

# S&P Dow Jones Indices

A Division of **S&P Global**

## **S&P/JPX GIVI Index** *Methodology*

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# Introduction

## Highlights

The S&P/JPX GIVI (Global Intrinsic Value Index) is designed to provide an alternative measure of Japanese equity market performance through the selection of a low-risk stock portfolio and a weighting scheme where a stock's index weight is determined by its calculated intrinsic value.

The index universe consists of the constituents of the Tokyo Stock Price Index (TOPIX).<sup>1</sup> The most volatile stocks, as measured by country market stock beta, that form 30% of the TOPIX's total float-adjusted market capitalization are excluded. The remaining stocks, making up 70% of the TOPIX's total float-adjusted market capitalization, are then selected and form the S&P/JPX GIVI.

This methodology describes the procedures that underlie the construction and maintenance of the S&P/JPX GIVI. These procedures are monitored by S&P Dow Jones Indices and revised as necessary.

This methodology was created by S&P Dow Jones Indices to achieve the aforementioned objective of measuring the underlying interest of each index governed by this methodology document. Any changes to or deviations from this methodology are made in the sole judgment and discretion of S&P Dow Jones Indices so that the index continues to achieve its objective.

## Supporting Documents

This methodology is meant to be read in conjunction with supporting documents providing greater detail with respect to the policies, procedures and calculations described herein. References throughout the methodology direct the reader to the relevant supporting document for further information on a specific topic. The list of the main supplemental documents for this methodology and the hyperlinks to those documents is as follows:

Supporting Document	URL
S&P Dow Jones Indices' Equity Indices Policies & Practices Methodology	<a href="#">Equity Indices Policies &amp; Practices</a>
S&P Dow Jones Indices' Index Mathematics Methodology	<a href="#">Index Mathematics Methodology</a>
S&P Dow Jones Indices' Float Adjustment Methodology	<a href="#">Float Adjustment Methodology</a>

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<sup>1</sup> The TOPIX is calculated and published by the Tokyo Stock Exchange (TSE) and is a float-adjusted market capitalization weighted index that is calculated based on all the domestic common stocks listed on the First Section of the TSE. For more information on the TOPIX, please refer to the Japan Exchange Group (JPX) Web site at [www.jpjx.co.jp/english/](http://www.jpjx.co.jp/english/).

# Index Construction

## Index Universe

The S&P/JPX GIVI is constructed from the constituents of the Tokyo Stock Price Index (TOPIX).<sup>2</sup>

## Intrinsic Value Weights

Each stock in the S&P/JPX GIVI is weighted by its calculated intrinsic value, rather than market capitalization. The intrinsic value of each stock is determined by its book value and its discounted projected earnings. The discount rate is calculated using a stock's beta, derived from its previous five years of price returns and a risk free interest rate. The intrinsic value of each stock is updated twice a year at the March and September index rebalancings.

*Please refer to Appendix B for details of the intrinsic value (IV) calculation.*

## Cap on Intrinsic Value Weights

A stock's weight is capped if its intrinsic value weight is above its TOPIX float-adjusted market cap weight by a specific upper bound. The bound for a stock is set as the minimum of:

- a. its float-adjusted market cap weight +  $\frac{1}{2\sqrt{N}}$ , where  $N$  is the number of stocks in the S&P/JPX GIVI, or
- b. three (3) times its float-adjusted market cap weight.

Note that the capping algorithm redistributes the excess weight to other stocks in the index in proportion to their original intrinsic value weight. Capping of the IV weights occurs twice a year on the IV index rebalancing date.

## Low Risk Stock Selection

The risk of each stock in the TOPIX universe is measured by the country market stock beta, where beta is calculated as defined in *Appendix A*. Stocks are sorted by their betas and the 70% of the universe with the lowest betas are selected. The 70% selection is measured by float-adjusted market capitalization. The resulting stock portfolio forms the S&P/JPX GIVI.

## Buffer Rule for Index Constituents' Beta

A 5% buffer is applied to stocks already in the index. For a constituent to be removed from the index during a rebalancing, it must be among the highest 25% of float-adjusted weights when ranked by beta. This 5% buffer reduces index portfolio turnover.

## Float Adjustment

Investable Weight Factors (IWF), which define the available float for a stock, are reviewed as part of the annual reconstitution process. The float-adjusted shares are used for the calculation of the intrinsic value of a stock.

