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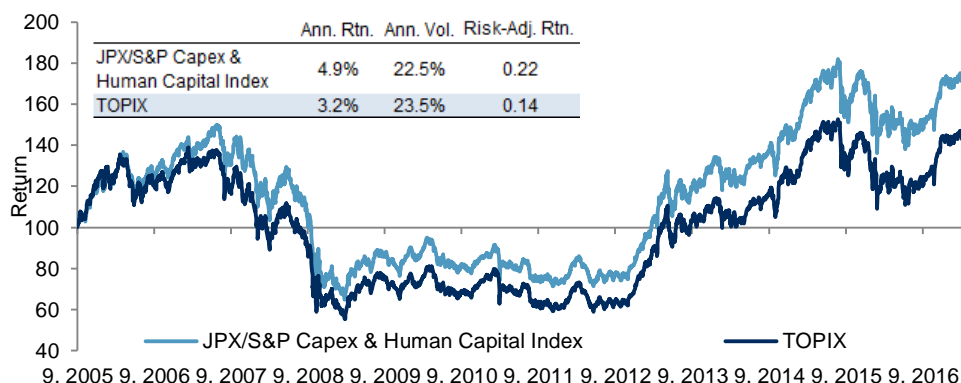
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Looking Into the JPX/S&P CAPEX & Human Capital Index

In April 2016, S&P Dow Jones Indices and Japan Exchange Group launched the [JPX/S&P CAPEX & Human Capital Index](#) in response to the ETF purchase program by the Bank of Japan (BoJ), which was designed to encourage corporate physical and human capital investment in Japan. In this paper, we dissect how the construction of the index helps to achieve its objective and examine how each of the construction criteria affects characteristics and return.

- The JPX/S&P CAPEX & Human Capital Index is designed to track the performance of companies in Japan with high capex growth and efficiency, along with high human capital investments.
- Creditworthiness, trading liquidity, profitability, and low beta criteria are considered to determine companies' eligibility for the index.
- The index overweighted the consumer discretionary, consumer staples, and health care sectors compared with the TOPIX.¹
- The index outperformed the TOPIX with reduced volatility between September 2005 and March 2017, mostly driven by companies with low beta and high capex and R&D spending growth.

Exhibit 1: Performance of the JPX/S&P CAPEX & Human Capital Index Versus the TOPIX



Source: S&P Dow Jones Indices LLC and Japan Exchange Group. Figures based on cumulative daily JPY gross total return. Data from Sept. 16, 2005, to March 31, 2017. Ann. Rtn. = Annualized Return. Ann. Vol. = Annualized Volatility. Risk-Adj. Rtn. = Annualized Return / Annualized Volatility. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

¹ Tokyo Stock Price Index

BOJ'S ETF PURCHASE PROGRAM TO BOOST ECONOMIC GROWTH AND CURB DEFLATION IN JAPAN

The BoJ's ETF purchase program is meant to encourage an increase in Japanese wages and capital investment.

Historically capex spending was mostly in the consumer discretionary and industrial sectors...

...but the highest-growth sectors for capex and R&D spending has been in health care and energy.

Since Shinzo Abe was elected Japanese prime minister in 2012, he has introduced a reform program (dubbed “Abenomics”) with greater emphasis on ESG issues in the Japanese economy, and he has pushed market participants and companies to promote economic growth.² In December 2015, the BoJ announced the introduction of supplementary measures for quantitative and qualitative monetary easing to encourage companies to invest in physical and human capital and boost Japan's economy.³ One of the measures was to establish a new program for purchasing ETFs (about JPY 300 billion annually) composed of stocks issued by companies that are proactively making investments in physical and human capital. The policy's objective is to encourage Japanese corporations to increase wages and capital investment as a way to boost economic growth and curb deflation in Japan.

Japanese corporations have been cautious about fixed investment, despite posting record high profits.⁴ Historically, the capex spending of Japanese corporations has been mostly from companies in the consumer discretionary and industrials sectors. Between March 2006 and March 2017, capex spending from these sectors, on average, represented 45% of the total amount from all TOPIX members. The R&D spending, on the other hand, has been mostly by companies in the consumer discretionary and information technology sectors, ranging from 54% to 66% over the past 12 years (see Exhibits 10 and 11 in the Appendix). These sectors also displayed high representation in traditional market-cap-weighted indices like the TOPIX.

However, the sectors that experienced strongest capex and R&D spending growth are different. Over the past 12 years, Japanese corporations in the TOPIX recorded 4.0% and 1.6% cumulative annual growth rates on capital expenditure and R&D spending, respectively. Companies in health care and energy recorded the highest capex growth across all sectors. Over the same period, R&D spending from health care companies experienced the highest cumulative annual growth rate (3.4%), while that of telecommunication services and utilities broadly contracted (see Exhibits 12 and 13 in the Appendix). As companies with strong growth in physical investment are not concentrated in the traditionally larger sectors, a tailor-

² “ESG's Growing Global Impact: Spotlight on Japan,” S&P Dow Jones Indices, Martina Macpherson, Emily Ulrich and Neil Mcindoe, April 2017.

³ For the official released document by the BoJ, see “Statement on Monetary Policy,” Dec. 18, 2015 (https://www.boj.or.jp/en/announcements/release_2015/k151218a.pdf).

⁴ “Corporate Profits and Business Fixed Investment: Why are Firms So Cautious about Investment?” Bank of Japan Review, Research and Statistics Department, Naoya Kato and Takuji Kawamoto, April 2016.

made index methodology is required to track the performance of these companies.

ETFs FOR COMPANIES WITH PROACTIVE INVESTMENT IN PHYSICAL AND HUMAN CAPITAL IN JAPAN

The index tracks Japanese companies with proactive investment in physical and human capital.

In March 2016, the BoJ announced detailed eligibility criteria for indices regarding the new ETF program.⁵ To be eligible, the capex and human capital index should consider companies' investment in physical and human capital, their creditworthiness, and the portfolio's diversification and investability.

Measures of investment are both quantitative and qualitative.

The evaluation of a company's physical capital investment should rely on quantitative measures of capital expenditure or R&D spending, while the evaluation of human capital investment should be based on quantitative or qualitative measures related to human resource development systems or diversity of labor force. The relationship between a company's investment in physical and human capital and its growth potential should also be considered by the index.

