



INDEX METHODOLOGY

## NASDAQ-100 VOLATILITY COMPASS AUTOCALLABLE INDEXES

### INDEX DESCRIPTION

The Nasdaq-100 Volatility Compass Autocallable Indexes, each an “Index” and collectively the “Indexes”, are designed to track the performance of a Portfolio of hypothetical autocallable contract replicas linked to a Reference Index.

Each Index employs a ladder structure of such hypothetical autocallable contract replicas, each a Component and which incorporates an autocall feature whereby they are “called” early if the performance of the Reference Index reaches or exceeds a pre-defined level at periodic observations. If a given Component is not called by its final Evaluation Date, the Index is exposed to downside risk on that Component through a European knock-in barrier. This means that for each Component, losses only apply if the performance of the Reference Index on the Expiration Date in relation to the Reference Index value on the Trade Date has fallen greater than the barrier level.

Each Index aims to generate enhanced premiums from the autocallable structure, but takes on downside risk for any Component that expires without being called, and breaches its knock-in barrier.

For each Index, a new Component is added to the Portfolio weekly. Components are removed from the Portfolio after they are deemed called on an Evaluation Date or after their Expiration Date. Therefore, on each Index Day, the ladder Portfolio consists of up to 156 Components.

The calculation details for a related set of indexes are also described in this methodology. The Nasdaq-100 Volatility Compass Autocallable Income Only Indexes, each an “Income Only Index” and collectively the “Income Only Indexes”, measure the accumulated income earned for a Nasdaq-100 Volatility Compass Autocallable Index.

*Unless stated otherwise, all capitalized terms used in this document are defined in Appendix A: Definitions.*

## INDEX CALCULATION

### Index value

For each Index Day  $t$ , the value of the Index is calculated in accordance with the following formula:

$$I_t = \sum_{k \in Live_t} (U_{k,t} \times P_{k,t}) + CA_t$$

where:

$I_t$  = the Index value for Index Day  $t$ .

$Live_t$  = the Live Component Set, as described in *Appendix A: Definitions*.

$U_{k,t}$  = the number of units of Component  $k$  for Index Day  $t$  (see *Component units* below for more details).

$P_{k,t}$  = the closing price of Component  $k$  for Index Day  $t$ , as defined in *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica*.

$CA_t$  = the cash account for Index Day  $t$  as determined in accordance with the following formula:<sup>1</sup>

$$CA_t = CA_{t-1} \times \left( 1 + RF_{t-1} \times \frac{Days_{t-1,t}}{360} \right) + CF_t + Adj_t$$

where:

$RF_{t-1}$  = the Effective Federal Funds Rate published by the Federal Reserve Bank of New York for Index Day  $t - 1$ . If such rate is unavailable, then the rate shall be the most recent rate available on an Index Day preceding Index Day  $t - 1$ .

$Days_{t-1,t}$  = the number of calendar days from Index Day  $t - 1$  (inclusive) to Index Day  $t$  (exclusive).

$CF_t$  = the total Portfolio cash inflows generated for Index Day  $t$  as determined in accordance with the following formula:

$$CF_t = \sum_{k \in Live_t} U_{k,t} \times ACPremium_{k,t} + \sum_{k \in Called_t} U_{k,t} \times ACCalled_{k,t} \\ + \sum_{k \in Expired_t} U_{k,t} \times ACExercise_{k,t}$$

where:

$ACPremium_{k,t}$  = the premium for Component  $k$  and Index Day  $t$ , where such day is the Trade Date for that Component, as defined in *Appendix C: Portfolio Cashflow*.

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<sup>1</sup> For the Index Base Date ( $t_0$ ) and Index Day prior to the Base Date ( $t_{0-1}$ ), the cash account is set at  $100 + CF_t + Adj_t$  and 100, respectively.

$ACCalled_{k,t}$  = the call cashflow for Component  $k$  and Index Day  $t$ , where such day is the Call Date for that Component, as defined in *Appendix C: Portfolio Cashflow*.

$ACExercise_{k,t}$  = the expiration cashflow of Component  $k$ , where such day is the Expiration Date for that Component, as defined in *Appendix C: Portfolio Cashflow*.

$Live_t = \{k \mid t < cd \text{ and } t < ed\}$ , which is the Live Component Set, as described in *Appendix A: Definitions*.

$Called_t = \{k \mid t = cd\}$ , which is the Called Component Set, as described in *Appendix A: Definitions*.

$Expired_t = \{k \mid k \in Live_{t-1} \text{ and } t = ed\}$ , which is the Expired Component Set, as described in *Appendix A: Definitions*.

$cd$  = the Call Date for Component  $k$ , as described in *Appendix A: Definitions*.

$ed$  = the Expiration Date of Component  $k$ , as described in *Appendix A: Definitions*.

$Adj_t$  = the Portfolio valuation risk adjustment applied to the Index for Index Day  $t$  (see *Appendix D: Portfolio Valuation Risk Adjustment*).

Index values are calculated using full precision, but are rounded to four decimal places for dissemination purposes.