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<sup>2</sup> The TOPIX is calculated and published by the Tokyo Stock Exchange (TSE) and is a float-adjusted market capitalization weighted index that is calculated based on all the domestic common stocks listed on the First Section of the TSE. For more information on the TOPIX, please refer to the Japan Exchange Group (JPX) Web site at [www.jpex.co.jp/english/](http://www.jpex.co.jp/english/).

*Please refer to S&P Dow Jones Indices' Float Adjustment Methodology for a detailed description of float adjustment and Investable Weight Factors (IWF).*

S&P Dow Jones Indices 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 an index, not for continued membership. As a result, an index constituent that appears to violate criteria for addition to that index will not be deleted unless ongoing conditions warrant an index change.

# Index Maintenance

## Index Calculations

The index is calculated using the divisor methodology used in all S&P Dow Jones Indices' equity indices and is calculated on all days except as noted in *Index Policy*. Index calculations include price and total return series.

The index is calculated using S&P Dow Jones Indices' modified market cap weighted methodology. A modified market cap weighted index is one where index constituents have a user-defined index weight. Each stock's weight is based on its intrinsic value which can be capped as detailed in *Index Construction*. Between semi-annual index rebalancings, corporate actions generally have no effect on index weights, as they are fixed through the processes defined under the corporate action events on the following pages. As stock prices move, the weights shift and the modified weights change. The index is rebalanced twice a year on the third Friday of March and September to update stocks' weights.

*Please refer to S&P Dow Jones Indices' Index Mathematics Methodology document for further details on the modified market cap methodology.*

Gross dividends are tabulated daily and included in the total return calculations on their ex-dates. When local market dividend announcement practices make ex-dates unavailable, dividend inclusion follows the local market practice. Gross dividends are reinvested on the ex-dividend date to calculate gross total returns, with alternative compounding periodicities available on a customized basis.

Returns-of-capital are treated as capital distributions and the index divisor is adjusted on the event ex-date. For spin-offs that include a cash distribution, the cash distribution is treated as a return-of-capital on the ex-date.

## Currency, Currency Hedged, and Risk Control Indices

The index is calculated in U.S. dollars and Japanese yen.

Currency, currency hedged, and risk control versions of the indices may be available. For a list of available currency, currency hedged, and risk control indices, please contact Client Services at [index\\_services@spglobal.com](mailto:index_services@spglobal.com).

*For more information on currency, currency hedged, and risk control indices, please refer to S&P Dow Jones Indices' Index Mathematics Methodology.*

## Exchange Rate

Daily index closing values are calculated in U.S. dollars using spot exchange rates as supplied by an established market information vendor.

## Rebalancing

The index is rebalanced twice a year, effective after the close on the third Friday of March and September. The rebalancing reference dates are the last trading day of the month prior to the rebalancing month.

## Corporate Actions and the Effect on the Divisor

Corporate Action	Adjustment Made to Index	Divisor Adjustment?
Spin-off	The spun-off company is added to all indices 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). If a spun-off company is determined not to be eligible to remain in the index, it will be removed after at least one day of regular way trading (with a divisor adjustment).  <i>For exceptions to this rule please refer to S&amp;P Dow Jones Indices' Equity Indices Policies &amp; Practices document.</i>	No
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
IWF Change	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.	Yes
Constituent Change	There are no intra-rebalancing additions except spinoffs that are index eligible.	-
	Deletions due to delistings, acquisition or any other corporate event resulting in the deletion of the stock from the Index will cause the weights of the rest of the stocks in the index to change. Relative weights will stay the same.	Yes

*For more information on Corporate Actions, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document.*

### Additions and Deletions

With the exception of spin-offs, no index constituents are added to the index between rebalancings. Since the index does not have a fixed number of constituents, additions to and deletions from the index are not the same number.

**Initial Public Offerings.** IPO additions to the index take place semi-annually on the rebalancing dates. To be considered eligible for inclusion in the S&P/JPX GIVI, an IPO must first meet the requirements of the TOPIX.<sup>3</sup>

If the stock has fewer than six months of history or fewer than 100 valid daily observations its beta is defaulted to one (1). Stock inclusion in the S&P/JPX GIVI is still subject to the Low Risk Stock Selection 70% rule as described in *Index Construction*. For the IPO, all other ratios required for calculation of the S&P/JPX GIVI default to its sector average until there is sufficient information to calculate the company specific IV weight.

