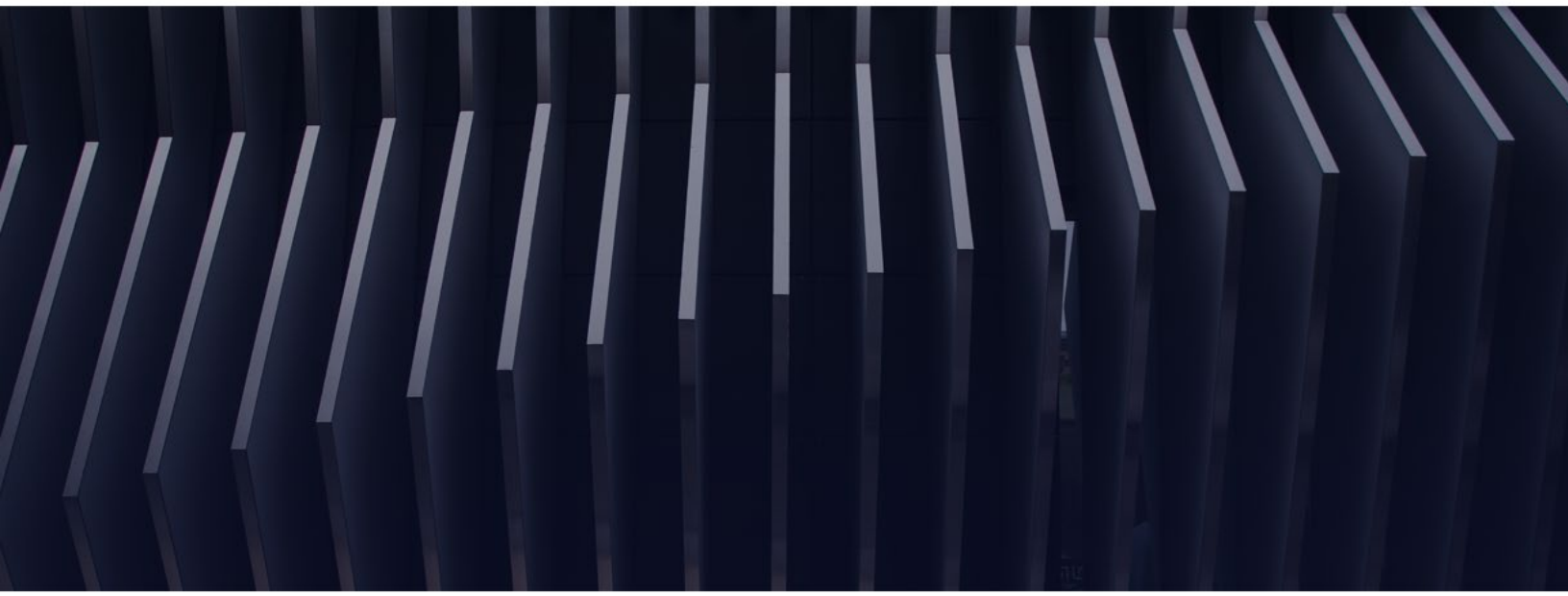
Wilshire Indexes

FT Wilshire NxtGen Index Series Methodology

November 2025



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Introduction

The FT Wilshire NxtGen Indexes are designed to deliver a portfolio allocation that maximizes future expected risk-adjusted returns of the portfolio, with controlled tracking error against the benchmark portfolio. This is achieved via stock level risk-adjusted return estimation using machine learning models and portfolio optimization. The details of the index construction are set out below.

Price, total, and net return indexes are calculated for all member indexes. Indexes are calculated in USD. Conversions to GBP, EUR, JPY, and other major currencies are calculated using the WM/Reuters 16.00 London rates.

This document describes the procedures used to construct and maintain the FT Wilshire NxtGen Index Series. The document is reviewed at least annually but more frequent updates may be made in the light of market events or as a result of feedback obtained via a consultation. It should be read in conjunction with the Wilshire Indexes Equity Index Calculation and Corporate Events Guide which describes the index treatment of corporate actions and events, and the procedures to be followed for suspended or delisted securities, and at times of market disruption. The Equity Index Calculation and Corporate Events Guide applies to all standard FT Wilshire equity indexes and to other indexes calculated or administered by Wilshire Indexes where this is stated in the methodology documentation for those indexes.