BoJ has several requirements around creditworthiness, liquidity, and diversification.

The BoJ also required the index constituents to fulfill certain creditworthiness criteria based on their reported net assets and operating income, as well as listing requirements by the exchange. For portfolio diversification, the index should include no fewer than 1,000 stocks in the eligible universe and no fewer than 100 members in the final index universe. Index members should be reviewed at least once a year and no single stock should represent more than 5% of the index weight. Finally, to ensure investability of the index, members should have been traded for 200 trading days, with total traded value not less than JPY 100 billion per year (see creditworthiness and liquidity criteria in Exhibit 2).

CONSTRUCTION OF THE JPX/S&P CAPEX & HUMAN CAPITAL INDEX

Construction of the index is divided into three major components: eligibility criteria, stock selection criteria, and weighting method.

In response to the demand for an index tracking Japanese companies that are proactively investing in physical and human capital, S&P Dow Jones Indices, in collaboration with Japan Exchange Group and RobecoSAM, launched the [JPX/S&P CAPEX & Human Capital Index](#), which is designed to measure the performance of TOPIX companies with high scores based on evaluation of capex and R&D expense growth, capex efficiency, and human capital investments. The index construction is divided into three major components: eligibility criteria, stock selection criteria, and weighting method.

⁵ For the official released document by the BoJ, see https://www.boj.or.jp/en/announcements/release_2016/rel160315c.pdf https://www.boj.or.jp/en/announcements/release_2016/rel160315d.pdf

Index Eligibility Requirements

The index considers creditworthiness, trading liquidity, profitability, and low beta in its eligibility criteria.

To be eligible for index inclusion, all companies have to satisfy the creditworthiness and liquidity criteria required by the BoJ. In addition, companies must fulfill the profitability and low beta criteria, which evaluate their growth potential and financial vulnerability (see Appendix). The profitability criteria based on three-year average operating income and net income ensure that all index members demonstrate good track records in terms of profit growth. After passing the creditworthiness, liquidity, and profitability criteria, stocks are then sorted by their betas, based on five-year daily stock price return versus the TOPIX, and the 70% of stocks with the lowest betas are selected to form the eligible universe of the [JPX/S&P CAPEX & Human Capital Index](#). Stocks that fulfill the low beta criteria tend to be less vulnerable to financial market turmoil.

Exhibit 2: Summary of Eligibility Criteria for the JPX/S&P CAPEX & Human Capital Index

PARENT UNIVERSE

Constituents of the TOPIX

CREDITWORTHINESS CRITERIA

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

Securities under supervision or securities to be delisted by the listed exchange have to be excluded

LIQUIDITY CRITERIA

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
-

PROFITABILITY CRITERIA

As of the rebalancing reference date, the company must have 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 CRITERIA

- As of the rebalancing reference date, the Scholes-Williams beta with exponential weight and Vasicek shrinkage is computed for each stock with up to five years of daily stock price return versus the TOPIX.
 - After passing the creditworthiness, liquidity, and profitability criteria, stocks are sorted by their betas and the 70% of stocks with the lowest betas are selected to form the eligible universe.
-

Source: S&P Dow Jones Indices LLC, Japan Exchange Group, and BoJ. Table is provided for illustrative purposes.

Eligible companies are evaluated on three metrics of physical and human capital investment.

Evaluating Companies' Investments in Physical and Human Capital

After being screened for the eligibility criteria, companies are further evaluated on the following physical and human capital investment metrics.

1. The company's proactiveness in making physical investments.
2. The efficiency of the company's physical investment to generate revenue (capex revenue effect).
3. The company's investment in human capital.

Physical investments are measured through capital expenditures and R&D expenses...

To evaluate if a company is proactively making physical investments, we measured the company’s growth of capital expenditure and R&D expenses over its three-year average values. In addition, we evaluated how efficiently a company used its physical investment to generate revenue by measuring its capex revenue effect ratio, which is defined as the company’s latest fiscal year revenue in relation to its three-year cumulative capital expenditure.

...while investment in human capital is evaluated by the human capital scores from RobecoSAM...

To evaluate a company’s investment in human capital, we obtained each company’s human capital scores from RobecoSAM. The scores are based on three human capital criteria used in RobecoSAM’s Corporate Sustainability Assessment (CSA)—human capital development, talent attraction & retention, and labor practice indicators & human rights. These criteria are assessed by RobecoSAM based on publicly disclosed data, as well as data provided directly from companies that participate in the CSA. Scoring details of the three human capital criteria are listed in Exhibit 3. Each company receives a score between 0 and 100 for each of the three criteria, which are then equally weighted to reach a composite human capital score of 0 to 100 for each company.

...which is based on criteria around human capital development, talent attraction & retention, and labor practice indicators & human rights.

Exhibit 3: Human Capital Scoring Criteria for the JPX/S&P CAPEX & Human Capital Index	
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:	
<ul style="list-style-type: none"> • 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 	
TALENT ATTRACTION AND RETENTION	
A company receives a score based on its employee turnover rate and its ability to:	
<ul style="list-style-type: none"> • 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 AND 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:	
<ul style="list-style-type: none"> • 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 	

Source: S&P Dow Jones Indices LLC, Japan Exchange Group and RobecoSAM. Table is provided for illustrative purposes.

Selection and Weighting of Index Members

As previously described, the [JPX/S&P CAPEX & Human Capital Index](#) is designed to measure companies that score well on capex and R&D spending growth, capex efficiency, and human capital investment. After evaluating all eligible companies based on these three metrics, we compute the z-scores of each individual component for the companies. The average

z-scores of the three components form the composite capex and human capital scores of the companies.

The top 200 eligible companies with the highest composite capex and human capital scores form the index.

The top 200 eligible companies with the highest composite capex and human capital scores are selected as index members and weighted by their float-adjusted market cap, tilted by their scores. This weighting method results in a tilt to companies with high average capex and human capital scores, while maintaining high investability for the index. Additionally, constituent weights are capped at 5% to ensure diversification of the portfolio, as required by the BoJ. The index is fully rebalanced at the end of September every year, with a semiannual weight rebalancing in March.

