Construction Rules for Morningstar US Style Indexes

Morningstar Methodology Paper

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Contents

Introduction

Morningstar Indexes were created to provide investors with accurate benchmarks for performance measurement, as well as offering discrete building blocks for portfolio construction. These indexes provide an accurate, comprehensive depiction of the performance and fundamental characteristics of U.S. equity markets. Five key objectives were considered in constructing the Morningstar index family:

1) Transparent and objective rules. Construction of indexes should be governed by a clear and transparent set of well-documented rules for security selection and exclusion, reconstitution, and adjustments for corporate actions.

2) The right balance between comprehensive market coverage and full investability. Indexes should reflect the actual investment opportunities available to active and passive managers. At the same time, they should reflect the overall economic importance of the company—the larger and more liquid the security, the more weight it deserves in the index. The goal is to find the right balance between completeness and investability.

3) A stable, consistent style model that correctly maps stocks in all economic cycles. Any individual stock characteristic, such as earnings, is by its nature more volatile than combinations of characteristics. With our style mappings, we use multiple inputs in order to accurately identify a stock's style. This reduces the volatility of the overall style measure.

4) Non-overlapping and hierarchical. Indexes should include all qualified stocks in the broad market index. There should be no "sampling" or other process whereby some stocks are ignored or their influence reduced. Each stock in the broad market index is included in one and only one of the nine style indexes (therefore each stock also appears in one of the three cap indexes and one of the three composite style indexes). And each stock in the style indexes is also included in the broad market index. The returns and fundamental characteristics of the broad market index are calculated as a simple weighted combination of the returns and characteristics of:

    a. the three composite style indexes, or

    b. the three cap indexes, or

    c. the nine style indexes

5) Minimize index turnover. Indexes incur turnover as they are rebalanced in line their stated methodology, which results in high management costs and difficulty in tracking. We designed the Morningstar indexes to limit unnecessary turnover.

Morningstar Index Characteristics

Structure of Morningstar Index Family

Morningstar index family consists of a comprehensive set of sixteen indexes that target 97% coverage of the U.S. equity markets. The Morningstar index family consists of:

▶ A broad market index: Morningstar US Market Index
▶ Three cap indexes: Large Cap, Mid Cap and Small Cap
▶ Three composite style indexes: US Value, US Core and US Growth
▶ Nine style indexes

This diagram summarizes the Morningstar index family:

US Market		US Value	US Core	US Growth

Large Cap		Large Value	Large Core	Large Growth
Mid Cap		Mid Value	Mid Core	Mid Growth
Small Cap		Small Value	Small Core	Small Growth
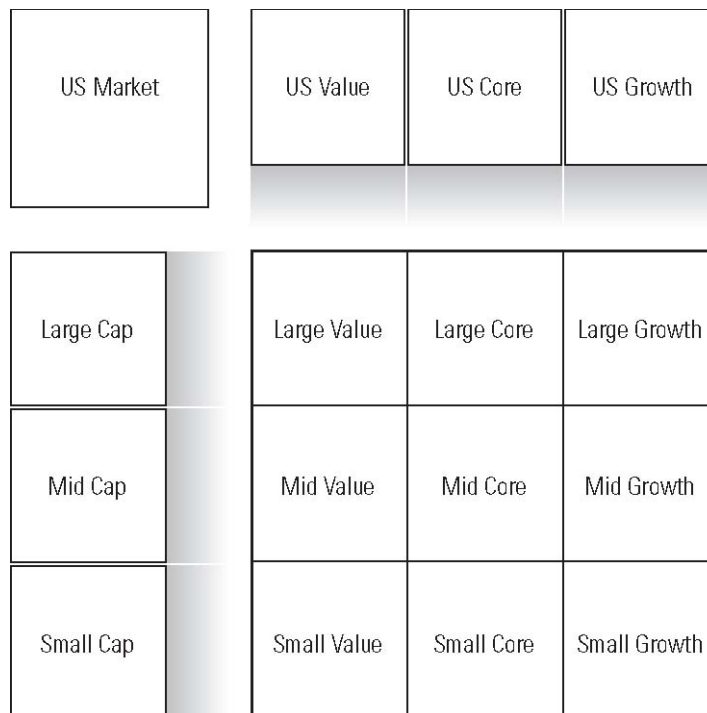
The Morningstar US Market Index is constructed by selecting 97% of the largest stock in the investable universe. The three cap indexes are constructed using the following guidelines:

► The Large Cap Index is constructed by selecting the largest stocks that comprise 70% of market capitalization of the investable universe.

► The Mid Cap Index represents the next largest stocks that comprise 20% of market capitalization of the investable universe.

► The Small Cap Index represents the next largest stocks that comprise 7% of the market capitalization of the investable universe.

Within each of the cap indexes, index constituents are assigned to one of three style indexes:

► The value-oriented index contains those stocks that, within the relevant cap index, have a stronger value orientation than growth orientation.

► The growth-oriented index contains those stocks that, within the relevant cap index, have a stronger growth orientation than value orientation.