**Spin-Offs.** The spun-off company is added to all indices 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). If a spun-off company is determined not to be eligible to remain in the index, it will be removed after at least one day of regular way trading (with a divisor adjustment).

The IV weight of the original stock is allocated to the parent and spun-off entity based on the ratio of their float-adjusted market cap weights.

<sup>3</sup> For more information on the TOPIX, please refer to the Japan Exchange Group (JPX) Web site at [www.jpj.co.jp/english/](http://www.jpj.co.jp/english/).



Upon rebalancing, if the spun-off entity is kept in the S&P/JPX GIVI, the IV weights and beta are calculated as if spin-offs are IPOs and follow the rules for IPOs described above.

**Mergers.** If two constituents of the S&P/JPX GIVI merge, the combined company remains in the index at least through the next rebalancing, when it is reviewed. The merged company carries the combined IV weights. The one exception is when a company in the index merges with a high-beta company in the TOPIX which is not in the S&P/JPX GIVI. If the surviving company is deemed to be the low-beta constituent, then the company remains in the index at its current weight; however, if the surviving company is deemed to be the high-beta non-constituent, then the merged company is dropped from the S&P/JPX GIVI on the merger ex-date and the weight is redistributed proportionately to the remaining index constituents.

If an S&P/JPX GIVI constituent is acquired by a company that is not a member of the TOPIX but is added to the TOPIX upon merger, then the new entity enters the S&P/JPX GIVI selection universe as an IPO and follows the rules for IPOs described above.

**All-Cash Takeovers.** All-cash takeovers become effective on the date of the takeover.

**Cash and Stock Takeovers.** Takeover valuations are calculated based on the equivalent value received by shareholders on the effective date of the transaction.

For fixed-proportion cash-and-stock takeovers, the calculated valuation is the value of the cash received plus the equivalent value of the stock as of the effective date.

For cash-and-stock takeovers where the choice of compensation is subject to election by the shareholders of the target company, the calculated valuation is the average proportionate value of the cash and stock received by all shareholders of the acquired company. The calculated valuation is applied to the company on the effective date of the acquisition. The weighting of the acquiring company increases in accordance with the terms of the offer to reflect the combined available float of the post-merger company.

Other than all-cash takeovers, deletions are made using the closing price of the stock on the date of the deletion.

**All-Stock Takeovers.** The calculated valuation is the proportionate value of the stock and/or other remuneration received by shareholders of the acquired company. The calculated valuation is applied to the company on the effective date of the acquisition. The weight of the acquiring company increases in accordance with the terms of the offer to reflect the combined available float of the post-merger company.

**Rights Offering.** The price adjustment is accompanied by a change to the index shares so that the company's weight remains the same as its weight before the rights offering. No divisor adjustment is made.

**Other Deletions.** Companies that fall below US\$ 25 million float-adjusted market capitalization are removed from the index after a minimum five days' notice. Evaluations are made on a quarterly basis.

If a company's shares are no longer available or are no longer trading, the company is deleted from the index as soon as reasonably practical, with every attempt to provide clients notice within two-to-five business days. In the event the information of delisting or bankruptcy becomes public after the fact, the stock may be removed with one-day notice. A company may be removed from the index at the discretion of the Index Committee.

## **Unforeseen Events**

S&P Dow Jones Indices retains the sole authority and final discretion regarding all index activity. In all cases, the index treatments for corporate actions are communicated through the daily Corporate Events .SDE file and/or special announcements delivered to all clients.

# Index Data

## Calculation Return Types

S&P Dow Jones Indices calculates multiple return types which vary based on the treatment of regular cash dividends. The classification of regular cash dividends is determined by S&P Dow Jones Indices.

- Price Return (PR) versions are calculated without adjustments for regular cash dividends.
- Gross Total Return (TR) versions reinvest regular cash dividends at the close on the ex-date without consideration for withholding taxes.
- Net Total Return (NTR) versions, if available, reinvest regular cash dividends at the close on the ex-date after the deduction of applicable withholding taxes.

In the event there are no regular cash dividends on the ex-date, the daily performance of all three indices will be identical.

For a complete list of indices available, please refer to the daily index levels file (“SDL”).

