

**Underlying supplement no. 2-I**  
*To the prospectus dated April 5, 2018 and  
the prospectus supplement dated April 5, 2018*

**Registration Statement Nos. 333-222672  
and 333-222672-01**  
**Dated April 5, 2018**  
**Rule 424(b)(2)**

## **JPMORGAN CHASE & CO.**

***Notes Linked to the S&P Economic Cycle Factor Rotator Index***

## **JPMORGAN CHASE FINANCIAL COMPANY LLC**

***Notes, Fully and Unconditionally Guaranteed by JPMorgan Chase & Co., Linked to the S&P Economic Cycle Factor Rotator Index***

Each of JPMorgan Chase & Co. and JPMorgan Chase Financial Company LLC may, from time to time, offer and sell notes linked in whole or in part to the S&P Economic Cycle Factor Rotator Index (the “**Index**”). The issuer of the notes, as specified in the relevant terms supplement, is referred to in this underlying supplement as the “**Issuer**.” The Issuer will be either JPMorgan Chase & Co. or JPMorgan Chase Financial Company LLC. For notes issued by JPMorgan Chase Financial Company LLC, JPMorgan Chase & Co., in its capacity as guarantor of those notes, is referred to in this product supplement as the “**Guarantor**.”

This underlying supplement describes the Index and the relationship between JPMorgan Chase & Co., JPMorgan Chase Financial Company LLC and the sponsor of the Index and provides other information. This underlying supplement supplements the terms described in the accompanying product supplement, the prospectus supplement and the prospectus. A separate term sheet or pricing supplement, as the case may be, will describe terms that apply to specific issuances of the notes. These term sheets and pricing supplements are referred to generally in this underlying supplement as terms supplements. If the terms described in the relevant terms supplement are inconsistent with those described in this underlying supplement, any other accompanying underlying supplement, the accompanying product supplement, the prospectus supplement or the prospectus, the terms described in the relevant terms supplement will control. In addition, if this underlying supplement and the accompanying product supplement or another accompanying underlying supplement contain information relating to the Index, the information contained in the document with the most recent date will control.

The Index’s component equity indices reflect the daily deduction of a notional financing cost.

**Investing in the notes involves a number of risks. See “Risk Factors” in the accompanying product supplement and “Risk Factors” beginning on page US-6 of this underlying supplement.**

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of the notes or passed upon the accuracy or the adequacy of the relevant terms supplement, this underlying supplement, any other accompanying underlying supplement, the accompanying product supplement, the prospectus supplement or the prospectus. Any representation to the contrary is a criminal offense.

***The notes are not bank deposits, are not insured by the Federal Deposit Insurance Corporation or any other governmental agency and are not obligations of, or guaranteed by, a bank.***

**J.P.Morgan**

April 5, 2018

## TABLE OF CONTENTS

	<u>Page</u>
Supplemental Terms of Notes.....	US-1
Risk Factors .....	US-6
The S&P Economic Cycle Factor Rotator Index .....	US-19
Background on the Chicago Fed National Activity Index.....	US-30
Background on the S&P Momentum United States LargeMidCap Index .....	US-32
Background on the S&P 500 <sup>®</sup> Pure Value Index .....	US-36
Background on the S&P 500 <sup>®</sup> Buyback FCF Index .....	US-40
Background on the S&P 500 <sup>®</sup> Low Volatility High Dividend Index .....	US-43
Background on the S&P 5-Year U.S. Treasury Note Futures Excess Return Index .....	US-46
Background on the S&P 500 <sup>®</sup> Index .....	US-48

The Issuer and the Guarantor (if applicable) have not authorized anyone to provide any information other than that contained or incorporated by reference in the relevant terms supplement, this underlying supplement, any other accompanying underlying supplement, the accompanying product supplement, the prospectus supplement or the prospectus with respect to the notes offered by the relevant terms supplement and with respect to the Issuer and the Guarantor (if applicable). The Issuer and the Guarantor (if applicable) take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may give you. The relevant terms supplement, together with this underlying supplement, any other accompanying underlying supplement, the accompanying product supplement, the prospectus supplement and the prospectus, will contain the terms of the notes and will supersede all other prior or contemporaneous oral statements as well as any other written materials including preliminary or indicative pricing terms, correspondence, trade ideas, structures for implementation, sample structures, fact sheets, brochures or other educational materials of the Issuer. The information in each of the relevant terms supplement, this underlying supplement, any other accompanying underlying supplement, the accompanying product supplement, the prospectus supplement and the prospectus may be accurate only as of the date of that document.

The notes are not appropriate for all investors and involve a number of risks and important legal and tax consequences that should be discussed with your professional advisers. You should be aware that the regulations of Financial Industry Regulatory Authority, Inc., or FINRA, and the laws of certain jurisdictions (including regulations and laws that require brokers to ensure that investments are suitable for their customers) may limit the availability of the notes. The relevant terms supplement, this underlying supplement, any other accompanying underlying supplement, the accompanying product supplement, the prospectus supplement and the prospectus do not constitute an offer to sell or a solicitation of an offer to buy the notes under any circumstances in which that offer or solicitation is unlawful.

In this underlying supplement, “we,” “us” and “our” refer to the Issuer, unless the context requires otherwise, and “JPMorgan Financial” refers to JPMorgan Chase Financial Company LLC. To the extent applicable, the index described in this underlying supplement is deemed to be one of the “Indices” referred to in the accompanying product supplement.

## SUPPLEMENTAL TERMS OF NOTES

*The following supplemental terms of the notes supplement, and to the extent they are inconsistent, supersede, the description of the general terms of the debt securities set forth in the accompanying product supplement and under the headings “Description of Notes” in the prospectus supplement and “Description of Debt Securities” in the prospectus. Capitalized terms used but not defined in this underlying supplement have the meanings assigned in the relevant terms supplement, any other accompanying underlying supplement, the accompanying product supplement, the prospectus supplement and the prospectus.*

### General

The notes are linked in whole or in part to the S&P Economic Cycle Factor Rotator Index (the “**Index**”). The Index tracks the return of a notional dynamic portfolio consisting of (a) one of four excess price return U.S. equity indices (each, an “**Underlying Equity Index**”) as set forth below and (b) the S&P 5-Year U.S. Treasury Note Futures Excess Return Index (the “**Underlying Treasury Index**”), while seeking to maintain an annualized realized volatility approximately equal to 6.0% (the “**Target Volatility**”).

- Each Underlying Equity Index seeks to provide exposure to the price change, less a notional financing cost deducted on a daily basis, of U.S. companies exhibiting one of the following sets of characteristics: momentum, value, high buybacks and free cash flows, or high dividends and low volatility. On a monthly basis, the Index selects one of the four Underlying Equity Indices based on the stage of the U.S. business cycle inferred from the recent trend and average level of the Chicago Fed National Activity Index (“**CFNAI**”). The CFNAI is a weighted average of 85 monthly indicators of national economic activity. See “Background on the Chicago Fed National Activity Index” in this underlying supplement for additional information about the CFNAI. Each Underlying Equity Index is an “excess price” return index because it does not reflect reinvestment of dividends and other distributions and its performance is reduced by a notional financing cost.
- The Underlying Treasury Index seeks to track the performance of a rolling position in the 5-Year U.S. Treasury Note futures contract. The Underlying Treasury Index is an “excess return” index and not a “total return” index because it does not reflect interest that could be earned on funds notionally committed to the trading of futures contracts. Negative roll returns associated with futures contracts may adversely affect the performance of the Underlying Treasury Index. For additional information, see “Background on the S&P 5-Year U.S. Treasury Note Futures Excess Return Index” below.

To achieve this, the Index selects from four sub-indices (each, a “**Sub-Index**”), each tracking the return of a notional dynamic portfolio consisting of one Underlying Equity Index and the Underlying Treasury Index, while seeking to maintain an annualized realized volatility approximately equal to the Target Volatility. The relevant Underlying Equity Index and the Underlying Treasury Index are each referred to as an “**Underlying Index**.” The Index allocates its entire exposure to one Sub-Index based on the stage of the U.S. business cycle inferred from the recent trend and average level of the CFNAI. For additional information, see “The S&P Economic Cycle Factor Rotator Index — Allocation to a Sub-Index Based on U.S. Business Cycle Stage” below.

Under normal market conditions, each Underlying Equity Index’s realized volatility has tended to be relatively more variable than the Underlying Treasury Index’s realized volatility. Consequently, and because the Index and each Sub-Index seek to maintain an annualized realized volatility approximately equal to the Target Volatility, the Index and each Sub-Index’s methodology may be more likely to shift exposure from the relevant Underlying Equity Index to the Underlying Treasury Index during periods of relatively higher market volatility and to shift exposure from the Underlying Treasury Index to the relevant Underlying Equity Index under normal market conditions exhibiting relatively lower market volatility.

In general, equity markets have historically been more likely to outperform fixed-income markets during periods of relatively lower market volatility and to underperform fixed-income markets during

periods of relatively higher market volatility. However, there can be no assurance that the Index or any Sub-Index's allocation strategy will achieve its intended results, or that the Index or any Sub-Index will outperform any alternative index or strategy that might reference the relevant Underlying Indices. Past performance should not be considered indicative of future performance.

In any initial selection between two eligible notional portfolios, each Sub-Index (and, therefore, the Index) will select the portfolio that has the higher allocation to the Underlying Index with a higher realized volatility, as described under "The S&P Economic Cycle Factor Rotator Index — Determining the Preliminary Portfolio of a Sub-Index for a Volatility Measure" below, which generally will cause the relevant Underlying Equity Index to receive a higher allocation than if the portfolio that has the higher allocation to the Underlying Index with a lower realized volatility were selected.

Furthermore, under normal market conditions, each Underlying Equity Index's realized volatility has tended to be significantly higher than the Underlying Treasury Index's realized volatility. Past performance should not be considered indicative of future performance. Under circumstances where an Underlying Equity Index's realized volatility is significantly higher than that of the Underlying Treasury Index, the performance of the relevant Sub-Index (and, therefore, of the Index) is expected to be influenced to a greater extent by the performance of the relevant Underlying Equity Index than by the performance of the Underlying Treasury Index, unless the weight of the Underlying Treasury Index is significantly greater than the weight of the relevant Underlying Equity Index.

Consequently, even in cases where the allocation to the Underlying Treasury Index is greater than the allocation to the relevant Underlying Equity Index, the relevant Sub-Index (and, therefore, the Index) may be influenced to a greater extent by the performance of the relevant Underlying Equity Index than by the performance of the Underlying Treasury Index because, under some conditions, the greater allocation to the Underlying Treasury Index will not be sufficiently large to offset the greater realized volatility of the relevant Underlying Equity Index.

The notional financing cost is intended to approximate the cost of maintaining a position in the relevant Underlying Equity Index using borrowed funds and is currently calculated as a composite rate of interest that is intended to track the overnight rate of return of a notional position in a 3-month time deposit in U.S. dollars, which is calculated by referencing the 2-month and 3-month USD LIBOR rates. LIBOR, which stands for "London Interbank Offered Rate," is the average interest rate estimated by leading banks in London that they would be charged if borrowing from other banks without pledging any collateral or security.

For additional information about the Index, see "The S&P Economic Cycle Factor Rotator Index" below.

This underlying supplement describes the Index and the relationship between JPMorgan Chase & Co., JPMorgan Chase Financial Company LLC and the sponsor of the Index and provides other information. This underlying supplement supplements the terms described in the accompanying product supplement, the prospectus supplement and the prospectus. A separate term sheet or pricing supplement, as the case may be, will describe terms that apply to specific issuances of the notes. These term sheets and pricing supplements are referred to generally in this underlying supplement as terms supplements. If the terms described in the relevant terms supplement are inconsistent with those described in this underlying supplement, any other accompanying underlying supplement, the accompanying product supplement, the prospectus supplement or the prospectus, the terms described in the relevant terms supplement will control. In addition, if this underlying supplement and the accompanying product supplement or another accompanying underlying supplement contain information relating to the Index, the information contained in the document with the most recent date will control.

## **Postponement of a Determination Date**

### ***Notes Linked Solely to the Index***

Notwithstanding any contrary provision in the accompanying product supplement, for notes linked solely to the Index, the following provisions will apply. If a Determination Date (as defined in the accompanying product supplement) is a Disrupted Day (as defined in the accompanying product supplement), the applicable Determination Date will be postponed to the immediately succeeding scheduled trading day that is not a Disrupted Day.

In no event, however, will any Determination Date be postponed to a date that is after the applicable Final Disrupted Determination Date (as defined in the accompanying product supplement). If a Determination Date is or has been postponed to the applicable Final Disrupted Determination Date and that day is a Disrupted Day, the calculation agent will determine the closing level of the Index for that Determination Date on that Final Disrupted Determination Date in accordance with the formula for and method of calculating the closing level of the Index last in effect prior to the commencement of the market disruption event (or prior to the non-trading day), using:

- (a) for any Underlying Index, the official closing level of that Underlying Index (or, if a market disruption event or a non-trading day that affected that Underlying Index has occurred, the closing level of that Underlying Index determined by the calculation agent in accordance with the formula for and method of calculating the closing level of that Underlying Index last in effect prior to the commencement of the market disruption event (or prior to the non-trading day), using the calculation agent's good faith estimate of the closing price, settlement price or other trading price or level of each security or futures contract most recently composing that Underlying Index that would have prevailed but for that suspension or limitation or non-trading day) on the scheduled trading day immediately preceding that Final Disrupted Determination Date and, with respect to the Underlying Treasury Index, any futures contract required to roll any expiring futures contract in accordance with the method of calculating the Underlying Treasury Index; and
- (b) the relevant interest rates associated with the notional financing cost (or, if such interest rates are not published on that day, the calculation agent's good faith estimate of such interest rates) on the scheduled trading day immediately preceding that Final Disrupted Determination Date.

### ***Notes Linked to the Index and Other Reference Assets***

If the notes are linked to the Index and other reference assets, the provisions relating to postponement of a Determination Date as set forth in the accompanying product supplement will apply, except that if a Determination Date is or has been postponed to the applicable Final Disrupted Determination Date and, on that day, the closing level of the Index has not been established in accordance with the postponement provisions of the accompanying product supplement that apply prior to the applicable Final Disrupted Determination Date, the closing level of the Index for that Determination Date will be determined by the calculation agent on the applicable Final Disrupted Determination Date in accordance with the formula for and method of calculating the closing level of the Index last in effect prior to the commencement of the market disruption event (or prior to the non-trading day), using:

- (a) for any Underlying Index, the official closing level of that Underlying Index (or, if a market disruption event or a non-trading day that affected that Underlying Index has occurred, the closing level of that Underlying Index determined by the calculation agent in accordance with the formula for and method of calculating the closing level of that Underlying Index last in effect prior to the commencement of the market disruption event (or prior to the non-trading day), using the calculation agent's good faith estimate of the closing price, settlement price or other trading price or level of each security or futures contract most recently composing that Underlying Index that would have prevailed but for that suspension or limitation or non-trading day) on the scheduled trading day immediately preceding that Final Disrupted Determination Date and, with respect to the Underlying Treasury Index, any futures contract required to roll any expiring futures contract in accordance with the method of calculating the Underlying Treasury Index; and

- (b) the relevant interest rates associated with the notional financing cost (or, if such interest rates are not published on that day, the calculation agent's good faith estimate of such interest rates) on the scheduled trading day immediately preceding that Final Disrupted Determination Date.

### **Additional Defined Terms**

Notwithstanding any contrary definition in the accompanying product supplement, a “**scheduled trading day**” is, unless otherwise specified in the relevant terms supplement, a day, as determined by the calculation agent, on which (a) each of the following exchanges is scheduled to be open for trading for their respective regular trading sessions: the relevant exchange for the Underlying Indices and the principal options and futures exchanges relating to the Underlying Indices, and (b) banking institutions in the City of New York are not scheduled to be authorized or required by law, regulation or executive order to close.

Notwithstanding anything to the contrary in the accompanying product supplement, a “**trading day**” is, unless otherwise specified in the relevant terms supplement, a day, as determined by the calculation agent, on which (a) trading is generally conducted on the relevant exchange for the Underlying Indices and the principal options and futures exchanges relating to the Underlying Indices and (b) banking institutions in the City of New York are not otherwise authorized or required by law, regulation or executive order to close.

Notwithstanding any contrary definition in the accompanying product supplement, “**relevant exchange**” means, with respect to an Underlying Index, the primary exchange or market of trading for any security or futures contract (or any combination thereof) included in that Underlying Index.

### **Market Disruption Events**

Notwithstanding any contrary provision in the accompanying product supplement, the following provisions will apply to notes linked in whole or in part to the Index. With respect to the Index or any relevant successor index (as defined in the accompanying product supplement), a “**market disruption event**,” unless otherwise specified in the relevant terms supplement, means:

- (1) any suspension of, or limitation on, trading imposed by the relevant exchange for any Underlying Index;
- (2) any other event has occurred that disrupts or impairs the ability of market participants in general to effect transactions in, or obtain market values for, (a) any Underlying Index, (b) any securities that compose 20% or more of the level of an Underlying Equity Index or (c) any futures contracts that compose the Underlying Treasury Index;
- (3) the closure of any relevant exchange for any Underlying Index prior to its scheduled closing time unless that earlier closing time is announced at least one hour prior to the actual closing time;
- (4) if the relevant exchange establishes limits on the range within which the price of any futures contract included in the Underlying Treasury Index may fluctuate, the official settlement price of that futures contract is at the upper or lower limit of that range on that day;
- (5) the failure of the relevant exchange with respect to any Underlying Index to open;
- (6) the closure of a material number of leading commercial banks in the City of New York prior to their scheduled weekday closing time;
- (7) the failure of the administrator or publisher of the relevant interest rates associated with the notional financing cost (or any other relevant entity) to report those interest rates; or
- (8) the failure of the Index Calculation Agent to calculate and publish the official closing level of the Index (or that successor Index),

in each case as determined by the calculation agent in its sole discretion; and

- in the case of an event described in clause (1), (2), (3) or (4) above, a determination by the calculation agent in its sole discretion that the applicable event described above materially interfered with our ability or the ability of any of our affiliates to adjust or unwind all or a material portion of any hedge with respect to the notes.

A limitation on the hours or number of days of trading will not constitute a market disruption event with respect to the Index or any relevant successor index if the limitation results from an announced change in the regular business hours of the relevant exchange or market.