► The core index contains those stocks which have value and growth characteristics of similar degree.

Inception Dates and Base Market Values

The inception date of the US Market Index and cap indexes is December 31, 1991. Daily price and total return series are available from this date forward. The base market value of the US Market Index at inception is 1,000.

The inception date of all style indexes is June 30, 1997. Daily price and total return series are available from this date forward. The index base market values at inception are 1,000.

Calculation and Dissemination of Index Values

Price return index values are disseminated electronically at 15-second intervals during regular U.S. trading hours, and daily index highs and lows are based on continuous calculations. Daily and monthly price and total return index values are distributed via various data distribution channels.

Trading Holidays

Morningstar index values are not calculated when U.S. exchanges are closed.

Index Value Currencies

The closing values of all Morningstar indexes are calculated in $US and converted to Yen, Pounds Sterling, Euro, Canadian Dollars, and Australian Dollars using an average of Reuters bid and ask price.

Target Market Coverage

At each reconstitution date, the largest U.S. equities meeting the eligibility criteria, which in aggregate account for approximately 97% of the total capitalization of U.S. equity markets, are identified as US Market Index constituents.

Assigning Stocks to the Morningstar US Market Index

Overview

At each reconstitution date, the investable U.S. market universe and index eligibility are defined based on the criteria described in this section. The investable universe and index eligibility criteria are applied in the sequence in which they appear below. Each criterion is applied only to the "survivors" of the criteria applied previously.

Investable Universe

To qualify for inclusion in the investable universe, a security must meet the following criteria:

1) It must trade on one of the three major exchanges—the NYSE, AMEX, or Nasdaq exchange.

2) The issuing company's country of domicile should be the U.S. or the issuing company's primary stock market activities are carried out in the U.S.

3) Securities that have more than **10** non-trading days in the prior quarter are excluded.

4) The following security types do not qualify:

    a. American Depository Receipts and American Depository Shares

    b. Fixed-dividend shares

    c. Convertible notes, warrants, and rights

    d. Tracking stocks

    e. Limited Partnerships

    f. Select holding companies

Index Eligibility

To qualify for inclusion in the US Market Index, a security must be among the top 75% of the companies in the investable universe based on its liquidity score. A security's liquidity score is the average of its ranks on each of the following measures:

► The average monthly trading volume in $US during the six calendar months immediately prior to reconstitution or, in the case of corporate entities younger than six months, since the security was first issued (partial month periods are prorated by number of trading days in the month)

► The lowest 2 months' total trading volume during the six calendar months immediately prior to reconstitution (the months need not be sequential)

If securities representing more than 97.25% of the capitalization of the investable universe qualify for inclusion in the US Market Index following application of this criterion, the securities with the lowest liquidity scores are removed from the index until 97.25% of the investable universe's total capitalization remains.

Liquidity criterion is waved for corporate takeovers, spin-offs or other corporate actions where the successor entity issues one or more securities that meet the following criteria:
► The new entity qualifies for index membership in either the mid cap or the large cap band
► The new entity's float value is greater than or equal to the smallest **float** in the mid cap band

To qualify for inclusion in the US Market Index, a security must have a known investment style, based on the procedures described in the Style Methodology.

Companies with Multiple Share Classes

For companies with multiple share classes of equity securities, the following general rules apply:
► All trading classes that meet the general eligibility criteria are considered for inclusion
► Use the market capitalization of a company by aggregating all share classes—both trading and non-trading shares—when determining the cap classifications for any class.
► When calculating the cumulative capitalization for the cap band (Large-Mid-Small), use the capitalization of the company only once, irrespective of the number of eligible share classes.
► The weight contribution of a given share class in a given index is based on free float of that particular share class

Assigning Stocks to Capitalization Indexes

Assigning Stocks to Cap Indexes

Each security that meets the general criteria documented immediately above is considered for inclusion in one of three cap indexes: large, mid, small. The size of the security, measured by market capitalization, determines membership in the appropriate cap index.

Assigning Large Cap Index Constituents:
► The stocks in the investable universe that meet eligibility criteria are ordered by market cap size in descending order.
► Selecting by size in descending order, the stocks that, in aggregate, account for 69% of the total market capitalization of the investable universe are assigned to the Large Cap Index.
► Among the stocks that fall between 69% and 70% of the capitalization of the investable universe (the upper end of the large cap/mid cap buffer zone), those that were classified as mid cap or small cap *and* ranked below 70% of the capitalization of the investable universe at the previous reconstitution date are assigned to the Mid Cap Index. The rest are assigned to the Large Cap Index.