*If the value for a Component is unavailable on a given Index Day  $t$ , then such value shall be the last available value for that Component, as determined by the Index Administrator.*

## INDEX CONSTRUCTION

### Index parameters

The table below details parameters specific to the construction and calculation of the Index.

| Index (Symbol)                                                                   | Components                                                              | Barrier | Expiration                   | Reference Index                                                          |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------|---------|------------------------------|--------------------------------------------------------------------------|
| Nasdaq-100 35% Volatility Compass 6D Autocallable A Index (NXA35C6A)             | Hypothetical autocallable contract replicas linked to a Reference Index | 35%     | Three years (756 Index Days) | Nasdaq-100 Intraday 35% Volatility Compass 6% Decrement Index (XNDX356C) |
| Nasdaq-100 35% Volatility Compass 6D Autocallable A Income Only Index (NXA35I6A) | Please refer to <i>Appendix G: Income Only Indexes</i> for details      |         |                              |                                                                          |

For information on the Reference Index, please refer to the [Nasdaq-100 Intraday Volatility Compass Indexes Methodology document](#).

## Autocall parameters

The table below details parameters specific to the Index's autocall process.

| Trade Date                           | Non-Call Period           | Evaluation Dates                                                                                                                                                                | Expiration Date                                    |
|--------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Weekly (last Index Day of each week) | One year (252 Index Days) | The first Evaluation Date is one year (252 Index Days) after the Trade Date. Subsequent Evaluation Dates occur quarterly (every 63 Index Days) after the first Evaluation Date. | Three years (756 Index Days) after the Trade Date. |

## Components

In respect of an Index, on each Trade Date, a new Component, comprised of a levered put spread on the Reference Index is added to the Index.

After their Non-Call Period, Components are evaluated each Evaluation Date to determine if they subject to be called. Components that have been called or that have reached the Expiration Date are removed from the Index on such date.

Theoretically, an Index can have as few as 52 Components and as many as 156 Components on a given Index Day.

## Component units

In respect of an Index and subject to a Hedge Delay, the units of the new weekly Component  $k$  are calculated on each Trade Date in accordance with the following formula:

$$U_{k,td} = \frac{I_{k,td-1}}{RI_{k,td} \times 52}$$

where:

$I_{k,td-1}$  = the Index Level on the Index Day prior to the Trade Date of Component  $k$ .

$RI_{k,td}$  = the closing value of the Reference Index for the Trade Date of Component  $k$  (rounded to four decimal places).

$td$  = the Trade Date of Component  $k$ , as described in *Appendix A: Definitions*.

For the Index Base Date ( $t_0$ ), the units of the first Component are calculated in accordance with the following formula:

$$U_{k,t_0} = \frac{Index\_Base\_Value}{RI_{k,td} \times 52}$$

## INDEX CALENDAR

### Holiday schedule

The Index is calculated Monday through Friday, except on days when the Exchange is scheduled to be closed (the “Holiday Schedule”).

### Index calculation and dissemination schedule

Index values are made available after the market close on each Index Day via the [Nasdaq Global Index Watch \(GIW\) website](#).

## ADDITIONAL INFORMATION

### Announcements

Nasdaq announces Index-related information via the [Nasdaq Global Index Watch \(GIW\) website](#).

For more information on the general Index Announcement procedures, please refer to the [Nasdaq Index Methodology Guide](#).

### Recalculation and restatement policy

For information on the Recalculation and Restatement Policy, please refer to the [Nasdaq Index Recalculation Policy](#).

### Contact information

For any questions regarding an Index, please contact the Nasdaq Index Client Services team at [indexservices@nasdaq.com](mailto:indexservices@nasdaq.com).

### Index dissemination

Where applicable, Index values and weightings information are available through the [Nasdaq Global Index Watch \(GIW\) website](#) as well as the Nasdaq Global Index FlexFile Delivery Service (GIFFD) and Global Index Dissemination Services (GIDS). Similar to the GIDS offerings, Genium Consolidated Feed (GCF) provides real-time Index values and weightings for the Nordic Indexes.

For more detailed information regarding Index Dissemination, please see the [Nasdaq Index Methodology Guide](#).

### Website

For further information, please refer to the [Nasdaq Global Index Watch \(GIW\) website](#).

## **FTP and dissemination service**

Where applicable, Index values and weightings are available via FTP on the Nasdaq Global Indexes FlexFile Delivery Service (GIFFD). Index values are available via Nasdaq's Global Index Dissemination Services (GIDS).

## **GOVERNANCE**

### **Index governance**

All Nasdaq Indexes are managed by the governance committee structure and have transparent governance, oversight, and accountability procedures for the index determination process. For further details on the Index Methodology and Governance overlay, please refer to the [Nasdaq Index Methodology Guide](#).