#### **Discontinuation of the Index; Alteration of Method of Calculation**

The provisions relating to the discontinuation of an index as set forth in the accompanying product supplement will apply, except that if the calculation agent is to determine the closing level of the Index or any successor index for any Determination Date because no successor index is available at that time, or the calculation agent has previously selected a successor index and publication of that successor index is discontinued prior to, and that discontinuation is continuing on, that Determination Date or other relevant date, then the closing level of the index will be computed by the calculation agent in accordance with the formula for and method of calculating the index or successor index, as applicable, last in effect prior to that discontinuation, using:

- (a) for any Underlying Index, the official closing level of that Underlying Index (or, if a market disruption event or a non-trading day that affected that Underlying Index has occurred, the closing level of that Underlying Index determined by the calculation agent in accordance with the formula for and method of calculating the closing level of that Underlying Index last in effect prior to the commencement of the market disruption event (or prior to the non-trading day), using the calculation agent's good faith estimate of the closing price, settlement price or other trading price or level of each security or futures contract most recently composing that Underlying Index that would have prevailed but for that suspension or limitation or non-trading day) on that date and, with respect to the Underlying Treasury Index, any futures contract required to roll any expiring futures contract in accordance with the method of calculating the Underlying Treasury Index; and
- (b) the relevant interest rates associated with the notional financing cost (or, if such interest rates are not published on that day, the calculation agent's good faith estimate of such interest rates) on that date.

## RISK FACTORS

Your investment in the notes will involve certain risks. Investing in the notes is not equivalent to investing directly in the Index or any of its component securities or futures contracts. ***You should consider carefully the following discussion of risks, as well as the discussion of risks included in the relevant terms supplement, the accompanying product supplement and any other accompanying underlying supplement, before you decide that an investment in the notes is suitable for you.***

### Risks Relating to the Index and the Sub-Indices

#### **Our affiliate, J.P. Morgan Securities LLC, helped develop the Index and the Sub-Indices.**

One of our affiliates, J.P. Morgan Securities LLC, which we refer to as JPMS, worked with S&P Dow Jones Indices LLC (“**S&P Dow Jones**”) in developing the guidelines and policies governing the composition and calculation of the Index and the Sub-Indices. Although judgments, policies and determinations concerning the Index and the Sub-Indices were made by JPMS, JPMorgan Chase & Co., as the ultimate parent company of JPMS, ultimately controls JPMS.

In addition, the policies and judgments for which JPMS was responsible could have an impact, positive or negative, on the levels of the Index and the Sub-Indices and the value of your notes. JPMS is under no obligation to consider your interests as an investor in the notes in its role in developing the guidelines and policies governing the Index and the Sub-Indices or making judgments that may affect the levels of the Index and the Sub-Indices. Furthermore, the inclusion of equity securities or futures contracts in the Index is not an investment recommendation by us or JPMS of the equity securities or futures contracts underlying the Index.

#### **The Index and the Sub-Indices may not be successful or outperform any alternative strategies that might be employed in respect of the CFNAI and the Underlying Indices.**

On a monthly basis, the Index allocates its entire exposure to one of four Sub-Indices, and thereby allocates its equity exposure to one of four Underlying Equity Indices, each providing exposure to U.S. companies with specified characteristics, based on the stage of the U.S. business cycle inferred from the recent trend and average level of the CFNAI. No assurance can be given that the inferred stage of the U.S. business cycle will be reflective of the actual current stage of the U.S. business cycle. Because the CFNAI is a backward-looking measure that reflects data from the preceding month, and because the Index references the 3-month average of the CFNAI, such inferred U.S. business cycle for purposes of the Index may lag behind the actual U.S. business cycle. In addition, no assurance can be given that the strategy the Index employs with respect to any U.S. business cycle stage is appropriate for that business cycle stage or will outperform any of the other strategies or any alternative investment strategy.

Each Sub-Index (and, therefore, the Index) tracks the return of a notional dynamic portfolio consisting of (a) an Underlying Equity Index and (b) the Underlying Treasury Index, while seeking to maintain an annualized realized volatility approximately equal to the Target Volatility of 6.0%. Each Sub Index (and, therefore, the Index) seeks to maintain an annualized realized volatility approximately equal to the Target Volatility by rebalancing its exposures to the relevant Underlying Indices on each day based on two measures of realized portfolio volatility: a shorter-term volatility measure and a longer-term volatility measure. Each volatility measure reflects an exponentially weighted moving average, meaning that greater weight is assigned to more recent performance and less weight is assigned to less recent performance. By seeking to maintain an annualized realized volatility approximately equal to the Target Volatility, the Index and each Sub-Index may underperform an alternative strategy that seeks to maintain a higher annualized realized volatility or an alternative strategy that does not seek to maintain a level volatility.

In addition, on each day, each Sub-Index (and, therefore, the Index) generally selects the notional portfolio identified for the volatility measure that has the lower allocation to the relevant Underlying Equity Index as the notional portfolio to be tracked by that Sub-Index (and, therefore, the Index). Each Sub-



Index's (and, therefore, the Index's) selection of the notional portfolio with the lower allocation to the relevant Underlying Equity Index may be more likely to result in that Sub-Index (and, therefore, the Index) tracking a notional portfolio with a lower realized volatility than if that Sub-Index (and, therefore, the Index) were to select the notional portfolio with the higher allocation to the relevant Underlying Equity Index.

No assurance can be given that the investment strategies on which the Index and each Sub-Index are based will be successful or that the Index and the Sub-Indices will outperform any alternative strategies that might be employed in respect of the CFNAI and the Underlying Indices.

**The Underlying Equity Indices reflect the daily deduction of a notional financing cost, the Index, the Sub-Indices and the Underlying Equity Indices are excess price return indices and the Underlying Treasury Index is an excess return index.**

One way in which the Index may differ from a typical index is that the levels of the Underlying Equity Indices tracked by its Sub-Indices will include the deduction from the price change of their component securities of a notional financing cost calculated based on a composite rate of interest that is intended to track the overnight rate of return of a notional position in a 3-month time deposit in U.S. dollars, which is currently calculated by referencing the 2-month and 3-month USD LIBOR rates. The notional financing cost will be deducted daily. As a result of the deduction of the notional financing cost, the level of the Index will trail the value of a hypothetical identically constituted notional portfolio that does not reflect the deduction of a notional financing cost.

LIBOR, which stands for "London Interbank Offered Rate," is the average interest rate estimated by leading banks in London that they would be charged if borrowing from other banks without pledging any collateral or security. USD LIBOR will be affected by many factors, including, among others described under "— Risks Relating to the Notional Financing Cost" below. USD LIBOR has fluctuated significantly over time. For example, on August 31, 2007, the 3-month USD LIBOR rate was 5.62125% and on February 28, 2018, the 3-month USD LIBOR was 2.01719%. Over the past three years, Federal Reserve has raised interest rates and may continue to do so in the future. Any increase in the 2-month and 3-month USD LIBOR rates, whether due to the Federal Reserve decisions to raise interest rates (specifically, its federal funds target rate) or otherwise, will increase the adverse effect of the notional financing cost on performance of the Index.

The deduction of the notional financing cost will place a significant drag on the performance of the Index, potentially offsetting positive returns of the relevant Underlying Equity Index's component securities and the Underlying Treasury Index, exacerbating negative returns of the relevant Underlying Equity Index's component securities and the Underlying Treasury Index and causing the level of the Index to decline steadily if the performances of the relevant Underlying Equity Index's component securities and the Underlying Treasury Index are relatively flat. The Index will not appreciate unless the performances of the relevant Underlying Equity Index's component securities and the Underlying Treasury Index are sufficient to offset the negative effects of the notional financing cost, and then only to the extent that such performances are greater than the deducted amounts. As a result of these deductions, the level of the Index may decline even if the performances of the relevant Underlying Equity Index's component securities and the Underlying Treasury Index are positive.

Because the Underlying Equity Indices reflect the deduction of a notional financing cost, they are excess return indices. In addition, the Underlying Treasury Index is an excess return index. See "Risks Relating to the Underlying Treasury Index — The Underlying Treasury Index is an 'excess return' index and not a 'total return' index because it does not reflect interest that could be earned on funds notionally committed to the trading of futures contracts" below. Consequently, each Sub-Index (and, therefore, the Index) is an excess return index, and the Index, each Sub-Index and each Underlying Index will each trail the performance of a corresponding total return index.

Furthermore, the levels of the Underlying Equity Indices tracked by its Sub-Indices will not reflect the reinvestment of dividends or other distributions. See "Risks Relating to the Underlying Equity Indices — The Underlying Equity Indices do not reflect the reinvestment of dividends or other distributions" below. Consequently, the Underlying Equity Indices (and, therefore, each Sub-Index and the Index) are excess

price return indices, and the Index, each Sub-Index and each Underlying Equity Index will trail the performance of corresponding excess return indices.

**The Index and any Sub-Index may not approximate the Target Volatility.**

No assurance can be given that the Index or any Sub-Index will maintain an annualized realized volatility that approximates the Target Volatility. The actual realized volatility of the Index and of each Sub-Index may be greater or less than the Target Volatility. Each Sub-Index (and, therefore, the Index) seeks to maintain an annualized realized volatility approximately equal to the Target Volatility of 6.0% by rebalancing its exposures to the relevant Underlying Indices on each day based on two measures of realized portfolio volatility. However, there is no guarantee that trends exhibited by either measure of realized portfolio volatility will continue in the future. The volatility of a notional portfolio on any day may change quickly and unexpectedly. Accordingly, the actual realized annualized volatility of the Index and of each Sub-Index on a daily basis may be greater than or less than the Target Volatility, which may adversely affect the level of the Index and the value of the notes.

**Each Sub-Index (and, therefore, the Index) may be significantly uninvested.**

For each volatility measure on each day, each Sub-Index (and, therefore, the Index) seeks to identify a notional portfolio composed of the relevant Underlying Indices that has an annualized realized volatility determined for that volatility measure approximately equal to the Target Volatility of 6.0% and an aggregate weight of 100%. If a Sub-Index (and, therefore, the Index) identifies and selects such a notional portfolio for a volatility measure, but the weight of either relevant Underlying Index is greater than 100%, the weight of that Underlying Index in the notional portfolio selected for that volatility measure on that day will be 100% and, if the weight of either relevant Underlying Index is less than 0%, the weight of that Underlying Index in the notional portfolio selected for that volatility measure on that day will be 0%. In addition, if there is no such notional portfolio for a volatility measure, the relevant Sub-Index (and, therefore, the Index) selects for that volatility measure on that day the notional portfolio with the lowest realized volatility.

As a result of applying a cap and floor and in the case of selecting the notional portfolio with the lowest realized volatility, the resulting notional portfolio may be greater than or less than 6.0% for the relevant volatility measure for the relevant Sub-Index (and, therefore, the Index). If the annualized realized volatility of the notional portfolio selected for a volatility measure on any day is greater than 6.0%, that notional portfolio for the relevant Sub-Index (and, therefore, the Index) will be adjusted so that the weight of each relevant Underlying Index in that notional portfolio will be reduced proportionately to achieve a notional portfolio that has an annualized realized volatility for the relevant volatility measure of 6.0%. Under these circumstances, the aggregate weight of the Underlying Indices in that notional portfolio for the relevant Sub-Index (and, therefore, the Index) will be less than 100%.

If a Sub-Index tracks a notional portfolio with an aggregate weight that is less than 100% and if the Index has allocated its exposure to that Sub-Index, the Index will not be fully invested, and any uninvested portion will earn no return. The Index may be significantly uninvested on any given day, and will realize only a portion of any gains due to appreciation of the Underlying Indices on any such day.

**Each Sub-Index (and, therefore, the Index) may be more heavily influenced by the performance of the relevant Underlying Equity Index than the performance of the Underlying Treasury Index in general over time.**

In any initial selection between two eligible notional portfolios, each Sub-Index (and, therefore, the Index) will select the portfolio that has the higher allocation to the Underlying Index with a higher realized volatility, as described under “The S&P Economic Cycle Factor Rotator Index — Determining the Preliminary Portfolio of a Sub-Index for a Volatility Measure” below, which generally will cause the relevant Underlying Equity Index to receive a higher allocation than if the portfolio that has the higher allocation to the Underlying Index with a lower realized volatility were selected.

Furthermore, under normal market conditions, each Underlying Equity Index's realized volatility has tended to be significantly higher than the Underlying Treasury Index's realized volatility. Past performance should not be considered indicative of future performance. Under circumstances where an Underlying Equity Index's realized volatility is significantly higher than that of the Underlying Treasury Index, the performance of the relevant Sub-Index (and, therefore, the Index) is expected to be influenced to a greater extent by the performance of the relevant Underlying Equity Index than by the performance of the Underlying Treasury Index, unless the weight of the Underlying Treasury Index is significantly greater than the weight of the relevant Underlying Equity Index.

Consequently, even in cases where the allocation to the Underlying Treasury Index is greater than the allocation to the relevant Underlying Equity Index, the relevant Sub-Index may be influenced to a greater extent by the performance of the relevant Underlying Equity Index than by the performance of the Underlying Treasury Index because, under some conditions, the greater allocation to the Underlying Treasury Index will not be sufficiently large to offset the greater realized volatility of the relevant Underlying Equity Index.

Accordingly, the level of the Index and of a Sub-Index may decline if the value of the relevant Underlying Equity Index declines, even if the level of the Underlying Treasury Index increases at the same time. See also “— Changes in the values of the relevant Underlying Indices may offset each other” below.

**A significant portion of each Sub-Index's exposure (and, therefore, the Index's exposure) may be allocated to the Underlying Treasury Index.**

Under normal market conditions, each Underlying Equity Index has tended to exhibit a realized volatility that is higher than the Target Volatility and that is higher than the realized volatility of the Underlying Treasury Index in general over time. As a result, each Sub-Index (and, therefore, the Index) will generally need to reduce its exposure to the relevant Underlying Equity Index in order to approximate the Target Volatility. Therefore, each Sub-Index (and, therefore, the Index) may have significant exposure for an extended period of time to the Underlying Treasury Index, and that exposure may be greater, perhaps significantly greater, than its exposure to the relevant Underlying Equity Index. Moreover, under certain circumstances, a Sub-Index (and, therefore, the Index) may have no exposure to the relevant Underlying Equity Index. However, the returns of the Underlying Treasury Index may be significantly lower than the returns of the relevant Underlying Equity Index, and possibly even negative while the returns of the relevant Underlying Equity Index are positive, which will adversely affect the levels of the Sub-Index and the Index and any payment on, and the value of, the notes.

**Correlation of performances between the relevant Underlying Indices may reduce the performance of the notes.**

Performances of the Underlying Indices referenced by a Sub-Index (and, therefore, the Index) may become highly correlated from time to time during the term of the notes, including, but not limited to, a period in which there is a substantial decline in the particular equity and bond exposures represented by the relevant Underlying Indices. High correlation during periods of negative returns between relevant Underlying Indices could have an adverse effect on any payment on, and the value of, your notes.

**Changes in the values of the relevant Underlying Indices may offset each other.**

Price movements between the Underlying Indices reference by a Sub-Index (and, therefore, the Index) may not correlate with each other. At a time when the value of one Underlying Index increases, the value of other Underlying Index referenced by the relevant Sub-Index (and, therefore, the Index) may not increase as much or may decline. Therefore, in calculating the level of a Sub-Index, increases in the value of one Underlying Index may be moderated, or more than offset, by lesser increases or declines in the value of other the Underlying Index, which will adversely affect the level of that Sub-Index and, if the Index provides exposure to that Sub-Index, any payment on, and the value of, the notes.

**S&P Dow Jones may adjust the Index or its component indices in a way that affects their value, and S&P Dow Jones has no obligation to consider your interests.**

S&P Dow Jones is responsible for maintaining the Index and its component indices. S&P Dow Jones can add, delete or substitute the indices or securities included in the Index or its component indices or make other methodological changes (including in response to any modification or rescission of its rights to reference the CFNAI) that could change the value of the Index or its component indices. You should realize that the changing of component indices of the Index or securities included in the Index or its component indices may affect the Index or its component indices, as a newly added index or security may perform significantly better or worse than the security it replaces. Additionally, S&P Dow Jones may alter, discontinue or suspend calculation or dissemination of the Index or its component indices, rescind the license or other rights of ours to reference the Index or its component indices in calculating the Index, or fail to make the Index or its component indices available for such use on commercially reasonable terms. Any of these actions could adversely affect the value of the notes. S&P Dow Jones has no obligation to consider your interests in calculating, revising, maintaining or disseminating the Index or its component indices.

**The calculation of the notional financing cost from and including August 4, 2016 to and including May 1, 2017 was based on fixed values instead of 2-month and 3-month USD LIBOR rates.**

The notional financing cost is intended to approximate the cost of maintaining a position in the Underlying Equity Indices using borrowed funds and is calculated as a composite rate of interest that is intended to track the overnight rate of return of a notional position in a 3-month time deposit in U.S. dollars, which is currently calculated by referencing the 2-month and 3-month USD LIBOR rates. However, from and including August 4, 2016 to and including May 1, 2017, the notional financing cost was calculated using fixed values of 0.6111% and 0.7776% instead of the 2-month and 3-month USD LIBOR rates, respectively. Investors in the notes should bear this difference in mind when evaluating the hypothetical back-tested and historical data shown in the accompanying terms supplement.

**Hypothetical backtested data relating to the Index do not represent actual historical data and are subject to inherent limitations.**

Hypothetical backtested performance measures of the Index are purely theoretical and do not represent the actual historical performance of the Index and have not been verified by an independent third party. Hypothetical backtested performance measures have inherent limitations. Alternative modelling techniques might produce significantly different results and may prove to be more appropriate. Past performance is not indicative of future results. This type of information has inherent limitations and you should carefully consider these limitations before placing reliance on such information. Backtested performance is achieved by means of a retroactive application of a back-tested model designed with the benefit of hindsight. In addition, the selection methodologies of the S&P 500<sup>®</sup> Buyback FCF Excess Return Index and the S&P 500<sup>®</sup> Pure Value Excess Return Index reference financial information reported by the issuers of the securities that are eligible to be included in the relevant index, and the selection methodology applied with respect to any period of backtested performance could reflect subsequent restatements or corrections of that financial information, even though those restatements or corrections would not have been available had the relevant index been calculated on a live basis.

**If the value of an Underlying Index changes, the level of the Index and the market value of your notes may not change in the same manner.**

Owning the notes is not the same as owning any Underlying Index. Accordingly, changes in the value of any Underlying Index may not result in a comparable change in the level of the Index or the market value of your notes.