*For more information on the classification of regular versus special cash dividends as well as the tax rates used in the calculation of net return, please refer to S&P Dow Jones Indices’ Equity Indices Policies & Practices Methodology.*

*For more information on the calculation of return types, please refer to S&P Dow Jones Indices’ Index Mathematics Methodology.*

# Index Governance

## Index Committee

S&P Dow Jones Indices' Global Benchmarks Index Committee oversees the S&P/JPX GIVI. All members of the Committee are full time employees of S&P Dow Jones Indices. It is the responsibility of the Index Committee to decide all matters relating to methodology, maintenance, constituent selection and index procedures. Committee decisions are based on publicly available information. No confidential or non-public information is available to the Index Committee. The Index Committee is separate from, and independent of, other analytical groups at Standard & Poor's. In particular, the Index Committee has no access to any information or decisions by Standard & Poor's ratings analysts or S&P CapitalIQ equity analysts.

S&P Dow Jones Indices' Index Committees reserve 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 the daily governance of indices and maintenance of index methodologies, at least once within any 12-month period, the Index Committee reviews the methodology to ensure the indices continue to achieve the stated objectives, and that the data and methodology remain effective. In certain instances, S&P Dow Jones Indices may publish a consultation inviting comments from external parties.

*For information on Quality Assurance and Internal Reviews of Methodology, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document located on our Web site, [www.spdji.com](http://www.spdji.com).*

# Index Policy

## Announcements

All index constituents are evaluated daily for data needed to calculate index levels and returns. All events affecting the daily index calculation are typically announced in advance via the Index Corporate Events report (.SDE), delivered daily via ftp to all clients. Any unusual treatment of a corporate action or short notice of an event may be communicated via email to clients.

Index methodology is constantly under review for best practices, and any changes are announced well ahead of time via the Web site and email to all clients.

*For more information on S&P Dow Jones Indices' announcements, please refer to the Announcement Policy located on our Web site, [www.spdji.com](http://www.spdji.com).*

## Pro-forma Files

In addition to the corporate events file (.SDE), S&P Dow Jones Indices provides constituent pro-forma files each time the index rebalances. The pro-forma file is typically provided in advance of the rebalancing date and contains all constituents and their corresponding weights and index shares effective for the upcoming rebalancing. Since index shares are assigned based on prices prior to the rebalancing, the actual weight of each stock at the rebalancing differs from these weights due to market movements.

*Please visit [www.spdji.com](http://www.spdji.com) for a complete schedule of rebalancing timelines and pro-forma delivery times.*

## Holiday Schedule

The index is calculated daily, throughout the calendar year. The only days the index is not calculated are on days when all exchanges where the index's constituents are listed are officially closed.

*A complete holiday schedule for the year is available at [www.spdji.com](http://www.spdji.com).*

## Unexpected Exchange Closures

For information on Unexpected Exchange Closures, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document.

## Recalculation Policy

For information on the recalculation policy, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document.

*For information on Calculations and Pricing Disruptions, Expert Judgment and Data Hierarchy, please refer to S&P Dow Jones Indices' Equity Indices Policies & Practices document.*

## Contact Information

For questions regarding an index, please contact: [index\\_services@spglobal.com](mailto:index_services@spglobal.com).

# Index Dissemination

Index levels are available through S&P Dow Jones Indices' Web site at [www.spdji.com](http://www.spdji.com), major quote vendors (see codes below), numerous investment-oriented Web sites, and various print and electronic media.

## Tickers

The table below lists headline indices covered by this document. All currency, currency hedged, risk control, and return type versions of the below indices that may exist are also covered by this document. Please contact [index\\_services@spglobal.com](mailto:index_services@spglobal.com) for a complete list of indices covered by this document.

Index (Currency)	Return Type	Bloomberg
S&P/JPX GIVI Index (JPY)	Price Return	SPJXVJP
	Total Return	SPJXVJT
S&P/JPX GIVI Index (USD)	Price Return	SPJXVUP
	Total Return	SPJXVUT

## FTP

Daily stock level and index data are available via FTP subscription.

For product information, please contact S&P Dow Jones Indices, [www.spdji.com/contact-us](http://www.spdji.com/contact-us).

## Web site

For further information, please refer to S&P Dow Jones Indices' Web site at [www.spdji.com](http://www.spdji.com).

# Appendix A: Beta Calculation

Beta is used in two ways in the S&P/JPX GIVI methodology: 1) to determine the discount rate used to compute intrinsic value, and 2) to sort stocks into risk stratified sub-indices.