## APPENDIX A: DEFINITIONS

| Term                                                                             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Calculation Disruption Event</b>                                              | <p>In respect of an Index and a Component, the occurrence of one or more of the following events that affects that Component or any underlying instrument of that Component, and that the Index Administrator deems to be material to the Index:</p> <ul style="list-style-type: none"> <li>• <b>Price Failure:</b> Any event that impairs or prevents the ability of the Index Administrator to obtain a relevant price, level, rate, value or any other information from an exchange or other source necessary, on a timely basis and in a manner acceptable to the Index Administrator, in order to perform the calculation of the Index.</li> <li>• <b>Inaccurate Data:</b> The price or value of a component, or other input data, used directly or indirectly in the Index that, in the determination of the Index Administrator, is inaccurate, incomplete and/or does not adequately reflect the true market price or value of such component or input data.</li> <li>• <b>Force Majeure:</b> Any event or circumstance (including, without limitation, a systems failure, natural or man-made disaster, act of God, armed conflict, act of terrorism, riot or labor disruption or any similar intervening circumstance, or restrictions due to emergency powers enforced by federal, state or local government agencies), that is beyond the reasonable control of the Index Administrator and that the Index Administrator determines, in its sole discretion, affects the Index, a Component of the Index, any input data required to calculate the Index, or that prevents the ability of the Index Administrator to calculate the Index.</li> <li>• <b>General Moratorium:</b> the Index Administrator observes on any day that there has been a declaration of a general moratorium in respect of banking activities in any relevant jurisdiction.</li> </ul> |
| <b>Call Date</b>                                                                 | <p>In respect of an Index and a Component, if applicable, the date that Component is deemed called. A Component is deemed called if, on an Evaluation Date, the value of the Reference Index on that Evaluation Date meets or exceeds the Reference Index value on the Trade Date for that Component, as further described in <i>Appendix C: Portfolio Cashflow</i>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Called Component Set</b>                                                      | <p>In respect of an Index, a Component and an Index Day, the set of Components that have a Call Date on that Index Day.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Component</b>                                                                 | <p>In respect of an Index, each hypothetical autocallable contract replica linked to a Reference Index.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Consequences of a Calculation Disruption Event or Market Disruption Event</b> | <p>In respect of an Index, if a Calculation Disruption Event or Market Disruption Event occurs or is occurring on an Index Day that the Index Administrator determines materially affects the Index, the Index Administrator may:</p> <ul style="list-style-type: none"> <li>• Delay the calculation of the Index and halt the dissemination of the value of the Index and /or other information relating to the Index until such time, which may be a subsequent Index Day, that the Index Administrator determines that such Calculation Disruption Event or Market Disruption Event is no longer occurring.</li> <li>• Determine a good faith estimate of any affected or missing input data required to calculate the Index or the value of the Index for such Index Day or time for such Index Day.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Disrupted Day</b>                                                             | <p>In respect of an Index and a Component, an Index Day on which there is a Market Disruption Event.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Evaluation Dates</b>        | In respect of an Index and a Component, each Index Day that the Component is evaluated to be potentially called. The first Evaluation Date shall be the Index Day that is 252 Index Days after the Trade Date for that Component. Subject to the Component not having a Call Date, subsequent Evaluation Dates shall occur every 63 Index Days thereafter up to the Expiration Date (excluded) for that Component, as detailed in the <i>Autocall parameters</i> section. Each series of Evaluation Dates for a Component is determined by the Index Administrator as of the Trade Date for such Component.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Exchange</b>                | The Nasdaq Stock Exchange.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Expiration Date</b>         | In respect of an Index and a Component, the date on which the Component is scheduled to expire. The Expiration Date is scheduled to be 756 Index Days after the Trade Date for that Component, as detailed in the <i>Autocall parameters</i> section.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Expired Component Set</b>   | In respect of an Index, a Component and an Index Day, the set of Components that have an Expiration Date on that Index Day, and that have not previously had a Call.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Hedge Delay</b>             | <p>In respect of an Index and a Component, if a Trading Disruption or Exchange Disruption, as defined in <i>Market Disruption Event</i> below, occurs on a scheduled Trade Date, Evaluation Date, or Expiration Date for such Component, then no change of units of that Component shall occur on that day. Instead, the Trade Date, Evaluation Date, or Expiration Date (as applicable) shall be postponed to the next Index Day where no such disruption event occurs.</p> <p>In the case of an Evaluation Date, the schedule of subsequent Evaluation Dates and the Expiration Date for such Component shall not change going forward.</p> <p>In the case of an Expiration Date, the settlement will be based on the Component exercise cashflow formula, as described in <i>Appendix C: Portfolio Cashflow</i>.</p>                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Index Administrator</b>     | Nasdaq, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Index Base Date</b>         | February 6, 2009                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Index Base Value</b>        | 100.0000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Index Day</b>               | In respect of an Index and starting with the Index Base Date, each weekday that is not a scheduled holiday according to the Index Holiday Schedule as defined in the <i>Index Calendar</i> section.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Live Component Set</b>      | In respect of an Index, a Component, and an Index Day, the set of Components that remain outstanding and that have not had a Call Date or an Expiration Date.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Market Disruption Event</b> | <p>In respect of an Index and a Component, the occurrence of one or more of the following events that affects that Component or any underlying instrument of that Component, and that the Index Administrator deems to be material to the Index:</p> <ul style="list-style-type: none"> <li>• <b>Exchange Disruption:</b> Any exchange-related event on a relevant exchange that disrupts or impairs the ability of market participants to effect transactions or obtain market values or price discovery of a component used directly or indirectly in the Index.</li> <li>• <b>Trading Disruption:</b> Any unscheduled closure of the relevant exchange; a material suspension, limitation or disruption of trading on such exchange; a failure of such exchange to publish the relevant price, level, value or other information; a halt in trading, such as a circuit breaker or other exchange imposed halt, including an exchange imposed daily “limit price”; or any other event that materially affects the ability of market participants to trade, effect transactions in, maintain or unwind positions in that Component or any underlying instrument of that Component.</li> </ul> |
| <b>Non-Call Period</b>         | In respect of an Index and a Component, the 252 Index Day period from the Trade Date (excluded) to the first Evaluation Date (included), whereby the Component is not subject to a call evaluation, as detailed in the <i>Autocall parameters</i> section.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



|                        |                                                                                                                                                                                           |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Portfolio</b>       | In respect of an Index, the collection of hypothetical autocallable contract replicas on a given Index Day.                                                                               |
| <b>Reference Index</b> | In respect of an Index, the Reference Index as detailed in the <i>Index parameters</i> section.                                                                                           |
| <b>Trade Date</b>      | In respect of an Index and a Component, the scheduled day of the relevant week on which a new Component enters into the Portfolio, as detailed in the <i>Autocall parameters</i> section. |

For additional key terms not defined above, please refer to the [Nasdaq Index Methodology Guide](#).

