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Collared Weighting: A Hybrid Approach to Indexing

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Introduction

The indexing community has long extolled the virtues of weighting index holdings according to their market capitalizations. Cap-weighted portfolios have the benefit of being macroconsistent, fully scalable, self-rebalancing, and low turnover, and low cost.[1] For these reasons, cap weighting has traditionally been recognized as the central organizing principle of good index construction.

Cap weighting is not without flaw, however. Unfortunately, cap weighting's reliance on market price results in maximum exposure to the most overheated parts of the market at the worst possible times (think energy in 1979, Japan in 1989, technology in 1999). As such, cap weighting, while ideal in theory, has not always led to a positive investor experience in practice.

As a result, some indexing proponents lately have eschewed the notion of cap weighting and are instead embracing fundamental indexation, where holdings are weighted not by market cap but by other fundamental measures of size, such as revenue, book value, dividends, and so forth (see Arnott, Hsu, Moore [2005]). Actually, the concepts behind fundamental indexation are not new: Many international indexes have traditionally based country weightings on GDP rather than market cap, and the notion of measuring company size using fundamentals was introduced by scholars years ago (see Berk [1995] and Grabowski and King [1996]). But while fundamental weighting addresses some of the valuation problems associated with cap weighting, it has shortcomings of its own. Namely, most fundamental weighting systems introduce value and small cap biases as well as higher turnover, higher costs, limited scalability and macro-inconsistency.

In this paper, we introduce a new methodology called collared weighting, which seeks to marry the market-cap and fundamental weighting concepts, preserving some of the benefits of each while minimizing some of the disadvantages. Essentially, a collared weighting scheme weights according to market cap, unless market caps deviate significantly relative to fundamentals. When market

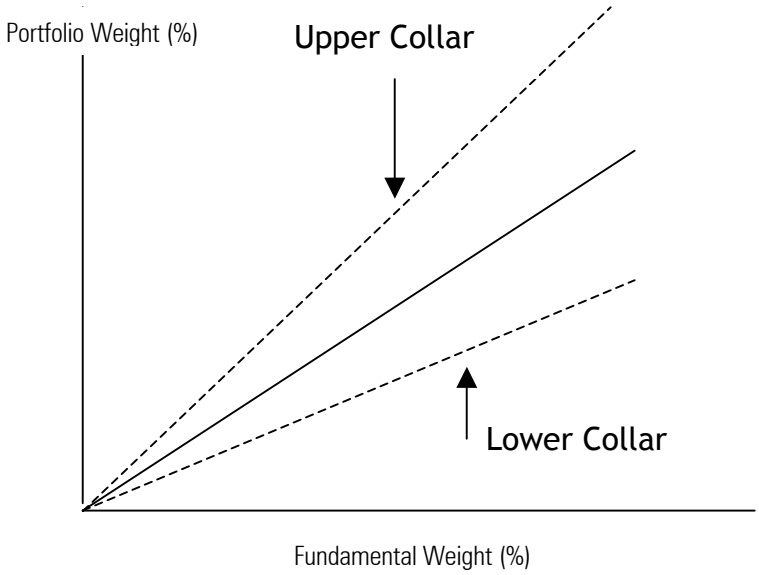
1 For a portfolio to be fully scalable means that it can be implemented at any level of assets. For a portfolio to be macroconsistent means that if all investors held it, all available shares of its constituent stocks would be held with none left over. Only a macroconsistent portfolio is fully scalable and only a float-adjusted market-cap weighted portfolio is completely macroconsistent. See Siegel [2003] for a discussion of these properties of market-cap weighted portfolios.

weights are out of line – due to mispricing in grossly overvalued or undervalued segments of the market – collared weighting reins them back in by linking them to fundamental weights. It is our belief that this new combined weighting philosophy can be better than the sum of its parts.

Collared Weighting Methodology

In collared weighting, the first step is to calculate a fundamental-based weight for each stock in an index. The next step is to establish bands around those fundamental weights that will serve as limits, or collars, for the securities in the portfolio. To determine these collars, the fundamental weights are multiplied by collar multipliers, such as 0.5 for the lower collar and 2.0 for the upper collar. These collars then prevent the portfolio weight of any given stock from varying too much relative to the fundamental weight, as illustrated in Figure 1.

Figure 1:



When establishing weights for the index, any security whose market-cap weighting falls within the collars retains its market weighting in the portfolio. A stock with a market weight that falls outside the collar, however, will be reassigned the collar weight. (Collar multipliers are then adjusted so that the new weights sum to 100%; see Appendix A for a full mathematical explanation.) Hence, some stocks within a collar-weighted portfolio are at market weights while others are weighted in proportion to their fundamentals.