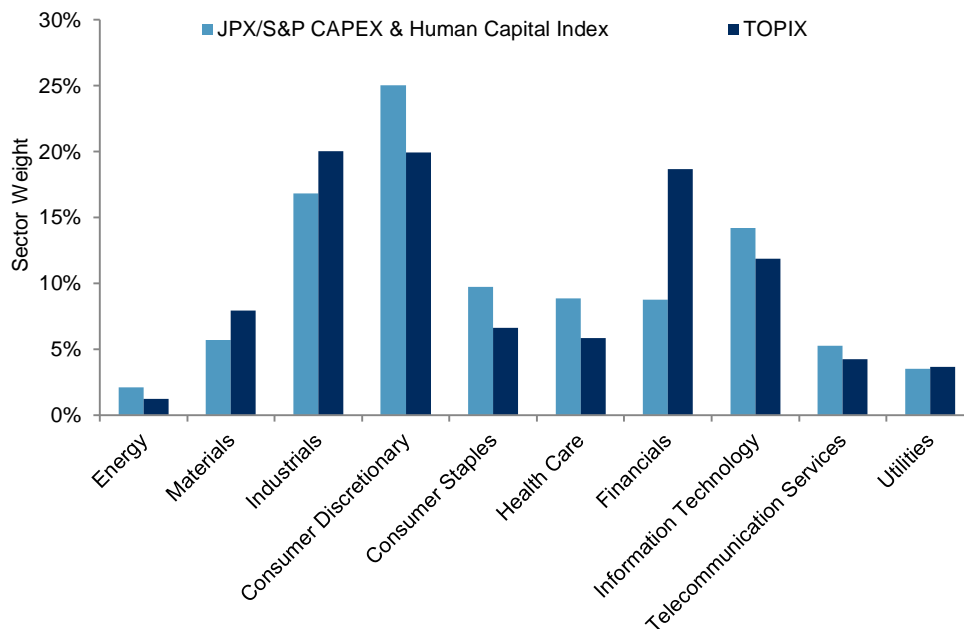
CHARACTERISTICS OF THE JPX/S&P CAPEX & HUMAN CAPITAL INDEX

Sector and Fundamental Characteristics of the Index

The index overweighted the consumer discretionary sector the most and underweighted the financials sector compared with the TOPIX.

The [JPX/S&P CAPEX & Human Capital Index](#) is most concentrated in the consumer discretionary, industrials, and information technology sectors (see Exhibit 4). Compared with the TOPIX, the JPX/S&P CAPEX & Human Capital Index tended to overweight the consumer discretionary, consumer staples, and health care sectors, and underweight the financials and industrials sectors. The low beta criteria was the major driver of these sector biases (see Exhibit 16 in the Appendix).

Exhibit 4: Sector Weight of the JPX/S&P CAPEX & Human Capital Index Versus the TOPIX

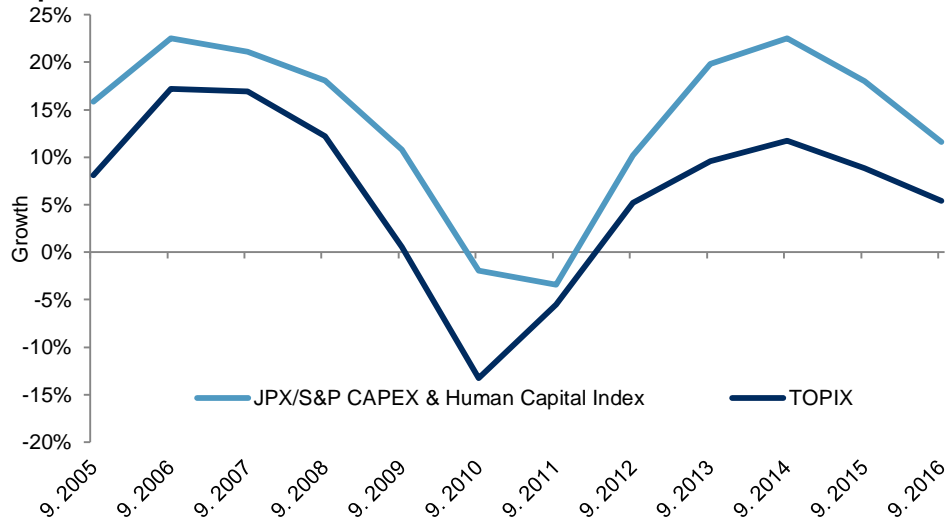


Source: S&P Dow Jones Indices LLC and Japan Exchange Group. Sector weights are average figures based on an annually rebalanced portfolio. For sector weights for each annual rebalancing, see Exhibit 14 and 15 in the Appendix. Data from Sept. 16, 2005, to Sept. 16, 2016. Chart is provided for illustrative purposes.

The capex and R&D spending growth cycles of the [JPX/S&P CAPEX & Human Capital Index](#) and TOPIX are similar, but the JPX/S&P CAPEX & Human Capital Index recorded a stronger growth rate than the TOPIX over the period studied and had higher capex efficiency to generate revenue for most of the period (see Exhibits 5 and 6).

Exhibit 5: Capex and R&D Expense Growth of the JPX/S&P CAPEX & Human Capital Index Versus the TOPIX

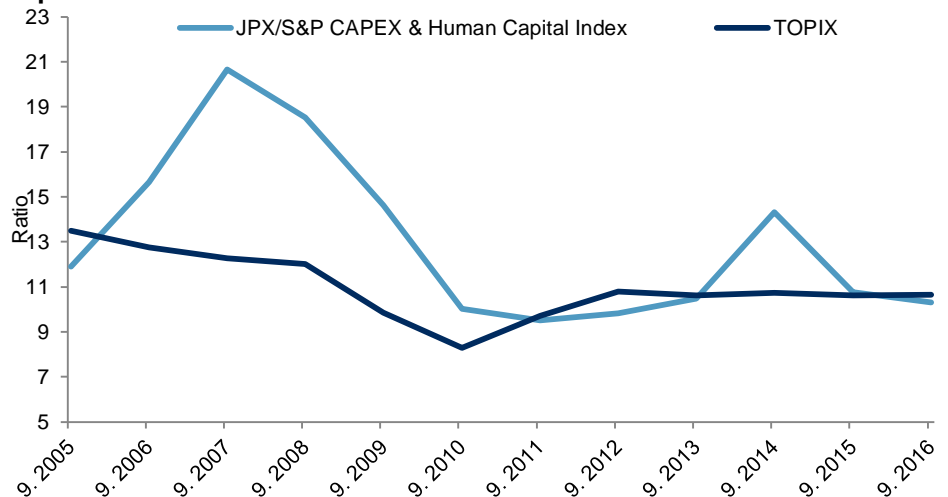
The index demonstrated broadly higher capex and R&D growth...



