

JPX/S&P CAPEX & Human Capital Index *Methodology*

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Introduction

Index Objective

The JPX/S&P CAPEX & Human Capital Index is designed to measure the performance of companies in the Japanese equity market based on capital expenditure growth and efficiency, and investments in human capital.

Capital expenditure growth and efficiency are assessed through a quantitative measure based on published data in public filings, while the human capital metric is assessed through scores provided by RobecoSAM.¹

Highlights

The index universe is drawn from the constituents of the Tokyo Stock Price Index (TOPIX).² Companies satisfying the liquidity, creditworthiness, profitability, and low beta eligibility factors form the selection universe. The 200 companies with the highest scores based on capex and R&D expense growth, capex revenue effect, and human capital scores are selected and form the JPX/S&P CAPEX & Human Capital Index. Each index constituent is weighted by the product of its float-adjusted market capitalization and composite capex and human capital score.

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	Equity Indices Policies & Practices
S&P Dow Jones Indices' Index Mathematics Methodology	Index Mathematics Methodology
S&P Dow Jones Indices' Float Adjustment Methodology	Float Adjustment Methodology

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.

¹ Refer to *Appendix B* for more information.

² The TOPIX is calculated and published by the Tokyo Stock Exchange (TSE). For more information please refer to www.jpx.co.jp/english/.

Eligibility Criteria

Index Eligibility

To be eligible for index inclusion, companies must first be constituents of the TOPIX.

Eligibility Factors

Liquidity. As of the rebalancing reference date, the stock must have at least:

- 200 active trading days over the past year.
- JPY 100 billion of total value traded over the past year.

Creditworthiness. As of the rebalancing reference date, the company must have:

- Total assets greater than total liabilities in all of the three most recently reported fiscal years.
- Positive operating income in at least one of the three most recently reported fiscal years.
- Positive net income in at least one of the three most recently reported fiscal years.

Profitability. As of the rebalancing reference date, the company must have a non-negative:

- Three-year average operating income, defined as the average of the annual operating income figures from the three most recently reported fiscal years.
- Three-year average net income, defined as the average of the annual net income figures from the three most recently reported fiscal years.

Low Beta. After applying the above eligibility factors, stocks are sorted by their betas (as defined in *Appendix A*) and the 70% of the stocks with the lowest betas are selected and form the eligible universe.

During the low beta screen, a 5% buffer is applied to current index constituents in order to reduce index turnover. A current constituent will remain eligible for index consideration at the annual reconstitution unless it is among the top 25% of float-adjusted weights when ranked by beta.

In cases where, after applying the above 5% buffer, the number of eligible companies is less than 200, the eligibility factors are relaxed as follows:

1. **Low Beta.** The low beta threshold is increased from 70% until the target count of 200 eligible companies is met.
2. **Profitability.** If after Step 1 the target count is still not met, the companies are sorted by their three-year average net income in descending order, and those with the smallest deficits are selected until the target count of 200 eligible companies is met.
3. **Profitability.** If after Step 2 the target count is still not met, companies are sorted by their three-year average operating income in descending order and those with the smallest operating deficits are selected until the target count of 200 eligible companies is met.

If after Step 3 the target count is still not met, all eligible companies are selected for index inclusion and the index will have less than 200 companies.

In extreme cases, if the number of eligible companies is less than 100, S&P Dow Jones Indices may relax the eligibility factors to ensure adequate index constituent representation. The decision to do so is at the sole discretion of the Index Committee.

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.

Those companies passing the above eligibility factors form the selection universe.

Index Construction

Approaches

There are two steps in the creation of the index. The first is the selection of the index constituents; the second is the weighting of the constituents within the index.

Constituent Selection

Scores based on capex and R&D growth, capex revenue effect, and human capital are calculated for each company in the selection universe. Companies are then ranked based on their composite capex and human capital scores (see *Appendix B*) and selected as follows:

1. The top 180 companies (whether a current constituent or not) are selected for index inclusion.
2. Existing constituent companies ranked 181-220 are selected in order of highest rank until the target constituent company count of 200 is reached.
3. If after Step 2 the target constituent company count is not met, non-constituent companies are selected in order of highest rank until the target constituent company count of 200 is reached.

Constituent Weightings

Each company is weighted by the product of its float-adjusted market capitalization and its composite capex and human capital score (see *Appendix B*), subject to an individual company weight cap of 5%. The capping algorithm redistributes the excess weight to other stocks in the index in proportion to their original modified market capitalization weight. Weight caps are applied twice a year during the annual reconstitution and mid-year review.

For more information on weighting schemes, please see S&P Dow Jones Indices' Index Mathematics Methodology document.

Index Calculations

The index is calculated using the divisor methodology used in most S&P Dow Jones Indices' equity indices.

For more information on index level calculations please refer to S&P Dow Jones Indices' Index Mathematics Methodology.

Index Maintenance

Rebalancing

Annual Reconstitution. The index undergoes a reconstitution, effective after the close of the third Friday of September. The reference date for data used in the annual reconstitution is after the close of the last trading day of August.