## APPENDIX B: VALUATION OF A HYPOTHETICAL AUTOCALLABLE CONTRACT REPLICA

The autocallable note valuation and associated greeks represent the daily per-unit mark-to-market price, delta, and gamma calculated for each Component. These terms are derived by applying a modified Black-Scholes model to a dynamic forward level and strike-specific implied volatilities as follows:

1. Determine the daily forward. The Forward quantity (*Forward*) represents the maturity-adjusted forward level used for pricing Component *k*. It grows  $RI_t$  over  $Tc_{k,t}$  using an implied spread and a smoothed leverage adjustment (net of the decrement), capturing financing and carry effects linked to the Reference Index for Index Day *t*.

$$Forward_{k,t} = RI_t \times e^{Tc_{k,t} \times (ImpliedSpread_{t-1} \times \frac{1}{21} \sum_{s=t-21}^{t-1} EE_s - 0.06)}$$

where:

$RI_t$  = the closing value of the Reference Index for Index Day *t* (rounded to four decimal places).

$Tc_{k,t}$  = the number of calendar days from Index Day *t* (exclusive) to the Expiration Date of Component *k* (inclusive) divided by 365.

$ImpliedSpread_t$  = the implied financing spread for Index Day *t*. See *Appendix F: Implied Financing Spread* for more details.

$EE_t$  = the effective exposure of the Reference Index for Index Day *t*.

2. Determine the strike levels. The strike quantities ( $K_{k,1}$  and  $K_{k,2}$ ) establish the fixed boundaries of the put spread replication for Component *k*. Both strikes are determined at inception as fixed percentages of the underlying Reference Index level on the Trade Date.

$$K_{k,1} = 63\% \times RI_{td}$$

$$K_{k,2} = 65\% \times RI_{td}$$

where:

$K_{k,1}$  = the lower strike boundary for Component *k*.

$K_{k,2}$  = the upper strike boundary for Component *k*.

$RI_{td}$  = the closing value of the Reference Index for Trade Date *td* (rounded to four decimal places).

3. Determine daily volatility. The volatility quantities ( $Vol_{k,1,t}$  and  $Vol_{k,2,t}$ ) represent the strike-specific implied volatility levels used for pricing the put spread replication Components of Component *k*. To account for the volatility skew between the two strikes ( $K_{k,1}$  and  $K_{k,2}$ ), a time-decaying shift is applied to a base volatility of 35%, generating distinct volatility inputs for each strike leg for Index Day *t*.

$$Vol_{k,1,t} = 35\% + Shift_{k,t}$$

$$Vol_{k,2,t} = 35\% - Shift_{k,t}$$

$$Shift_{k,t} = \max\left(0.19\% \times \frac{(3 - (t - td))}{3}, 0\right)$$

where:

$Vol_{k,1,t}$  = the implied volatility applied to the first strike ( $K_{k,1}$ ) for Index Day  $t$  for Component  $k$ .

$Vol_{k,2,t}$  = the implied volatility applied to the second strike ( $K_{k,2}$ ) for Index Day  $t$  for Component  $k$ .

$Shift_{k,t}$  = the volatility skew adjustment factor for Index Day  $t$ , which linearly decays to zero over a three-day period following the Trade Date.

4. Determine Black-Scholes d1. The Black-Scholes d1 quantity represents the standard intermediary term measuring volatility- and time-scaled moneyness. It drives both option values, delta and gamma computed in the functions below.

$$d1(F, K, Vol, T) = \frac{\ln\left(\frac{F}{K}\right) + 0.5 Vol^2 T}{Vol \sqrt{T}}$$

where:

$F$  = the maturity-adjusted forward level.

$K$  = the fixed strike boundary.

$Vol$  = the implied volatility applicable to the specific strike.

$T$  = the number of Index Days from Index Day  $t$  (exclusive) to the Expiration Date (inclusive) divided by 252.

5. Determine Black-Scholes put value, delta, and gamma. The Black-Scholes outputs represent the discounted European put value and its delta and gamma, with respect to the forward. These outputs feed the Component valuation ( $ACPrice$ ) and the greeks used by the gap and floor profit and loss (P&L) calculations.

$$BSPut(DF, Vol, F, K, T) = DF \times \left[ -F N(-d1(F, K, Vol, T)) + K N(-d1(F, K, Vol, T) + Vol \times \sqrt{T}) \right]$$

$$BSPutDelta(DF, Vol, F, K, T) = -N(-d1(F, K, Vol, T))$$

$$BSGamma(DF, Vol, F, K, T) = \frac{N'(d1(F, K, Vol, T))}{F \times Vol \times \sqrt{T}}$$

where:

$DF$  = the applicable discount factor. See *Appendix E: Discount Factor* for more details.