Source: S&P Dow Jones Indices LLC, Japan Exchange Group, and Factset. Figures based on an annually rebalanced portfolio. Data from Sept. 16, 2005, to Sept. 16, 2016. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 6: Capex Revenue Effect Ratio of the JPX/S&P CAPEX & Human Capital Index Versus the TOPIX

...better capex efficiency...

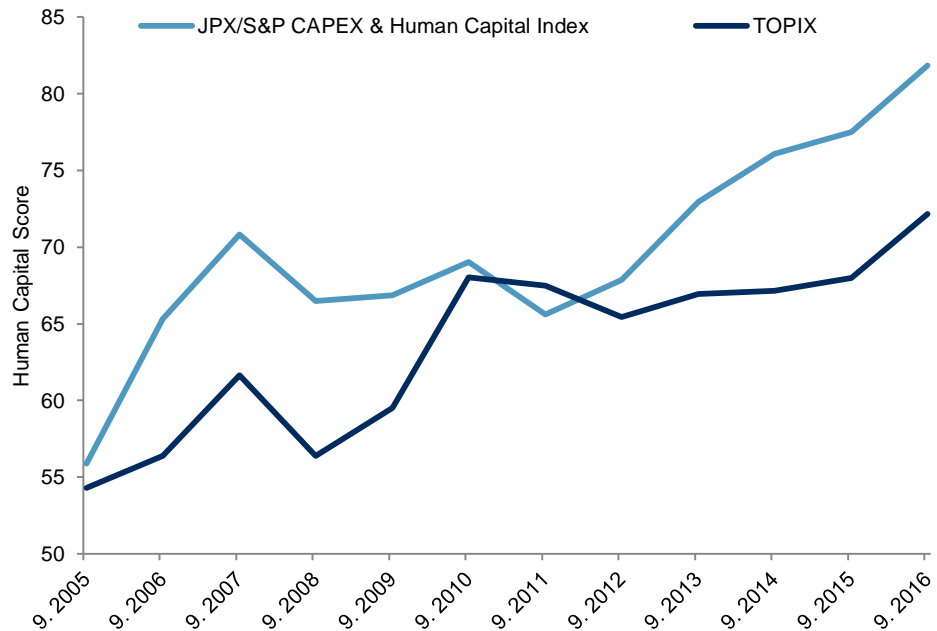


Source: S&P Dow Jones Indices LLC, Japan Exchange Group, and Factset. Figures based on an annually rebalanced portfolio. Data from Sept. 16, 2005, to Sept. 16, 2016. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

The human capital scores for the JPX/S&P CAPEX & Human Capital Index and TOPIX have been improving since September 2005. The JPX/S&P CAPEX & Human Capital Index tended to have a higher human capital score than the TOPIX and has been improving at a significantly faster pace since 2012, when “Abenomics” was introduced (see Exhibit 7).

Exhibit 7: Human Capital Score of the JPX/S&P CAPEX & Human Capital Index Versus the TOPIX

...and a higher human capital score than the TOPIX.



Source: S&P Dow Jones Indices LLC, Japan Exchange Group, and Factset. Figures based on an annually rebalanced portfolio. Data from Sept. 16, 2005, to Sept. 16, 2016. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Risk/Return Profile of the Index

The JPX/S&P Capex & Human Capital Index outperformed the TOPIX with volatility reduction.

The [JPX/S&P CAPEX & Human Capital Index](#) had smaller return drawdowns during market crises, such as in 2007 and 2008, while moderately lagging the TOPIX during a strong bull market due to the low beta criteria. Overall, during the entire index history between end of September 2005 and March 2017, the JPX/S&P CAPEX & Human Capital Index outperformed TOPIX by 1.7%, with a volatility reduction of 1%. The index tracked the TOPIX with a tracking error of 3.8% and information ratio of 0.44.

Exhibit 8: Risk/Return Profile of the JPX/S&P Capex & Human Capital Index		
PERIOD	PERIOD RETURN (JPY GROSS TR, %)	
	JPX/S&P CAPEX & HUMAN CAPITAL INDEX	TOPIX
Sept. 15, 2005- March 31, 2006	30.9	31.4
FY2006	4.9	0.3
FY2007	-20.1	-28.1
FY2008	-34.2	-34.8
FY2009	29.8	28.5
FY2010	-10.9	-9.2
FY2011	1.9	0.6
FY2012	22.7	23.8
FY2013	21.2	18.6
FY2014	28.7	30.7
FY2015	-6.3	-10.8
FY2016	11.6	14.7
SEPT. 15, 2005- MARCH 31, 2017	RISK/RETURN PROFILE (ANNUALIZED)	
	JPX/S&P CAPEX & HUMAN CAPITAL INDEX	TOPIX
Annualized Return (%)	4.8	3.2
Annualized Volatility (%)	22.5	23.5
Risk-Adjusted Return	0.22	0.14
Excess Return (%)	1.7	NA
Tracking Error (%)	3.8	NA
Information Ratio	0.44	NA

Source: S&P Dow Jones Indices LLC and Japan Exchange Group. Figures based on daily JPY gross total return. Data from Sept 16, 2005, to March 31, 2017. Excess return, tracking error, and information ratio are calculated versus the TOPIX. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

The low beta criteria and stock selection based on high capex and R&D spending growth were the two biggest return drivers.

Return Drivers of the Index

The eligibility and stock selection criteria affect returns of the index in their own ways. To analyze the return drivers of the [JPX/S&P CAPEX & Human Capital Index](#), we constructed and examined the hypothetical portfolios of companies passing different eligibility criteria⁶ and the top 200 eligible stocks by each of the stock selection metrics of the index (capex and R&D growth, capex revenue effect, and human capital).⁷

The risk/return profile of stocks passing different eligibility criteria indicates that the profitability and low beta criteria contributed to excess return compared with the TOPIX, with the contribution by low beta being more

⁶ All portfolios are weighted by score-tilted market cap with stocks selected from the JPX/S&P CAPEX & Human Capital Index eligible universe and follow the same rebalancing schedule as the JPX/S&P CAPEX & Human Capital Index.