1 Index Construction

The index construction process is divided into three steps: risk-adjusted returns estimation, covariance matrix estimation and mean-tracking error optimization.

In addition, further eligibility criteria such as liquidity, size, and nationality will be based upon the eligibility criteria contained within the methodologies for the underlying indexes, namely, the FT Wilshire Global Equity Market Series and FT Wilshire 5000 Index Series methodologies.

1.1 Risk-adjusted Return Estimation

1.1.1 Factor Definitions

Over 100 stock level fundamental and market characteristics from 12 major factor categories (as listed in the table below) are used to estimate quarterly future stock risk-adjusted returns. This list of fundamental and market characteristics is in close alignment with those described in the academic literature (refer to Appendix A).

Category (#)	List of Fundamental and Market Characteristics
Accounting Conservatism (12)	Accounts Receivable Accrual, Accrual, Accrual CFO, Change in Deferred Revenue, Change in Net Non-Cash Working Capital, Growth in Long-Term NOA, Inventory Accrual, NOA Scaled, Percentage Operating Accrual, Percentage Total Operating Accrual, Tax Income Ratio, Total Accrual
Default Risk (11)	Cash Flow Volatility, Cash Ratio, Cash to Assets, Change in Financial Liabilities, Convertible Debt to Total Debt, Debt Coverage Ratio, Earnings Volatility, Leverage, Current Ratio, Long-Term Debt to Book, Market Leverage
Growth (12)	Cash Flow Growth, Change in Gross Margin, Change in Profit Margin, Change in ROA, Consecutive Quarters with Earnings Increases, Earnings Consistency, Earnings Growth, Earnings Surprise, EBIT Growth, Growth in Revenue minus SG&A, Revenue Growth, Revenue Surprise
Investment Conservatism (16)	Abnormal Capital Investment, Abnormal Capital Investment Scaled, Asset Growth, Change in Current Operating Assets, Change in Current Operating Liabilities, Change in Long-Term Investments, Change in Net Financial Assets, Change in Net Non-Current Operating assets, Change in Non-Current Operating Assets, Change in Non-Current Operating Liabilities, Goodwill Growth, Goodwill to Assets, Investment Growth, Investment to Assets Ratio, Investment to Capital Ratio, Net Non-Current Operating Assets
Issuance (9)	Composite Debt Issuance, Composite Equity Issuance, Earnings Distributed to Equity Holder, Growth in Debt, Net Cash Distributed to Equity Holder, Net External Financing, Payout, Payout Yield, Repurchase Binary
Liquidity (6)	Amihud's Measure for Illiquidity, Average Share Turnover, Average Traded Value, Change of Traded Value to Market Value of Equity, Traded Value to Market Value of Equity, Traded Value Volatility

Category (#)	List of Fundamental and Market Characteristics
Low Risk (7)	12-Month Lottery, Idiosyncratic Volatility, Log Price, Market Beta, Market Beta 60-Day, Return Volatility, Semi-Variance
Momentum	Price Momentum
Productivity (11)	Asset Turnover, Average R&D, Change in Asset Turnover, Firm Age, Firm Productivity, F-score, Operating Leverage, Overproduction, R&D Capital to Assets Ratio, R&D Reporting Biases, R&D to Sales Ratio
Profitability (8)	Gross Profit to Assets Ratio, Operating Profit to Equity Ratio, Profit Margin, Return on Assets (ROA), Return on Capital Employed, Return on Equity (ROE), Return on Net Operating Assets, Tax Expense Surprise
Size	Log Market Capitalization
Value (11)	Book to Price, Cash Flow to Price, CFO to Price, Dividend Yield, Earnings to Price, Enterprise Component of Book to Price, Invertible Enterprise Multiple Leverage Component of Book to Price, Long-Term Reversal, Momentum Reversal, Sales to Price,

1.1.2 Machine Learning Models

Machine learning models are used to estimate the next three-month stock risk-adjusted returns, $\alpha_{i,t}$, using stock characteristics available by the end of the prior month, $X_{i,t-1}$. All models have the following general functional form:

$$E_j(\alpha_{i,t}) = f_j(X_{i,t-1}) \quad (1)$$

where $E_j(\alpha_{i,t})$ is the expected next three-month risk-adjusted return produced by model j for stock i from the start of month t.