Assigning Mid Cap Index Constituents:
► Among the stocks that fall between 70% and 71% of the investable universe (the lower end of the large cap/mid cap buffer zone), those that were classified as large cap *and* ranked within the top 70% of the capitalization of the U.S. equity market at the previous reconstitution date are reassigned to the Large Cap Index. The rest are assigned to the Mid Cap Index.
► Selecting from the remaining stocks by size in descending order, the stocks that fall between 71% and 89.5% of the investable universe are assigned to the Mid Cap Index.
► Among the stocks that fall between 89.5% and 90% of the capitalization of the investable universe (the upper end of the mid cap/small cap buffer zone), those that were classified as small cap *and* ranked below 90% of the capitalization of the investable universe at the previous reconstitution date are reassigned to the Small Cap Index. The rest are assigned to the Mid Cap Index.

Assigning Small Cap Index Constituents:
► Among the stocks that fall between 90% and 90.5% of the investable universe (the lower end of the mid cap/small cap buffer zone), those that were classified as mid cap or large

cap *and* were ranked within the top 90% of the capitalization of the U.S. equity market at the previous reconstitution date are assigned to the Mid Cap Index. The rest are assigned to the Small Cap Index.

► Selecting from the remaining stocks by size in descending order, the stocks that fall between 90.5% and 96.75% of the capitalization of the investable universe are assigned to the Small Cap Index.

► Among the stocks that fall between 96.75% and 97.25% of the capitalization of the investable universe (the small cap/micro cap buffer zone), those that were excluded from the US Market Index *and* ranked lower than 97% of the capitalization of the investable universe at the previous reconstitution date, are excluded from the Small Cap Index. The rest are assigned to the Small Cap Index.

Assigning Stocks to Style Indexes

Assigning Large Cap Stocks to a Style Index
Each index constituent within the Large Cap Index is assigned to the Large Value, the Large Core, or the Large Growth Index. Style assignment is based on the stocks style orientation score and the threshold levels between value and core and core and growth.

Determining a Stock's Style Orientation Score:
Each stock is assigned a value orientation score and a growth orientation score (see Style Methodology section for how stock style scores are calculated); each of these ranges between zero and 100. The net style orientation score is calculated for each stock by subtracting the stock's value orientation score from its growth orientation score. The result can range from 100 (for low-yield, extremely growth-oriented stocks) to–100 (high-yield, low-growth stocks).

Determining the Threshold Levels:
Threshold levels for value, core and growth styles are set so that, the average of each style over time, represents roughly one-third of the investable universe within the capitalization band. Value/core and core/growth threshold values are reset at each reconstitution. The threshold levels are determined based on a target weight for the style index using the following process. Calculate the Large Value Index weight as of the previous reconstitution:

$$IWPR_v = \frac{\sum_{i=1}^{n}\left(floatcap_i\right)}{\sum_{i=1}^{m}\left(floatcap_i\right)}$$

Where:

$IWPR_v$	=	weight of Large Value Index at previous reconstitution
floatcap	=	stock's free float Market Cap
n	=	number of stocks in Large Value Index
m	=	number of stocks in Large Cap Index

Calculate the Large Value Index weight just prior to the current reconstitution. Just prior to reconstitution is defined as the last business day of April and October for the June and December reconstitutions respectively.

$$IWCR_v = \frac{\sum\limits_{i=1}^{n}\left(floatcap_i\right)}{\sum\limits_{i=1}^{m}\left(floatcap_i\right)}$$

Where:

$IWCR_v$	=	weight of Large Value Index just prior to current reconstitution
floatcap	=	free float of company
n	=	number of stocks in Large Value Index
m	=	number of stocks in Large Cap Index

Calculate the target weight for the Large Value Index using the following formula:

$$\overline{X_V}^* = \begin{cases} \overline{X_V}\min, if \overline{X}_v < \overline{X}_v \min \\ \overline{X_V}, if \overline{X_V}\min < \overline{X_V} < \overline{X_V}\max \\ \overline{X_V}\max, if \overline{X_V} > \overline{X_V}\max \end{cases}$$

Where:

X_v	=	[1/3* |WPR$_V$ + 1/3* IWCR$_V$ + 1/3* 33.33]
X_v min	=	30%
X_v max	=	36.67%

Repeat the same process for determining the weight of the Large Growth Index.
The weight of Large Core Style Index is the residual free float market cap, i.e.:

$$\overline{X_C}^* = 100 - \left(\overline{X_V}^* + \overline{X_G}^*\right)$$

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Find value and growth thresholds using the following process:

▶ Rank stocks within the Large Cap Index by their style orientation score in ascending order
▶ Calculate cumulative free float market cap for stocks in the Large Cap Index
▶ The value threshold is equal to the stock's style score where cumulative free float market cap is equal to or just greater than the target weight for the Large Value Index $\left(\overline{X}_V^*\right)$
▶ The growth threshold is equal to the stock's style score where the cumulative free float market cap is equal to or just greater than the target weight for Large Value Index + target weight for Large Core Index $\left(\overline{X}_V^* + \overline{X}_G^*\right)$

Style Assignment and Buffering:
The index constituents within the Large Cap Index are ordered by their style orientation score ("score") in ascending order.