Mid-Year Review. The index undergoes a mid-year reweighting, effective after the close of the third Friday of March. Constituent weights are updated based on each company's float-adjusted market capitalization as of the close of the last trading day of February, and the composite capex and human capital score computed during the annual reconstitution. The composite capex and human capital scores are not updated during the mid-year review.

Additions. No companies are added to the index between annual reconstitutions except for spin-offs as detailed in *Corporate Actions*.

Deletions. Deletions can occur due to acquisitions, mergers and spin-offs or due to bankruptcies or suspensions. A constituent is also removed from the index at the time when it is removed from the TOPIX.

Negative Screening

S&P Dow Jones Indices reviews the securities on the following JPX lists at the annual rebalancing. A stock that under supervision, scheduled to delist, or designated as a trading alert security is not considered for index inclusion.

- <http://www.jpx.co.jp/english/listing/stocks/supervision/index.html> (Securities under supervision and securities to be delisted).
- <http://www.jpx.co.jp/english/listing/stocks/alert/index.html> (Designation of securities on alert).

Corporate Actions

Mergers and Acquisitions. Mergers and Acquisitions treatments are as follows:

- If two current index constituents merge, the combined company remains in the index at least until the next annual reconstitution, when it is reviewed for continuing eligibility. The merged company carries the combined weights.
- If a current index constituent acquires a non-constituent, the company remains in the index at its current weight.
- If a current index constituent is acquired by a non-constituent, the company is dropped from the index and its weight is redistributed proportionately to the remaining index constituents.

Spin-offs. A spun-off company is added to the index at a zero price on the ex-date and is removed from the index after at least one day of regular way trading.

Delistings. 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 with advanced notice of two-to-five business days. In the event the delisting or bankruptcy information becomes public after the fact, the stock may be removed with advanced notice of one day. A company may be removed from the index at the discretion of the Index Committee.

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

Currency, Currency Hedged, and Risk Control Indices

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

Real-time spot Forex rates, as supplied by Reuters, are used for ongoing index calculation. The end-of-day value of the index is calculated using the real-time spot exchange rate provided by Reuters at the time the index is closed.

Additional 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.

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

Base Dates and History Availability

Index history availability, base dates and base values for are shown in the table below.

Index	Launch Date	First Value Date	Base Date	Base Value
JPX/S&P CAPEX & Human Capital Index	04/27/2016	09/16/2005	09/16/2005	1000

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 document.

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

Index Governance

Index Committee

The S&P/JPX Index Committee maintains the index. The Index Committee meets regularly. All committee members are full-time professional members of S&P Dow Jones Indices' and the Japan Exchange Group. At each meeting, the Index Committee reviews pending corporate actions that may affect index constituents, statistics comparing the composition of the index to the market, companies that are being considered as candidates for addition to the index, and any significant market events. In addition, the Index Committee may revise index policy covering rules for selecting companies, treatment of dividends, share counts or other matters.

S&P Dow Jones Indices considers information about changes to its indices and related matters to be potentially market moving and material. Therefore, all Index Committee discussions are confidential.

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.

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.

For more information, please refer to the Announcements section of S&P Dow Jones Indices' Equity Indices Policies & Practices document.

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 seven business days 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 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.

Rebalancing

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

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.

Index Dissemination

Index levels are available through S&P Dow Jones Indices' Web site at 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 for a complete list of indices covered by this document.

Index (Currency)	Return Type	Bloomberg	Reuters	QUICK
JPX/S&P CAPEX & Human Capital Index (JPY)	Price Return	SPCHCJP	.SPCHCJP	SSPCHCJP/SPJ
	Total Return	SPCHCJT	.SPCHCJT	SSPCHCJT/SPJ
	Net Total Return	SPCHCJN	.SPCHCJN	SSPCHCJN/SPJ
JPX/S&P CAPEX & Human Capital Index (USD)	Price Return	SPCHCUP	--	SSPCHCUP/SPJ
	Total Return	SPCHCUT	--	SSPCHCUT/SPJ
	Net Total Return	SPCHCUN	--	SSPCHCUN/SPJ

FTP

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

For product information, please contact S&P Dow Jones Indices, www.spdji.com/contact-us.

Web site

For further information, please refer to S&P Dow Jones Indices' Web site at www.spdji.com.

Appendix A: Beta Calculation

A security's beta is used in order to refine the index's eligible universe.

Key characteristics of the beta calculations include:

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

On each of the reconstitution 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 reference index is calculated. Non-trading days are excluded from the beta calculation and the stock's return for the subsequent day is converted into 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.

Return Calculations

Stock price and index returns for beta calculations are as follows:

1. S&P Dow Jones Indices uses five years of closing price history for both the stock and the reference index.
2. In rare cases when a daily stock price is available but the reference 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 reference 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 a zero 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. However, if a stock does not have five years of closing values, S&P Dow Jones Indices will calculate beta values based on the stock's length of trading history.

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 reconstitution reference date, where $d = 1$ means the data point is one trading day away from the reconstitution reference date, and $d = D$ means the data point is 1,260 trading days away from the reconstitution reference date.