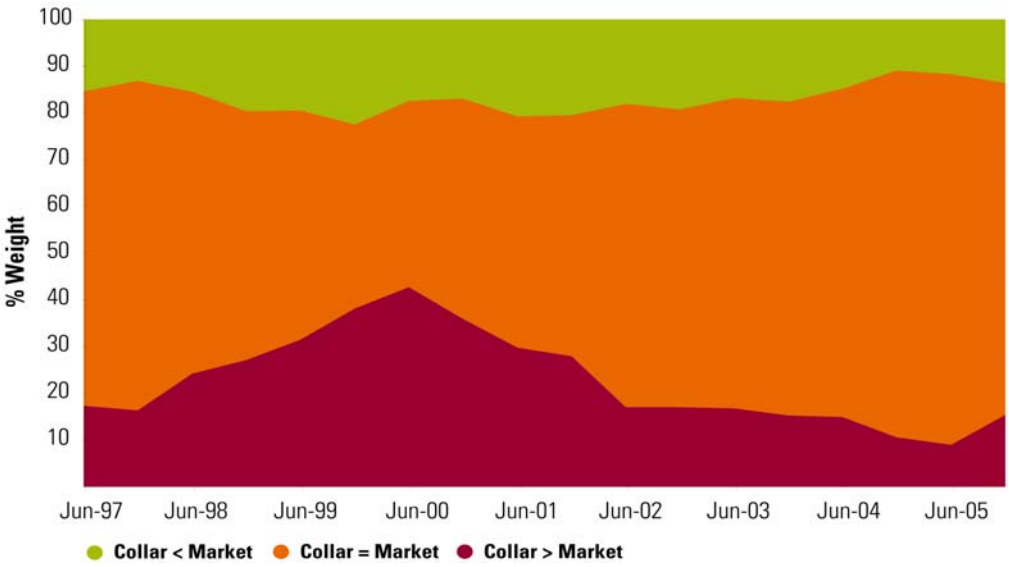
Data

For the purposes of this paper, we constructed a fundamental and a collar-weighted version of the Morningstar US Market Index using the fundamental factors described in Appendix B. The Morningstar US Market Index is a float-adjusted market-cap weighted index that represents 97% of the market-cap of the US equity market. (See Phillips and Kaplan [2003] for details.) For the collar-weighted index, we used collar multipliers of 0.5 and 2.0. The market-weighted index, the fundamental index, and the collar-weighted index are all rebalanced quarterly and reconstituted semiannually. We formed the back history of the monthly total returns and constituents of three indexes over the period July 1997 – December 2005.

Impact of Collaring

Under normal market conditions, one would expect the majority of assets in a collar-weighted portfolio to be weighted according to market capitalization. In 2004 and 2005, for example, roughly three fourths of the assets in the collar-weighted Morningstar US Market Index retained their market weights. A look at the historical data shown in Figure 2, however, reveals some notable exceptions.

Figure 2: Impact of Collaring on the Morningstar US Market Index



In June 1997, the beginning of the measured period, 67% of the index's assets were market weighted, with the remaining 33% of assets on either extreme using the adjusted collar weights. However, as the technology bubble grew and valuations surged throughout the late 1990s, more and more securities adopted their collared weights. By late 1999, only 39% of the portfolio was governed by market weights. When the market collapsed and valuations moderated, market weighting became more dominant once again as the collars became less necessary.

The picture is similar with regard to sector weightings. As Figure 3 shows, the technology-oriented sector weightings in the cap-weighted index spiked as tech valuations rose, resulting in a very tech-heavy portfolio at the top of the cycle. By contrast, as Figure 4 shows, the collar-weighted portfolio's sector weightings remained more constant, leaving the portfolio less vulnerable in the tech correction.