$F, K, Vol, T$  = the forward, strike, implied volatility, and year fraction inputs as defined in step 4. above.

$N(x)$  = the standard normal cumulative distribution function.

$N'(x)$  = the standard normal probability density function.

6. Determine the autocall price, delta, and gamma. The autocall replication functions represent a fixed linear combination of a put spread and a discounted cash reserve:

$$17.5 \times \text{put}(K1, Vol1) - 18.5 \times \text{put}(K2, Vol2) + 0.067 \times RI_{td}$$

The daily price of Component  $k$  for Index Day  $t$  represents its theoretical per-unit mark-to-market value, which is evaluated by passing the Component-specific parameters into this generic framework.

$$\begin{aligned} P_{k,t} &= ACPrice(DF_{k,t}, Vol_{k,1,t}, Vol_{k,2,t}, Forward_{k,t}, K_{k,1}, K_{k,2}, Tb_{k,t}, RI_{k,td}) \\ ACPrice(DF, Vol_1, Vol_2, F, K_1, K_2, T, RI_{td}) \\ &= 17.5 \times BSPut(DF, Vol_1, F, K_1, T) - 18.5 \times BSPut(DF, Vol_2, F, K_2, T) + \\ &\quad 0.067 \times RI_{td} \times DF \end{aligned}$$

where:

$P_{k,t}$  = the closing price of Component  $k$  for Index Day  $t$ .

$DF_{k,t}$  = the discount factor for Component  $k$  for Index Day  $t$ . See *Appendix E: Discount Factor* for more details.

$Vol_{k,1,t}, Vol_{k,2,t}$  = the implied volatilities for the lower and upper strikes respectively for Component  $k$  for Index Day  $t$ , as defined in the Daily Volatility section.

$Forward_{k,t}$  = the maturity-adjusted forward level for Component  $k$  for Index Day  $t$ .

$K_{k,1}, K_{k,2}$  = the lower and upper strike boundaries, respectively, for Component  $k$ .

$Tb_{k,t}$  = the number of Index Days from Index Day  $t$  (exclusive) to the Expiration Date of Component  $k$  (inclusive) divided by 252.

$RI_{k,td}$  = the closing value of the Reference Index for the Trade Date of Component  $k$  (rounded to four decimal places).

## APPENDIX C: PORTFOLIO CASHFLOW

This section defines the Component valuation and cashflow terms used in the index bookkeeping: the premium on the Trade Date of a new Component, the call cashflow on a Call Date, if applicable, and the payoff at the Expiration Date of the Component. All of these amounts are captured in the cash account of the Index.

In respect of an Index and a Component:

1. Determine the Component premium. The premium represents the hypothetical amount received when the Component is entered on its Trade Date.

$$ACP_{k,t} = \begin{cases} -P_{k,t} & \text{if } t = td \\ 0 & \text{otherwise} \end{cases}$$

where:

$td$  = the Trade Date of Component  $k$ , as described in *Appendix A: Definitions*.

$P_{k,t}$  = the closing price of Component  $k$  for Index Day  $t$ , as defined in *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica*.

2. Determine the Component call cashflow. The call cashflow represents the hypothetical settlement amount realized when a Component is called prior to its scheduled Expiration Date. By definition, the Component call cashflow is equal to the Component's price on the Call Date, which ensures continuity of the Index level across the call event.

$$ACC_{k,t} = \begin{cases} P_{k,t} & \text{if } t = cd \text{ and } t \neq ed \\ 0 & \text{otherwise} \end{cases}$$

The Component Call Date represents the specific date on which a Component terminates prior to its scheduled Expiration Date. A Component is called on scheduled Evaluation Dates after the non-callable period if the barrier condition is met.

$$cd_t = \min_{\substack{(D - td) \bmod 63 = 0 \\ 0 < Tb_{k,t} \leq 2 \\ RI_t \geq RI_{td}}} D$$

where:

$cd_t$  = the Call Date for Component  $k$ . If, for Index Day  $t$ , the conditions have not been met, then  $cd_t = ed$ .

$ed$  = the Expiration Date of Component  $k$ , as described in *Appendix A: Definitions*.

$D$  = an Index Day evaluated during the life of the Component.

$Tb_{k,t}$  = the number of Index Days from Index Day  $t$  (exclusive) to the Expiration Date of Component  $k$  (inclusive) divided by 252.

$RI_t$  = the closing value of the Reference Index for Index Day  $t$  (rounded to four decimal places).

$RI_{td}$  = the closing value of the Reference Index for the Trade Date of Component  $k$  (rounded to four decimal places).

3. Determine the Component exercise. The exercise cashflow represents the hypothetical terminal amount realized based on the Reference Index level on the Expiration Date. It is non-zero only on the Expiration Date and is treated as an amount to the Index if positive and cash outflow if negative.

$$ACExercise_{k,t} = \begin{cases} [17.5 \max(K_1 - RI_t, 0) - 18.5 \max(K_2 - RI_t, 0) + 0.067 \times RI_{td}] & \text{if } t = ed \\ 0 & \text{Otherwise} \end{cases}$$

where:

$K_1^k, K_2^k$  = the lower and upper strike boundaries, respectively, for Component  $k$ , as defined in *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica*.