For the model fitting process, the stock universe comprises of the FT Wilshire Global Index constituents as of the end of month $t-1$. The realized risk-adjusted stock returns are calculated as the alpha (or intercept) obtained by regressing the daily stock returns against the corresponding daily market returns during the three-month period from the start of month t.

Market returns are calculated as the free float market capitalization weighted returns of all the universe stocks within the same exchange country. The realized risk-adjusted stock returns and stock level characteristics are winsorized at 1% and then standardized as cross-sectional Z-scores for each month. Missing Z-scores are assigned a neutral value of zero. Each machine learning model is trained every month from June 1999 up to the last available realized risk-adjusted stock returns (three months ago).

Once the models have been fitted across all available months, they are used to estimate the next three-month risk-adjusted stock returns based on the stock level characteristics as of the month end prior to the reconstitution month. For each machine learning model, the expected stock risk-adjusted return estimates are aggregated across all months using an exponentially weighted moving average with a decay factor of 0.996. These aggregated values are then averaged across the different types of machine learning models to become the final expected stock risk-adjusted return estimates, $E(\alpha_{i,t})$.

The set of machine learning models used are linear ridge, gradient boosting and random forest. The hyperparameters of these models are provided below.

Model	Parameter	Value
Linear Ridge	L2 regularization parameter	100
Gradient Boosting	Learning rate	0.1
	Minimum loss reduction required to make a split	0
	Maximum depth of a tree	5
	Maximum rounds of boosting iterations	500
Random Forest	Number of trees in the forest	200
	Percentage of samples to draw from training dataset as bootstrap samples	60%
	Minimum number of samples required to split an internal node	10
	Number of features to consider when looking for the best split	5

1.2 Covariance Matrix Estimation

The covariance matrix of stock returns is estimated via a statistical factor model. Specifically, the factor returns are calculated as the top 50 principal components derived from a principal component analysis (PCA) of daily stock returns over the prior 24 months. The stock universe for the PCA comprises of the FT Wilshire Global Index constituents as at the month end prior to the reconstitution month.

To estimate the covariance matrix, daily returns of each stock in the underlying index are regressed on these factor returns in the same period to obtain a coefficient (or factor exposure) matrix and a residual (or idiosyncratic) variance series. The covariance matrix, V, is calculated as:

$$\mathrm{V} = B\,\Sigma\,B^T + D \tag{2}$$

where B is the $N \times K$ coefficient matrix with N being the number of stocks in the underlying index and K being the number of factors which is fixed at 50, Σ is the $K \times K$ factor covariance matrix (which is diagonal since principal components are uncorrelated with each other), and D is the $N \times N$ diagonal matrix of residual variances.

1.3 Mean-Tracking Error Optimization

A mean-tracking error optimization solves for the optimal weights of an portfolio that maximizes an expression for the expected return of the portfolio penalized by its tracking error and turnover:

$$\max_{w} E\left(\alpha_{i,t}\right)^T (W - W_B) - \lambda_{TE}(W - W_B)^T \mathrm{V}(W - W_B) - \lambda_{TO}|W - W_{t-1}|_1 \tag{3}$$

where W is the target weights of the NxtGen Index, W_B is the weights of the underlying index (as of the price cut-off date), W_{t-1} is the current weights of the NxtGen Index (as of the price cut-off date), λ_{TE} is the tracking error aversion coefficient and λ_{TO} is the turnover aversion coefficient.

The constraints used in the optimization are long only, fully invested, maximum stock weight, maximum capacity ratio, maximum active stock weight, and maximum active industry (country) weight.

The table below describes the precise optimization parameters.

Parameter	Value
Tracking error aversion coefficient	25
Turnover aversion coefficient	See Turnover Aversion in Section 2
Maximum stock weight	See Max Weight in Section 2
Maximum capacity ratio	10
Maximum active stock weight	2%
Maximum active industry weight	2%
Maximum active country weight (if applicable)	2%

Finally, stocks with trivial target weights (as defined by Min Weight in Section 2) are removed from the index. Their weights are distributed pro-rata amongst the remaining constituents.