▶ The percentage of total cap index free float represented by stocks with a score less than or equal to the value threshold amount is calculated. This percentage is the "current value threshold," or CVT. The percentage of total cap index free float represented by stocks with a score less than or equal to the growth threshold amount is calculated. This is the "current growth threshold", or CGT.
▶ Selecting by style score in ascending order, the stocks that, in aggregate, account for the CVT-5% of the free float of the cap index are assigned to the Large Value Index.
▶ Selecting by score in ascending order, the stocks that fall between CVT-5% and CVT are either classified as either value or core. Among these, stocks that were classified as large core and fell between the CVT and the CGT or stocks that were classified as large growth at the previous reconstitution date are reassigned to the Large Core Index. The rest are assigned to the Large Value Index.
▶ Selecting by score in ascending order, the stocks that fall between CVT and CVT+5% are classified as either value or core. Among these, stocks that were classified as large value and fell below the CVT at the previous reconstitution date are reassigned to the Large Value Index. The rest are assigned to the Large Core Index.
▶ Selecting by score in ascending order, the stocks that fall between CVT+5% and CGT-5% are assigned to the Large Core Index.
▶ Selecting by score in ascending order, the stocks that fall between CGT-5% and CGT are classified as either core or growth. Among these, stocks that were classified as large growth and fell above the CGT at the previous reconstitution date are reassigned to the Large Growth Index. The rest are assigned to the Large Core Index.
▶ Selecting by score in ascending order, the stocks that fall between CGT and CGT+5% are classified as either core or growth. Among these, stocks that were classified as large core and fell between the CVT and the CGT or stocks that were classified as large value at the previous reconstitution date are reassigned to the Large Core Index. The rest are assigned to the Large Growth Index.
▶ Selecting by score in ascending order, the stocks that fall beyond the CGT+5% are assigned to the Large Growth Index.

Assigning Mid and Small Cap Stocks to a Style Index
The process described above for assigning stocks to large style indexes is also used for mid and small style indexes.

Assigning Stocks to a Composite Style Index
The US Value, US Core, and US Growth Indexes are simple aggregates of the style indexes. For example, the US Value Index comprises all securities from the Large, Mid, and Small Value Indexes.

Adjustment for Corporate Actions

Delisting, Bankruptcy, and Financial Distress:
If the constituent is delisted by its principal exchange, enters bankruptcy proceedings, or is under extreme financial distress, the security is removed from the US Market Index. Exceptions are made on a case by case basis. For example, a security might not be removed immediately when a bankruptcy filing is not a result of operating or financial difficulties.

Change of Principal Exchange:
A security is removed from the US Market Index if its principal exchange ceases to be the NYSE, AMEX, or Nasdaq exchange.

Change of Domicile:
If a company ceases to meet the Company Domicile eligibility rule, the company is removed from US Market Index.

Third-Party Acquisition or Merger:
If the issuing company of one or more US Market Index constituents is acquired by or merges with another company, then the original constituent and the acquirer are replaced by one or more securities of the successor entity. The style and size classification of the successor entity is based on the style and size of the largest of the merged entities, as of the most recent reconstitution date.

Spin-Offs and IPO's:
If a spin-off of an index constituent or an IPO occurs before the last trading day of the first month of a quarter, it is considered for inclusion in the index at the time of the next rebalancing. The new security qualifies for inclusion, if its market cap on the last trading day of the first month of a quarter is at least as large as the smallest stock in the Morningstar Mid Cap Index (as of the last reconstitution) and it has a known investment style.

Loss of Liquidity:
If a constituent accumulates 10 consecutive non-trading days between reconstitution dates, it is removed from the indexes. Two business days' prior notice of its removal is provided.

Index Weighting and Rebalancing

Free Float

The free float is defined as a security's outstanding shares adjusted by block ownership to reflect only truly tradable and investable shares. A security's outstanding shares are adjusted if an entity owns 5% or more of the security through one of the following types of block ownership:

► Cross ownership—shares that are owned by other companies (including banks and life insurance companies)
► Government ownership—shares that are owned by governments (central or municipal) or their agencies
► Private ownership—shares that are owned by individuals or families
► Restricted shares—shares that cannot be traded during a certain time period

However, a security's outstanding shares are not adjusted for institutional investors' holdings, which include, but are not limited to, the following categories:

► Custodian nominees
► Trustee companies
► Mutual funds
► Investment companies
► Pension fund holdings

Constituent Weight Calculation

Each index constituent is weighted according to its free float value, which is the product of free float and the most recent traded price of the security. While free float value is calculated continually for each index constituent, the free float of each potential US Market Index constituent is only calculated at each rebalancing.

Scheduled Reconstitution Dates

The Morningstar indexes are reconstituted—i.e., the index membership is reset—twice annually, on the Monday following the third Friday of June and the third Friday of December. If the Monday is a holiday, reconstitution occurs on the Tuesday immediately following. Reconstitution is carried out after the day's closing index values have been determined.