A few key characteristics of beta calculations are the following:

<b>Reference index:</b>	Unhedged TOPIX
<b>Frequency of return data:</b>	Daily
<b>Estimation window / half-life:</b>	Five-year (5) estimation window, two-and-one-half-year (2 ½) half-life.
<b>Non-synchronous returns:</b>	Scholes-Williams approach.
<b>Estimation bias handling:</b>	Shrink towards 1.0 using the Vasicek approach (i.e., shrink based on each beta's standard error).
<b>Extreme beta estimates:</b>	Winsorize at 0.5 and 2.0.

In short, on each of the rebalancing reference dates, S&P Dow Jones Indices uses up to five years of daily returns to compute Scholes-Williams betas with exponential weights and Vasicek shrinkage.

## Non-trading Days

Non-trading days are business days where a company's stock return is missing, but the relevant index is calculated. If a stock has a non-trading day, the day is excluded from the beta calculation and the stock's return for the following day is adjusted to be a multi-day return. Multi-day returns are used for up to five days. If a stock does not trade for more than five consecutive days, the non-trading days are excluded from the beta calculation, as is the first day trading resumes.

## Required Observations

Companies with fewer than six months of history or fewer than 100 valid daily observations (including multi-day returns) are assigned a beta of one (1).

## Return Calculations

The steps required to compute stock price and index returns for beta calculations are as follows.

1. S&P Dow Jones Indices uses five (5) years of closing price history for both the stock and its relative index, in U.S. dollars.
2. In rare cases when a daily stock price is available but the related index value is not, this day's observation is excluded from the beta calculation.
3. The stock return is computed as:

$$\text{StockReturn} = \frac{\text{ClosePrice} - \text{PreviousDayClosePrice}}{\text{PreviousDayClosePrice}}$$

4. The index return is computed as:

$$\text{IndexReturn} = \frac{\text{IndexValue} - \text{PreviousDayIndexValue}}{\text{PreviousDayIndexValue}}$$

5. These stock and index returns are used for the beta calculations.

## Exceptions Handling

1. In some cases, a stock may have the same price for two consecutive days and the price return is 0.0%. This is a valid scenario and this observation and the corresponding index return is used for the beta calculation.
2. If a stock's closing price is reported to S&P Dow Jones Indices as US\$ 0.00 or a null value, it is excluded from the return calculation, as is its corresponding index value.
3. If a stock does not trade for more than five consecutive days, the non-trading days are excluded from the beta calculation, as is the first day trading resumes.
4. Standard beta calculations are for a five-year time period, but S&P Dow Jones Indices will calculate beta values if a stock does not have five years of closing values.
5. However, if the stock has fewer than six months of history or fewer than 100 valid daily observations its beta is defaulted to one (1).

## Exponential Weighting

The calculation of beta places more weight on recent observations, with exponential decay and a half-life of 2.5 years.

Exponential weights are based on a stock's trading days.  $W_d$  is the weight on day  $d$ , where  $d$  ranges from 1 to  $D$ , the total number of valid stock returns in the estimation window.  $D$  can be up to five years (1,260 observations) if closing prices are available. Day  $d$  is measured from the rebalancing reference date, where  $d = 1$  means the data point is one trading day away from the rebalancing reference date, and  $d = D$  means the data point is 1,260 trading days away from the rebalancing reference date.

$$W_d = 2^{-d/\lambda}$$

where  $\lambda = 630$  days (the half-life of the decay for all stocks).

## Scholes-Williams Beta

In the formulae for beta estimation for stock  $i$  below, the subscript  $t$  refers to daily observations used in the estimation, where  $t$  ranges from 1 to  $T$ , the total number of observations used (after removing dates with missing stock returns).

$$Stk_{i,t} = \log(1 + \text{return of stock}_i \text{ on day } t);$$

$$Ind_t = \log(1 + \text{return of index on day } t);$$

$$Ind3_t = Ind_{t-1} + Ind_t + Ind_{t+1} = \text{the three-day return on the index}$$

The Scholes-Williams Beta is the ratio of two regression coefficients:

$$\beta_{sw,i} = \frac{Cov(Stk_{i,t}, Ind3_t) / Var(Ind3_t)}{Cov(Ind_t, Ind3_t) / Var(Ind3_t)}$$

The variances  $Var()$  and covariances  $Cov()$  are computed using stocks returns and index returns, weighted by the exponential weight  $W_t$ .