2 Available NxtGen Indexes

The table below sets out the names, underlying universes, optimization parameters and reconstitution schedules of the various available FT Wilshire NxtGen Indexes:

Index Name	Underlying Benchmark	Turnover Aversion	Max Weight (%)	Min Weight (bps)	Reconstitution Schedule
FT Wilshire US Large NxtGen Index	FT Wilshire US Large Cap Index	0.0075	10	5	Jan, Apr, Jul, Oct
FT Wilshire US Small NxtGen Index	FT Wilshire US Small Cap Index	0.015	5	2	Jan, Apr, Jul, Oct
FT Wilshire Developed Large NxtGen Index	FT Wilshire Developed Large Cap Index	0.0075	5	2	Jan, Apr, Jul, Oct
FT Wilshire Developed ex US Large NxtGen Index	FT Wilshire Developed ex US Large Cap Index	0.0075	5	2	Jan, Apr, Jul, Oct
FT Wilshire Emerging Large NxtGen Index	FT Wilshire Emerging Large Cap Index	0.0075	10	2	Jan, Apr, Jul, Oct
FT Wilshire Emerging ex China Large NxtGen Index	FT Wilshire Emerging ex China Large Cap Index	0.0075	15	2	Jan, Apr, Jul, Oct

3 Index Maintenance

3.1 Index Reconstitution

The FT Wilshire NxtGen Indexes will be reconstituted in January, April, July, and October as per Section 1. The data cut-off date for stock risk-adjusted returns and covariance matrix estimation is the month end prior to the reconstitution month. The price cut-off date for current index weights and underlying index weights calculation is the Wednesday before the first Friday of the reconstitution month. Constituent and free-float changes are updated after the close of trading on the third Friday of the reconstitution month.

3.2 Intra-reconstitution Additions

Additions to the underlying FT Wilshire index will be eligible for inclusion at the next index reconstitution of the FT Wilshire NxtGen Index in January, April, July, and October.

3.3 Intra-reconstitution Deletions

A constituent will be removed from a FT Wilshire NxtGen Index if it is removed from the corresponding underlying FT Wilshire index. The deletion will be concurrent with that from the underlying index and its weight will be distributed pro-rata amongst the remaining constituents in the FT Wilshire NxtGen Index.

4 Corporate Events

4.1 Corporate Action Treatment

The Corporate action treatment for the FT Wilshire NxtGen Index Series can be found in the Wilshire Indexes Equity Index Calculation and Corporate Action Guide. The Index Series will follow the non-market capitalization sections of the guide.

4.2 Suspension of Dealing

Suspension of Dealing rules can be found in the Wilshire Indexes Equity Index Calculation and Corporate Action Guide.

4.3 Takeovers, Mergers and Spinoffs

The treatment of takeovers, mergers and spinoffs can be found in the Wilshire Indexes Equity Index Calculation and Corporate Action Guide.

Methodology Approval

This Methodology was approved by the Index Management Committee on 26 November 2025.

Appendix A: Fundamental and Market Characteristics

The tables below describe the stock level fundamental and market characteristics that are used by machine learning models for expected risk-adjusted return estimation.