**The Index comprises notional assets and liabilities.**

The exposure of the Index to the Sub-Indices and their Underlying Indices is purely notional and will exist solely in the records maintained by or on behalf of the Index Calculation Agent. There is no actual

portfolio of assets to which any person is entitled or in which any person has any ownership interest. Consequently, you will not have any claim against any of the reference assets that compose any Underlying Index.

**The Index and some of its component indices have limited histories and may perform in unexpected ways.**

The Index and the Sub-Indices each began publishing on August 16, 2016, the S&P Momentum United States LargeMidCap Index began publishing on November 18, 2014, the S&P 500<sup>®</sup> Buyback FCF Index began publishing on March 17, 2014 and the S&P 500<sup>®</sup> Low Volatility High Dividend Index began publishing on September 17, 2012. Therefore, the Index and these component indices have limited histories. S&P Dow Jones has calculated the returns that hypothetically might have been generated had the Index and these component indices existed in the past, but those calculations are subject to many limitations. The models used to calculate these hypothetical returns are based on certain data, assumptions and estimates. Different models or models using different data, assumptions or estimates might result in materially different hypothetical performance. Regardless of the hypothetical historical and actual historical performance of the Index and these component indices, the value of the notes could be adversely affected by future performance of the Index and these component indices.

**The Index is subject to market risks.**

The performance of the Index is dependent in part on the performance of the Underlying Indices referenced by the Sub-Indices. As a consequence, your investment in the notes is exposed to the performance of the Underlying Indices, and of the securities that they track directly and indirectly.

**The investment strategy used to construct the Index involves daily adjustments to each Sub-Index's notional exposure to its Underlying Indices.**

Each Sub-Index (and, therefore, the Index) is subject to daily adjustments to its notional exposure to its Underlying Indices. By contrast, a notional portfolio that is not subject to daily exposure adjustments in this manner could see greater compounded gains over time through exposure to a consistently and rapidly appreciating portfolio consisting of the relevant Underlying Indices. Therefore, your return on the notes may be less than the return you could realize on an alternative investment in the relevant Underlying Indices that is not subject to daily exposure adjustments. No assurance can be given that the investment strategy used to construct the Index will outperform any alternative investment in the relevant Underlying Indices.

**Risks Relating to the Underlying Equity Indices**

**JPMorgan Chase & Co. is currently one of the companies that make up the S&P 500<sup>®</sup> Index and may be included in the S&P Momentum United States LargeMidCap (USD) Excess Return Index, the S&P 500<sup>®</sup> Pure Value Excess Return Index or the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index.**

The securities of JPMorgan Chase & Co. are included in the S&P 500<sup>®</sup> Index and may be included in the S&P Momentum United States LargeMidCap (USD) Excess Return Index, the S&P 500<sup>®</sup> Pure Value Excess Return Index or the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index. JPMorgan Chase & Co. has no obligation to consider your interests as a holder of the notes in taking any action that might affect the value of your notes. As a general matter, we will have no ability to control the actions of the issuers of the securities included in any of the Underlying Equity Indices, including actions that could affect the value of the securities included in the relevant Underlying Equity Index or your notes. None of those issuers will have any obligation to consider your interests as a holder of the notes in taking any actions that might affect the value of your notes. None of the money you pay for the notes will go to any of the other issuers of the securities included in the relevant Underlying Equity Index.

**There is no assurance that the strategy employed by the S&P Momentum United States LargeMidCap (USD) Excess Return Index will be successful.**

The S&P Momentum United States LargeMidCap (USD) Excess Return Index, the Underlying Equity Index of the Momentum Sub-Index, is designed to measure the performance of U.S. large- and mid-capitalization companies with relatively higher recent performance compared to the S&P United States LargeMidCap Index. The S&P United States LargeMidCap Index seeks to measure the large- and mid-capitalization U.S. equity market and represents the top 85% of the float-adjusted market capitalization of the S&P United States BMI (Broad Market Index). The Index allocates to the Momentum Sub-Index when it determines the business cycle to be in “Expansion” in an attempt to provide exposure to companies that are moving with a strong and strengthening U.S. economy. There is, however, no assurance that the S&P Momentum United States LargeMidCap (USD) Excess Return Index will outperform any other index or strategy that tracks U.S. stocks selected using other criteria. There is no guarantee that price trends existing in the past will continue in the future. If market conditions do not represent a continuation of prior trends, the level of the S&P Momentum United States LargeMidCap (USD) Excess Return Index may decline. In addition, the S&P Momentum United States LargeMidCap (USD) Excess Return Index is constructed pursuant to a modified market capitalization-weighting methodology. It is possible that the stock selection and weighting methodology of the S&P Momentum United States LargeMidCap (USD) Excess Return Index will adversely affect its return and, consequently, the value of the Index and of the notes.

**There is no assurance that the strategy employed by the S&P 500<sup>®</sup> Pure Value Excess Return Index will be successful.**

The S&P 500<sup>®</sup> Pure Value Excess Return Index, the Underlying Equity Index of the Value Sub-Index, is designed to measure the performance of companies in the S&P 500<sup>®</sup> Index that exhibit relatively strong value characteristics (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 (by reference to EPS growth, sales per share growth and price momentum). The Index allocates to the Value Sub-Index when it determines the business cycle to be in “Recovery” in an attempt to provide exposure to companies that may be undervalued. There is, however, no assurance that the S&P 500<sup>®</sup> Pure Value Excess Return Index will outperform any other index or strategy that tracks U.S. stocks selected using other criteria. The value characteristic referenced by the S&P 500<sup>®</sup> Pure Value Excess Return Index may not be accurate predictors of under-valued stocks, and there is no guarantee that undervalued stocks will appreciate. In addition, the S&P 500<sup>®</sup> Pure Value Excess Return Index’s “pure value” selection methodology includes a strong bias against growth stocks, which might outperform value stocks. Furthermore, the S&P 500<sup>®</sup> Pure Value Excess Return Index is constructed pursuant to a value-based weighting methodology, in which the weights of components are proportional to the strength of their value characteristics. It is possible that the stock selection and weighting methodology of the S&P 500<sup>®</sup> Pure Value Excess Return Index will adversely affect its return and, consequently, the value of the Index and of the notes.

**There is no assurance that the strategy employed by the S&P 500<sup>®</sup> Buyback FCF Excess Return Index will be successful.**

The S&P 500<sup>®</sup> Buyback FCF Excess Return Index, the Underlying Equity Index of the Buyback Sub-Index, is designed to measure the performance of 30 companies (excluding JPMorgan Chase & Co., Visa and their past or present affiliated companies) with relatively higher rates of buying back their own stock, relatively higher levels of trading activity in their stock, and relatively higher free cash flow yields, as compared to the S&P 500<sup>®</sup> Index. The Index allocates to the Buyback Sub-Index when it determines the business cycle to be in “Slowdown” in an attempt to provide exposure to companies that are supporting their stocks through buybacks and have sufficient free cash flow to maintain this program. There is, however, no assurance that stocks with a high free cash flow or with high buyback ratios will continue to have high free cash flow or high buyback ratios or that the S&P 500<sup>®</sup> Buyback FCF Excess Return Index will outperform any other index or strategy that tracks U.S. stocks selected using other criteria. In addition, the S&P 500<sup>®</sup> Buyback FCF Excess Return Index is constructed pursuant to a weighting methodology in which the weights of components are proportional to their free cash flow yields. It is

possible that the stock selection and weighting methodology of the S&P 500<sup>®</sup> Buyback FCF Excess Return Index will adversely affect its return and, consequently, the value of the Index and of the notes.

**There is no assurance that the strategy employed by the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index will be successful.**

The S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index, the Underlying Equity Index of the High Dividend Low Volatility Sub-Index, is designed to measure the performance of the 50 least-volatile among the 75 highest dividend-yielding companies in the S&P 500<sup>®</sup> Index, subject to sector and individual constituent concentration limits. The Index allocates to the High Dividend Low Volatility Sub-Index when it determines the business cycle to be in “Contraction” in an attempt to provide exposure to defensive companies that pay relatively higher dividends and have relatively lower volatility. There is, however, no assurance that the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index will exhibit low volatility or provide higher risk-weighted returns than the S&P 500<sup>®</sup> Index or any other index or strategy. In addition, although the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index measures the performance of high dividend-yielding companies, the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index will not include any dividends paid on the securities that make up the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index. It is possible that the stock selection and weighting methodology of the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index will adversely affect its return (for example, by providing exposure to stocks that do not perform as well as other stocks with higher volatility or with lower dividend yields) and, consequently, the value of the Index and of the notes.

**The Underlying Equity Indices do not reflect the reinvestment of dividends or other distributions.**

The Underlying Equity Indices reflect only changes in the market prices of the securities composing each Underlying Equity Index and do not reflect dividends or other distributions paid on those securities. Accordingly, the level of each Underlying Equity Index will trail the value of a hypothetical identically constituted notional portfolio that reflects the reinvestment of dividends and other distributions.

**The Underlying Equity Indices are subject to concentration risk.**

The strategy employed by each Underlying Equity Index may result in concentration to a significant degree in securities of issuers located in a single industry or sector or a small number of industries or sectors. Under these circumstances, an Underlying Equity Index may face more risks than if it were diversified broadly over numerous industries or sectors. Accordingly, each Underlying Equity Index may be more adversely affected by negative economic, political or regulatory occurrences affecting its constituents and the relevant industries and sectors than a more broadly diversified stock index.

**Risks Relating to the Underlying Treasury Index**

**JPMS is a primary dealer in connection with purchases and sales of U.S. Treasury securities by the Federal Reserve, and JPMS’s actions in that capacity may affect the level of the Underlying Treasury Index.**

One of our affiliates, JPMS, is one of the primary dealers through which the Federal Reserve conducts open-market purchases and sales of U.S. Treasury and federal agency securities, including U.S. Treasury notes. These activities may affect the prices and yields on the U.S. Treasury notes, which may in turn affect the level of the Underlying Treasury Index and the level of the Index. JPMS has no obligation to take into consideration your interests as a holder of the notes when undertaking these activities.

**The Underlying Treasury Index is an “excess return” index and not a “total return” index because it does not reflect interest that could be earned on funds notionally committed to the trading of futures contracts.**

The Underlying Treasury Index is an excess return index and not a total return index. The return from investing in futures contracts derives from three sources: (a) changes in the price of the relevant futures

contracts (which is known as the “price return”); (b) any profit or loss realized when rolling the relevant futures contracts (which is known as the “roll return”); and (c) any interest earned on the cash deposited as collateral for the purchase of the relevant futures contracts (which is known as the “collateral return”).

Some indices, including the Underlying Treasury Index, that track futures contracts are excess return indices that measure the returns accrued from investing in uncollateralized futures contracts (*i.e.*, the sum of the price return and the roll return associated with an investment in futures contracts). By contrast, a total return index, in addition to reflecting those returns, also reflects interest that could be earned on funds committed to the trading of the underlying futures contracts (*i.e.*, the collateral return associated with an investment in futures contracts). Investing in the notes will not generate the same return as would be generated from investing directly in the relevant futures contracts or in a total return index related to those futures contracts.

**Negative roll returns associated with futures contracts may adversely affect the performance of the Underlying Treasury Index and the value of the notes.**

The Underlying Treasury Index notionally invests in the 5-Year U.S. Treasury Note futures contract. As the contract that underlies the Underlying Treasury Index at any given time nears expiration, it is replaced by a contract that has a later expiration. For example, a contract purchased and held in July may specify a September expiration. As time passes, the contract expiring in September is replaced by a contract for delivery in December. This is accomplished by selling the September contract and purchasing the December contract. This process is referred to as “rolling.” Excluding other considerations, if prices are higher in more distant delivery months than in nearer delivery months, the purchase of the December contract would take place at a price that is higher than the price of the September contract, thereby creating a negative “roll return,” which could adversely affect the level of the Underlying Treasury Index and the Index and, accordingly, any payments on, and the value of, the notes. In addition, interest rates have been historically low for an extended period and, if interest rates revert to their historic means, the adverse effect of negative roll returns will increase.

**The Underlying Treasury Index is subject to significant risks associated with futures contracts.**

The Underlying Treasury Index tracks the returns of futures contracts. The price of a futures contract depends not only on the price of the underlying asset referenced by the futures contract, but also on a range of other factors, including but not limited to changing supply and demand relationships, interest rates, governmental and regulatory policies and the policies of the exchanges on which the futures contracts trade. In addition, the 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. These factors and others can cause the prices of futures contracts to be volatile and could adversely affect the level of the Underlying Treasury Index and the Index and accordingly, any payments on, and the value of, your notes.

**Suspension or disruptions of market trading in futures contracts may adversely affect the value of your notes.**

Futures markets are subject to temporary distortions or other disruptions due to various factors, including lack of liquidity, the participation of speculators, and government regulation and intervention. In addition, futures exchanges generally have regulations that limit the amount of futures contract price fluctuations that may occur in a single 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 set 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 Underlying Treasury Index and the Index and therefore could adversely affect any payments on, and the value of, your notes.



**An increase in the margin requirements for futures contracts included in the Underlying Treasury Index may adversely affect the level of the Underlying Treasury Index.**

Futures exchanges require market participants to post collateral in order to open and keep open positions in futures contracts. If an exchange increases the amount of collateral required to be posted to hold positions in futures contracts underlying the Underlying Treasury Index, market participants who are unwilling or unable to post additional collateral may liquidate their positions, which may cause the price of the relevant futures contracts to decline significantly. As a result, the level of the Underlying Treasury Index and the Index and any payments on, and the value of, the notes may be adversely affected.

**The notes are subject to significant risks associated with fixed-income securities, including interest rate-related risks.**

Investing in the notes differs significantly from investing directly in bonds to be held to maturity, as the value of the futures contract included in the Underlying Treasury Index changes, at times significantly, during each trading day based upon the current market prices of the U.S. Treasury notes it references (the “underlying bonds”). The market prices of the underlying bonds are volatile and significantly influenced by a number of factors, particularly the duration of the underlying bonds, the yields on the underlying bonds as compared to current market interest rates and the actual or perceived credit quality of the governmental issuers of the underlying bonds.

In general, fixed-income securities are significantly affected by changes in current market interest rates. As interest rates rise, the prices of fixed-income securities, such as the underlying bonds, are likely to decrease. Instruments with longer durations tend to be more sensitive to interest rate changes, usually making them more volatile than securities with shorter durations. As a result, rising interest rates may cause the value of the underlying bonds to decline, possibly significantly, which would adversely affect the value of the notes.

Interest rates are subject to volatility due to a variety of factors, including:

- sentiment regarding underlying strength or weakness in economies of the governments issuing the underlying bonds and global economies;
- expectations regarding the level of price inflation;
- sentiment regarding credit quality of the governments issuing the underlying bonds and global credit markets;
- central bank policies regarding interest rates; and
- the performance of global capital markets.

The underlying bonds have traded at implied nominal yields near historic lows for an extended period of time. If the yields of the underlying bonds revert to their historic means as a result of a general increase in interest rates, government policies or actions, including actions by the Federal Reserve, or perceptions of reduced credit quality of the relevant governments or otherwise, the value of the underlying bonds will decline, which could have a negative impact on the performance of the notes.

**The value of the notes may be influenced by unpredictable changes in the U.S. government and economy.**

The market price of the futures contracts included in the Underlying Treasury Index generally increases or decreases in connection with, among other factors, the market’s expectations about increases or decreases in the market price of the underlying bonds. Accordingly, the value of the notes may be affected by unpredictable changes, or expectations of changes, in the markets for the underlying bonds. Changes in the U.S. government that may influence the value of the notes include:

- economic performance, including any financial or economic crises and changes in the gross domestic product, the principal sectors, inflation, employment and labor, and prevailing prices and wages;

- the monetary system, including the monetary policy, the exchange rate policy, the economic and tax policies, banking regulation, credit allocation and exchange controls;
- the external sector, including the amount and types of foreign trade, the geographic distribution of trade, the balance of payments, and reserves and exchange rates;
- public finance, including the budget process, any entry into or termination of any economic or monetary agreement or union, the prevailing accounting methodology, the measures of fiscal balance, revenues and expenditures, and any government enterprise or privatization program; and
- public debt, including external debt, debt service and the debt record.

These factors interrelate in complex ways, and the effect of one factor on the market value of the underlying bonds, and therefore on the futures contract included in the Underlying Treasury Index, may offset or enhance the effect of another factor, which could have a negative impact on the performance of the notes.

**The Underlying Treasury Index may be affected by changes in the perceived creditworthiness of the United States.**

The price of each underlying bond and related Underlying Futures Contracts are significantly influenced by the creditworthiness of the United States. U.S. rating agencies have downgraded the credit ratings and/or assigned negative outlooks to many governments worldwide, including the United States, and may continue to do so in the future. Any perceived decline in the creditworthiness of United States, as a result of a credit rating downgrade or otherwise, may cause the yield on the relevant underlying bonds to increase and the prices of such underlying bonds to fall, perhaps significantly, and may cause increased volatility in local or global credit markets. Any such decline over the term of the notes would adversely impact the prices of the futures contract included in the Underlying Treasury Index and could have a negative impact on the level of the Index and the value of the notes.

**Risks Relating to the Notional Financing Cost**

**JPMorgan Chase Bank, N.A. London Branch, one of our affiliates, is a LIBOR contributing bank.**

ICE Benchmark Administration calculates LIBOR using a trimmed arithmetic mean of submissions from contributing banks that excludes the submissions in the highest and lowest 25%. JPMorgan Chase Bank, N.A. London Branch, is one of the LIBOR contributing banks. We and our affiliates will have no obligation to consider your interests as a holder of the notes in taking any actions in connection with acting as a LIBOR contributing bank that might affect the 2-month USD LIBOR and 3-month USD LIBOR or the notes.

**The interest rates referenced by the notional financing cost will be affected by a number of factors.**

A number of factors can affect the levels of 2-month USD LIBOR and 3-month USD LIBOR, including, but not limited to:

- *changes in, or perceptions about, future rates*: increased interest rate volatility is historically associated with an increased spread between long- and short-term interest rates and, conversely, decreased volatility is historically associated with tighter spreads;
- *general economic conditions*: the economic, financial, political, regulatory and judicial events that affect financial markets generally will affect 2-month USD LIBOR and 3-month USD LIBOR;
- *prevailing interest rates*: 2-month USD LIBOR and 3-month USD LIBOR are subject to daily fluctuations depending on the levels of prevailing interest rates in the market generally; in addition, lower overall interest rates are historically associated with an increased spread between long and short-term interest rates and, conversely, higher overall interest rates are historically associated with tighter spreads; and

- *policy of the Federal Reserve Board or central banks or other countries regarding interest rates:* an easing of monetary policy is historically associated with an increased spread between long and short-term interest rates and, conversely, a tightening of monetary policy is historically associated with tighter spreads.