⁷ All portfolios are weighted by float-adjusted market cap, with stocks selected from the TOPIX based on different eligibility criteria, and all follow the same rebalancing schedule as the JPX/S&P CAPEX & Human Capital Index.

Among the three stock selection metrics, the capex and R&D growth and efficiency were the stronger return drivers.

pronounced. Low beta was also the major driver of lower return volatility of the index. In contrast, the liquidity and creditworthiness criteria did not have a significant impact on return or risk.

Among the three stock selection metrics for the [JPX/S&P CAPEX & Human Capital Index](#), the capex and R&D growth and the capex revenue effect ratio were the stronger return drivers. Companies that scored high in capex and R&D growth and capex revenue effect ratios outperformed the eligible universe. Companies with the highest capex and R&D growth had the highest risk-adjusted return (at 0.21) and information ratio (at 0.67) relative to the TOPIX between September 2005 and September 2016. On the other hand, the excess return delivered by companies with high human capital scores was marginal in comparison with the eligible universe (see Exhibit 9).

This suggests that the low beta criteria and stock selection based on high capex and R&D spending growth were the two biggest return drivers of the JPX/S&P CAPEX & Human Capital Index.

Exhibit 9: Risk/Return Profile of Stocks Passing Different Eligibility Criteria and Top 200 Eligible Stocks By Different Stock Selection Factors

CRITERIA AND METRICS	ANN. RETURN (%)	ANN. VOL. (%)	RISK-ADJ. RETURN	EXCESS RETURN (%)	TRACKING ERROR (%)	I.R.
	(JPY, GROSS TR)			(VERSUS TOPIX)		
STOCKS PASSING DIFFERENT ELIGIBILITY CRITERIA						
Liquidity and Creditworthiness	1.80	24.2	0.07	0.01	1.06	0.01
Liquidity, Creditworthiness, and Profitability	2.16	24.0	0.09	0.36	1.34	0.27
Liquidity, Creditworthiness, Profitability, and Low Beta (Eligible Universe)	3.70	21.9	0.17	1.91	3.99	0.48
TOP 200 ELIGIBLE STOCKS BY DIFFERENT STOCK SELECTION METRICS						
Capex Revenue Effect Ratios	4.18	22.7	0.18	2.39	4.77	0.50
Capex & R&D Expense Growth	4.68	22.2	0.21	2.88	4.29	0.67
Human Capital Scores	3.72	23.8	0.16	1.93	5.39	0.36
JPX/S&P CAPEX & HUMAN CAPITAL AND TOPIX INDICES						
JPX/S&P Capex & Human Capital Index	3.75	22.9	0.16	1.95	3.87	0.50
TOPIX	1.80	23.8	0.08	N.A.	N.A.	N.A.

Source: S&P Dow Jones Indices LLC and Japan Exchange Group. Figures based on daily JPY gross total return. Data from Sept. 16, 2005, to Sept. 16, 2016. Ann. Return = Annualized Return, Ann. Vol. = Annualized Volatility, Risk-Adj. Return = Risk-Adjusted Return, I.R. = Information Ratio. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

CONCLUSION

The BoJ's program of purchasing ETFs that include companies proactively making physical and human capital investment aims to encourage Japanese corporations to increase wages and capital investment as a way to boost economic growth and curb deflation in Japan. In April 2016, the [JPX/S&P CAPEX & Human Capital Index](#) was launched by S&P Dow Jones Indices and Japan Exchange Group, attempting to track the performance of companies with strong growth in capex and R&D spending, high capex efficiency in generating revenue, and a high score in human capital criteria.

The JPX/S&P CAPEX & Human Capital Index considers four elements in its eligibility criteria, including creditworthiness, trading liquidity, profitability, and low beta. The first two criteria are required by BoJ in an effort to ensure financial strength of the index members and tradability of the index, while the latter two criteria focus on growth potential and low financial vulnerability of the index members. Historically, the profitability and low beta criteria contributed to excess return and volatility reduction of the index compared with the TOPIX.

The JPX/S&P CAPEX & Human Capital Index considers four elements in its eligibility criteria, including creditworthiness, trading liquidity, profitability, and low beta.

To evaluate a company's proactiveness in physical investment and its capex efficiency to generate revenue, the JPX/S&P CAPEX & Human Capital Index adopted the quantitative approach of measuring the capex and R&D expense growth and the revenue-to-capex ratio. Historically, companies ranked highly by these two measures outperformed their peers in the eligible universe of the index. The human capital investment of companies, on the other hand, is measured by the human capital score obtained from RobecoSAM's CSA. Companies are scored based on three human capital criteria, including human capital development, talent attraction & retention, and labor practice indicators & human rights. Excess return recorded for companies with high human capital scores was marginal.

The JPX/S&P CAPEX & Human Capital Index, which seeks to measure 200 companies with the highest average scores on physical and human capital investment measurements, demonstrated higher capex and R&D growth, better capex efficiency, and a higher human capital score than the TOPIX across most of the period since September 2005. The index overweighted the consumer discretionary, consumer staples, and health care sectors (compared with the TOPIX), and it outperformed the TOPIX with volatility reduction. The low beta criteria and stock selection based on high capex and R&D spending growth were the two biggest return drivers of the index during the period studied.