Category	Characteristics	Description	Reference
Accounting Conservatism	Accounts Receivable Accrual	Change in Accounts Receivable (AR), scaled by average Assets over the past year	Gu and Jain (2011)
Accounting Conservatism	Accrual	((Change in Current Assets - Change in Cash) - (Change in Current Liabilities - Change in Income Taxes Payable) – Depreciation and Amortization Expense)) / average Total Assets over the past year	Sloan (AR 1996)
Accounting Conservatism	Accrual CFO	Earnings deducted by Operating Cash Flow (CFO), and then scaled by average Total Assets over the past year	Sloan (AR 1996)
Accounting Conservatism	Change in Deferred Revenue	Change in Deferred Revenue, scaled by average Total Assets over the past year	Zhong (ARA, 2017)
Accounting Conservatism	Change in Net Non-Cash Working Capital	Change in Net Non-Cash Working Capital, scaled by average Total Assets over the past year, where net Non-Cash Working Capital is the difference of Current Non-Cash Assets and Current Non-Cash Liabilities	Soliman (AR 2008)
Accounting Conservatism	Growth in Long-Term NOA	Growth in Net Operating Assets (NOA) over the past year minus Accruals	Fairfield, Whisenant and Yohn (AR 2003)
Accounting Conservatism	Inventory Accrual	Change in Inventory over the past year, scaled by average Total Assets over the past year	Thomas and Zhang (RAS 2002)
Accounting Conservatism	NOA Scaled	NOA scaled by Total Assets, where NOA = Total Assets - Cash - Long-Term Securities - (Total Liabilities - Short-Term Debt - Long-Term Debt))	Hirshleifer, Hou, Teoh and Zhang (JAE 2004)
Accounting Conservatism	Percentage Operating Accrual	Earnings deducted by CFO, and then scaled by the absolute value of Earnings	Hafzalla, Lundholm and Van Winkle (AR 2011)
Accounting Conservatism	Percentage Total Operating Accrual	(Earnings - (-Issuance + Repurchase + Dividends + CFO + CFF + CFI)) / absolute value of Earnings	Hafzalla, Lundholm and Van Winkle (AR 2011)
Accounting Conservatism	Tax Income Ratio	Income Tax scaled by Net Income	Lev and Nissim (AR 2004)
Accounting Conservatism	Total Accrual	Sum of the change in Net Non-Cash Working Capital, change in net Non-Current Operating Assets and change in Net Financial Assets, where Non-Cash Working Capital is Current Operating Asset - Current Operating Liabilities, Net Non-Current Operating Assets is Non-Current Operating Assets - Non-Current Operating Liabilities, and Net Financial Assets is Financial Assets - Financial Liabilities.	Richardson, Sloan, Soliman and Tuna (JAE 2005)

Category	Characteristics	Description	Reference
Default Risk	Cash Flow Volatility	Standard deviation of the ratio of CFO to market value of Equity over the past 5 years	Haugen and Baker (JFE 1996)
Default Risk	Cash Ratio	Cash holdings divided by Current Liabilities	
Default Risk	Cash to Assets	Cash holdings divided by Total Assets	Palazzo (JFE 2012)
Default Risk	Change in Financial Liabilities	Change in Financial Liabilities scaled by average Total Assets over the past year	
Default Risk	Convertible Debt to Total Debt	Convertible Debt divided by Total Debt	Valta (JFAQA 2016)
Default Risk	Debt Coverage Ratio	Net Operating Income divided by Total Debt Service, where Total Debt Service is Short-Term Debt + Interest Expense	
Default Risk	Earnings Volatility	Standard deviation of the quarterly Earnings to Price ratio over the past 5 years	Ahmed (AF, 2020)
Default Risk	Leverage	Total Liabilities divided by Total Assets	
Default Risk	Current Ratio	Current Assets divided by Current Liabilities	Husna (IJEF, 2019)
Default Risk	Long-Term Debt to Book	Long-Term Debt divided by book value of Equity	Bhandari (JF 1988)
Default Risk	Market Leverage	Total Debt divided by the sum of Total Debt and market value of Equity	Bhandari (JF 1988)
Growth	Cash Flow Growth	Change in the ratio of CFO to Total Assets over the past year	
Growth	Change in Gross Margin	Yearly change in Gross Margin, where Gross Margin is Gross Profit divided by Revenue	Hou, Xue and Zhang (RFS 2015)
Growth	Change in Profit Margin	Change in the ratio of Earnings to Revenue over the past year	Soliman (AR 2008)
Growth	Change in ROA	Change in Return on Assets (ROA) over the past year	Balakrishnan, Bartov and Faurel (JAE 2010)
Growth	Consecutive Quarters with Earnings Increases	The number of consecutive quarters (up to eight quarters) with an increase in Earnings over the same quarter in the prior year	Barth, Elliott, and Finn (JAR 1999)
Growth	Earnings Consistency	Geometric average of growth rate of Earnings Per Share (EPS) over the past 5 years, where growth rate of EPS is change of EPS between year t and t-1 scaled by the average of absolute value of EPS between year t and t-1.	Alwathainani (BAR 2009)
Growth	Earnings Growth	Change in the ratio of Earnings to Total Assets over the past year	Kyosev (JBF, 2020)
Growth	Earnings Surprise	Change in Earnings over the past year, scaled by the standard deviation of this yearly change over year t-5 to t-1.	Foster, Olsen and Shevlin (AR 1984)
Growth	EBIT Growth	Change in the ratio of EBIT to Total Assets over the past year	Stevens (JFQA, 1973)