Scheduled Rebalancing Dates

The Morningstar indexes are rebalanced—i.e. the number of free float shares of each constituent security are adjusted—four times annually. Adjustments are made on the Monday following the third Friday of March, June, September and December. If the Monday is a holiday, rebalancing occurs on the Tuesday immediately following. Rebalancing is carried out after the day's closing index values have been determined. Market data used for rebalancing is from the last trading day of the first month of each quarter. Index constituent float factors and shares outstanding updates are announced at least two business days prior to rebalancing.

Unscheduled Index Rebalancing

In addition to scheduled rebalancing, the Morningstar indexes are rebalanced whenever a constituent's free float changes by 10% or more. However, if one company takes over another and both were index constituents, their shares and free float are adjusted even if the change is less than 10%. Rebalancing is carried out at the close of trading on the day of the event. The Morningstar indexes are not reconstituted when unscheduled rebalancing occurs.

Halted Stocks

If there is a trading halt on an index constituent, the most recent traded price of the constituent is used in calculating index free float value.

Index Calculations

Basic Formula

Both price returns and total returns of each index are calculated using Laspeyres' formula. The only difference is that the divisor D(t) is different for the two indexes:

$$Index(t) = \frac{\sum_{i=1}^{n}(p_{i(t)} * q_{i(t)})}{C(t)\sum_{i=1}^{n}(p_{i(0)} * q_{i(0)})} * BaseIndexValue = (M(t)/B(t)) * BaseIndexValue$$

The above formulas can be simplified as: $Index(t) = \dfrac{M(t)}{D(t)}$

Where:

$D_{(t)}$	=	divisor at time (t)＝B(t)/Base Index Value
N	=	number of stocks in the index
$pi_{(0)}$	=	closing price of stock i at time (t)
$qi_{(0)}$	=	constructed shares of company i at the base date (December 31, 1991)
$pi_{(t)}$	=	price of stock i at time (t)
$qi_{(t)}$	=	constructed shares of company i at time (t)
$C_{(t)}$	=	adjustment factor for the base date market capitalization
T	=	time the index is calculated
$M_{(t)}$	=	market capitalization of the index at time (t)
$B_{(t)}$	=	adjusted base date market capitalization of the index at time (t)

Dividends are reinvested in the index sample of the total return index. Any dividend larger than 10% of the equity price is considered special cash dividend, which requires a divisor adjustment.

Divisor Adjustments

To avoid distortions caused by corporate actions that affect the share capital of index constituents, the divisor of the index is adjusted accordingly.

The following formulae will be used for divisor adjustments due to corporate action. Note: No divisor adjustment are necessary for stock splits, since market capitalization does not change and the share number and share price are adjusted prior to the opening of trading on the split's ex-date.

$$D_{t+1} = D_t * \frac{\sum_{i=1}^{n} (p_{i(t)} * q_{i(t)}) \pm \left[\Delta MC(t+1) \right]}{\sum_{i=1}^{n} (p_{i(t)} * q_{i(t)})}$$

Where:

$D_{(t)}$	=	divisor at time (t)
$D_{(t+1)}$	=	divisor at time (t+1)
$P_{i(t)}$	=	stock price of company i at time (t)
$q_{i(t)}$	=	number of shares of company i at time (t)
$\Delta MC_{(t+1)}$	=	add new components' market capitalization and adjusted market capitalization (calculated with adjusted closing prices and shares effective at time t+1 and/or minus market capitalization of companies to be deleted (calculated with closing prices and shares at time t)

Note: If the current trading price of an issue is unavailable, the previous trading session's closing price is used. However, if the issue is affected by any corporate action that requires an adjustment, then the adjusted price is used.

Intraday Index Data Corrections

Commercially reasonable efforts are made to ensure the correctness of data used in real-time index calculations. If incorrect price or corporate action data affects index daily high or lows, it is corrected retroactively as soon as feasible.

Index-Related Data and Divisor Corrections

Incorrect pricing and corporate action data for individual issues in the database will be corrected upon detection. In addition, an incorrect divisor of an index, if discovered within five days of its occurrence, will always be fixed retroactively on the day it is discovered to prevent an error from being carried forward. Commercially reasonable efforts are made to correct an older error subject to its significance and feasibility.

Computational and Reporting Precision

All calculated and adjusted data are stored in real numbers. For reporting purposes, index values are rounded to two decimal places and divisors are rounded to appropriate decimal places.

The number of shares outstanding in determining the free float or capitalization of a company is the actual number of shares.

Undocumented Events

Any matter arising from undocumented events will be resolved at the discretion of the Morningstar Index Committee.

Determining the Value-Core-Growth Assignment for U.S. Common Stocks

Basic Concepts

A stock's value orientation and growth orientation are separate measures, each of interest to investors. As such, they are estimated using related but separate variables. Once estimated, depending on the purpose, they may be used individually, or they may be combined into a single value-core-growth ("VCG") orientation measure. For instance, style-based index construction requires the use of a single VCG measure for each stock.

VCG orientation is calculated within capitalization classes ("cap bands"). That is, a stock is assigned to a cap band before its VCG orientation is determined. Two stocks that have similar financial ratios and growth prospects but are in different cap bands may be given different VCG assignments.