## APPENDIX D: PORTFOLIO VALUATION RISK ADJUSTMENT

The Portfolio valuation risk adjustment represents the comprehensive daily deductions applied to the Index to account for non-linear tail risks not captured by standard continuous-diffusion pricing. By scaling the per-unit greeks and stressed valuations by each Component's designated units ( $U_{k,t}$ ), the Index aggregates the total portfolio exposure to extreme downside market movements. This total risk adjustment ( $Adj_t$ ) is evaluated as the sum of a deterministic gamma charge ( $DeepGap_t$ ) and a scenario-based shortfall cost ( $FloorGap_t$ ).

1. Determine the Portfolio valuation risk adjustment. The total Portfolio valuation risk adjustment represents the comprehensive daily risk adjustment applied to the Index to account for extreme downside market movements. By aggregating the deterministic DeepGap charge with the scenario-based Floor cost, it encapsulates the total non-linear tail risk deduction for the portfolio into a single daily quantity.

$$Adj_t = DeepGap_t + FloorGap_t$$

where:

$Adj_t$  = the total combined gap risk charge applied to the Index for Index Day  $t$ .

2. Determine the DeepGap. The DeepGap adjustment represents a deterministic daily cost applied to the portfolio to adjust for downside jump risk not captured by continuous-diffusion pricing. This quantity links the risk charge directly to the positive gamma exposure of the portfolio.

The Component gamma, aggregated Index gamma, and the resulting DeepGap charge for Index Day  $t$  are calculated as follows:

$$Gamma_{k,t} = ACGamma(DF_{k,t}, 35\%, 35\%, Forward_{k,t}, K_{k,1}, K_{k,2}, Tb_{k,t})$$

$$\begin{aligned} ACGamma(DF, Vol_1, Vol_2, F, K_1, K_2, T) \\ = 17.5 \times BSGamma(DF, Vol_1, F, K_1, T) \\ - 18.5 \times BSGamma(DF, Vol_2, F, K_2, T) \end{aligned}$$

$$IndexGamma_t = \sum_{k \in Live_t} U_{k,t} \times Gamma_{k,t} \times Forward_{k,t}^2 \times DF_{k,t}$$

$$DeepGap_t = \frac{-\max(IndexGamma_{t-1}, 0)}{2} \times (0.012\%)$$

where:

$DeepGap_t$  = the total gap risk charge applied to the Index for Index Day  $t$ .

$IndexGamma_t$  = the aggregated portfolio gamma evaluated for Index Day  $t$ .

$Gamma_{k,t}$  = the Component-level gamma of Component  $k$  for Index Day  $t$ .

$DF_{k,t}$  = the discount factor for Component  $k$  for Index Day  $t$ . See *Appendix E: Discount Factor* for more details.

$Forward_{k,t}$  = the maturity-adjusted forward level for Component  $k$  for Index Day  $t$ , as defined in *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica*.

$K_{k,1}, K_{k,2}$  = the lower and upper strike boundaries, respectively, for Component  $k$ , as defined in *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica*.

$Tb_{k,t}$  = the number of Index Days from Index Day  $t$  (exclusive) to the Expiration Date of Component  $k$  (inclusive) divided by 252.

$BSGamma(\dots)$  = See *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica*.

3. Determine the Floor. The Floor represents a scenario-based tail-risk adjustment. The Index portfolio is revalued under discrete negative shocks ( $G$ ) and compared to the current Index level after accounting for delta. If the stressed value implies a shortfall, a cost is charged using the calibration grid.

The scenario-based Index values, portfolio delta and resulting floor gap charge for Index Day  $t$  are calculated as follows:

$$IndexGapped_t(G) = \max(0, CA_t + MtMPortfolioGapped_t(G))$$

$$MtMPortfolioGapped_t(G) = \sum_{k \in Live_t} U_{k,t} \times PriceGapped_{k,t}(G)$$

$$\begin{aligned} PriceGapped_{k,t}(G) &= ACPrice(DF_{k,t}, 35\%, 35\%, \max(0, Forward_{k,t} \\ &\times (1 + EE_t \times G)), K_{k,1}, K_{k,2}, Tb_{k,t}, RI_{td}) \end{aligned}$$

$$Delta_{k,t} = ACDelta(DF_{k,t}, 35\%, 35\%, Forward_{k,t}, K_{k,1}, K_{k,2}, Tb_{k,t})$$

$$\begin{aligned} ACDelta(DF, Vol_1, Vol_2, F, K_1, K_2, T) &= 17.5 \times BSPutDelta(DF, Vol_1, F, K_1, T) \\ &- 18.5 \times BSPutDelta(DF, Vol_2, F, K_2, T) \end{aligned}$$

$$IndexDelta_t = \sum_{k \in Live_t} U_{k,t} \times Delta_{k,t} \times Forward_{k,t} \times DF_{k,t}$$

$$\begin{aligned} GapContribution_t(G) &= \max(0, IndexGapped_t(G) - IndexGapped_t(0) \\ &- IndexDelta_t \times EE_t \times G) \end{aligned}$$

$$\begin{aligned} FloorGap_t &= \frac{-Days_{t-1,t}}{365} \\ &\times \sum_{l=1}^5 \max(0, GapContribution_{t-1}(G_l) - GapContribution_{t-1}(G_{l-1})) \\ &\times FloorCost_l \end{aligned}$$

where:

$FloorGap_t$  = the total scenario-based floor risk charge applied for Index Day  $t$ .