Category	Characteristics	Description	Reference
Growth	Growth in Revenue minus SG&A	Changes of Sales subtracted by changes of SG&A over the past year, and then scaled by the average value of Sales between year t-1 and t-2. Changes of Sales is Sales at year t minus the average value of Sales between year t-1 and t-2. Similarly, changes of SG&A is SG&A at year t minus the average value of SG&A between year t-1 and t-2	Abarbanell and Bushee (AR, 1998)
Growth	Revenue Growth	Percentage change of Revenue over the past year	Hou, Xue and Zhang (RFS 2015)
Growth	Revenue Surprise	Change in Revenue over the past year scaled by the standard deviation of this yearly change over year t-5 to t-1.	Jegadeesh and Livnat (JAE 2006)
Investment Conservatism	Abnormal Capital Investment	Capital Expenditure (CAPEX) subtracted by its three year average, and then scaled by average Net Property, Plant, and Equipment (PP&E) over the past 3 years, where Net PP&E is Gross PP&E + Capital Expenditures - Accumulated Depreciation	
Investment Conservatism	Abnormal Capital Investment Scaled	CAPEX scaled by Revenue, and then subtracted by its three years' average	Titman, Wei, and Xie (JFQA 2004)
Investment Conservatism	Asset Growth	Percentage change of Total Assets over the past year	Cooper, Guylen and Schill (JF 2008)
Investment Conservatism	Change in Current Operating Assets	Change in Current Operating Assets, scaled by average Total Assets over the past year	
Investment Conservatism	Change in Current Operating Liabilities	Change in Current Operating Liabilities, scaled by average Total Assets over the past year	
Investment Conservatism	Change in Long-Term Investments	Change in Long-Term Investment over the past year, scaled by average Total Assets over the past year	
Investment Conservatism	Change in Net Financial Assets	Change in Net Financial Assets, scaled by average Total Assets over the past year, where Net Financial Assets is the sum of changes in Long-Term and Short-Term Investments, Long-Term and Short-Term Debt, and Preferred Stock	
Investment Conservatism	Change in Net Non-Current Operating assets	Change in Net Non-Current Operating Assets over the past year, scaled by average Total Assets over the past year	Soliman (AR 2008)
Investment Conservatism	Change in Non-Current Operating Assets	Change in Non-Current Operating Assets over the past year, divided by average Total Assets over the past year	Soliman (AR 2008)
Investment Conservatism	Change in Non-Current Operating Liabilities	Change in Non-Current Operating Liabilities over the past year, divided by average Total Assets over the past year	Soliman (AR 2008)
Investment Conservatism	Goodwill Growth	Change in Goodwill over past year, divided by average Total Assets over the past year	Aharony, Barniv and Falk (EAR 2010)

Category	Characteristics	Description	Reference
Investment Conservatism	Goodwill to Assets	Goodwill divided by Total Assets	
Investment Conservatism	Investment Growth	Change in CAPEX over the past year, divided by average Net PP&E over the past year	Xing (RFS 2008)
Investment Conservatism	Investment to Assets Ratio	Change in Net PP&E plus Inventory, divided by average Total Assets over the past year	Cooper, Gulen and Schill (JF 2008)
Investment Conservatism	Investment to Capital Ratio	CAPEX divided by average Net PP&E over the past year	
Investment Conservatism	Net Non-Current Operating Assets	Net Non-Current Operating Assets scaled by Total Assets	Soliman (AR 2008)
Issuance	Composite Debt Issuance	Growth rate of the book value of debt over the past 5 years	Lyandres, Sun and Zhang (RFS 2008)
Issuance	Composite Equity Issuance	Log growth rate in the market Equity not attributable to stock return over past 5 years	Daniel and Titman (JF 2006)
Issuance	Earnings Distributed to Equity Holder	Earnings subtracted by changes of book value of Equity over the past year, and then divided by average Total Assets over the past year	Papanastasopoulos, Thomakos and Wang (RAF 2010)
Issuance	Growth in Debt	Percentage change of Total Debt over the past year	Richardson, Sloan, Soliman and Tuna (JAE 2005)
Issuance	Net Cash Distributed to Equity Holder	Net Cash Distributed divided by average Total Assets over the past year, where Net Cash Distributed is Cash Dividend + Repurchase - Issuance	Papanastasopoulos, Thomakos and Wang (RAF 2010)
Issuance	Net External Financing	Sum of Net Equity Financing and Net Debt Financing, scaled by average Total Assets over the past year, where Net Equity Financing is New Issuance minus Repurchase and Dividends, and Net Debt Financing is the sum of changes in Long-Term and Short-Term Debt.	Bradshaw, Richardson and Sloan (JAE 2006)
Issuance	Payout	Dividends divided by Earnings	Hou, Xue and Zhang (RFS 2015)
Issuance	Payout Yield	The sum of Dividends and Repurchases, scaled by market value of Equity	Boudoukh, Michaely, Richardson and Roberts (JF 2007)
Issuance	Repurchase Binary	Binary variable: 1 if repurchase > 0; otherwise, 0	Ikenberry, Lakonishok, and Vermaelen (JFE 1995)
Liquidity	Amihud's Measure for Illiquidity	Average daily absolute value of return scaled by daily traded value over the past 126 trading days	Amihud (JFM 2002)
Liquidity	Average Share Turnover	Average daily traded value scaled by free float market capitalization over the past 126 trading days	Datair, Naik, and Radcliffe (JFM 1998)
Liquidity	Average Traded Value	Average daily traded value over the past 126 trading days	