## Vasicek Shrinkage

Betas are shrunk towards one (1) based on the standard error of the estimates.

First, for each stock  $i$ , Scholes-Williams betas are estimated, and one-day betas are also estimated using a linear regression with exponential weights.

$$Stk_{i,t} = \alpha_i + \beta_i Ind_t + U_{SW,i,t}$$

Scholes-Williams residuals are:

$$U_{SW,i,t} = Stk_{i,t} - \alpha_i - \beta_i Ind_t$$

The volatility of the residuals is calculated as:

$W_h$  = Exponential weight for observation  $h$

$\sigma_{e,i}^2$  = Decay-weighted variance of Scholes-Williams residuals

$$\sigma_{e,i}^2 = \frac{1}{(N-2)} \sum_{h=1}^N U_{SW,i,t-h}^2 W_h^2$$

where  $N$  is the total number of observations (when there are no missing returns in the observation window,  $N = D = 1,260$ ).

Autocorrelation terms and the index variance are as follows:

$\rho_i$  = Correlation( $Stk_{i,t}, Stk_{i,t-1}$ )

$\rho_{ind}$  = Correlation( $Ind_j, Ind_{3j}$ )

$\sigma_{Ind}^2$  = Variance( $Ind$ )

Scholes-Williams standard error is given by:

$$\sigma_{SW,i} = \frac{\sigma_{e,i} \sqrt{1 + 2\rho_{ind} + 2\rho_i}}{\sigma_{ind} \rho_{ind} \sqrt{N}}$$

Scholes-Williams betas with Vasicek shrinkage is:

$$k_i = 1 - \frac{\sigma_{SW,i}^2}{\sigma_{SW,i}^2 + \text{Cross sectional Dispersion of } \beta_{SW,i}}$$

$$\beta_{SW,i}^{vasicek} = k_i * \beta_{SW,i} + (1 - k_i)$$



## Appendix B: Intrinsic Value Calculation

The estimates of intrinsic value (IV) are used to determine index weights. Extreme estimates of intrinsic value (both absolute and relative to float-adjusted market capitalization) are not trimmed. However, the intrinsic value weight of a stock is capped according to a formula discussed in *IV Weight Calculation Details* below.

Using the residual income model (RIM), let  $V_0$  denote the estimate of intrinsic value for stock  $j$  (subscript omitted) as of the beginning of the current fiscal year (the fiscal year corresponding to the estimate, FY1):

$$V_0 = B_0 + \frac{(\rho_1 - r)B_0}{(1+r)^{1/2}} + \sum_{t=2}^{21} \frac{(\rho_t - r)B_{t-1}}{(1+r)^{t-1/2}} \quad (1)$$

where:

$V_0$  = Intrinsic value at the end of fiscal year  $t = 0$  (beginning of FY1).

$B_t$  = Book value of common equity at the end of year  $t$ .

$\rho_t$  = Return on equity (ROE) during year  $t$  (details below).

$r$  = Discount rate/cost of capital (assumed constant for all periods  $t$  as of a given valuation date) .

$t = 21$ , the number of years for which abnormal earnings are nonzero:  $\rho_t \neq r$  (in the model it is assumed there are no abnormal earnings after 21 years).

$B_0$  = The fiscal year or quarter that is closest to the beginning of the current year (as defined by FY1). For example, if FY1 corresponds to calendar year 2010, then book value is measured as of December 2009 (or September 2009 if the company has not yet released its December 2009 financial statements).

The following expression (clean surplus relation) is used to compute the book value of common equity over time:

$$B_t = B_{t-1} + (1 - k^b) \rho_t B_{t-1}, \quad \text{for } t = 1, 2, 3, \dots \quad (2)$$

Where  $k^b$  is the dividend payout ratio and  $\rho_t$  is the forecasted return on equity (ROE) for year  $t$  (both defined below).

Estimates of ROE are updated at each index rebalancing date using the most recent estimates for the next two fiscal years (FY1 and FY2).

The discount rate  $r$  for each stock  $j$  on valuation date  $t$  is computed using the following expression:

$$r_t = r_f + \beta * ERP$$

where  $r_f$  is the risk-free rate,  $\beta$  is the beta for stock  $j$  (described in *Appendix A*), and ERP is the equity risk premium.