A high value orientation score (as defined below) indicates that a stock's price is relatively low, given the anticipated per-share earnings, book value, revenues and so forth that the stock provides to investors. A high price relative to these measures indicates that a stock's value orientation is weak, but does not necessarily mean that the stock is growth-oriented.

A high growth orientation score (as defined below) indicates that a stock's per-share earnings, book value, revenues etc. are expected to grow quickly relative to those of other stocks in the same cap band. A weak growth orientation does not necessarily mean that a stock has a strong value orientation.

It follows that an individual stock may have any combination of strong or weak growth and value characteristics. Where one set of characteristics is dominant, the stock can be classified accordingly. Where the stock's growth and value characteristics are similar in strength, the stock will be assigned a "core" VCG orientation.

Terminology and Notation

The following short forms relate to the 10 factors used to determine a stock's VCG score:

e_1/p	=	prospective earnings yield (forecasted earnings per share for the current fiscal year, divided by current price per share)
r_1/p	=	prospective revenue yield
c_1/p	=	prospective cash flow yield
d_1/p	=	prospective dividend yield
b_1/p	=	prospective book value yield
$g'(e)$	=	forecasted growth rate of earnings per share
$g'(c)$	=	forecasted growth rate of cash flow per share
$g'(r)$	=	forecasted growth rate of revenue per share
$g'(b)$	=	forecasted growth rate of book value per share
$g'(e_5)$	=	IBES median long-term earnings growth forecast

The following short forms relate to a company's fundamental data, e.g. earnings per share:

e_1	=	forecasted earnings per share (EPS) for the current fiscal year (the basis for the yield variable defined above). When available, value is provided by IBES.
e_0	=	EPS for most recent fiscal year
e_{-1}	=	EPS for the fiscal year prior to e_0
e_{-2}	=	EPS for the fiscal year prior to e_{-1}
e_{-3}	=	EPS for the fiscal year prior to e_{-2}
e_{-4}	=	EPS for the fiscal year prior to e_{-3}

As needed to determine the stock's VCG score, the same notations are used for cash flow per share, revenue per share, book value per share, and dividends per share except that "c," "r," "b,"or "d," respectively, are substituted for "e" in the example above.

Measuring Stock Value Orientation

Basic Process

A stock's value orientation reflects the price investors are willing to pay for a share of some combination of the stock's prospective earnings, dividends, sales, cash flow, and book value.

Value orientation is determined using the following three steps:

1) Calculate up to five prospective yields (e_1/p, d_1/p, c_1/p, r_1/p, and b_1/p) for each stock. Where possible, third-party forecasts for e_1, d_1, c_1, r_1 and b_1 are used; otherwise they are determined using the process described in the next section.

2) Calculate a float-weighted percentile score for each available yield factor, for each stock, within each cap band (large, mid, and small).

3) Calculate a weighted average of the individual percentile scores for each stock, using the weighting scheme detailed in "Calculating Overall Value Orientation Scores" below. The weighted average score represents the strength of the stock's value orientation.

Details of each of these steps are provided below.

Calculating Prospective Yields

As many as possible of e_1/p, d_1/p, c_1/p, r_1/p, and b_1/p are calculated for each stock. Because p is known, the method used to forecast e_1, d_1, etc. is key.

If a positive third-party forecast of e_1, c_1, r_1, or b_1 is available, it is used to calculate the prospective yield. If e_1, c_1, r_1, or b_1 is forecasted to be negative by a third party, or if e_0, c_0, r_0, or b_0 is negative and no third party forecast is available, prospective yield on that factor is excluded for that stock. If no third-party forecast is available and e_0, c_0, r_0, or b_0 is positive, then forecasted values are calculated as described below (using EPS as an example).

The relationship between prospective and current EPS is straightforward:

[1] $$e_1 = e_0 * \left(1 + g(e_1)\right)$$

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Because e_0 is known, only $g(e_1)$ must be calculated to provide a forecast of e_1. Also, $g(e_1)$ is calculated from historical earnings information.

First calculate as many as possible of four periodic growth rates:

$$[2] \qquad g(e)_{-4} = \left(\frac{e_0}{e_{-4}} \right)^{\frac{1}{4}} - 1$$

$$[3] \qquad g(e)_{-3} = \left(\frac{e_0}{e_{-3}} \right)^{\frac{1}{3}} - 1$$

$$[4] \qquad g(e)_{-2} = \left(\frac{e_0}{e_{-2}} \right)^{\frac{1}{2}} - 1$$

$$[5] \qquad g(e)_{-1} = \left(\frac{e_0}{e_{-1}} \right) - 1$$

Where e_{-1}, e_{-2}, e_{-3}, or e_{-4} is negative, no growth rate is calculated using that data point. Availability for restated cash flow is limited to three years.