Category	Characteristics	Description	Reference
Liquidity	Change of Traded Value to Market Value of Equity	Change in the ratio of traded value to market value of Equity between month t-60 and t	Haugen and Baker (JFE 1996)
Liquidity	Traded Value to Market Value of Equity	Monthly average traded value over the past 12 months scaled by market value of Equity	Haugen and Baker (JFE 1996)
Liquidity	Traded Value Volatility	Standard deviation of monthly traded value over the past 36 months	Chordia, Subranhmanyam and Anshuman (JFE 2001)
Low Risk	12-Month Lottery	Average of maximum daily return per month over the past 12 months	Bali, Cakici and Whitelaw (JFE 2011)
Low Risk	Idiosyncratic Volatility	The residual volatility from regressing stock daily returns on the market returns over the past 252 trading days, where market returns are represented by free float capitalization weighted returns of FT Wilshire Global All Cap Index constituents in the same exchange country	Ang, Hodrick, Xing and Zhang (JF 2006)
Low Risk	Log Price	Log of stock price	Blume and Husic (JF 1972)
Low Risk	Market Beta	Beta from regressing stock returns on the market returns over the past 252 trading days, where market returns are represented by free float capitalization weighted returns of FT Wilshire Global All Cap Index constituents in the same exchange country	Fama and MacBeth (JPE 1973)
Low Risk	Market Beta 60-Day	Beta from regressing stock returns on the market returns over the past 60 trading days, where market returns are represented by free float capitalization weighted returns of FT Wilshire Global All Cap Index constituents in the same exchange country	
Low Risk	Return Volatility	Standard deviation of stock daily returns over the past 252 trading days	Ang, Hodrick, Xing and Zhang (JF 2006)
Low Risk	Semi-Variance	Semi-variance of stock daily returns over the past 252 trading days	Estrada (IREF 2007)
Momentum	Price Momentum	Buy-and-hold returns from month t-12 to t-1	Jegadeesh and Titman (JF 1993)
Productivity	Asset Turnover	Revenue divided by NOA	Soliman (AR 2008)
Productivity	Average R&D	(R&D Expense (t) + 0.8 * R&D Expense (t - 1) + 0.6 * R&D Expense (t - 2) + 0.4 * R&D Expense (t - 3) + 0.2 * R&D Expense (t - 4)) / Total Assets	Lev, Sarath and Sougiannis (CAR 2010)
Productivity	Change in Asset Turnover	Change in the ratio of Revenue to NOA over the past year	Soliman (AR 2008)
Productivity	Firm Age	The number of months since the firm has been listed	Barry and Brown (JFE 1984)
Productivity	Firm Productivity	Operating Income divided by Non-Cash Assets	Hou, Xue and Zhang (RFS 2015)