These and other factors may have an impact on the performance of 2-month USD LIBOR and 3-month USD LIBOR.

**The interest rates referenced by the notional financing cost and the manner in which they are calculated may change in the future.**

There can be no assurance that the method by which 2-month USD LIBOR and 3-month USD LIBOR are calculated will not change. Such changes in the method of calculation could reduce or increase the level of the relevant interest rates.

**Regulatory developments may result in changes to the rules or methodology used to determine the value of LIBOR, which may adversely affect any payment on the notes.**

The methodologies used to determine the value of certain “benchmarks,” including LIBOR, are the subject of recent national, international and other regulatory guidance, proposals for reform and investigations. These reforms or changes made in response to these investigations may cause those benchmarks to perform differently than in the past and may have other consequences that cannot be predicted. In addition, market participants may elect not to continue to participate in the administration of certain benchmarks if these reforms and investigations increase the costs and risks associated with those activities, which could cause changes in the rules or methodologies used in certain benchmarks or lead to the disappearance of certain benchmarks. Any of these changes could adversely affect the value of the notes and any payment on the notes.

**The interest rates referenced by the notional financing cost may be volatile.**

Two-month USD LIBOR and 3-month USD LIBOR are subject to volatility due to a variety of factors affecting interest rates generally, including:

- sentiment regarding underlying strength in the U.S. and global economies;
- expectation regarding the level of price inflation;
- sentiment regarding credit quality in U.S. and global credit markets;
- central bank policy regarding interest rates; and
- performance of capital markets.

**Uncertainty about the future of LIBOR may affect 2-month and 3-month USD LIBOR rates, which may adversely affect the Index and therefore the return on and the market value of the notes.**

On July 27, 2017, the Chief Executive of the U.K. Financial Conduct Authority (the “FCA”), which regulates LIBOR, announced that the FCA intends to stop persuading or compelling banks to submit rates for the calculation of LIBOR rates to the LIBOR administrator after 2021. The announcement indicates that the continuation of LIBOR on the current basis cannot and will not be guaranteed. It is impossible to predict whether and to what extent banks will continue to provide LIBOR submissions to the administrator of LIBOR, whether LIBOR rates will cease to be published or supported before or after 2021 or whether any additional reforms to LIBOR may be enacted in the United Kingdom or elsewhere. At this time, no consensus exists as to what rate or rates may become accepted alternatives to LIBOR and it is impossible to predict the effect of any such alternatives on the notes. Uncertainty as to the nature of alternative reference rates and as to potential changes or other reforms to LIBOR may affect the 2-month and 3-month USD LIBOR rates used to determine the notional financing cost during the term of the notes, which may adversely affect the Index and therefore the return on and market value of the notes. Any successor or replacement interest rates may perform differently from the 2-month and 3-month USD

LIBOR rates, which may adversely affect the Index and therefore the return on and the market value of the notes.

## THE S&P ECONOMIC CYCLE FACTOR ROTATOR INDEX

All information contained in this underlying supplement regarding the S&P Economic Cycle Factor Rotator Index (the “**Index**”), including, without limitation, its make-up, method of calculation and changes in its components, has been derived from publicly available information and other information provided by S&P Dow Jones Indices LLC (“**S&P Dow Jones**”), without independent verification. This information reflects the policies of, and is subject to change by, S&P Dow Jones. The Index was developed by S&P Dow Jones and J.P. Morgan Securities LLC and is calculated, maintained and published by S&P Dow Jones. S&P Dow Jones has granted a license to JPMorgan Chase & Co. and certain of its affiliates or subsidiaries, including JPMorgan Financial, which was previously exclusive, and JPMorgan Chase & Co. intends to renew the exclusivity of its license. S&P Dow Jones has no obligation to continue to publish, and may discontinue publication of, the Index.

The Index began publishing on August 16, 2016 and has a base date of August 1, 1995 and a base value of 100.00. The Index is reported by Bloomberg, L.P. under the ticker symbol “SPECFR6P.”

The Index tracks the return of a notional dynamic portfolio consisting of (a) one of four excess price return U.S. equity indices (each, an “**Underlying Equity Index**”) as set forth below and (b) the S&P 5-Year U.S. Treasury Note Futures Excess Return Index (the “**Underlying Treasury Index**”), while seeking to maintain an annualized realized volatility approximately equal to 6.0% (the “**Target Volatility**”).

- Each Underlying Equity Index seeks to provide exposure to the price change, *less* a notional financing cost deducted on a daily basis, of U.S. companies exhibiting one of the following sets of characteristics: momentum, value, high buybacks and free cash flows, or high dividends and low volatility. On a monthly basis, the Index selects one of the four Underlying Equity Indices based on the stage of the U.S. business cycle inferred from the recent trend and average level of the Chicago Fed National Activity Index (“**CFNAI**”). The CFNAI is a weighted average of 85 monthly indicators of national economic activity. See “Background on the Chicago Fed National Activity Index” in this underlying supplement for additional information about the CFNAI. Each Underlying Equity Index is an “excess price” return index because it does not reflect reinvestment of dividends and other distributions and its performance is reduced by a notional financing cost.
- The Underlying Treasury Index seeks to track the performance of a rolling position in the 5-Year U.S. Treasury Note futures contract. The Underlying Treasury Index is an “excess return” index and not a “total return” index because it does not reflect interest that could be earned on funds notionally committed to the trading of futures contracts. Negative roll returns associated with futures contracts may adversely affect the performance of the Underlying Treasury Index. For additional information, see “Background on the S&P 5-Year U.S. Treasury Note Futures Excess Return Index” below.

To achieve this, the Index selects from four sub-indices (each, a “**Sub-Index**”), each tracking the return of a notional dynamic portfolio consisting of one Underlying Equity Index and the Underlying Treasury Index, while seeking to maintain an annualized realized volatility approximately equal to the Target Volatility. The relevant Underlying Equity Index and the Underlying Treasury Index are each referred to as an “**Underlying Index**.” The Index allocates its entire exposure to one Sub-Index based on the stage of the U.S. business cycle inferred from the recent trend and average level of the CFNAI. For additional information, see “— Allocation to a Sub-Index Based on U.S. Business Cycle Stage” below.

Under normal market conditions, each Underlying Equity Index’s realized volatility has tended to be relatively more variable than the Underlying Treasury Index’s realized volatility. Consequently, and because the Index and each Sub-Index seek to maintain an annualized realized volatility approximately equal to the Target Volatility, the Index and each Sub-Index’s methodology may be more likely to shift exposure from the relevant Underlying Equity Index to the Underlying Treasury Index during periods of relatively higher market volatility and to shift exposure from the Underlying Treasury Index to the relevant Underlying Equity Index under normal market conditions exhibiting relatively lower market volatility.

In general, equity markets have historically been more likely to outperform fixed-income markets during periods of relatively lower market volatility and to underperform fixed-income markets during periods of relatively higher market volatility. However, there can be no assurance that the Index or any Sub-Index's allocation strategy will achieve its intended results, or that the Index or any Sub-Index will outperform any alternative index or strategy that might reference the relevant Underlying Indices. Past performance should not be considered indicative of future performance.

In any initial selection between two eligible notional portfolios, each Sub-Index (and, therefore, the Index) will select the portfolio that has the higher allocation to the Underlying Index with a higher realized volatility, as described under “— Determining the Preliminary Portfolio of a Sub-Index for a Volatility Measure” below, which generally will cause the relevant Underlying Equity Index to receive a higher allocation than if the portfolio that has the higher allocation to the Underlying Index with a lower realized volatility were selected.

Furthermore, under normal market conditions, each Underlying Equity Index's realized volatility has tended to be significantly higher than the Underlying Treasury Index's realized volatility. Past performance should not be considered indicative of future performance. Under circumstances where an Underlying Equity Index's realized volatility is significantly higher than that of the Underlying Treasury Index, the performance of the relevant Sub-Index (and, therefore, of the Index) is expected to be influenced to a greater extent by the performance of the relevant Underlying Equity Index than by the performance of the Underlying Treasury Index, unless the weight of the Underlying Treasury Index is significantly greater than the weight of the relevant Underlying Equity Index.

Consequently, even in cases where the allocation to the Underlying Treasury Index is greater than the allocation to the relevant Underlying Equity Index, the relevant Sub-Index (and, therefore, the Index) may be influenced to a greater extent by the performance of the relevant Underlying Equity Index than by the performance of the Underlying Treasury Index because, under some conditions, the greater allocation to the Underlying Treasury Index will not be sufficiently large to offset the greater realized volatility of the relevant Underlying Equity Index.

The notional financing cost is intended to approximate the cost of maintaining a position in the relevant Underlying Equity Index using borrowed funds and is currently calculated as a composite rate of interest that is intended to track the overnight rate of return of a notional position in a 3-month time deposit in U.S. dollars, which is calculated by referencing the 2-month and 3-month USD LIBOR rates. LIBOR, which stands for “London Interbank Offered Rate,” is the average interest rate estimated by leading banks in London that they would be charged if borrowing from other banks without pledging any collateral or security.

On July 27, 2017, the Chief Executive of the U.K. Financial Conduct Authority (the “**FCA**”), which regulates LIBOR, announced that the FCA intends to stop persuading or compelling banks to submit rates for the calculation of LIBOR rates to the LIBOR administrator after 2021. It is impossible to predict the impact of this announcement on LIBOR rates, whether LIBOR rates will cease to be published or supported before or after 2021, the impact of any alternative reference rates or whether any additional reforms to LIBOR may be enacted in the United Kingdom or elsewhere. Uncertainty as to the nature of alternative reference rates and as to potential changes or other reforms to LIBOR may affect the 2-month and 3-month USD LIBOR rates used to determine the notional financing cost during the term of the notes, which may adversely affect the Index and therefore the return on and market value of the notes. See “Risk Factors — Risks Relating to the Notional Financing Cost — Uncertainty about the future of LIBOR may affect 2-month and 3-month USD LIBOR rates, which may adversely affect the Index and therefore the return on and the market value of the notes” in this underlying supplement.

### **Allocation to a Sub-Index Based on U.S. Business Cycle Stage**

On a monthly basis, the Index allocates its entire exposure to one of the four Sub-Indices based on the stage of the U.S. business cycle inferred from the recent trend and average level of the CFNAI. The CFNAI is constructed to have an average value of zero. Since economic activity tends toward a trend growth rate over time, a zero value for the CFNAI indicates that the U.S. economy is expanding at its

historical trend rate of growth; negative values indicate below-average growth; and positive values indicate above-average growth. See “Background on the Chicago Fed National Activity Index” in this underlying supplement for additional information about the CFNAI.

For purposes of allocating its exposure, the Index attempts to determine the stage of the business cycle based on the recent trend and average level of the CFNAI each month in the following manner:

- **Expansion:** the CFNAI 3-month average and the CFNAI 3-month change are both flat or positive, indicating that the U.S. economy is growing at an average or an above-average growth rate and that the growth rate is flat or accelerating;
- **Recovery:** the CFNAI 3-month average is negative, and the CFNAI 3-month change is flat or positive, indicating that the U.S. economy is growing at a below-average growth rate (or is shrinking) and that the growth rate is flat or accelerating (or that the rate of shrinking is flat or slowing);
- **Slowdown:** the CFNAI 3-month average is flat or positive, and the CFNAI 3-month change is negative, indicating that the U.S. economy is growing at an average or an above-average growth rate and that the growth rate is slowing; and
- **Contraction:** the CFNAI 3-month average and the CFNAI 3-month change are both negative, indicating that the U.S. economy is growing at a below-average growth rate (or is shrinking) and that the growth rate is slowing (or that the rate of shrinking is accelerating).

If the business cycle is determined to be in Contraction immediately following a month in which it was determined to be in Recovery, the Index will determine it to be in Recovery unless and until a second consecutive month in which the CFNAI 3-month average and the CFNAI 3-month change are both negative.

The following table sets forth the Sub-Index associated with each stage of the business cycle for purposes of the Index, and the Underlying Equity Index underlying each Sub-Index.

<b>Business Cycle Stage</b>	<b>Sub-Index (Bloomberg Ticker)</b>	<b>Underlying Equity Index</b>
Expansion	S&P Momentum Daily Risk Control 6% Excess Return Index (SPECFM6P) (the “ <b>Momentum Sub-Index</b> ”)	S&P Momentum United States LargeMidCap (USD) Excess Return Index
Recovery	S&P Value Daily Risk Control 6% Excess Return Index (SPECV6P) (the “ <b>Value Sub-Index</b> ”)	S&P 500 <sup>®</sup> Pure Value Excess Return Index
Slowdown	S&P Buyback Daily Risk Control 6% Excess Return Index (SPECB6P) (the “ <b>Buyback Sub-Index</b> ”)	S&P 500 <sup>®</sup> Buyback FCF Excess Return Index
Contraction	S&P Low Volatility High Dividend Daily Risk Control 6% Excess Return Index (SPECFL6P) (the “ <b>High Dividend Low Volatility Sub-Index</b> ”)	S&P 500 <sup>®</sup> Low Volatility High Dividend Excess Return Index

The S&P Momentum United States LargeMidCap (USD) Excess Return Index, the Underlying Equity Index of the Momentum Sub-Index, is designed to measure the performance of U.S. large- and mid-capitalization companies with relatively higher recent performance compared to the S&P United States LargeMidCap Index. The Index allocates to the Momentum Sub-Index when it determines the business cycle to be in Expansion in an attempt to provide exposure to companies that are moving with a strong and strengthening U.S. economy. See “Background on the S&P Momentum United States LargeMidCap Index” below.

The S&P 500<sup>®</sup> Pure Value Excess Return Index, the Underlying Equity Index of the Value Sub-Index, is designed to measure the performance of stocks in the S&P 500<sup>®</sup> Index that exhibit relatively strong value characteristics (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 (by reference to EPS growth, sales per share growth and price momentum). The Index allocates to Value Sub-Index when it determines the business cycle to be in Recovery in an attempt to provide exposure to companies that may be undervalued. See “Background on the S&P 500<sup>®</sup> Pure Value Index” below.

The S&P 500<sup>®</sup> Buyback FCF Excess Return Index, the Underlying Equity Index of the Buyback Sub-Index, is designed to measure the performance of 30 companies (excluding JPMorgan Chase & Co., Visa and their past or present affiliated companies) with relatively higher rates of buying back their own stock, relatively higher levels of trading activity in their stock, and relatively higher free cash flow yields, as compared to the S&P 500<sup>®</sup> Index. The Index allocates to Buyback Sub-Index when it determines the business cycle to be in Slowdown in an attempt to provide exposure to companies that are supporting their stocks through buybacks and have sufficient free cash flow to maintain this program. See “Background on the S&P 500<sup>®</sup> Buyback FCF Index” below.

The S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index, the Underlying Equity Index of the High Dividend Low Volatility Sub-Index, is designed to measure the performance of the 50 least-volatile among the 75 highest dividend-yielding companies in the S&P 500<sup>®</sup> Index, subject to sector and individual constituent concentration limits. The Index allocates to the High Dividend Low Volatility Sub-Index when it determines the business cycle to be in Contraction in an attempt to provide exposure to defensive companies that pay relatively higher dividends and have relatively lower volatility. Although the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index measures the performance of high dividend-yielding companies, the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index will not include any dividends paid on the securities that make up the S&P 500<sup>®</sup> Low Volatility High Dividend Excess Return Index. See “Background on the S&P 500<sup>®</sup> Low Volatility High Dividend Index” below.

The S&P 5-Year U.S. Treasury Note Futures Excess Return Index seeks to track the performance of a rolling position in the 5-Year U.S. Treasury Note futures contract. See “Background on the S&P 5-Year U.S. Treasury Note Futures Excess Return Index” below.

The Index is rebalanced monthly after the market close on the first business day of each month. Index allocation changes are typically announced three business days prior to the rebalancing date. The selected Sub-Index is not expected to change between rebalancings. If a Sub-Index is discontinued, the index committee may elect to discontinue representation of the affected strategy within the Index or designate a successor Sub-Index.

### **Calculation of the CFNAI 3-Month Average and the CFNAI 3-Month Change**

Each month, the Index (i) obtains the average of the three most recent monthly CFNAI values from the Federal Reserve Bank of Chicago (the “**CFNAI 3-month average**”) and (ii) subtracts the fourth most recent monthly CFNAI value from the most recent monthly CFNAI value (the “**CFNAI 3-month change**”). If restated CFNAI values are available for previous months, they will be used in the calculation of the CFNAI 3-month change. However, S&P Dow Jones will not revise previously calculated CFNAI 3-month changes from previous Index rebalancings. Prior to March 1, 2012 and since February 1, 2017, the Index uses CFNAI values and CFNAI 3-month averages that have first been rounded to the nearest 0.01.

### **Determining the Daily Portfolio of a Sub-Index**

Each Sub-Index seeks to maintain an annualized realized volatility approximately equal to the Target Volatility of 6.0% by rebalancing its exposures to the relevant Underlying Indices on each S&P business day (as defined below) based on two measures of realized portfolio volatility: a shorter-term volatility measure and a longer-term volatility measure. Each volatility measure reflects an exponentially weighted moving average, meaning that greater weight is assigned to more recent performance and less weight is assigned to less recent performance. The shorter-term volatility measure assigns greater weight to more recent performance than does the longer-term volatility measure. For additional information about how



the Index determines the volatility of a notional portfolio, see “— Determining the Preliminary Portfolio of a Sub-Index for a Volatility Measure” below.

For each volatility measure on each S&P business day, each Sub-Index seeks to identify a notional portfolio composed of the relevant Underlying Indices that has an annualized realized volatility of 6.0% (or less, in limited circumstances described below) determined for that volatility measure, subject to the conditions described below. We refer to the notional portfolio identified for each volatility measure in the manner described below as the “**Preliminary Portfolio**” for that volatility measure for the relevant Sub-Index. Each Sub-Index will then select the Preliminary Portfolio for the volatility measure that has the lower allocation to the relevant Underlying Equity Index as the “**Daily Portfolio**” as of that S&P business day.<sup>1</sup> A Sub-Index’s selection of the notional portfolio with the lower allocation to the relevant Underlying Equity Index may be more likely to result in that Sub-Index tracking a notional portfolio with a lower realized volatility than if that Sub-Index were to select the notional portfolio with the higher allocation to the relevant Underlying Equity Index.