The risk-free rate is updated at each index rebalancing. It is the Japan Government Bond Year to maturity 10 Year Simple Yield. The ERP is a global constant taken to be 3.5%.

## Dividend Payout Ratio

Let  $H$  denote the number of years during the past five years for which dividend and earnings data are available.

Let  $k^r$  denote the raw five-year (or  $H$ -year) earnings-weighted mean dividend payout ratio for stock  $j$  (stock subscript omitted):

$$k^r = (D_{-4} + D_{-3} + D_{-2} + D_{-1} + D_0) / (E_{-4} + E_{-3} + E_{-2} + E_{-1} + E_0)$$

Let  $k^w$  denote the dividend payout ratio winsorized at 0.0 and 1.0. Please note, if  $k^r$  lies between the two  $k^w$  extremes, then  $k^w = k^r$ , otherwise  $k^w$  is assigned the cap of 1.0 or floor of 0.0.

If the sum of earning over the past five years is zero or negative, and the sum of dividends are positive, then the dividend payout ratio defaults to 1.0. If the sum of earning and dividend are both 0, then the ratio is defaulted to 0.0.

Let  $ND^{cs}$  denote the number of stocks in stock  $j$ 's country-sector for which  $k^w$  is available, and let  $k^{cs}$  denote the equal-weighted country-sector mean of  $k^w$ .

Let  $k^{gs}$  denote the equal-weighted global-sector mean of  $k^w$ .

Let  $k^s$  denote the sector mean dividend payout ratio for stock  $j$ , defined as:

$$k^s = (\min\{ND^{cs}, 50\}/50) * k^{cs} + (1 - \min\{ND^{cs}, 50\}/50) * k^{gs}$$

Finally, let  $k^b$  denote the blended dividend payout ratio for stock  $j$ :

$$k^b = (H/10) * k^w + (1 - H/10) * k^s$$

The blended dividend payout ratio  $k^b$  is a measure of the dividend payout ratio  $k$  used in the book value calculation (equation 2) above and ROE calculations below.

## Return on Equity

Let  $ROE1^r$  and  $ROE2^r$  denote raw forecasts of return on equity (ROE) based on mean annual analyst earnings forecasts for  $FY1$  and  $FY2$ :

$$ROE1^r = Nshrs_{FY1} * E_{FY1} / B_0$$

$$ROE2^r = (Nshrs_{FY2} * E_{FY2}) / (B_0 + (1 - k^b) * Nshrs_{FY1} * E_{FY2})$$

where  $Nshrs_{FY1}$  and  $Nshrs_{FY2}$  are the number of shares outstanding,  $E_{FY1}$  and  $E_{FY2}$  are earnings-per-share forecasts that are corresponding to  $FY1$  and  $FY2$ ,  $B_0$  is the book value of common equity at the end of year 0 (the beginning of the year corresponding to  $FY1$ ), and  $k^b$  is the dividend payout ratio defined above.

Let  $ROE1^w$  and  $ROE2^w$  denote the winsorized values of  $ROE1^r$  and  $ROE2^r$ , where the lower and upper bounds are -0.25 and 0.5. Please note, if either  $ROE^r$  lies between the two  $ROE^w$  extremes, then  $ROE^w = ROE^r$ , otherwise  $ROE^w$  it is assigned the cap of 0.5 or floor of 0.25.

Let  $NR1^{cs}$  and  $NR2^{cs}$  denote the numbers of stocks in the country-sector of stock  $j$  for which  $ROE1^w$  and  $ROE2^w$  are available, and let  $ROE1^{cs}$  and  $ROE2^{cs}$  denote the equal-weighted country-sector means of  $ROE1^w$  and  $ROE2^w$ .

Let  $ROE1^{gs}$  and  $ROE2^{gs}$  denote the equal-weighted global-sector means of  $ROE1^w$  and  $ROE2^w$ .