$IndexGapped_t(G)$  = the simulated Index level for Index Day  $t$ , evaluated under a discrete negative shock  $G$ .



$MtMPortfolioGapped_t(G)$  = the aggregated mark-to-market value evaluated under shock  $G$ .

$GapContribution_t(G)$  = the isolated portfolio shortfall contribution under shock  $G$ .

$IndexDelta_t$  = the aggregated portfolio delta evaluated for Index Day  $t$ .

$CA_t$  = the cash account for Index Day  $t$ .

$Days_{t-1,t}$  = the number of calendar days from Index Day  $t - 1$  (inclusive) to Index Day  $t$  (exclusive).

$PriceGapped_{k,t}(G)$  = the gapped price of Component  $k$  evaluated under shock  $G$ .

$Delta_{k,t}$  = the Component-level delta of Component  $k$  for Index Day  $t$ , as defined in *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica*.

$EE_t$  = the effective exposure of the Reference Index for Index Day  $t$ .

$RI_{td}$  = the closing value of the Reference Index for the Trade Date of Component  $k$  (rounded to four decimal places).

$DF_{k,t}, Forward_{k,t}, K_{k,1}, K_{k,2}, Tb_{k,t}$  = the discount factor, forward level, strike boundaries, and time to expiration inputs for Component  $k$  for Index Day  $t$ , as defined in *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica* and *Appendix E: Discount Factor*.

$G_l$  = the sequence of discrete negative shock scenarios evaluated in the calibration grid (see Table 1 below).

$FloorCost_l$  = the corresponding scenario cost multipliers associated with each shock  $G_l$  (see Table 1 below).

$ACPrice(...), ACDelta(...)$  = the analytical pricing and delta function, as defined in *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica* and in step 3. above, respectively.

$BSPutDelta(...)$  = See *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica*.

**Table 1: Index Floor Calibration Table**

| $l$ | $G_l$  | $FloorCost_l$ |
|-----|--------|---------------|
| 0   | 0.0%   | 0.0%          |
| 1   | -5%    | 180.0%        |
| 2   | -10%   | 36.0%         |
| 3   | -15%   | 14.0%         |
| 4   | -25%   | 3.1%          |
| 5   | -37.5% | 1.6%          |

## APPENDIX E: DISCOUNT FACTOR

The discount factor function, denoted as  $DF_{k,t} = DF(Tc_{k,t}, t)$ , is used to construct a maturity-specific discount curve for each Index Day  $t$ .

If Index Day  $t \geq$  January 1, 2019, then the discount factor is determined in accordance with the following steps:

1. Determine the Secured Overnight Financing Rate (SOFR) Accrual and Forward Rates. The discount curve relies on the realized overnight SOFR compounding and the forward rates implied by listed futures.

$$SOFR_{Accrual}_t = \begin{cases} 1 & \text{if } t = T_{0,1,t} \\ \prod_{s=T_{0,1,t}+1}^t \left( 1 + SOFR_{s-1} \times \frac{Days_{s-1,s}}{360} \right) & \text{otherwise}^2 \end{cases}$$

$$ForwardDF_{i,t} = \frac{1}{\left( 1 - \frac{3mSOFR_{i,t}}{100} \right) \times \frac{Days_{T_{0,i,t}, T_{1,i,t}}}{360} + 1}$$

where:

$SOFR_{Accrual}_t$  = the realized overnight SOFR accrual multiplier evaluated for Index Day  $t$ .

$ForwardDF_{i,t}$  = the forward discount factor implied by the  $i$ -th CME three-Month SOFR Future for Index Day  $t$ .

$SOFR_t$  = the level of the SOFR rate for Index Day  $t$ . If such rate is unavailable, then the rate shall be the most recent rate available on an Index Day preceding Index Day  $t$ .

$3mSOFR_{i,t}$  = the settlement price of the  $i$ -th CME three-month SOFR Future for Index Day  $t$ .

$T_{0,i,t}$  = the Futures Interest Start Date of the  $i$ -th three-month SOFR Future listed on CME for Index Day  $t$ .

$T_{1,i,t}$  = the Futures Interest End Date of the  $i$ -th three-month SOFR Future listed on CME for Index Day  $t$ .

$Days_{x,y}$  = the number of calendar days from Index Day  $x$  (inclusive) to Index Day  $y$  (exclusive).

2. Determine the implied term structure. The implied term structure represents the discrete nodal points used to construct the discount curve. By chaining the realized overnight SOFR accrual with the sequence of futures-implied forward discount factors, the framework constructs an exact discount factor and corresponding standardized tenor for each future node.

<sup>2</sup> In cases where  $s$  = a U.S. federal holiday and  $s \neq t$ , then  $\left( 1 + SOFR_{s-1} \times \frac{Days_{s-1,s}}{360} \right)$  is set to 1.

$$ImpliedDF_{i,t} = SOFRAccrual_t \times \prod_{j=1}^i ForwardDF_{j,t}$$

where:

$ImpliedDF_{i,t}$  = the implied discount factor at the  $i$ -th node for Index Day  $t$ .