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

where:

$$\lambda = 630 \text{ days (the half-life of the decay for all stocks)}$$

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 both stock 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.

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 = 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:

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

ρ_{ind} = Correlation ($Ind_i, Ind3_i$)

σ_{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: Composite Capex and Human Capital Score Calculation

The first step to determine the overall composite capex and human capital score is to calculate, as of the reconstitution reference date, the capex and R&D expense growth ratio, capex revenue effect ratio, and human capital score for each company in the eligible universe.

Capex and R&D Expense Growth Ratio

Capex and R&D expense growth is calculated for non-financial companies with reported R&D expenses in the three most recently reported fiscal years.

$$\text{Capex and R\&D Expense Growth} = \frac{\text{Sum of Latest Fiscal Year's Capex and R\&D Expense}}{\text{Three - year Average Capex and R\&D Expense}} - 1$$

For all financial companies and non-financial companies without reported R&D expenses in the three most recently reported fiscal years, only capex growth is calculated.

$$\text{Capex Growth} = \frac{\text{Latest Fiscal Year's Capex}}{\text{Three - year Average Capex}} - 1$$

Capex Revenue Effect Ratio

This is calculated as a company's latest revenue divided by its cumulative capex for the three most recently reported fiscal years.

$$\text{Capex Revenue Effect} = \frac{\text{Latest Fiscal Year's Revenue}}{\text{Three - year Cumulative Capex}}$$

Human Capital Score

The human capital score is obtained as of the reconstitution reference date from the latest assessment available from RobecoSAM and takes into account three criteria used in RobecoSAM's Corporate Sustainability Assessment (CSA).³ These criteria are assessed for all industries based on publicly disclosed data as well as data provided directly from companies that participate in the CSA. The three criteria are:

Human Capital Development. A company receives a score based on its ability to quantify and proactively manage its investments in human capital. A company scores well if it is able to:

- Track and report quantitative measures of its training and development programs.
- Effectively explain the link between its development programs and the impact on its business.
- Quantify the economic benefits of its human capital investments and demonstrate higher economic value from these investments over time.

³ For a more detailed review of the CSA methodology and the CSA Questionnaires, refer to RobecoSAM's Corporate Sustainability Assessment Methodology document available at www.sustainability-indices.com. For more information about RobecoSAM, please visit www.robecosam.com.

Talent Attraction & Retention. A company receives a score based on its employee turnover rate and its ability to:

- Demonstrate effective measures for evaluating employee performance.
- Provide long-term employee incentives (given that this is essential to the long-term performance of companies).
- Effectively maintain a relatively low turnover rate and retain talent over time.

Labor Practice Indicators & Human Rights. A company receives a score based on its ability to demonstrate gender equality within its organization and strong commitment to employee human rights. A company scores well if it is able to demonstrate:

- The retention of female employees from junior to senior management.
- Relatively equitable levels of pay among male and female employees in similar roles.
- Human rights due diligence processes incorporating the United Nations' Guiding Principles on Human Rights.

Each company receives a score of 0-100 for each of the three criteria detailed above. Each score is then equally weighted to obtain an overall human capital score of 0-100 for each company.

Outlier Handling and Winsorization

Outlier capex and R&D expense growth ratios, and capex revenue effect ratios are winsorized to ensure that the average values used to calculate the overall composite capex and human capital score are less distorted by extreme values. For a given variable, the values for all eligible companies are first ranked in ascending order. Then, for companies that lie above the 97.5 percentile rank or below the 2.5 percentile rank, their value is set as equal to the value of the 97.5 percentile ranked or the 2.5 percentile ranked company, whichever is applicable.

Z-score Computation

Computing a z-score is a widely adopted method of standardizing a variable in order to combine it with other variables that may have a different scale or unit of measurement. The z-score for the winsorized capex and R&D expense growth ratio, winsorized capex revenue effect ratio, and human capital score is calculated for each eligible company using the mean and standard deviation of the relevant variable within the eligible universe.

The z-score is calculated as follows:

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

where:

z_{α} = Z-score for a given company

x_{α} = Winsorized variable for a given company

μ_{α} = Arithmetic mean of the relevant variable in the eligible universe, excluding any missing values

σ_{α} = Standard deviation of the relevant variable in the eligible universe

Capping and Transformation of Z-scores

Z-scores of the capex and R&D expense growth ratio, and capex revenue effect ratio are winsorized to ensure that the average values used to calculate the composite capex and human capital score are less distorted by extreme values. To do this, z-scores for these two ratios are subject to a floor and ceiling of -2 and +2, respectively. Then, by adding 2 to each of these z-score values, they are transformed to a value within the range of 0 and 4.

All eligible companies with human capital scores above the average of the eligible universe are assigned positive z-scores, subject to a ceiling of 4. Companies with human capital scores below the average of the eligible universe and companies without human capital scores are assigned z-scores of 0.

Composite Capex and Human Capital Score

For each eligible company, the average z-score is computed by taking a simple average of the three scores to form the composite capex and human capital score. A company must have all three z-scores for computation of the average score.

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