The level of each Sub-Index calculated on each S&P business day references the weights of the relevant Underlying Indices in the Daily Portfolio of that Sub-Index as of the second immediately preceding S&P business day. Accordingly, there is a one-S&P business day delay between the S&P business day on which a Daily Portfolio is determined and the S&P business day on which the relevant Sub-Index will be allocated to that Daily Portfolio and a two-S&P business day delay between the S&P business day on which a Daily Portfolio is determined and the S&P business day on which the weights of that Daily Portfolio are referenced to calculate the level of the relevant Sub-Index.

#### **Determining the Preliminary Portfolio of a Sub-Index for a Volatility Measure**

For each volatility measure on each S&P business day, each Sub-Index seeks to identify a notional portfolio composed of the relevant Underlying Indices that has an annualized realized volatility determined for that volatility measure of 6.0% and an aggregate weight of 100%. For each volatility measure for a Sub-Index, there may be one or two such notional portfolios, or there may be no such notional portfolio:

- if there are two such notional portfolios for a volatility measure, subject to adjustment as described below, the relevant Sub-Index selects for that volatility measure on that S&P business day the notional portfolio that has the higher allocation to the Underlying Index with a higher realized volatility determined for that volatility measure;<sup>2</sup>
- if there is one such notional portfolio for a volatility measure, subject to adjustment as described below, the relevant Sub-Index selects for that volatility measure on that S&P business day that notional portfolio; and

---

<sup>1</sup> If, however, the weight of the relevant Underlying Equity Index in the Preliminary Portfolio for both volatility measures is the same and is not 0%, the relevant Sub-Index will select as the Daily Portfolio for the relevant S&P business day the Preliminary Portfolio for the longer-term volatility measure. If the weight of the relevant Underlying Equity Index in the Preliminary Portfolio for both volatility measures is 0%, the relevant Sub-Index will select as the Daily Portfolio for the relevant S&P business day the Preliminary Portfolio for the volatility measure that has the lower allocation to the Underlying Treasury Index.

<sup>2</sup> If, however, the relevant Underlying Indices have the same realized volatility for a volatility measure on an S&P business day, subject to adjustment as described below, the Preliminary Portfolio for that volatility measure on that S&P business day is the notional portfolio that has the higher allocation to the relevant Underlying Equity Index.

- if there is no such notional portfolio for a volatility measure<sup>3</sup>, subject to adjustment as described below, the relevant Sub-Index selects for that volatility measure on that S&P business day the notional portfolio with the lowest realized volatility,

*provided that*, if the weight of either Underlying Index is greater than 100%, the weight of that Underlying Index in the notional portfolio selected for that volatility measure on that S&P business day will be 100% and, if the weight of either Underlying Index is less than 0%, the weight of that Underlying Index in the notional portfolio selected for that volatility measure on that S&P business day will be 0%. Applying this cap and floor may cause the annualized realized volatility of the resulting notional portfolio to be greater than or less than 6.0% for that volatility measure.

In the limited circumstance in which the annualized realized volatility of the notional portfolio selected for a volatility measure for a Sub-Index on an S&P business day as described above is greater than 6.0%, that notional portfolio will be adjusted so that the weight of each Underlying Index in that notional portfolio will be reduced proportionately to achieve a notional portfolio that has an annualized realized volatility for the relevant volatility measure of 6.0%. Under these circumstances, the aggregate weight of the Underlying Indices in that notional portfolio for that Sub-Index will be less than 100%.

The notional portfolio selected for each volatility measure for the relevant Sub-Index for an S&P business day, subject to the adjustments described above, is that Preliminary Portfolio for that volatility measure for that S&P business day.

Under normal market conditions, each Underlying Equity Index has tended to exhibit a realized volatility that is higher than the realized volatility of the Underlying Treasury Index in general over time. As a result, in the case where there are two candidate notional portfolios for a volatility measure, a Sub-Index's selection of the notional portfolio that has the higher allocation to the Underlying Index with a higher realized volatility determined for that volatility measure will generally cause that Sub-Index's allocation to the relevant Underlying Equity Index over time to be greater than if that Sub-Index were to select the notional portfolio with a higher allocation to the Underlying Index with a lower realized volatility under those circumstances.

**No assurance can be given that the investment strategy used to construct the Sub-Indices will achieve its intended results or that any Sub-Index will be successful or will outperform any alternative index or strategy that might reference the relevant Underlying Indices. Furthermore, no assurance can be given that the realized volatility of any Sub-Index will approximate the Target Volatility. The actual realized volatility of each Sub-Index may be greater or less than the Target Volatility.**

**If the aggregate weight of the relevant Underlying Indices in a Sub-Index is less than 100%, that Sub-Index will not be fully invested, and any uninvested portion will earn no return.**

#### **Determining the Volatility of a Notional Portfolio of a Sub-Index**

Volatility is a measure of the degree of variation in the value of an asset over a period of time. The realized volatility of a portfolio reflects the weight and realized volatility of each of its constituents, as well as the degree of the realized correlation between those constituents. Correlation is a measure of the degree to which the daily returns of two assets are similar to each other over a given period in terms of timing and direction. A portfolio with a lower degree of correlation between its constituents will have a lower volatility than a portfolio with a higher degree of correlation between its constituents, assuming that the volatilities and weights of the individual constituents are the same. This is because the returns of constituents with a lower degree of correlation will offset each other to a greater extent than the returns of constituents with a higher degree of correlation, resulting in less variability in portfolio returns for a

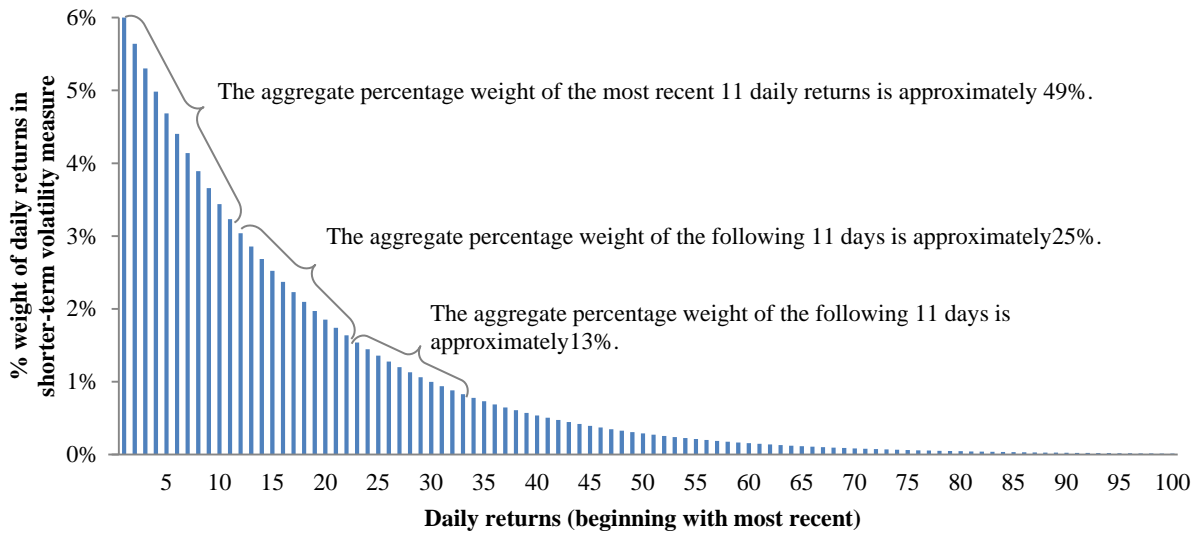
---

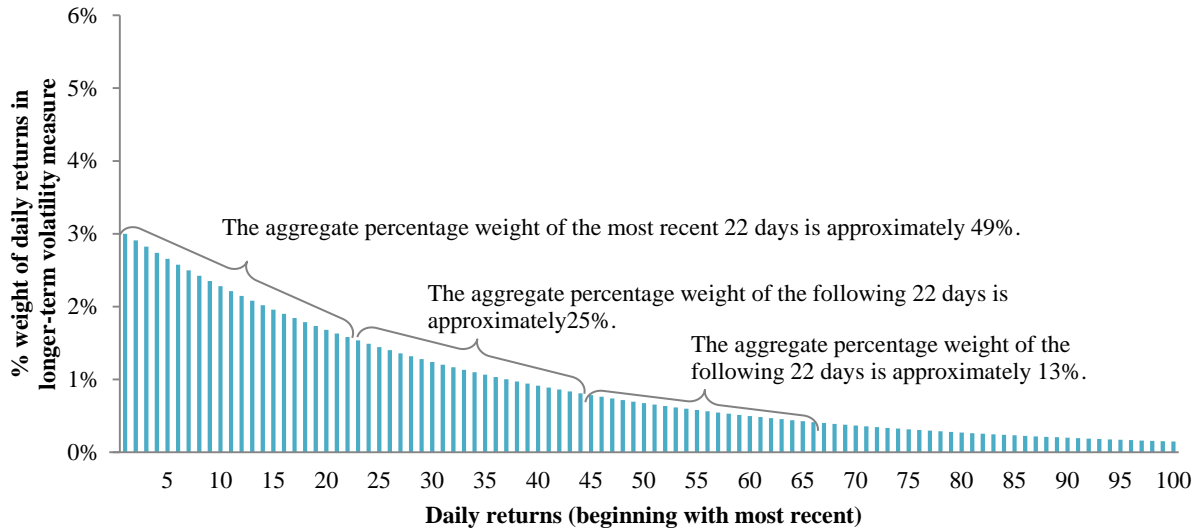
<sup>3</sup> There will be no such portfolio only if the annualized realized volatility of all notional portfolios composed of the relevant Underlying Indices with an aggregate weight of 100% is greater than 6.0%.

portfolio composed of constituents with a lower degree of correlation and more variability in portfolio returns for a portfolio composed of constituents with a higher degree of correlation.

The realized volatility of the notional portfolios composed of the relevant Underlying Indices for a Sub-Index are calculated using two volatility measures: a shorter-term volatility measure and a longer-term volatility measure. Each volatility measure reflects an exponentially weighted moving average, meaning that greater weight is assigned to more recent performance and less weight is assigned to less recent performance; however, the shorter-term volatility measure assigns greater weight to more recent performance than does the longer-term volatility measure. For example, approximately 50% of the realized value for the shorter-term volatility measure is determined based on the most recent 11 daily returns, and approximately 75% of the realized value for the shorter-term volatility measure is determined based on the most recent 22 daily returns. In contrast, approximately 50% of the realized value for the longer-term volatility measure is determined based on the most recent 22 daily returns, and approximately 75% of the realized value for the shorter-term volatility measure is determined based on the most recent 44 daily returns.

The charts below further illustrate the effect of the exponential weighting described above for the shorter-term volatility measure and longer-term volatility measure for the most recent 100 daily returns. For each daily return shown, the charts indicate the percentage weight that will be given to that daily return in calculating the relevant exponentially weighted average. As the charts illustrate, the most recent daily returns have a significantly greater weight than less recent daily returns in determining the relevant exponentially weighted average.





For each volatility measure and each S&P business day, each Sub-Index seeks to identify a notional portfolio composed of the relevant Underlying Indices that has an annualized realized volatility of 6.0% (or less, in limited circumstances described above) determined for that volatility measure, subject to the conditions described above.

#### Calculation of the Level of the Index

The level of the Index on any S&P business day  $t$  reflects the excess return of the relevant Sub-Index since the immediately preceding S&P business day and is calculated as follows:

$$\text{Index}_t = \text{Index}_{t-1} \times (1 + \text{SubIndex Return}_t)$$

where:

$\text{Index}_t =$  the level of the Index as of S&P business day  $t$ ;

$\text{Index}_{t-1} =$  the level of the Index as of the immediately preceding S&P business day; and

$\text{SubIndex Return}_t =$  the return of the relevant Sub-Index since the immediately preceding S&P business day, which is calculated as follows:

$$\text{SubIndex Return}_t = \frac{\text{SubIndex}_t}{\text{SubIndex}_{t-1}} - 1$$

where:

$\text{SubIndex}_t =$  the level of the relevant Sub-Index as of S&P business day  $t$ ; and

$\text{SubIndex}_{t-1} =$  the level of the relevant Sub-Index as of the immediately preceding S&P business day.

### Calculation of the Level of each Sub-Index

The level of each Sub-Index on any S&P business day t reflects the weighted excess returns of the Underlying Equity Index of that Sub-Index and the Underlying Treasury Index since the immediately preceding S&P business day and is calculated as follows:

$$\text{Sub-Index}_t = \text{Sub-Index}_{t-1} \times \left[ 1 + W_{E,t-2} \times \left( \frac{\text{ER}_{E,t}}{\text{ER}_{E,t-1}} - 1 \right) + W_{B,t-2} \times \left( \frac{\text{ER}_{B,t}}{\text{ER}_{B,t-1}} - 1 \right) \right]$$

where:

- Sub-Index<sub>t</sub> = the level of the relevant Sub-Index as of S&P business day t;
- Sub-Index<sub>t-1</sub> = the level of the relevant Sub-Index as of the immediately preceding S&P business day;
- W<sub>E,t-2</sub> = the weight of the relevant Underlying Equity Index as of the second immediately preceding S&P business day;
- W<sub>B,t-2</sub> = the weight of the Underlying Treasury Index as of the second immediately preceding S&P business day;
- ER<sub>E,t</sub> = the closing level of the relevant Underlying Equity Index as of S&P business day t;
- ER<sub>E,t-1</sub> = the closing level of the relevant Underlying Equity Index as of the immediately preceding S&P business day;
- ER<sub>B,t</sub> = the closing level of the Underlying Treasury Index as of S&P business day t; and
- ER<sub>B,t-1</sub> = the closing level of the Underlying Treasury Index as of the immediately preceding S&P business day.

“**S&P business day**” means any U.S. equity market business day as determined by S&P Dow Jones.

See “Background on the S&P 5-Year U.S. Treasury Note Futures Excess Return Index” in this underlying supplement for additional information about how the closing excess return level of the Underlying Treasury Index is calculated.

### Calculation of the Closing Level of each Underlying Equity Index

The closing level of each Underlying Equity Index at time t reflects (a) the return of the price return version of that Underlying Equity Index (each, an “**Underlying Price Return Index**”) and (b) the deduction of the notional financing cost that has accrued since the immediately preceding S&P business day, and is calculated as follows:

$$\text{ER}_{E,t} = \text{ER}_{E,t-1} \times \left[ \frac{\text{PR}_{E,t}}{\text{PR}_{E,t-1}} - \frac{\text{InterestRate}_{t-i}}{360} \times D_{t-1,t} \right]$$

where:

- ER<sub>E,t</sub> = the closing level of the relevant Underlying Equity Index as of S&P business day t;

$ER_{E,t-1}$ =	the closing level of the relevant Underlying Equity Index as of the immediately preceding S&P business day;
$PR_{E,t}$ =	the closing level of the relevant Underlying Price Return Index as of S&P business day t;
$PR_{E,t-1}$ =	the closing level of the relevant Underlying Price Return Index as of the immediately preceding S&P business day;
$InterestRate_{t-i}$ =	the Interest Rate as of the immediately preceding S&P business day, which is the return from a synthetically daily rolling of a 3-month bond, calculated by reference to the 2-month and 3-month USD LIBOR rates as of the immediately preceding S&P business day, <i>provided</i> that, from and including August 4, 2016 to and including May 1, 2017, the Interest Rate was calculated using fixed values of 0.6111% and 0.7776% instead of the 2-month and 3-month USD LIBOR rates, respectively; and
$D_{t-1,t}$ =	the number of calendar days from and including the immediately preceding S&P business day to but excluding S&P business day t.

See “Risk Factors — Risks Relating to the Index and the Sub-Indices — The calculation of the notional financing cost from and including August 4, 2016 to and including May 1, 2017 was based on fixed values instead of 2-month and 3-month USD LIBOR rates” for additional information about the use of fixed values in the calculation of the Interest Rate set forth above.

See the descriptions of the Underlying Price Return Indices in this underlying supplement for additional information about how their closing levels are calculated. The Underlying Price Return Index corresponding to each Underlying Equity Index is set forth below.

Underlying Equity Index	Underlying Price Return Index
S&P Momentum United States LargeMidCap (USD) Excess Return Index	S&P Momentum United States LargeMidCap Index
S&P 500 <sup>®</sup> Pure Value Excess Return Index	S&P 500 <sup>®</sup> Pure Value Index
S&P 500 <sup>®</sup> Buyback FCF Excess Return Index	S&P 500 <sup>®</sup> Buyback FCF Index
S&P 500 <sup>®</sup> Low Volatility High Dividend Excess Return Index	S&P 500 <sup>®</sup> Low Volatility High Dividend Index

### Governance of the Index and each Sub-Index

The S&P Dow Jones’ Global Benchmarks Index Committee maintains the Index and each Sub-Index. All committee members are full-time professional members of S&P Dow Jones’ staff. The index committee meets monthly. At each meeting, the index committee may revise index policy covering rules for including other assets or asset classes, changes to target weight allocations, currencies, the timing of rebalancing or other matters.

### License Agreement with S&P Dow Jones

JPMorgan Chase & Co. or its affiliate has entered into an agreement with S&P Dow Jones that provides it and certain of its affiliates or subsidiaries, including JPMorgan Financial, with a license and with the right for a fee to use the Index, which is owned and published by S&P Dow Jones, in connection with certain financial products, including the notes. This license was previously exclusive, and JPMorgan Chase & Co. intends to renew the exclusivity of its license.

The notes are not sponsored, endorsed, sold or promoted by S&P Dow Jones or its third party licensors. Neither S&P Dow Jones nor its third party licensors makes any representation or warranty,

express or implied, to the owners of the notes or any member of the public regarding the advisability of investing in financial products generally or in the notes particularly or the ability of the Index to track general stock market performance. S&P Dow Jones's and its third party licensor's only relationship to JPMorgan Chase & Co. and JPMorgan Financial is the licensing of certain trademarks and trade names of S&P Dow Jones and the third party licensors and of the Index which is determined, composed and calculated by S&P Dow Jones or its third party licensors without regard to JPMorgan Chase & Co., JPMorgan Financial or the notes. S&P Dow Jones and its third party licensors have no obligation to take the needs of the Issuer, the Guarantor (if applicable) or the holders of the notes into consideration in determining, composing or calculating the Index. Neither S&P Dow Jones nor its third party licensors is responsible for or has participated in the determination of the prices and amount of the notes or the timing of the issuance or sale of the notes or in the determination or calculation of the equation by which the notes are to be converted into cash. S&P Dow Jones has no obligation or liability in connection with the administration, marketing or trading of the notes.

