but only under circumstances and in jurisdictions where it is lawful to do so. The information contained in this underlier supplement no. 42, the accompanying prospectus supplement and the accompanying prospectus is current only as of the respective dates of such documents.

TABLE OF CONTENTS

Underlier Supplement No. 42

<a href="#">Additional Risk Factors Specific to the Securities</a>	Page
<a href="#">The Underliers</a>	S-2
<a href="#">Dow Jones Industrial Average®</a>	S-17
<a href="#">Dow Jones Industrial Average Futures Excess Return Index</a>	S-19
<a href="#">Dow Jones U.S. Select Dividend Index</a>	S-23
<a href="#">EURO STOXX 50® Index</a>	S-26
<a href="#">FTSE® 100 Index</a>	S-36
<a href="#">MSCI Indices</a>	S-42
<a href="#">MSCI USA Momentum Top 50 Select Index</a>	S-49
<a href="#">Nasdaq-100 Futures Excess Return™ Index</a>	S-57
<a href="#">Nasdaq-100 Index®</a>	S-61
<a href="#">Nasdaq-100 Technology Sector Index</a>	S-65
<a href="#">Nikkei 225</a>	S-74
<a href="#">Russell 2000® Futures Excess Return Index</a>	S-80
<a href="#">Russell 2000® Index</a>	S-84
<a href="#">Russell 2000® Value Index</a>	S-87
<a href="#">S&amp;P/ASX 200 Index</a>	S-94
<a href="#">S&amp;P 500® Daily Risk Control 5% USD Excess Return Index</a>	S-103
<a href="#">S&amp;P 500® Daily Risk Control 10% USD Excess Return Index</a>	S-110
<a href="#">S&amp;P 500® Futures Excess Return Index</a>	S-114
<a href="#">S&amp;P 500® Futures Volatility Plus Daily Risk Control Index</a>	S-118
<a href="#">S&amp;P 500® Index</a>	S-121
<a href="#">S&amp;P 500® Value Index</a>	S-124
<a href="#">S&amp;P 500® Volatility Plus Daily Risk Control Index</a>	S-131
<a href="#">S&amp;P MidCap 400® Index</a>	S-135
<a href="#">Swiss Market Index</a>	S-138
<a href="#">TOPIX</a>	S-146
<a href="#">Non-Seasonally Adjusted U.S. City Average All Items Consumer Price Index for All Urban Consumers</a>	S-150
	S-156

**GS Finance Corp.**

Medium-Term Notes, Series F

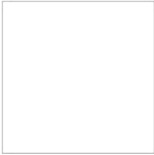
Warrants, Series G

guaranteed by

**The Goldman Sachs Group, Inc.**

**Underlier Supplement**

Securities Linked to the Performance of One or More Indices



**Goldman Sachs & Co. LLC**