3. Determine the discount factor. The discount factor is derived via linear interpolation between the bounding nodes of the implied SOFR term structure. The realized tenors and indexes required for interpolation are calculated as follows:

$$DF(T, t) = \frac{(RT_{HIdx_{t,T},t} - T) \times ImpliedDF_{LIdx_{t,T},t} + (T - RT_{LIdx_{t,T},t}) \times ImpliedDF_{HIdx_{t,T},t}}{RT_{HIdx_{t,T},t} - RT_{LIdx_{t,T},t}}$$

where:

$$RT_{0,t} = 0$$

$$RT_{i,t} = \frac{Days_{t,T_{1,i,t}}}{365}$$

$$T = \frac{Days_{t,T}}{365}$$

$$LIdx_{t,T} = \max_{i \geq 0}(i | RT_{i,t} < T)$$

$$HIdx_{t,T} = \min_{i \geq 0}(i | RT_{i,t} \geq T)$$

If Index Day  $t < \text{January 1, 2019}$ , then the discount factor is derived continuously from the overnight Federal Funds rate:

$$DF(T, t) = e^{-RF_t \times T}$$

where:

$RF_t$  = the Effective Federal Funds Rate published by the Federal Reserve Bank of New York for Index Day  $t$ . If such rate is unavailable, then the rate shall be the most recent rate available on an Index Day preceding Index Day  $t$ .

## APPENDIX F: IMPLIED FINANCING SPREAD

The implied financing spread represents a drift adjustment inferred from rolling component return differentials and is used to adjust  $Forward_{k,t}$  (see *Appendix B: Valuation of a Hypothetical Autocallable Contract Replica*). This is intended to account for component funding/financing effects.

$$ImpliedSpread_t = ImpliedFinancing_t - 0.50\%$$

$$ImpliedFinancing_t = \frac{1}{10} \times \max \left( 0, \sum_{k=0}^9 \left( \frac{ERI_{XNDX,t-k}}{ERI_{XNDX,t-k-65}} - \frac{P_{NDXNQER,t-k}}{P_{NDXNQER,t-k-65}} \right) \times \frac{360}{Days_{t-k-65,t-k}} \right)$$

$$ERI_{XNDX,t} = ERI_{XNDX,t-1} \times \left( \frac{P_{XNDX,t}}{P_{XNDX,t-1}} - RF_{t-1} \times \frac{Days_{t-1,t}}{360} \right)$$

where:

$RF_{t-1}$  = the Effective Federal Funds Rate published by the Federal Reserve Bank of New York for Index Day  $t - 1$ .

$P_{NDXNQER,t}$  = the daily closing price of the Nasdaq-100 Futures Excess Return™ Index (NDXNQER) for Index Day  $t$  (rounded to two decimal places).

$P_{XNDX,t}$  = the daily closing price of the Nasdaq-100 Total Return Index® (XNDX®) for Index Day  $t$  (rounded to two decimal places).

$Days_{x,y}$  = the number of calendar days from Index Day  $x$  (inclusive) to Index Day  $y$  (exclusive).

$ERI_{XNDX,t}$  = the excess return Index level of the Nasdaq-100 Total Return Index® (XNDX®) for Index Day  $t$ .

If, a given Index Day  $t$  falls on a U.S. federal holiday,  $ERI_{XNDX,t}$  will not be calculated. Therefore:

$$ImpliedSpread_t = ImpliedSpread_{t-1}$$

If, for a given Index Day  $t$ , there is no published Effective Federal Funds Rate, Nasdaq-100 Futures Excess Return™ Index (NDXNQER) closing price, or Nasdaq-100 Total Return Index® (XNDX®) closing price, then:

$$ERI_{XNDX,t} = ERI_{XNDX,t-1}$$

$$ImpliedSpread_t = ImpliedSpread_{t-1}$$

Note: for history prior to January 1, 2022,  $ImpliedFinancing_t$  was deemed to be 0.50%.

## APPENDIX G: INCOME ONLY INDEXES

Each Income Only Index represents a corresponding Nasdaq-100 Volatility Compass Autocallable Index's accumulated income earned as of a given Index Day  $t$  and is calculated as follows:

$$I_t^{IO} = I_{t-1}^{IO} + CA_{t-1} \times RF_{t-1} \times \frac{Days_{t-1,t}}{360} + \sum_{k \in Live_t} (U_{k,t} \times ACPremium_{k,t})$$

where:

$I_t^{IO}$  = the Income Only Index value for Index Day  $t$ .

$CA_{t-1}$  = the cash account for Index Day  $t - 1$ .

$RF_{t-1}$  = the Effective Federal Funds Rate published by the Federal Reserve Bank of New York for Index Day  $t - 1$ . If such rate is unavailable, then the rate shall be the most recent rate available on an Index Day preceding Index Day  $t - 1$ .

$Days_{t-1,t}$  = the number of calendar days from Index Day  $t - 1$  (inclusive) to Index Day  $t$  (exclusive).

$U_{k,t}$  = the number of units of the Component  $k$  for Index Day  $t$  (see *Component units* below for more details).

$ACPremium_{k,t}$  = the premium for Component  $k$  and Index Day  $t$ , where such day is the Trade Date for that Component, as defined in *Appendix C: Portfolio Cashflow*.

$Live_t$  = The Live Component Set, as described in *Appendix A: Definitions*.

For the Index Base Date ( $t_0$ ), the Cumulative Income Index value is calculated as follows:

$$I_{t_0}^{IO} = \sum_{k \in Live_{t_0}} (U_{k,t_0} \times ACPremium_{k,t_0})$$

Each Income Only Index is calculated using full precision, but is rounded to four decimal places for dissemination purposes.

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