NEITHER S&P DOW JONES, ITS AFFILIATES NOR THEIR THIRD PARTY LICENSORS GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS OR COMPLETENESS OF THE INDEX OR ANY DATA INCLUDED THEREIN OR ANY COMMUNICATIONS, INCLUDING BUT NOT LIMITED TO, ORAL OR WRITTEN COMMUNICATIONS (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES, ITS AFFILIATES AND THEIR THIRD PARTY LICENSORS SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS OR DELAYS THEREIN. S&P DOW JONES 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 MARKS, THE INDEX OR ANY DATA INCLUDED THEREIN. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES, ITS AFFILIATES OR THEIR THIRD PARTY LICENSORS 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.

"Standard & Poor's," "S&P" and "S&P 500<sup>®</sup>" are trademarks of Standard & Poor's Financial Services LLC and have been licensed for use by JPMorgan Chase & Co. and certain of its affiliated or subsidiary companies, including JPMorgan Financial.

## BACKGROUND ON THE CHICAGO FED NATIONAL ACTIVITY INDEX

All information contained in this underlying supplement regarding the Chicago Fed National Activity Index (the “**CFNAI**”), including, without limitation, its make-up, method of calculation and changes in its components, has been derived from publicly available information, without independent verification. This information reflects the policies of, and is subject to change by, the Federal Reserve Bank of Chicago. The Federal Reserve Bank of Chicago has no obligation to continue to calculate and publish, and may discontinue calculation and publication of, the CFNAI.

### General

The CFNAI is a weighted average of 85 monthly indicators of national economic activity that provides a single, summary measure of a common factor in these national economic data. The Federal Reserve Bank of Chicago’s goal in releasing the CFNAI monthly is to provide an objective, “real-time” statistical measure of coincident economic activity derived from a wide range of monthly indicators.

### Index Construction

The economic indicators used for the CFNAI are drawn from four broad categories of data:

1. production and income (e.g., industrial production) (23 series);
2. employment, unemployment, and hours (e.g., payroll employment) (24 series);
3. personal consumption and housing (e.g., housing starts) (15 series); and
4. sales, orders, and inventories (e.g., manufacturing and trade sales) (23 series).

All of the data are adjusted for inflation. The CFNAI is a weighted average of the 85 economic indicators that provides a single, summary measure of a common factor in these economic indicators.

The CFNAI is designed to capture the co-movement of all 85 economic indicators within a month. To the extent that all 85 series track together in a month, the degree of co-movement will be high. In this case, the individual weights on each data series are relatively unimportant. But when the data point in different directions, the degree of co-movement is low. In this case, the individual weights critically determine how the CFNAI resolves the conflict and reports the common element. The weights of the CFNAI are determined by the historical importance of each variable’s contribution to the overall co-movement of the 85 series.

The CFNAI is constructed to have an average value of zero and a standard deviation of one. Since economic activity tends toward a trend growth rate over time, a zero value for the CFNAI indicates that the national economy is expanding at its historical trend rate of growth; negative values indicate below-average growth; and positive values indicate above-average growth. The underlying monthly data series are somewhat volatile; consequently, the monthly CFNAI is also quite volatile. Using a three-month moving average of the CFNAI reduces month-to-month volatility.

### Index Maintenance

The CFNAI is released by the Federal Reserve Bank of Chicago each month via its website: <https://www.chicagofed.org/publications/cfnai/index>, normally toward the end of each calendar month. Information contained in the Federal Reserve Bank of Chicago’s website is not incorporated by reference in, and should not be considered a part of, this underlying supplement or the relevant terms supplement. The CFNAI is revised with each monthly release. For every release there are two potential reasons for minor revisions to the CFNAI. First, the underlying monthly data are released with varying degrees of delay. The Federal Reserve Bank of Chicago aims to release the CFNAI each month in a timely fashion. Consequently, the initial release includes projected monthly values for approximately one-third of the 85 series. In the following month’s release when these missing data become available, correcting the projection error becomes a source of revision in the CFNAI. Second, throughout the calendar year, the



85 monthly data series are systematically revised by the original reporting institutions. These revisions will also alter the underlying monthly data. Finally, the weighting is re-estimated each month so that changes in the weighting will affect the history of the CFNAI. However, in practice this is only a minor source of revision.

## BACKGROUND ON THE S&P MOMENTUM UNITED STATES LARGEMIDCAP INDEX

All information contained in this underlying supplement regarding the S&P Momentum United States LargeMidCap Index (the “**Momentum Index**”), including, without limitation, its make-up, method of calculation and changes in its components, has been derived from publicly available information, without independent verification. This information reflects the policies of, and is subject to change by, S&P Dow Jones Indices LLC (“**S&P Dow Jones**”). The Momentum Index is calculated, maintained and published by S&P Dow Jones. S&P Dow Jones has no obligation to continue to publish, and may discontinue the publication of, the Momentum Index.

The Momentum Index began publishing on November 18, 2014 and has a base date of December 30, 1994 and a base value of 100.00. The Momentum Index is reported by Bloomberg, L.P. under the ticker symbol “SPUSMUP.”

The Momentum Index is a modified market capitalization-weighted index that is designed to measure the performance of U.S. large- and mid-capitalization companies with relatively higher recent performance compared to the S&P United States LargeMidCap Index. The Index allocates to the “Momentum” Sub-Index when it determines the business cycle to be in “Expansion” in an attempt to provide exposure to companies that are moving with a strong and strengthening U.S. economy.

### Index Constituent Selection

To be eligible for inclusion in the Momentum Index, a stock must be a constituent of the S&P United States LargeMidCap Index. The S&P United States LargeMidCap Index is composed of the top 85% of the float-adjusted market capitalization of the S&P United States BMI (Broad Market Index). The S&P United States BMI includes publicly listed U.S. equities with a minimum float-adjusted market cap of \$100 million and a minimum annual dollar value traded of \$50 million. At the annual reconstitution, index constituents are removed from the S&P United States BMI if their float-adjusted market cap is less than \$75 million or their minimum annual dollar value traded is less than \$35 million. The following shares are not eligible for inclusion in the S&P United States BMI: fixed-dividend shares, closed-end funds, investment trusts, convertible bonds, unit trusts, equity warrants, mutual fund shares, limited partnerships and business development companies.

S&P Dow Jones first selects the stocks to be included in the Momentum Index and then weights those constituents. Generally, a stock must have been trading at least 150 days in the 12 months leading up to the rebalancing reference date to be included in the Momentum Index. S&P Dow Jones selects the stocks to be included in the Momentum Index by ranking the stocks in the S&P United States LargeMidCap Index in descending order by their risk-adjusted momentum values (the 12-month price change, excluding the most recent month, of the security, divided by the standard deviation of its daily price returns over the same time period).

Securities with the highest risk-adjusted momentum values (those in the first quintile) are eligible for inclusion in the Momentum Index. The target stock count for the Momentum Index is 20% of the total number of stocks included in the S&P United States LargeMidCap Index. In order to reduce turnover, a 20% buffer rule is applied to the security selection at each rebalancing:

- All securities ranked within the top 80% of the target stock count are automatically selected for the Momentum Index.
- Next, any current constituents remaining within the top 120% of the target stock count are re-selected for the index, in order by rank, until the target stock count has been reached.
- Then, if the target stock count still has not been reached, any non-current constituents remaining and ranked from 80% to 100% of the target stock count are selected for inclusion until the target stock count is reached.

The risk-adjusted momentum value of each stock is updated semi-annually at each rebalancing.

S&P Dow Jones believes turnover in index membership should be avoided when possible. At times, a company may appear to temporarily violate one or more of the addition criteria. However, the addition criteria are for addition to the Momentum Index, not for continued membership. As a result, an index constituent that appears to violate criteria for addition to the Momentum Index is not deleted unless ongoing conditions warrant an index change. If a stock is deleted from the S&P United States LargeMidCap Index universe, it will be deleted from the Momentum Index simultaneously.

A momentum score is then determined for each of the securities based on the z-scores for their risk-adjusted momentum values, capped at 3 and floored at -3.

Computing a z-score is a widely adopted method of standardizing a variable. The z-score for the risk-adjusted momentum value for each security is calculated using the mean and standard deviation of the risk-adjusted momentum values, as follows:

$$z_{\alpha} = \frac{(x_{\alpha} - \mu_{\alpha})}{\sigma_{\alpha}}$$

where:

$z_{\alpha}$  = Z-score for a given security

$x_{\alpha}$  = Observed risk-adjusted momentum value for a given security

$\mu_{\alpha}$  = Arithmetic mean of the risk-adjusted momentum values

$\sigma_{\alpha}$  = Standard deviation of the risk-adjusted momentum values

For a given security, if its capped and floored z-score is above 0, then its momentum score will be calculated by adding 1. On the other hand, if its capped and floored z-score is below 0, then its momentum score will be the inverse of 1 minus its capped and floored z-score.

If  $Z > 0$ , Momentum Score =  $1 + Z$

If  $Z < 0$ , Momentum Score =  $(1 / (1 - Z))$

If  $Z = 0$ , Momentum Score = 1

As a consequence, the momentum score for each security will vary between 0.25 and 4.

For a given rebalancing date, all the securities eligible for inclusion in the Momentum Index are weighted by the product of their market capitalization in the eligible index universe and their momentum score, subject to security constraints. The maximum weight of each security is the lower of 9% and three times its market capitalization weight in the Momentum Index.

Investable Weight Factors (IWFs), which define the available float for each stock, are reviewed annually. The float-adjusted shares are used in the calculation of each stock's momentum weight.

## Index Rebalancing

The Momentum Index is rebalanced semi-annually after the close on the third Friday of March and September. As part of the rebalancing process, constituent stock weights are updated. The rebalancing reference dates are the last business day of February and August, respectively. Weights calculated as a result of the reference date data are implemented in the Momentum Index using closing prices as of the rebalancing reference date.

## Index Calculation

The Momentum Index is calculated using the same methodology as the S&P 500<sup>®</sup> Index, except that the constituents of the Momentum Index are weighted by the product of their market capitalization in the eligible index universe and their momentum score, subject to the maximum weight of each security described above. For additional information about the calculation of the S&P 500<sup>®</sup> Index, see “Background on the S&P 500<sup>®</sup> Index” below.

## Corporate Actions

The table below summarizes types of index maintenance adjustments and indicates whether or not a divisor adjustment is required.

<b>Type of Corporate Action</b>	<b>Adjustment Made to Index</b>	<b>Divisor Adjustment</b>
Spin-off	See below for more information.	
Rights Offering	The price is adjusted to the price of the parent company minus (the price of the rights offering/rights ratio). Index shares change so that the company's weight remains the same as its weight before the rights offering.	No
Stock Dividend, Stock Split, Reverse Stock Split	Index shares are multiplied by and price is divided by the split factor.	No
Share Issuance, Share Repurchase, Equity Offering or Warrant Conversion	None.	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.	No
Constituent Change	There are no intra-rebalancing additions.	—
	Deletions due to delistings, acquisition or any other corporate event resulting in the deletion of the stock from the Momentum Index causes the weights of the rest of the stocks in the Momentum Index to change. Relative weights stay the same.	Yes

## Spin-offs

The spun-off company is added to the Momentum Index at a zero price and will be dropped from the Momentum Index after the first day of regular way trading provided the drop event has been announced at least two days prior to the drop date.

## 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 S&P Dow Jones's U.S. index committee's discretion, in recognition of the constraints faced by investors in trading bankrupt or suspended stocks.

## Index Committee

The Momentum Index is maintained by the S&P Dow Jones's U.S. index committee. All index committee members are full-time professional members of S&P Dow Jones' staff. The index committee

meets monthly. At each meeting, the index committee reviews pending corporate actions that may affect index constituents, statistics comparing the composition of the indices to the market, companies that are being considered as candidates for addition to an index, and any significant market events. In addition, the index committee may revise index policy covering rules for selecting companies, treatment of dividends, share counts or other matters.

## BACKGROUND ON THE S&P 500<sup>®</sup> PURE VALUE INDEX

All information contained in this underlying supplement regarding the S&P 500<sup>®</sup> Pure Value Index (the “**Pure Value Index**”), including, without limitation, its make-up, method of calculation and changes in its components, has been derived from publicly available information, without independent verification. This information reflects the policies of, and is subject to change by, S&P Dow Jones Indices LLC (“**S&P Dow Jones**”). The Pure Value Index is calculated, maintained and published by S&P Dow Jones. S&P Dow Jones has no obligation to continue to publish, and may discontinue the publication of, the Pure Value Index.

The Pure Value Index began publishing on December 16, 2005 and has a base date of June 30, 1995 and a base value of 1,020.02. The Pure Value Index is reported by Bloomberg, L.P. under the ticker symbol “SPXPV.”

The Pure Value Index is an index designed to measure the performance of companies in the S&P 500<sup>®</sup> Index that exhibit relatively strong value characteristics (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 (by reference to EPS growth, sales per share growth and price momentum). The Index allocates to the Value Sub-Index when it determines the business cycle to be in “Recovery” in an attempt to provide exposure to companies that may be undervalued.

### Index Constituent Selection

S&P Dow Jones draws the constituents of the Pure Value Index from the S&P 500<sup>®</sup> Index and identifies a portion of the S&P 500<sup>®</sup> Index’s market capitalization as pure growth and a portion as pure value. There are no overlapping stocks, and the stocks in the Pure Value Index are weighted in proportion to their respective value scores, subject to a cap. For additional information about the S&P 500<sup>®</sup> Index, see “Background on the S&P 500<sup>®</sup> Index.”

To determine the constituency of the Pure Value Index, S&P Dow Jones calculates three value factors for each constituent of the S&P<sup>®</sup> Total Market Index: (1) book value to price ratio, (2) earnings to price ratio and (3) sales to price ratio.<sup>4</sup> Raw values for each of the three factors are calculated for each company in the S&P<sup>®</sup> Total Market Index and are first narrowed to the 90th percentile 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. This narrowing reduces the impact of outliers on a data set. The S&P<sup>®</sup> Total Market Index is designed to track the broad U.S. equity market, including large-, mid-, small-, and micro-cap stocks. The S&P 500<sup>®</sup> Index is a subset of the S&P<sup>®</sup> Total Market Index. A value score for each company is computed as the average of the standardized values of the three value factors. Growth scores are determined similarly for each company in the S&P<sup>®</sup> Total Market Index based on three growth benchmarks: (1) three-year change in earnings per share (excluding extra items) over price per share, (2) three-year sales per share growth rate and (3) momentum (12-month percent price change).<sup>5</sup>

---

<sup>4</sup> When book value to price ratio, earnings to price ratio, or sales to price ratio is not available, the factor is set equal to zero.

<sup>5</sup> When earnings from three years prior are not available, then 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, then one-year change in earnings per share (excluding extra items) over price per share is used. When earnings from one year prior are not available, the factor is set equal to zero. If the starting values is less than zero, the score is multiplied by a factor of negative 1.

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, the factor is set equal to zero. If the starting values is less than zero, the score is multiplied by a factor of negative 1.

The universe of constituents is then restricted to the constituents of the S&P 500<sup>®</sup> Index. The S&P 500<sup>®</sup> Index consists of stocks of 500 companies selected to provide a performance benchmark for the U.S. equity markets.

The companies are then ranked based on their respective scores. A company with a high growth or value score will have a high growth or value rank (where the highest ranking is 1), respectively, while a company with a low growth or value score will have a low growth or value rank (where the lowest rank is 500), respectively. Next, the companies are sorted in ascending order based on their growth rank divided by their value rank (i.e., the companies with the highest value scores are at the bottom of the list). The companies at the bottom of the list have a higher value rank (and value score) and a lower growth rank (and growth score) and, therefore, exhibit pure value characteristics.

The companies at the bottom of this list with a combined market capitalization of 33% of the market capitalization of the S&P 500<sup>®</sup> Index form the “Value Basket,” those at the top of this list with a combined market capitalization of 33% of the market capitalization of the S&P 500<sup>®</sup> Index form the “Growth Basket,” and the remainder from the Blended Basket. S&P Dow Jones then calculates the average growth and value scores of both the Growth Basket and the Value Basket. The distance of a company in the Blended Basket from the Growth Basket is then determined as follows:

- if the company's growth score is greater than or equal to the average growth score of the Growth Basket, then its distance from the Growth Basket is equal to the absolute value of the difference between its value score and the average value score of the Growth Basket;
- if the company's growth score is less than the average growth score of the Growth Basket and its value score is less than or equal to the average value score of the Growth Basket, then its distance from the Growth Basket is equal to the average value score of the Growth Basket minus the company's value score; and
- if the company's growth score is less than the average growth score of the Growth Basket and its value score is greater than the average value score of the Growth Basket, then its distance from the Growth Basket is equal to the square root of the sum of (i) the difference between its value score and the average value score of the Growth Basket, squared, and (ii) the difference between its growth score and the average growth score of the Growth basket, squared.

The distance of a company in the Blended Basket from the Value Basket is then determined as follows:

- if the company's value score is greater than or equal to the average value score of the Value Basket, then its distance from the Value Basket is equal to the absolute value of the difference between its growth score and the average growth score of the Value Basket;
- if the company's value score is less than the average value score of the Value Basket and its growth score is less than or equal to the average growth score of the Value Basket, then its distance from the Value Basket is equal to the average growth score of the Value Basket minus the company's growth score; and
- if the company's value score is less than the average value score of the Value Basket and its growth score is greater than the average growth score of the Value Basket, then its distance from the Value Basket is equal to the square root of the sum of (i) the difference between its value score and the average value score of the Value Basket, squared, and (ii) the difference between its growth score and the average growth score of the Value basket, squared.

---

When there is not enough trading history to calculate 12-month momentum, then momentum is calculated from the stock's listing date.

Pure Value Index constituents are those that are both (i) either (x) companies in the Value Basket or (y) companies in the Blended Basket whose distance from the Growth Basket is 80% or more of the sum of their distances from the Growth Basket and Value Basket, and (ii) companies whose respective value scores are greater than the mean of all the S&P 500<sup>®</sup> Index value scores plus 0.25.

The constituents of the Pure Value Index are weighted by their respective value scores capped at 2, so that no outlying constituents will have outsize weight.