Figure 3: Sector Distribution Using Market Weighting

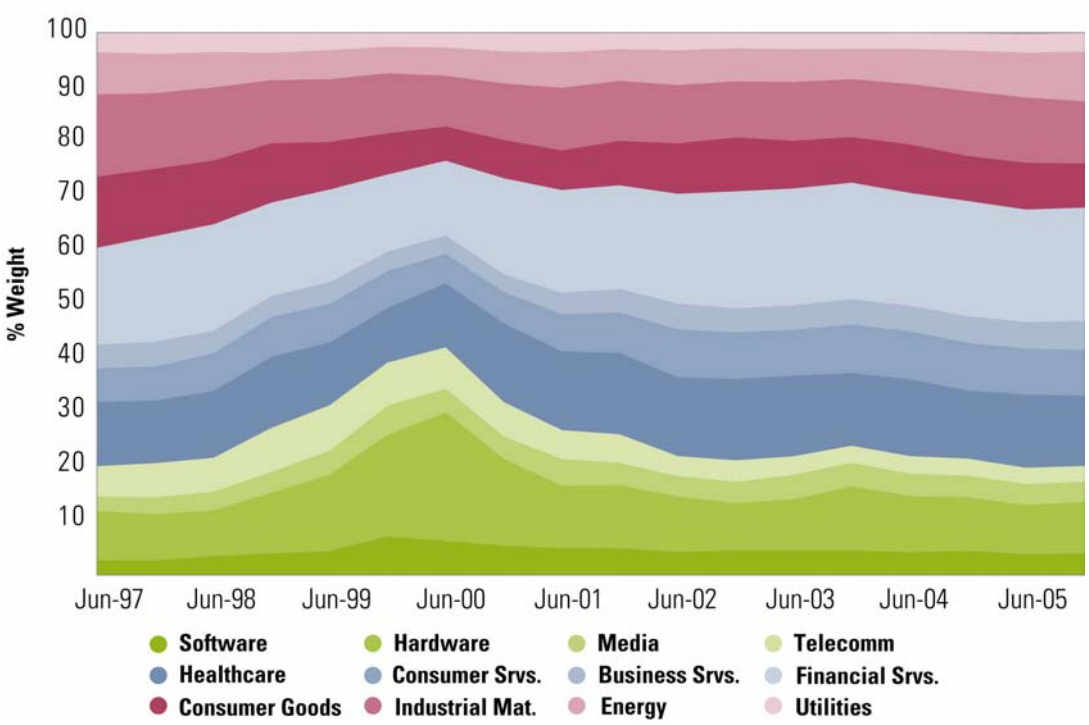
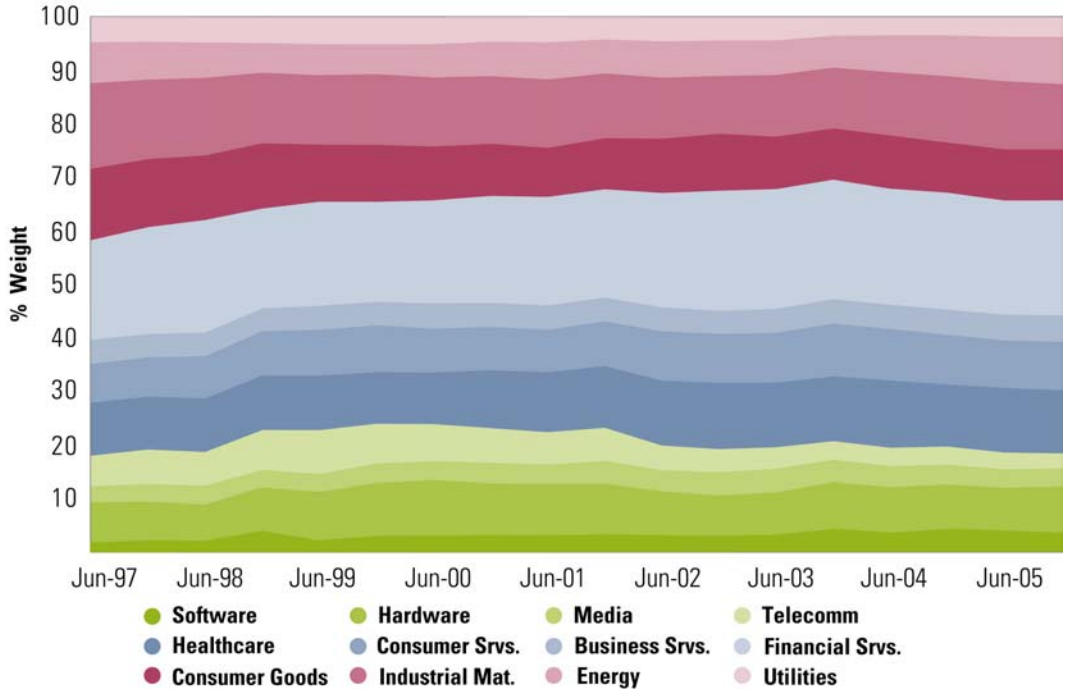


Figure 4: Sector Distribution Using Collared Weighting



Performance

Figure 5 shows the growth of $1 invested on June 30, 1997 in each of the three indexes and Table 1 presents summary performance data.