When as many as possible of the growth rates defined above have been calculated, average the results:

$$[6] \qquad g(e)_{-1} = \text{Average} \big[g(e)_{-4}, g(e)_{-3}, g(e)_{-2}, g(e)_{-1} \big]$$

Thus:
► Estimated earnings growth $g(e_1)$ and forecasted earnings (e_1) are calculated only for stocks where e_0 is a positive number.
► In calculating $g(e_1)$, recent growth rates are include in more of the averaged terms than are older growth rates; recent growth rates are therefore weighted more heavily than are older growth rates.

If third-party forecasts are unavailable, e_1/p, c_1/p, r_1/p, and b_1/p are calculated in the same way.

The prospective dividend is determined based on the stock's most recent dividend and published frequency:

$$d_1 = d_0 * f_0$$

If d_1/p is the only available forecasted yield figure, the stock is not given a VCG assignment.

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Calculating Percentile Scores for Each Value Factor

When one or more of e_1/p, d_1/p, c_1/p, r_1/p, and b_1/p values have been calculated, with or without d_1/p, each stock is assigned a float-weighted percentile score for each relevant factor. The percentile scores are calculated within the stock's cap.

Prospective earnings yield scores for large capitalization stocks are used in the following example.

To calculate an earnings yield score for each stock in the large cap:
► Order all stocks in the large cap by their e_1/p scores.
► Calculate the float-weighted trimmed mean e_1/p for all stocks in the large cap band— where the upper and lower 5% of the float is trimmed before the average is calculated. When a stock "straddles" the 5th percentile point or 95th percentile point, remove it from the investable universe.
► Calculate the ratio of each stock's e_1/p to the trimmed mean e_1/p for the large cap.
► Assign each stock to an e/p "bucket" as follows:
   1) If the stock's e_1/p is equal to or less than 0.75 times the trimmed mean e_1/p ("the lower value cutoff"), the stock is assigned to the low e/p bucket; or
   2) if the stock's e_1/p is equal to or less than the trimmed mean e_1/p, the stock is assigned to the mid-minus e/p bucket; or
   3) if the stock's e_1/p is equal to or less than 1.25 ("the upper value cutoff") times the trimmed mean e_i/p, the stock is assigned to the mid-plus e_1/p bucket; or
   4) the stock is assigned to the high e/p bucket.

When each stock has been assigned to an e/p bucket, it is then scaled relative to other stocks in the same bucket. The low e/p bucket is used as an example here:

► Order the stocks within the low e/p bucket by their raw e_1/p scores, from lowest to highest.
► Within the low e/p bucket, assign each stock a value equal to the cumulative float represented by that stock and all stocks with a lower e_1/p. Thus, the stocks in the low e/p bucket have values ranging from 0.00+ (the stock with the lowest e_1/p in the low e/p bucket) to 100 (the stock with the highest e_1/p in the low e/p bucket).
► Where two or more stocks have the same e_1/p, they are assigned a value that represents the cumulative float of all stocks with a lower e_1/p plus one half of the total float of the stocks that share the same e_1/p.
► Rescale the scores in the low e/p bucket to final values between 0.00+ and 33.33. Note: In the case of dividends, zero is considered a valid data point. If d_0 is zero, then d_1 is set to zero.

Repeat the four steps immediately above for each of the mid-minus, mid-plus, and high e/p buckets; and rescale the values as follows:

Bucket	Minimum Score	Maximum Score
Low e/p	0.00+	33.33
Mid-minus e/p	33.34	50.00
Mid-plus e/p	50.01	66.66
High e/p	66.67	100.00

All of the steps in this section are then repeated for each of c_1/p, r_1/p, and b_1/p and d_1/p.

Calculating Overall Value Orientation Scores
When the steps above are complete for each of the five value factors, a weighted average is calculated for each stock. In calculating the weighted average, e/p scores, if available, are assigned a weight of 50%; each of the other value factors is assigned an equal share of the remaining weight (either 50% or, if e/p is unavailable, 100%). The weighted average result is the stock's overall value orientation score.

Measuring Stock Growth Orientation

Basic Process

A stock's growth orientation reflects the rates at which its earnings, sales, cash flow and book value are expected to grow. Forecasted dividend growth rates are not used in determining stock growth orientation.

Determining a stock's growth orientation comprises three steps:

1) For each stock, calculate as many as possible of the four average growth rates $g'(e)$, $g'(c)$, $g'(r)$, and $g'(b)$ using the process described in the next section.

2) Calculate a float -weighted percentile score for each calculated growth rate, for each stock, within each band (large, mid and small), and a float-weighted percentile score for $g(e_5)$, if this is available from a third-party source.

3) Calculate a weighted average of the individual growth rate percentile scores for each stock, using the weighting scheme detailed in "Calculating Overall Growth Orientation Scores" below.

The weighted average score calculated in step 3 above represents the strength of the stock's growth orientation.

Calculating Stock Growth Scores

As many as possible of $g'(e)$, $g'(c)$, $g'(r)$, and $g'(b)$ are calculated for each stock. In addition, if $g(e_5)$ is available from a third party, it is used as a fifth growth rate indicator. The example growth rate calculation below uses $g'(e)$, but the process is identical for $g'(c)$, $g'(r)$, and $g'(b)$.