### Index Calculation

The Pure Value Index is calculated using the same methodology as the S&P 500<sup>®</sup> Index, except that the constituents of the Pure Value Index are weighted in proportion to their respective value scores, subject to a cap of 2 as described above. Some companies may have more than one share class line represented in the S&P 500<sup>®</sup> Index. In the Pure Value Index, the weight determined at the rebalance is distributed proportionally to the market capitalization ratio of the share class lines. For additional information about the calculation of the S&P 500<sup>®</sup> Index, see “Background on the S&P 500<sup>®</sup> Index” below.

### Index Rebalancing

The Pure Value Index is rebalanced annually on the third Friday of December. The reference date for growth and value expressions is after the close of the last trading date of the previous month. Closing prices as of the second Friday of December are used for setting index weights. Style scores and weights are reset annually at the rebalancing date. The Index Committee (as defined below) may change the date of a given rebalancing for reasons including market holidays occurring on or around the scheduled rebalancing date. Any such change will be announced by S&P Dow Jones with proper advance notice where possible. Other changes are made on an as-needed basis according to the S&P 500<sup>®</sup> Index’s guidelines. Changes in response to corporate actions and market developments can be made at any time.

### Index Changes

Actions that affect the S&P 500<sup>®</sup> Index may result in adjustments to the Pure Value Index. The table below summarizes types of index maintenance adjustments and indicates whether or not a divisor adjustment is required.

<b>S&amp;P 500<sup>®</sup> Index Action</b>	<b>Adjustment Made to Index</b>	<b>Divisor Adjustment</b>
Spin-off	Index membership follows the S&P 500 <sup>®</sup> Index. The child stock is assigned the same Pure Weight Factor and style score as the parent stock on the effective date of the spin-off.	No
Rights offering	The weight of stocks is unchanged. Price follows the S&P 500 <sup>®</sup> Index price change. To keep weights of stocks unchanged following price change, Modified Index Shares are adjusted for the stock whose shares are being changed.	No



<b>S&amp;P 500® Index Action</b>	<b>Adjustment Made to Index</b>	<b>Divisor Adjustment</b>
Constituent change	If the constituent being dropped is a member of the Pure Value Index, it is removed from the Pure Value Index. The replacement stock can be added to either the Pure Value Index or the Pure Growth Index, or to neither. If the stock is added to the Pure Value Index, S&P Dow Jones will include the weight at which the stock will enter the Pure Value Index. The weight is the ratio of the capped style score of the added stock divided by the sum of style scores of all index constituents.	Yes
Share changes between quarterly share adjustments	The weight of stocks is unchanged.	No
Quarterly share changes	The weight of stocks is unchanged during March, June and September quarterly share changes. For the annual rebalancing, new constituents and their weights are announced two-to-five days before the December quarterly date. At the rebalancing, the weight of each stock is simply proportional to its capped style score.	Only on the December quarterly adjustment date, since it coincides with the annual rebalancing of the Pure Value Index.

#### **Index Governance**

The Pure Value Index is supervised by the S&P U.S. Index Committee (the "Index Committee"). The Index Committee will, from time to time, consult practitioners and academics to keep index methodology current and relevant.

## BACKGROUND ON THE S&P 500<sup>®</sup> BUYBACK FCF INDEX

All information contained in this underlying supplement regarding the S&P 500<sup>®</sup> Buyback FCF Index (the “**Buyback FCF Index**”), including, without limitation, its make-up, method of calculation and changes in its components, has been derived from publicly available information, without independent verification. This information reflects the policies of, and is subject to change by, S&P Dow Jones Indices LLC (“**S&P Dow Jones**”). The Buyback FCF Index is calculated, maintained and published by S&P Dow Jones. S&P Dow Jones has no obligation to continue to publish, and may discontinue the publication of, the Buyback FCF Index.

The Buyback FCF Index began publishing on March 17, 2014 and has a base date of January 21, 1994 and a base value of 1,000.00. The Buyback FCF Index is reported by Bloomberg, L.P. under the ticker symbol “SPBUYFUP.”

The Buyback FCF Index is a modified market capitalization-weighted index that is designed to measure the performance of 30 companies in the S&P 500<sup>®</sup> Buyback Index (the “**Buyback Index**”) (excluding JPMorgan Chase & Co., Visa and their past or present affiliated companies) with relatively higher rates of buying back their own stock, relatively higher levels of trading activity in their stock, and relatively higher free cash flow yields, as compared to the S&P 500<sup>®</sup> Index. The Index allocates to the Buyback Sub-Index when it determines the business cycle to be in “Slowdown” in an attempt to provide exposure to companies that are supporting their stocks through buybacks and have sufficient free cash flow to maintain this program. The Buyback Index is designed to measure the performance of the 100 companies in the S&P 500<sup>®</sup> Index with the highest buyback ratios during the preceding 12 months.

### Index Constituent Selection

To be eligible for inclusion in the Buyback FCF Index, a stock must be a constituent of the Buyback Index. The Buyback Index selects its constituents from the S&P 500<sup>®</sup> Index. For additional information about the S&P 500<sup>®</sup> Index, see “Background on the S&P 500<sup>®</sup> Index” below. In connection with the quarterly rebalancing of the Buyback Index, the buyback ratio of each constituent of the S&P 500<sup>®</sup> Index is calculated by dividing the cash paid for buybacks of common shares during the observation period by the total market capitalization of common shares at the beginning of the observation period. Assuming a three-month lagging period for the release of company reports, the observation period for the calculation of the buyback ratio is the 12-month (or four-quarter) period ending one quarter before the reference date for the quarterly rebalancing of the Buyback Index (which is after the close of the last business day of March, June, September or December, as applicable). The constituents of the S&P 500<sup>®</sup> Index are then ranked in descending order based on the buyback ratio. The top 100 securities form the Buyback Index.

S&P Dow Jones selects the constituents of the Buyback FCF Index quarterly as of each rebalancing reference date. S&P Dow Jones begins by excluding JPMorgan Chase & Co., Visa and their past or present affiliated companies if they are included in the Buyback Index. S&P Dow Jones then obtains the free cash flow data from the latest quarterly report for each constituent of the Buyback Index not already excluded. Free cash flow represents the net change in cash from all items classified in the operating activities section on a statement of cash flows, minus capital spending and cash dividends. Any company without available free cash flow data is not eligible. Next, the three-month average daily value traded (“ADVT”), as of the rebalancing reference date, is obtained for the remaining companies, and the 50 companies with the highest ADVT are selected as the sub-universe. Free cash flow yield is then calculated for each company in the sub-universe by dividing the free cash flow by the closing price of one share of the company’s stock as of the applicable rebalancing reference date. The companies are then ranked in accordance with their free cash flow yield, and the top 30 companies are selected for inclusion in the Buyback FCF Index.

Except for major corporate actions, such as mergers and spin-offs, additions and deletions of stocks only take place at the time of the quarterly rebalancing. In addition, constituents removed from the Buyback Index are also removed from the Buyback FCF Index simultaneously.

## Index Rebalancing

The Buyback FCF Index is rebalanced quarterly, effective after the close of business on the third Friday of January, April, July and October of each year, based on market data from the rebalancing reference dates, which are the last business days of December, March, June and September, respectively. The constituents' shares are calculated using closing prices on the second Friday of the rebalancing month as the reference price. The constituents' shares are calculated and assigned to each stock to arrive at the weights determined on the rebalancing reference date. Because the constituents' shares are assigned based on reference prices five business days prior to rebalancing, the actual weight of each constituent at the rebalancing will differ from these weights due to market movements.

## Index Calculation

The Buyback FCF Index is calculated using the same methodology as the S&P 500<sup>®</sup> Index, except that the initial weight for each constituent at each rebalancing is set proportional to the ratio of its free cash flow yield to the sum of all constituents' free cash flow yields. If the initial weight of any constituent is above 7.5%, the weight is capped at 7.5%, with the excess weight re-distributed among all non-capped constituents on a pro rata basis. For additional information about the calculation of the S&P 500<sup>®</sup> Index, see "Background on the S&P 500<sup>®</sup> Index" below.

## Corporate Actions

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.

The table below summarizes types of index maintenance adjustments and indicates whether or not a divisor adjustment is required.

<b>Type of Corporate Action</b>	<b>Adjustment Made to Index</b>	<b>Divisor Adjustment</b>
Spin-off	See below for more information.	
Rights offering	The price is adjusted to the price of the parent company minus (the price of the rights offering/rights ratio). Index shares change so that the company's weight remains the same as its weight before the rights offering.	No
Stock split	Index shares are multiplied by and price is divided by the split factor.	No
Share issuance or share repurchase	None. Actual shares outstanding of the company play no role in the daily index calculation.	No
Special dividends	The 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
Delisting, acquisition or any other corporate action resulting in the deletion of the stock from the Buyback Index	The stock is dropped from the Buyback FCF Index. This will cause the weights of the rest of the stocks in the Buyback FCF Index to change proportionately. Additions are made to the Buyback FCF Index only at the time of the quarterly rebalancing.	Yes

**Spin-offs**

The spun-off company is added to the Buyback FCF Index if the parent is a constituent, at a zero price at the market close of the day before the ex-date (with no divisor adjustment). The spun-off company is then removed after at least one day of regular way trading (with a 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 Committee**

The Buyback FCF Index is maintained by the Americas Thematic and Strategy Index Committee. All index committee members are full-time professional members of S&P Dow Jones' staff. The index committee meets monthly. At each meeting, the index committee reviews pending corporate actions that may affect index constituents, statistics comparing the composition of the indices to the market, companies that are being considered as candidates for addition to an index, and any significant market events. In addition, the index committee may revise index policy covering rules for selecting companies, treatment of dividends, share counts or other matters.

## BACKGROUND ON THE S&P 500<sup>®</sup> LOW VOLATILITY HIGH DIVIDEND INDEX

All information contained in this underlying supplement regarding the S&P 500<sup>®</sup> Low Volatility High Dividend Index (the “**Low Volatility High Dividend Index**”), including, without limitation, its make-up, method of calculation and changes in its components, has been derived from publicly available information, without independent verification. This information reflects the policies of, and is subject to change by, S&P Dow Jones Indices LLC (“**S&P Dow Jones**”). The Low Volatility High Dividend Index is calculated, maintained and published by S&P Dow Jones. S&P Dow Jones has no obligation to continue to publish, and may discontinue the publication of, the Low Volatility High Dividend Index.

The Low Volatility High Dividend Index began publishing on September 17, 2012 and has a base date of January 31, 1990 and a base value of 100.00. The Low Volatility High Dividend Index is reported by Bloomberg, L.P. under the ticker symbol “SP5LVHD.”

The Low Volatility High Dividend Index is a modified dividend yield-weighted index that is designed to measure the performance of the 50 least-volatile among the 75 highest dividend-yielding companies in the S&P 500<sup>®</sup> Index, subject to sector and individual constituent concentration limits. Although the Low Volatility High Dividend Index measures the performance of high dividend-yielding companies, it is a price return index and, therefore, the return on the Low Volatility High Dividend Index will not include any dividends paid on the securities that make up the Low Volatility High Dividend Index.

### Index Constituent Selection

To be eligible for inclusion in the Low Volatility High Dividend Index, a stock must be a constituent of the S&P 500<sup>®</sup> Index. For additional information about the S&P 500<sup>®</sup> Index, including the methodology for inclusion in the S&P 500<sup>®</sup> Index, see “Background on the S&P 500<sup>®</sup> Index” below.

S&P Dow Jones first selects the stocks to be included in the Low Volatility High Dividend Index and then weights those constituents. Generally, a stock must have been issued and trading on all trading days in the 12 months leading up to the rebalancing reference date to be included in the Low Volatility High Dividend Index. Some companies may have more than one share class in the S&P 500<sup>®</sup> Index. In the Low Volatility High Dividend Index, each company is represented once by the primary listing, which is generally the most liquid share class. S&P Dow Jones selects the stocks to be included in the Low Volatility High Dividend Index by ranking the stocks in the S&P 500<sup>®</sup> Index in descending order by their 12-month trailing dividend yield. Dividend yield is calculated by dividing each stock’s dividends per share for the prior 12 months by the stock price as of the rebalancing reference date. Special dividends are not considered in the calculation of dividend yields. The 75 stocks with the highest dividend yield are selected, with the number of stocks from each Global Industry Classification Standard (“**GICS**<sup>®</sup>”) sector capped at 10. If the number of stocks from a GICS<sup>®</sup> sector reaches 10, the remaining highest yielding stocks from other sectors are selected until the number of selected stocks reaches 75. Using available price return data for the trailing 252 trading day leading up to the rebalancing reference date, the realized volatilities of these stocks are calculated. Realized volatility is defined as the standard deviation of the stock’s daily price returns over the prior 252 trading days. Those stocks are then ranked in ascending order based on their realized volatility. The 50 stocks with the lowest realized volatility form the Low Volatility High Dividend Index.

At times, a company may appear to temporarily violate one or more of the addition criteria. However, the addition criteria are for addition to the Low Volatility High Dividend Index, not for continued membership. As a result, an index constituent that appears to violate criteria for addition to the Low Volatility High Dividend Index is not deleted unless ongoing conditions warrant an index change.

At the discretion of S&P Dow Jones, a stock may be excluded from the Low Volatility High Dividend Index, or not considered for membership, at a semi-annual rebalancing if S&P Dow Jones determines the stock’s dividend yield to be unsustainable.

Except for major corporate actions, such as mergers and spin-offs, additions and deletions of stocks generally only take place at the time of the reconstitution. In addition, constituents removed from the S&P 500<sup>®</sup> Index are also removed from the Low Volatility High Dividend Index simultaneously.

## Index Rebalancing

The Low Volatility High Dividend Index is rebalanced after the close of the last business day of January and July based on market data from the rebalancing reference dates, which are the last business day of December and June, respectively. The constituents' shares are calculated using closing prices five business days prior to the rebalancing date as the reference price. The constituents' shares are calculated and assigned to each stock to arrive at the weights determined on the rebalancing reference date.

The index committee may change the date of a given rebalancing for reasons including market holidays occurring on or around the scheduled rebalancing date. Any change will be announced with proper advance notice where possible.

## Index Calculation and Governance

The Low Volatility High Dividend Index is calculated using the same methodology as the S&P 500<sup>®</sup> Index, except that the constituents of the S&P 500<sup>®</sup> Low Volatility High Dividend Index are weighted by dividend yield. In addition, at each rebalancing, modifications are made to stock weights to increase diversification across individual stocks and sectors. The weight for each constituent of the S&P 500<sup>®</sup> Low Volatility High Dividend Index is constrained between 0.05% and 3.0%, and the weight of each GICS<sup>®</sup> sector is capped at 25%. The Low Volatility High Dividend Index is governed using the same methodology as the S&P 500<sup>®</sup> Index. For additional information about the calculation of the S&P 500<sup>®</sup> Index, see "Background on the S&P 500<sup>®</sup> Index" below.

## Corporate Actions

The table below summarizes types of index maintenance adjustments and indicates whether or not a divisor adjustment is required.

Type of Corporate Action	Adjustment Made to Index	Divisor Adjustment
Spin-off	The spun-off company is added to the Low Volatility High Dividend Index of which the parent is a constituent, at a zero price at the market close of the day before the ex-date (with no divisor adjustment). The spun-off company is then removed after at least one day of regular way trading (with a divisor adjustment).	See "Adjustment Made to Index"
Rights Offering	The price is adjusted to the price of the parent company minus (the price of the rights offering/rights ratio). Index shares change so that the company's weight remains the same as its weight before the rights offering.	No
Stock Dividend, Stock Split, Reverse Stock Split	Index shares are multiplied by and price is divided by the split factor.	No
Share Issuance, Share Repurchase, Equity Offering or Warrant Conversion	None.	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.	No
Constituent Change	There are no intra-rebalancing additions.	—

Type of Corporate Action	Adjustment Made to Index	Divisor Adjustment
	Deletions due to delistings, acquisition or any other corporate event resulting in the deletion of the stock from the index causes the weights of the rest of the stocks in the index to change. Relative weights stay the same.	Yes

### 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 Committee

The Low Volatility High Dividend Index is maintained by the S&P Dow Jones's U.S. index committee. All index committee members are full-time professional members of S&P Dow Jones' staff. The index committee meets monthly. At each meeting, the index committee reviews pending corporate actions that may affect index constituents, statistics comparing the composition of the indices to the market, companies that are being considered as candidates for addition to an index, and any significant market events. In addition, the index committee may revise index policy covering rules for selecting companies, treatment of dividends, share counts or other matters.

## BACKGROUND ON THE S&P 5-YEAR U.S. TREASURY NOTE FUTURES EXCESS RETURN INDEX

All information contained in this underlying supplement regarding the S&P 5-Year U.S. Treasury Note Futures Excess Return Index (the “**U.S. Treasury Note Futures Index**”), including, without limitation, its make-up, method of calculation and changes in its components, has been derived from publicly available information, without independent verification. This information reflects the policies of, and is subject to change by, S&P Dow Jones Indices LLC (“**S&P Dow Jones**”). The U.S. Treasury Note Futures Index was developed by S&P Dow Jones and is calculated, maintained and published by S&P Dow Jones. S&P Dow Jones has no obligation to continue to publish, and may discontinue the publication of, the U.S. Treasury Note Futures Index.

The U.S. Treasury Note Futures Index has a base date of June 30, 1988 and a base value of 100.00. The U.S. Treasury Note Futures Index is reported by Bloomberg L.P. under the ticker symbol “SPUST5P.”

The U.S. Treasury Note Futures Index seeks to track the performance of a portfolio that holds one futures contract, the 5-Year U.S. Treasury Note futures contract (the “**Treasury Futures Contract**”), which rolls quarterly and is traded on the Chicago Mercantile Exchange (the “**CME**”). At any given time, the Treasury Futures Contract tracked by the U.S. Treasury Note Futures Index is either the Treasury Futures Contract closest to expiration (each, the “**Near Month Futures Contract**”) or the Treasury Futures Contract that is scheduled to expire immediately following the Near Month Futures Contract (the “**Far Month Futures Contract**”).

The Treasury Futures Contracts are legally binding agreements for the buying or selling of U.S. Treasury notes at a fixed price for physical settlement on a future date (such date being its expiry date). Each Treasury Futures Contract has a face value at maturity of \$100,000 and requires the delivery of a U.S. Treasury note that has a remaining term to maturity of at least 4 years and 2 months, but not more than 5 years and 3 months, from the first day of the delivery month. The closing prices of Treasury Futures Contracts are calculated by the CME and reported on Bloomberg under the ticker symbol “TY.”