Let  $ROE1^s$  ( $ROE2^s$ ) denote the sector mean ROE for stock  $j$ , defined to be the following combination of  $ROE1^{rs}$  ( $ROE2^{rs}$ ) and  $ROE1^{gs}$  ( $ROE2^{gs}$ ):

$$ROE1^s = (\min\{NR1^{rs}, 50\}/50) * ROE1^{rs} + (1 - \min\{NR1^{rs}, 50\}/50) * ROE1^{gs}$$

$$ROE2^s = (\min\{NR2^{rs}, 50\}/50) * ROE2^{rs} + (1 - \min\{NR2^{rs}, 50\}/50) * ROE2^{gs}$$

Finally, let  $ROE1^b$  and  $ROE2^b$  denote the 50-50 blended ROEs for stock  $j$ :

$$ROE1^b = \frac{1}{2} ROE1^w + \frac{1}{2} ROE1^s$$

$$ROE2^b = \frac{1}{2} ROE2^w + \frac{1}{2} ROE2^s$$

If  $ROE1^w$  or  $ROE2^w$  is missing,  $ROE1^b$  and  $ROE2^b$  become  $ROE1^s$  and  $ROE2^s$  (their sector averages) respectively.

If a company has multiple share classes, each share class uses the same company-level earnings-per-share estimate. If the company level earnings estimate is not available but share-class level estimates are available, then the per-share estimate from the share-class with the largest market capitalization is used as the company-level per-share estimate. If neither the company level nor the share-class level earnings estimate is available, then the country and sector average detailed above is used.

For equation (1) above, the estimates of ROE for stock  $j$  appearing in the residual income model (RIM),  $\rho_t$ , decays towards the stock's discount rate  $r$  as follows:

$$\rho_t = \begin{cases} ROE1^b & \text{for } t = 1 \\ \delta_t ROE2^b + (1 - \delta_t) r & \text{for } t = 2, 3 \dots 21, \\ r & \text{for } t \geq 22 \end{cases}$$

The multipliers  $\delta_t$  take on the values in the following table:

Year	Multiplier
2	1.0000
3	0.9205
4	0.8456
5	0.7748
6	0.7079
7	0.6446
8	0.5848
9	0.5281
10	0.4743
11	0.4234
12	0.3750
13	0.3290
14	0.2853
15	0.2436
16	0.2039
17	0.1661
18	0.1299
19	0.0953
20	0.0622
21	0.0304

The multipliers are based on a combination of an exponential decay with a 10-year half-life and a 20-year linear decay (to ensure the multiplier converges to 0.0 in year 22).

## IV Weight Calculation Details

The IV weights on each individual stock in the index are calculated as follows:

1. **Remove the most volatile stocks from the TOPIX while retaining 70% of its float-adjusted market capitalization (MCAP).**
  - a. All TOPIX constituents, as of the rebalancing day, are obtained.
  - b. The stocks are sorted in descending order of IVs (null values on top).
  - c. All stocks where the IV is either not available or less than or equal to 0 are removed.
  - d. If the remaining MCAP is more than 70% of the original MCAP, the remaining stocks are listed in descending order of beta.
  - e. The stocks with the highest beta are removed until 70% of the original MCAP is reached, but not breached. For example, assuming the next stock has a 3% index weight and the remaining MCAP is 72%, S&P Dow Jones Indices will not remove this stock, as the MCAP would fall to 69% of the original.
2. **Compute the IV weight for all the stocks in the S&P/JPX GIVI.**

For any index stock  $i$  its weight is calculated as follows:

$$StockIVWeight_i = \frac{IVvalue_i * IWF_i}{\sum_{j=1}^N IVvalue_j * IWF_j}$$

where:

$StockIVWeight_i$  = Weight of stock  $i$  in the index, as of the index rebalancing date.

$IVvalue_j$  = Intrinsic value of stock  $j$  as of the index rebalancing reference date, as calculated in equation (1).

$IWF_j$  = Investable Weight Factor of stock  $j$ .

$N$  = Number of stocks in the index.

### 3. Multiple share classes

If a company is represented by multiple share classes in the index, then the IV weight of each share class is calculated based on the stock's beta and the company's earnings forecasts, with the company book value allocated to each share class according to the ratio of their respective float-adjusted market-cap weights.

### 4. Capping of the IV weights

A stock's weight is capped if its intrinsic value weight is above its TOPIX float-adjusted market cap weight by a specific upper bound. The bound for a stock is set as the minimum of:

- a. Its float-adjusted market cap weight +  $\frac{1}{2\sqrt{N}}$ , where  $N$  is the number of stocks in the S&P/JPX GIVI, or
- b. Three (3) times its float-adjusted market cap weight.

Note that the capping algorithm redistributes the excess weight to other stocks in the index in proportion to their original intrinsic value weight. Capping of the IV weights occurs twice a year on the IV index rebalancing date. The excess weight redistribution is limited by the maximum weight limit outlined in points a) and b).

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