APPENDIX

Exhibit 10: Contribution to TOPIX Total Capital Expenditure (Sector Total as Percentage of TOPIX Total)													
SECTOR	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	AVERAGE
Energy	0.9	1.1	1.3	1.6	2.3	1.9	1.5	2.4	3.0	2.9	2.6	2.0	2.0
Materials	7.6	8.3	9.1	9.8	9.8	8.5	8.5	8.1	7.8	7.3	6.9	8.3	8.3
Industrials	19.0	19.0	20.5	20.3	20.1	20.2	20.9	20.3	19.2	18.2	17.8	19.6	19.6
Consumer Discretionary	26.7	25.8	24.0	25.7	22.6	23.6	23.3	24.7	25.2	26.7	28.1	25.1	25.1
Consumer Staples	4.5	4.0	3.8	4.4	5.5	5.2	5.0	5.6	5.9	5.6	5.9	5.0	5.0
Health Care	1.1	1.0	1.1	1.3	1.8	1.8	1.9	2.1	1.9	2.1	2.2	1.7	1.7
Financials	15.1	15.2	15.1	9.4	8.3	9.8	9.3	9.3	10.6	12.5	11.9	11.5	11.5
Information Technology	10.3	11.1	11.1	11.4	9.9	9.8	10.4	9.2	7.8	7.6	8.2	9.7	9.7
Telecommunication Services	9.0	9.2	8.0	8.9	10.9	10.3	10.6	10.5	11.3	10.6	9.4	9.9	9.9
Utilities	5.9	5.2	5.9	7.3	8.9	8.9	8.6	7.8	7.2	6.6	7.0	7.2	7.2

Source: S&P Dow Jones Indices LLC, Japan Exchange Group, and Factset. Figures based on the TOPIX universe. Data as of March 30, 2017. Table is provided for illustrative purposes.

Exhibit 11: Contribution to TOPIX R&D Spending (Sector Total as Percentage of TOPIX Total)													
SECTOR	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	AVERAGE
Energy	0.3	0.3	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.4
Materials	7.8	8.4	8.7	8.9	9.7	9.5	9.7	9.4	9.8	9.6	9.7	9.2	9.2
Industrials	10.1	10.0	10.1	9.9	10.3	11.2	11.5	11.8	15.3	14.4	14.9	11.8	11.8
Consumer Discretionary	41.5	41.4	38.3	37.3	35.3	35.3	34.2	35.5	35.4	36.4	36.9	37.0	37.0
Consumer Staples	2.8	2.5	2.5	2.7	3.0	2.9	2.7	3.1	3.1	3.0	3.1	2.9	2.9
Health Care	8.5	9.0	10.1	11.1	12.2	11.7	12.4	12.9	13.7	13.5	13.4	11.7	11.7
Financials	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Information Technology	24.3	24.4	26.0	25.6	24.5	24.4	24.8	22.7	18.6	19.4	18.6	23.0	23.0
Telecommunication Services	3.5	3.0	2.9	2.9	3.4	3.3	3.3	3.3	2.9	2.7	2.3	3.1	3.1
Utilities	1.2	1.0	1.0	1.1	1.1	1.1	0.9	0.9	0.7	0.7	0.7	1.0	1.0

Source: S&P Dow Jones Indices LLC, Japan Exchange Group, and Factset. Figures based on the TOPIX universe. Data as of March 30, 2017. Table is provided for illustrative purposes.

Exhibit 12: TOPIX Capex Expenditure Annual Growth Rate – Sector Median Ratio

SECTOR	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	CAGR
Energy	7.9	22.2	3.2	-2.6	-4.2	-9.8	-12.7	27.4	20.1	5.2	10.3	7.7	5.5
Materials	23.7	13.5	15.0	-3.8	-28.0	-10.6	15.6	16.8	2.4	4.1	-3.1	-0.4	2.8
Industrials	14.8	12.0	11.0	-2.5	-24.7	-8.8	14.1	17.5	7.2	6.0	10.9	9.8	4.9
Consumer Discretionary	9.4	9.7	6.4	-6.0	-30.0	2.6	11.9	21.9	17.5	10.4	0.9	-0.7	3.6
Consumer Staples	0.8	5.2	0.0	8.2	-5.1	-2.9	1.6	20.6	14.2	1.8	5.3	7.3	4.5
Health Care	14.0	15.8	11.3	-3.0	-9.2	1.9	8.3	15.7	16.5	8.0	11.1	9.7	8.1
Financials	1.2	21.2	3.2	-24.4	-17.0	-1.6	5.8	6.0	18.8	8.4	2.7	0.1	1.2
Information Technology	12.0	12.3	7.7	-11.3	-32.8	4.1	21.5	10.5	5.9	7.6	9.4	8.9	3.6
Telecommunication Services	5.6	4.7	2.7	0.6	-7.0	-7.1	2.1	7.8	9.2	-1.7	-7.5	-7.5	0.0
Utilities	7.8	6.0	18.8	8.2	-3.1	2.1	-2.1	8.1	3.5	-6.6	9.3	9.5	4.9
All Sectors	11.4	12.2	7.7	-5.7	-24.3	-3.2	11.2	16.4	11.1	6.9	5.9	5.3	4.0