If e_0 and e_{-1} are negative, then $g'(e)$ is not calculated. If e_0 or e_{-1} is positive, then $g'(e)$ is calculated as follows:

First calculate as many as possible of five periodic growth rates:

$$[1] \qquad g'(e)_{-4} = \left(\frac{e_n}{e_{-4}} \right)^{\frac{1}{n+4}} - 1$$

$$[2] \qquad g'(e)_{-3} = \left(\frac{e_n}{e_{-3}} \right)^{\frac{1}{n+3}} - 1$$

$$[3] \qquad g'(e)_{-2} = \left(\frac{e_n}{e_{-2}} \right)^{\frac{1}{n+2}} - 1$$

$$[4] \qquad g'(e)_{-1} = \left(\frac{e_n}{e_{-1}} \right)^{\frac{1}{n+1}} - 1$$

$$[5] \qquad g'(e)_{0} = \left(\frac{e_n}{e_{0}} \right)^{\frac{1}{n}} - 1$$

Where:

n	=	Latest period (0 or -1) in which EPS is positive

If e_0, e_{-1}, e_{-2}, e_{-3}, or e_{-4} is negative, no growth rate is calculated using that data point. If $n=0$, up to four rates are calculated and if $n=-1$, up to three growth rates are calculated.

When all available growth rates defined above have been calculated, average the results:

$$[6] \qquad g'(e) = \text{Average}\big[g'(e)_{-4}, g'(e)_{-3}, g'(e)_{-2}, g'(e)_{-1} \big]$$

Revenue, cash flow, and book value growth rates are calculated in the same way.

If growth information for at least one factor, spanning at least two separate growth periods, is unavailable for a given stock, the stock is not given a VCG assignment.

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Calculating Percentile Scores for Each Growth Factor
As with value orientation factors, the growth orientation factor scores for each stock are next translated into rescaled percentile scores. The percentile scores are calculated within the stock's cap band.

Prospective earnings growth rate scores for large cap stocks are used in the following example.

To calculate a prospective earnings growth rate score for each stock in the large cap band:
► Order all stocks in the large cap band by their growth rate $g'(e)$ scores.
► Calculate the float-weighted trimmed mean growth rate $g'(e)$ for all stocks in the large cap band—where the upper and lower 5% of float is trimmed, before the average is calculated.
► Calculate the ratio of each stock's $g'(e)$ to the trimmed mean $g'(e)$ for the large cap band.
► Assign each stock to a $g'(e)$ "bucket" as follows:
   1) If the stock's $g'(e)$ is equal to or less that 0.75 times the trimmed mean $g'(e)$ ("the lower growth cutoff"), the stock is assigned to the low $g'(e)$ bucket; or
   2) if the stock's $g'(e)$ is equal to or less than the trimmed mean $g'(e)$, the stock is assigned to the mid-minus $g'(e)$ bucket; or
   3) if the stock's $g'(e)$ is equal to or less than 1.25 times the trimmed mean $g'(e)$ ("the upper growth cutoff"), the stock is assigned to the mid-plus bucket; or
   4) the stock is assigned to the high $g'(e)$ bucket.

When each stock has been assigned to a $g'(e)$ bucket, it is then scaled relative to other stocks in the same bucket. The low $g'(e)$ bucket is used as an example here:
► Order the stocks within each bucket by raw $g'(e)$ score, from lowest to highest.
► Within the low $g'(e)$ bucket, assign each stock a value equal to the cumulative float represented by that stock and all stocks with a lower $g'(e)$. Thus, the stocks in the low $g'(e)$ bucket have values ranging from 0.00+ (the stock with the lowest $g'(e)$ in the low $g'(e)$ bucket) to 100 (the stock with the highest $g'(e)$ in the low $g'(e)$ bucket).
► Where two or more stocks have the same $g'(e)$, they are assigned a value that represents the cumulative float of all stocks with a lower $g'(e)$, plus one half of the total float of the stocks that share the same $g'(e)$.
► Rescale the scores in the low $g'(e)$ bucket to final values between 0.00+ and 33.33.

Repeat the four steps immediately above for each of the mid-minus, mid-plus, and high g'(e) buckets, but rescale the values as follows:

Bucket	Minimum Score	Maximum Score
Low g'(e)	0.00+	33.33
Mid-minus g'(e)	33.34	50.00
Mid-plus g'(e)	50.01	66.66
High g'(e)	66.67	100.00

All of the steps in this section are then repeated for each of the other four growth orientation factors, including $g(e_5)$.

Calculating Overall Growth Orientation Scores
When the steps above are completed for each of the five growth orientation factors, a weighted average is calculated for each stock. In calculating the weighted average, $g(e_5)$ scores, if available, are assigned a weight of 50%; each of the other growth factors is assigned an equal share of the remaining weight (either 50% or, if $g(e_5)$ is unavailable, 100%). The weighted average result is the stock's overall growth orientation score.

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