The U.S. Treasury Note Futures Index maintains a long position in the Treasury Futures Contract by undergoing a process called a “roll” from the Near Month Futures Contract into the Far Month Futures Contract each quarter. The roll takes place over a one-day rolling period every quarter, starting two days prior to the “first position date,” which is a date published by CME Group (the parent company of the CME). Currently, the “first position date” is generally the business day immediately preceding the last business day of the month immediately preceding an expiring contract’s delivery month. The expected expiry months of the Near Month Futures Contracts are March, June, September and December, with the corresponding roll dates falling in February, May, August and November.

Market disruptions are situations where the CME has failed to open so that no trading is possible due to unforeseen events, such as computer or electric power failures, weather conditions or other events. If any such event happens on the roll date, the roll will take place on the next business day on which no market disruptions exist.

The U.S. Treasury Note Futures Index is calculated daily when the CME is open for official trading, excluding holidays and weekends. In situations where the CME is forced to close early due to unforeseen events, such as computer or electric power failures, weather conditions or other events, S&P will calculate the value of the U.S. Treasury Note Futures Index based on the settlement price published by the CME, or if not settlement price is available, the S&P Dow Jones determines the course of action. If the CME fails to open due to unforeseen circumstances, such as natural disasters, inclement weather, outages, or other events, the U.S. Treasury Note Futures Index uses the prior day’s settlement prices.

The U.S. Treasury Note Futures Index is an “excess return” index and not a “total return” index because it does not reflect interest that could be earned on funds notionally committed to the trading of futures contracts.

On any trading date,  $t$ , the level of the U.S. Treasury Note Futures Index is calculated as follows:



$$ExcessReturnIndex_t = ExcessReturnIndex_{t-1} * (1 + IndexExcessReturn_t)$$

where:

$ExcessReturnIndex_{t-1}$  = The U.S. Treasury Note Futures Index level on the preceding trading day.

$IndexExcessReturn_t$  = The excess return from holding the Treasury Futures Contract, calculated by reference to the change in the settlement price of the Treasury Futures Contract from the immediately preceding trading day.

## BACKGROUND ON THE S&P 500<sup>®</sup> INDEX

All information contained in this underlying supplement regarding the S&P 500<sup>®</sup> Index, including, without limitation, its make-up, method of calculation and changes in its components, has been derived from publicly available information, without independent verification. This information reflects the policies of, and is subject to change by, S&P Dow Jones. The S&P 500<sup>®</sup> Index is calculated, maintained and published by S&P Dow Jones. S&P Dow Jones has no obligation to continue to publish, and may discontinue the publication of, the S&P 500<sup>®</sup> Index.

The S&P 500<sup>®</sup> Index consists of stocks of 500 companies selected to provide a performance benchmark for the U.S. equity markets. The S&P 500<sup>®</sup> Index is reported by Bloomberg L.P. under the ticker symbol "SPX."

### Composition of the S&P 500<sup>®</sup> Index

Securities must satisfy the following eligibility factors to be considered for inclusion in the S&P 500<sup>®</sup> Index. Constituent selection is at the discretion of the S&P Dow Jones's U.S. index committee (the "Index Committee") and is based on the eligibility criteria. The S&P 500<sup>®</sup> Index has a fixed constituent company count of 500.

Changes to the S&P 500<sup>®</sup> Index are made as needed, with no scheduled reconstitution. Rather, changes in response to corporate actions and market developments can be made at any time. Constituent changes are typically announced one to five days before they are scheduled to be implemented.

Additions to the S&P 500<sup>®</sup> Index are evaluated based on the following eligibility criteria:

- *Domicile.* Only common stocks of U.S. companies are eligible. For index purposes, a U.S. company has the following characteristics:
  - the company files 10-K annual reports;
  - the U.S. portion of fixed assets and revenues constitutes a plurality of the total, but need not exceed 50%. When these factors are in conflict, assets determine plurality. Revenue determines plurality when there is incomplete asset information. If this criteria is not met or is ambiguous, S&P Dow Jones may still deem the company to be a U.S. company for index purposes if its primary listing, headquarters and incorporation are all in the United States and/or "a domicile of convenience" (Bermuda, Channel Islands, Gibraltar, islands in the Caribbean, Isle of Man, Luxembourg, Liberia or Panama); and
  - the primary listing is on an eligible U.S. exchange as described below.

In situations where the only factor suggesting that a company is not a U.S. company is its tax registration in a "domicile of convenience" or another location chosen for tax-related reasons, S&P Dow Jones normally determines that the company is still a U.S. company. The final determination of domicile eligibility is made by the Index Committee, which can consider other factors including, but not limited to, operational headquarters location, ownership information, location of officers, directors and employees, investor perception and other factors deemed to be relevant.

- *Exchange Listing.* A primary listing on one of the following U.S. exchanges is required: NYSE, NYSE Arca, NYSE American, NASDAQ Global Select Market, NASDAQ Select Market, NASDAQ Capital Market, Bats BZX, Bats BYX, Bats EDGA, Bats EDGX or Investors Exchange (IEX) exchanges. Ineligible exchanges include the OTC Bulletin Board and Pink Sheets.
- *Organizational Structure and Share Type.* Eligible organizational structures and share types are corporations (including equity and mortgage REITS) and common stock (*i.e.*, shares). Ineligible

organizational structures and share types include business development companies, limited partnerships, master limited partnerships, limited liability companies, closed-end funds, exchange-traded funds, exchange-traded notes, royalty trusts, preferred and convertible preferred stock, unit trusts, equity warrants, convertible bonds, investment trusts, rights, American Depositary Receipts and tracking stocks.

As of July 31, 2017, companies with multiple share class structures are not eligible to be added to the S&P 500<sup>®</sup> Index, but securities already included in the S&P 500<sup>®</sup> Index have been grandfathered and will remain in the S&P 500<sup>®</sup> Index.

- *Market Capitalization.* The unadjusted company market capitalization should be within a specified range, which is currently \$6.1 billion or more. This range is subject to review from time to time to assure consistency with market conditions. For spin-offs, S&P 500<sup>®</sup> Index membership eligibility is determined using when-issued prices, if available.
- *Liquidity.* Using composite pricing and volume, the ratio of annual dollar value traded (defined as average closing price over the period multiplied by historical volume) to float-adjusted market capitalization should be at least 1.00, and the stock should trade a minimum of 250,000 shares in each of the six months leading up to the evaluation date.
- *Investable Weight Factor.* The Investable Weight Factor (“IWF”) for each company represents the portion of the total shares outstanding that are considered part of the public float for purposes of the S&P 500<sup>®</sup> Index. An IWF of at least 0.50 is required.
- *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. For equity real estate investment trusts (REITs), financial viability is based on GAAP earnings and/or Funds From Operations (FFO), if reported.
- *Treatment of IPOs.* Initial public offerings should be traded on an eligible exchange for at least 12 months before being considered for addition to the S&P 500<sup>®</sup> Index. Spin-offs or in-specie distributions from existing constituents do not need to be seasoned for 12 months prior to their inclusion in the S&P 500<sup>®</sup> Index.
- *Sector Balance.* Sector balance, as measured by a comparison of each GICS<sup>®</sup> sector’s weight in the S&P 500<sup>®</sup> Index with its weight in the S&P Total Market Index, in the relevant market capitalization range, is also considered in the selection of companies for the S&P 500<sup>®</sup> Index. The S&P Total Market Index is a float-adjusted, market-capitalization weighted index designed to track the broad U.S. equity market, including large-, mid-, small- and micro-cap stocks.

Exceptions to the above criteria include:

- A company not included in the S&P 500<sup>®</sup> Index, the S&P MidCap 400<sup>®</sup> Index or the S&P SmallCap 600<sup>®</sup> Index (each, an “S&P Composite 1500<sup>®</sup> component index”) that acquires a company included in an S&P Composite 1500<sup>®</sup> component index, but that does not fully meet the financial viability or IWF criteria, may still be added to an S&P Composite 1500 index at the discretion of the Index Committee if the Committee determines that the addition could minimize turnover and enhance the representativeness of the index as a market benchmark
- Current constituents of an S&P Composite 1500<sup>®</sup> component index can be migrated from one S&P Composite 1500<sup>®</sup> component index to another without meeting the financial viability, public float and/or liquidity eligibility criteria if the Index Committee decides that such a move will enhance the representativeness of the relevant index as a market benchmark.
- Companies that are spun-off from a S&P Composite 1500<sup>®</sup> component index do not need to meet the addition criteria above, but they should be considered U.S. domiciled as described above and

have a total market capitalization representative of the S&P 500<sup>®</sup> Index to be added to the S&P 500<sup>®</sup> Index.

- S&P Dow Jones Indices consolidates the share count for the Berkshire Hathaway Inc. under the B share class line due to turnover and liquidity concerns.

S&P Dow Jones believes turnover in membership in the S&P 500<sup>®</sup> Index should be avoided when possible. At times a stock may appear to temporarily violate one or more of the addition criteria. However, the addition criteria are for addition to the S&P 500<sup>®</sup> Index, not for continued membership. As a result, a constituent of the S&P 500<sup>®</sup> Index that appears to violate criteria for addition to the S&P 500<sup>®</sup> Index is not deleted unless ongoing conditions warrant an index change.

Removals from the S&P 500<sup>®</sup> Index are evaluated based as follows:

- A company involved in a merger, acquisition or significant restructuring such that it no longer meets the eligibility criteria is deleted from the S&P 500<sup>®</sup> Index at a time announced by S&P Dow Jones, normally at the close of the last day of trading or expiration of a tender offer. Constituents that are halted from trading may be kept in the index until trading resumes, at the discretion of the Index Committee. If a stock is moved to the pink sheets or the bulletin board, the stock is removed.
- A company that substantially violates one or more of the eligibility criteria may be deleted at the Index Committee's discretion.

Any company that is removed from the S&P 500<sup>®</sup> Index (including discretionary and bankruptcy/exchange delistings) must wait a minimum of one year from its index removal date before being reconsidered as a replacement candidate.

### **Calculation of the S&P 500<sup>®</sup> Index**

The S&P 500<sup>®</sup> Index is a float-adjusted market capitalization-weighted index. On any given day, the index value of the S&P 500<sup>®</sup> Index is the total float-adjusted market capitalization of the S&P 500<sup>®</sup> Index's constituents *divided* by its divisor. The float-adjusted market capitalization reflects the price of each stock in the S&P 500<sup>®</sup> Index *multiplied* by the number of shares used in the index value calculation.

*Float Adjustment.* Float adjustment means that the number of shares outstanding is reduced to exclude closely held shares from the calculation of the index value because such shares are not available to investors. The goal of float adjustment is to distinguish between strategic (control) shareholders, whose holdings depend on concerns such as maintaining control rather than the economic fortunes of the company, and those holders whose investments depend on the stock's price and their evaluation of a company's future prospects. Generally, these "control holders" include officers and directors, private equity, venture capital and special equity firms, other publicly traded companies that hold shares for control, strategic partners, holders of restricted shares, employee stock ownership plans, employee and family trusts, foundations associated with the company, holders of unlisted share classes of stock or government entities at all levels (other than government retirement/pension funds) and any individual person who controls a 5% or greater stake in a company as reported in regulatory filings. Shares that are not considered outstanding are also not included in the available float. These generally include treasury stock, stock options, equity participation units, warrants, preferred stock, convertible stock and rights.

For each component, S&P Dow Jones calculates an IWF, which represents the portion of the total shares outstanding that are considered part of the public float for purposes of the S&P 500<sup>®</sup> Index.

*Divisor.* Continuity in index values of the S&P 500<sup>®</sup> Index is maintained by adjusting its divisor for all changes in its constituents' share capital after its base date. This includes additions and deletions to the S&P 500<sup>®</sup> Index, rights issues, share buybacks and issuances and non-zero price spin-offs. The value of the S&P 500<sup>®</sup> Index's divisor over time is, in effect, a chronological summary of all changes affecting the base capital of the S&P 500<sup>®</sup> Index. The divisor of the S&P 500<sup>®</sup> Index is adjusted such that the index

value of the S&P 500<sup>®</sup> Index at an instant just prior to a change in base capital equals the index value of the S&P 500<sup>®</sup> Index at an instant immediately following that change.

### **Maintenance of the S&P 500<sup>®</sup> Index**

Changes in response to corporate actions and market developments can be made at any time. Constituent changes are typically announced one to five days before they are scheduled to be implemented.

*Share Updates.* All mergers and acquisitions (“M&A”) driven changes to the S&P 500<sup>®</sup> Index are implemented with one to five business days’ notice on a best efforts basis. Any share issuance for the acquirer is implemented to coincide with the drop event for the target. An M&A driven share/IWF change does not need to meet any minimum threshold requirement for implementation. This helps minimize turnover in indices. Any merger related IWF change that results in an IWF of 0.96 or greater is rounded up to 1.00 at the next annual IWF review. At S&P Dow Jones’ discretion, de minimis merger and acquisition share changes are accumulated and implemented with the quarterly share rebalancing. All other changes of less than 5% are accumulated and made quarterly on the third Friday of March, June, September and December.

*5% Rule.* Confirmed share changes that are at least 5% of the total shares outstanding are implemented weekly. Total shares outstanding and 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.

Changes to an index constituent’s total shares outstanding of at least 5% are applied weekly and are announced after the market close on Fridays for implementation after the close of trading the following Friday (i.e., one week later). Examples of such changes include public offerings (also known as secondary offerings or follow-on offerings), tender offers, Dutch auctions, exchange offers, bought deal equity offerings, prospectus offerings, company stock repurchases, private placements, redemptions, exercise of options, warrants, conversion of derivative securities, at-the-market stock offerings, and acquisitions of private companies or non-index companies that do not trade on a major exchange. If an exchange holiday/closure falls on a Friday, the weekly share change announcement will be made the day before the exchange holiday/closure, and the implementation date will remain after the close of trading the following Friday (i.e., one week later).

If a 5% or more share change causes a company’s IWF to change by five percentage points or more (for example from 0.80 to 0.85), the IWF is updated at the same time as the share change. IWF changes resulting from partial tender offers are considered on a case by case basis.

Notwithstanding the foregoing, share or IWF changes of 5% or more due to public offerings (also known as placements or secondary offerings) are made effective at the open of the next day under certain conditions. Secondary offerings by selling shareholders are recognized the next day if certain conditions are met, or weekly via an IWF change if the secondary offering is at least 5% of total shares outstanding.

*Share/IWF Freezes.* A share/IWF freeze period is implemented during each quarterly rebalancing. The freeze period begins after the market close on the Tuesday preceding 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 a rebalancing month. Pro-forma files are normally released after the market close on the second Friday, one week prior to the rebalancing effective date. In September, preliminary share and float data are released on the first Friday of the month, but the share freeze period for September will follow the same schedule as the other three quarterly share freeze periods. For illustration purposes, if rebalancing pro-forma files are scheduled to be released on Friday, March 13, the share/IWF freeze period will begin after the close of trading on Tuesday, March 10 and will end after the close of trading the following Friday, March 20 (i.e., the third Friday of the rebalancing month).

During the share/IWF freeze period, shares and IWFs are not changed except for certain corporate action events (such as merger activity, stock splits, rights offerings). Share/IWF changes for the S&P 500<sup>®</sup> Index constituents resulting from secondary public offerings that would otherwise be eligible for next day implementation are instead collected during the freeze period and added to the weekly share change announcement on the third Friday of the rebalancing month for implementation the following Friday night. There is no weekly share change announcement on the second Friday of a rebalancing month.

*Corporate Actions.* Corporate actions (such as stock splits, stock dividends, non-zero price spin-offs and rights offerings) are applied after the close of trading on the day prior to the ex-date.

*Other Adjustments.* In cases where there is no achievable market price for a stock being deleted, it can be removed at a zero or minimal price at the Index Committee's discretion.

The table below summarizes the types of index maintenance adjustments and indicates whether or not a divisor adjustment is required.

<b>Type of Corporate Action</b>	<b>Comments</b>	<b>Divisor Adjustment</b>
Company added/deleted	Net change in market value determines divisor adjustment.	Yes
Change in shares outstanding	Any combination of secondary issuance, share repurchase or buy back – share counts revised to reflect change.	Yes
Stock split	Share count revised to reflect new count. Divisor adjustment is not required since the share count and price changes are offsetting.	No
Spin-off	The spin-off is added to the S&P 500 <sup>®</sup> Index on the ex-date at a price of zero.	No
Change in IWF	Increasing (decreasing) the IWF increases (decreases) the total market value of the S&P 500 <sup>®</sup> Index. The divisor change reflects the change in market value caused by the change to an IWF.	Yes
Special dividend	When a company pays a special dividend, the share price is assumed to drop by the amount of the dividend; the divisor adjustment reflects this drop market value of the S&P 500 <sup>®</sup> Index.	Yes
Rights offering	Each shareholder receives the right to buy a proportional number of additional shares at a set (often discounted) price. The calculation assumes that the offering is fully subscribed. Divisor adjustment reflects increase in market capitalization measured as the shares issued multiplied by the price paid.	Yes

Stock splits and stock dividends do not affect the divisor, because following a split or dividend, both the stock price and number of shares outstanding are adjusted by S&P Dow Jones so that there is no change in the market value of the relevant component. All stock split and dividend adjustments are made after the close of trading on the day before the ex-date.

### **Governance of the S&P 500<sup>®</sup> Index**

The S&P 500<sup>®</sup> Index is maintained by the Index Committee. All Index Committee members are full-time professional members of S&P Dow Jones' staff. The Index Committee meets monthly. At each meeting, the Index Committee reviews pending corporate actions that may affect S&P 500<sup>®</sup> Index

constituents, statistics comparing the composition of the S&P 500<sup>®</sup> Index to the market, companies that are being considered as candidates for addition to the S&P 500<sup>®</sup> Index, and any significant market events. In addition, the Index Committee may revise index policy covering rules for selecting companies, treatment of dividends, share counts or other matters.

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 stated in this document or supplemental documents, clients will receive sufficient notice, whenever possible.

In addition to its daily governance of the S&P 500<sup>®</sup> Index and maintenance of index methodologies, at least once within any 12-month period, the Index Committee reviews this methodology to ensure the S&P 500<sup>®</sup> Index continues to achieve the stated objectives, and that the data and methodology remain effective. In certain instances, S&P Dow Jones may publish a consultation inviting comments from external parties.

The Index Committee may change the date of a given rebalancing for reasons including market holidays occurring on or around the scheduled rebalancing date. Any such changes will be announced by S&P Dow Jones with proper advance notice where possible.