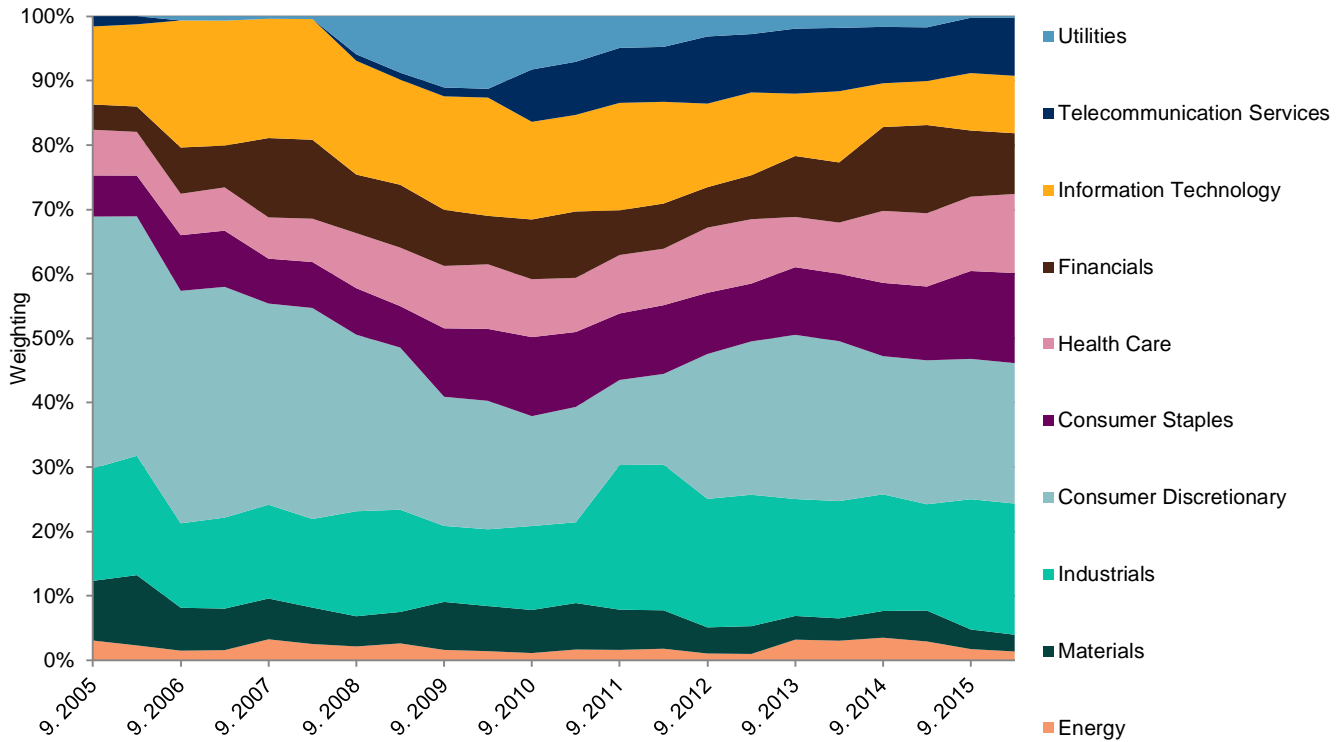
Source: S&P Dow Jones Indices LLC, Japan Exchange Group, and Factset. Figures based on the TOPIX universe. Data as of March 30, 2017. Table is provided for illustrative purposes.

Exhibit 13: TOPIX R&D Spending Annual Growth Rate – Sector Median Ratio

SECTOR	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	CAGR
Energy	0.0	4.2	34.5	0.6	-5.3	0.2	2.9	-19.4	-13.1	0.4	0.0	0.7	-0.2
Materials	5.6	4.4	4.4	1.3	-5.1	1.2	1.5	-0.1	2.9	2.5	2.3	2.8	1.9
Industrials	1.1	2.9	4.0	0.3	-7.3	0.9	1.7	1.4	3.9	3.5	4.0	3.1	1.6
Consumer Discretionary	3.1	1.5	3.3	-1.9	-9.6	2.5	1.8	3.6	5.1	4.9	1.8	1.8	1.4
Consumer Staples	2.4	3.8	1.7	0.7	2.4	0.9	0.6	1.7	2.1	1.1	2.1	1.9	1.8
Health Care	9.8	3.9	2.2	0.0	2.5	3.1	-0.7	1.0	5.7	2.9	6.9	5.9	3.6
Financials	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Information Technology	4.4	5.0	5.5	-2.0	-13.6	1.5	2.5	0.4	3.9	4.3	5.4	3.3	1.6
Telecommunication Services	0.6	-14.3	11.4	-0.1	6.4	3.3	-0.9	0.5	-8.3	-5.6	-13.1	-13.1	-3.1
Utilities	-0.7	-3.0	2.4	-0.2	-0.5	-1.4	-9.7	-5.9	-12.4	0.7	0.0	0.0	-2.6
All Sectors	3.3	3.4	3.9	-0.1	-7.2	1.3	1.4	1.0	3.5	3.3	3.3	2.9	1.6

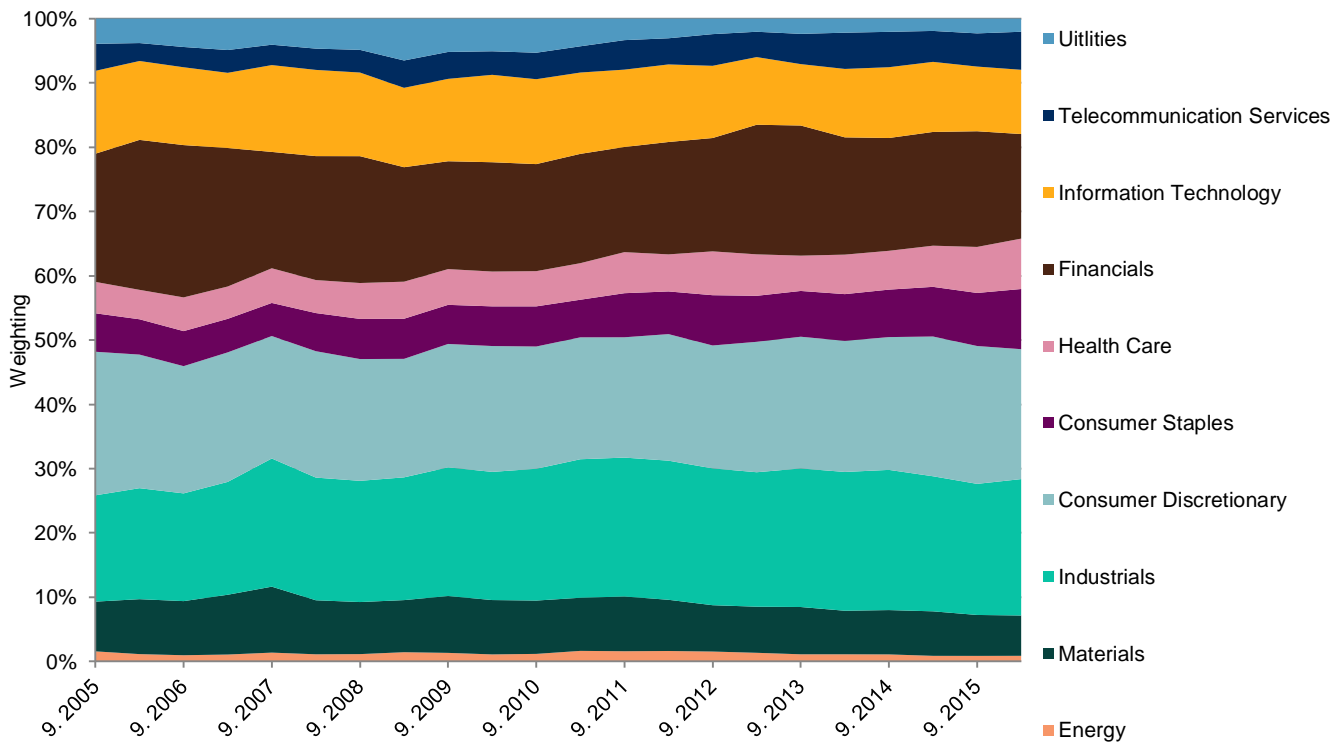
Source: S&P Dow Jones Indices LLC, Japan Exchange Group, and Factset. Figures based on the TOPIX universe. Data as of March 30, 2017. Table is provided for illustrative purposes.