Category	Characteristics	Description	Reference
Productivity	F-score	Measure ranging from zero to nine based on the sum of the following indicator variables: one if net income > zero; one if CFO > zero; otherwise, one if ROE increased during the previous year; one if CFO > net income; one if the ratio of Long-Term Debt to equity decreased during the previous year; one if the ratio of Current Assets to Current Liabilities increased during the previous year; one if the firm did not issue common shares; one if the ratio of EBIT to Revenue increased during the previous year; and one if the ratio of ROA increased during the previous year.	Piotroski (AR 2000)
Productivity	Operating Leverage	The sum of Cost of Goods Sold (COGS) and Selling, General and Administrative Expenses (SG&A) divided by Total Assets	Novy-Marx (ROF 2010)
Productivity	Overproduction	Change of Inventory over the past year deducted by COGS, and then scaled by average Total Assets over the past year	
Productivity	R&D Capital to Assets Ratio	R&D Expense divided by average Total Assets over the past year	Li (RFS 2011)
Productivity	R&D Reporting Biases	Difference of R&D Expense growth rate and Earnings growth rate over the past year	Lev, Sarath and Sougiannis (CAR 2010)
Productivity	R&D to Sales Ratio	R&D expense divided by Revenue	Chan, Lakonishok and Sougiannis (JF 2001)
Profitability	Gross Profit to Assets Ratio	Gross Profit divided by average Total Assets over the past year, where gross profit is Revenue subtracted by COGS	Novy-Marx (JFE 2013)
Profitability	Operating Profit to Equity Ratio	Operating Profit scaled by average book value of Equity over the past year, where Operating Profit is Revenue subtracted by COGS, SG&A and Interest Expense.	Fama and French (JFE 2015)
Profitability	Profit Margin	EBIT divided by Revenue	Soliman (AR 2008)
Profitability	Return on Assets (ROA)	Net Income divided by Average Total assets over the past year	Balakrishnan, Bartov and Faurel (JAE 2010)
Profitability	Return on Capital Employed	EBIT divided by average Capital Employed (CE) over the past year, where CE is Total Assets minus Current Liabilities	Rutherford (FA&M, 2002)
Profitability	Return on Equity (ROE)	Net Income scaled by average book value of Equity over the past year	Haugen and Baker (JFE 1996)
Profitability	Return on Net Operating Assets	EBIT divided by NOA	Soliman (AR 2008)
Profitability	Tax Expense Surprise	Change in Tax Expense over the past year, scaled by average Total Assets over the past year	Thomas and Zhang (JAR 2011)

Category	Characteristics	Description	Reference
Size	Log Market Capitalization	The log of market value of Equity	Banz (JFE 1981)
Value	Book to Price	Book value of Equity divided by market value of Equity	Fama and French (JF 1992)
Value	Cash Flow to Price	Cash holdings divided by market value of Equity	Lakonishok, Shleifer, and Vishny (JF 1994)
Value	CFO to Price	CFO divided by market value of Equity	Desai, Rajgopal and Venkatachalam (TAR 2004)
Value	Dividend Yield	Dividends divided by market value of Equity	Litzenberger and Ramaswamy (JF, 1982)
Value	Earnings to Price	Net Income divided by market value of Equity	Basu (JF 1977)
Value	Enterprise Component of Book to Price	Book value of NOA divided by market value of NOA, where book value of NOA is Book Value of Equity + Long-Term Debt + Short-Term Debt + Preferred Stock - Cash, and market value of NOA is Market Value of Equity + Long-Term Debt + Short-Term Debt + Preferred Stock - Cash	Penman, Richardson and Tuna (JAR 2007)
Value	Invertible Enterprise Multiple	CFO scaled by Enterprise Value, where Enterprise Value is Market Value of Equity + Long-Term Debt + Debt in Current Liabilities + Preferred Stock – Cash	Loughran and Wellman (JFQA 2011)
Value	Leverage Component of Book to Price	Difference of Book to Price and Enterprise Component of Book to Price, where Book to Price is book value of Equity divided by market value of Equity	Penman, Richardson and Tuna (JAR 2007)
Value	Long-Term Reversal	Buy-and-hold returns from month t-60 to t-12	Werner, De Bondt, and Thaler (JF 1985)
Value	Momentum Reversal	Buy-and-hold returns from month t-18 to t-12	Jegadeesh and Titman (JF 1993)
Value	Sales to Price	Revenue divided by market value of Equity	Barbee, Mukherji and Raines (FAJ 1996)

Legal Notices

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