Exhibit 14: Historical Sector Weighting of the JPX/S&P CAPEX & Human Capital Index



Source: S&P Dow Jones Indices LLC and Japan Exchange Group. Figures based on annually rebalanced portfolio. Data from Sept. 16, 2005, to Sept. 16, 2016. Chart is provided for illustrative purposes.

Exhibit 15: Historical Sector Weighting of the TOPIX



Source: S&P Dow Jones Indices LLC and Japan Exchange Group. Figures based on annually rebalanced portfolio. Data from Sept. 16, 2005, to Sept. 16, 2016. Chart is provided for illustrative purposes.

Exhibit 16: Sector Composition of Eligible Stocks After Applying Different Eligible Criteria (Percent of Constituents)

SECTOR	TOPIX (%)	LIQUIDITY AND CREDITWORTHINESS (%)	LIQUIDITY, CREDITWORTHINESS, AND PROFITABILITY (%)	LIQUIDITY, CREDITWORTHINESS, PROFITABILITY, AND LOW BETA (%)
Energy	1.2	1.1	1.0	1.4
Materials	7.9	7.9	8.0	7.5
Industrials	20.0	19.6	20.5	18.3
Consumer Discretionary	19.9	19.9	19.2	23.4
Consumer Staples	6.6	5.8	6.2	8.6
Health Care	5.8	5.9	6.0	8.3
Financials	18.7	18.7	18.0	7.0
Information Technology	11.9	12.2	12.0	13.2
Telecommunication Services	4.2	4.9	5.2	6.9
Utilities	3.7	4.0	3.9	5.3

Source: S&P Dow Jones Indices LLC and Japan Exchange Group. Data from Sept. 16, 2005, to Sept. 16, 2016. Stocks are selected from the TOPIX based on different eligibility criteria following the same rebalancing schedule as the JPX/S&P CAPEX & Human Capital Index, weighted by float-adjusted market cap. Sector weights are average figures based on annually rebalanced portfolio. Table is provided for illustrative purposes.

GLOSSARY

Beta

Beta is used in the [JPX/S&P CAPEX & Human Capital Index](#) methodology to sort stocks in terms of their low beta criteria. 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 as shown in Exhibit 17.

Exhibit 17: Scholes-Williams Betas	
CHARACTERISTIC	DESCRIPTION
Reference Index	Unhedged TOPIX
Frequency of Return Data	Daily
Estimation Window/Half-Life	5-year estimation window, 2.5 -year half-life
Non-Synchronous Returns	Scholes-Williams approach
Estimation Bias Handling	Shrink toward 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

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

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 formulas 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 stock returns and index returns, weighted by the exponential weight W_t .

Vasicek Shrinkage

Betas are shrunk toward 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:

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

ρ_{ind} = Correlation($Ind_t, Ind3_t$)

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:

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

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

Capex and R&D Expense Growth Ratio

For non-financial companies reporting R&D expenses in the latest three reported fiscal years, capex and R&D expense growth are calculated. For all financial companies and non-financial companies did not report R&D expenses in the latest three reported fiscal years, capex growth is calculated.

Capex and R&D expense growth is calculated as a company's sum of latest capex and R&D expense divided by the average value for the most recent three reported years, minus one, as:

$$\frac{\text{Sum of Latest Capex and R\&D Expense}}{3 - \text{year Average Capex and R\&D Expense}} - 1$$

Capex growth is calculated as a company's latest capex divided by the average capex for the most recent three reported years, minus one, as:

$$\frac{\text{Latest Capex}}{3 - \text{year Average Capex}} - 1$$

Capex Revenue Effect Ratios

This is calculated as a company's latest revenue divided by its cumulative capex in the most recent three reported fiscal years:

$$\text{Capex Revenue Effect} = \frac{\text{Latest Revenue}}{3 - \text{year Cumulative Capex}}$$

Human Capital Scores

The human capital score is obtained as of the rebalancing reference date from the latest assessment available from RobecoSAM.

The human capital score includes the scores of three criteria in the RobecoSAM methodology that is used for the Corporate Sustainability Assessment (CSA): Human Capital Development, Talent Attraction & Retention, Labor Practice Indicators, and Human Rights. These criteria are assessed for all industries, and all three criteria include publicly disclosed data and data provided directly from companies that participate in the CSA.

Within the human capital development criteria, companies are scored based on their ability to quantify and proactively manage their investments in human capital. Companies score well if they are able to track and report quantitative measures of their training and development programs, as well as effectively explain the link between their development programs and their impact on the business. The highest scores are awarded to those companies that are able to quantify the economic benefits of their

human capital investments and to demonstrate higher economic value from these investments over time.

The Talent Attraction & Retention criterion awards higher scores for companies that are able to demonstrate effective measures for evaluating employee performance. Companies are also evaluated on their ability to provide long-term incentives to their employees, given that this is essential to the long-term performance of companies. Finally, companies are evaluated on their employee turnover rate and their ability to effectively maintain a relatively low turnover rate and retain talent over time.

The Labor Practice Indicators & Human Rights criterion rewards companies that demonstrate proactiveness with regard to gender equality within their organizations. Companies score well if they are able to demonstrate the retention of female employees from junior to senior management, as well as relatively equitable levels of pay between male and female employees. Finally, companies in this criterion score well by demonstrating a strong commitment to the human rights of their employees. Companies that have conducted a human rights due diligence in relation to the UN's Guiding Principles on Human Rights receive the highest scores in this criteria.

In order to obtain an overall human capital score, each of these three human capital criteria are relatively ranked and given a score between 0 and 100. Each of the criterion scores are then equally weighted to obtain an overall Human Capital score between 0 and 100.

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