Figure 5: Performance (Growth of $1 in Each Index)

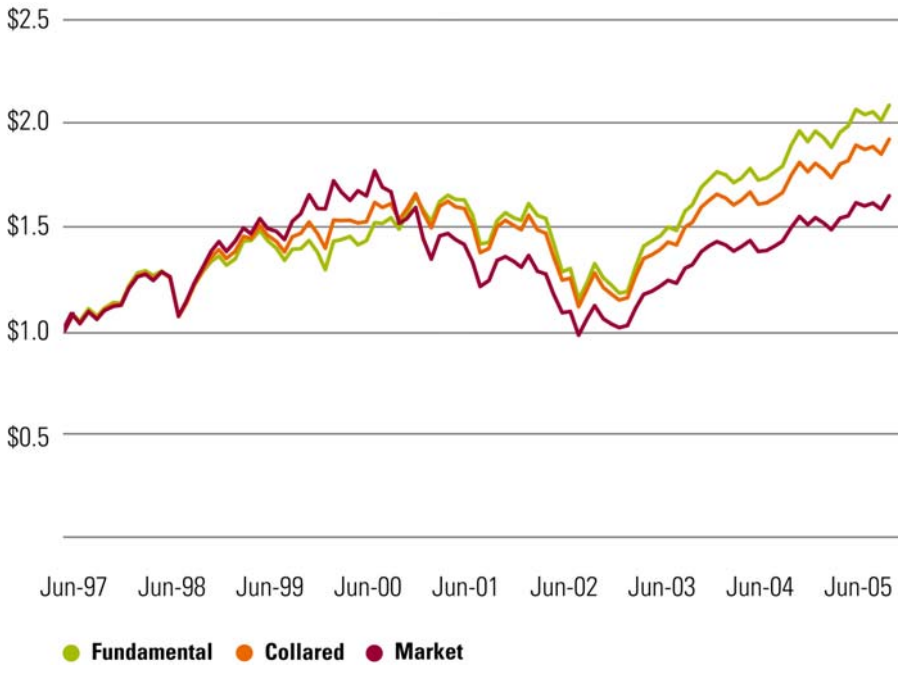


Table 1: Summary Statistics for the Three Indexes: July 1997 – December 2005

	Total Return (%)	Standard Deviation
Market	6.08	17.43
Collared	8.01	16.76
Fundamental	9.07	17.11

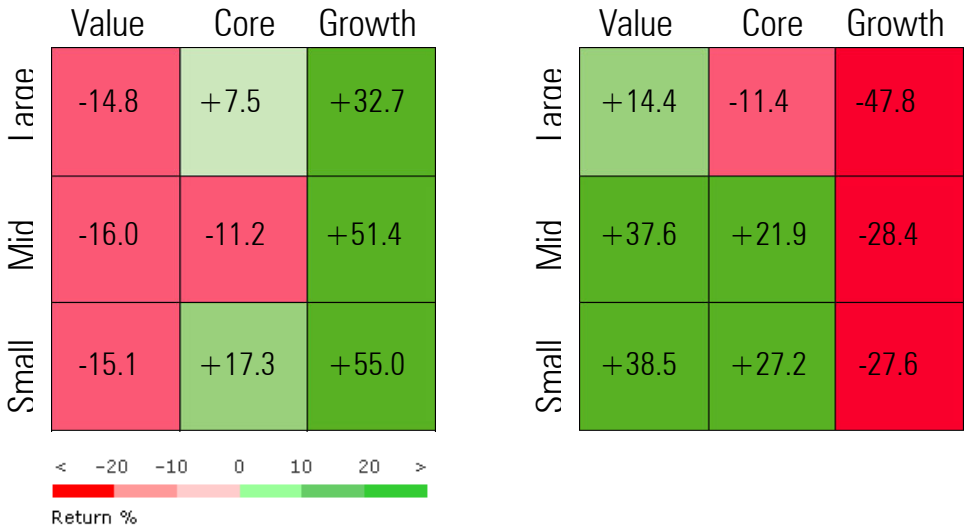
During the period measured, fundamental weighting produced the highest total returns, followed by collared weighting and then market-cap. This can be attributed largely to the value bias inherent in the fundamental scheme as value stocks handily outperformed growth stocks during the period. The effects of this value bias can be seen more clearly in the 12-month returns shown in Table 2.

Table 2: Morningstar US Market Index Performance Comparison (Total Return %)

12 Months Ending June 30	Market (%)	Collared (%)	Fundamental (%)
1998	28.20	28.09	28.61
1999	20.08	17.64	15.26
2000	8.77	0.79	-4.71
2001	-14.15	5.11	15.50
2002	-18.16	-14.94	-12.66
2003	1.06	0.52	0.45
2004	20.57	22.17	24.45
2005	8.31	9.13	11.54

The largest performance discrepancies among the various weighting schemes occurred between 1999 and 2001. In the 12 months ending June 2000, the cap-weighted index gained 8.77% while fundamental fell -4.71%. This stems from a steep decline in the value stocks favored by the fundamental weighting methodology, as illustrated in the Morningstar Market Barometer graphics shown in Figure 6. (The Market Barometers show total returns for the Morningstar Style Indexes described by Phillips and Kaplan [2003]. See Morningstar [2005] for details.)

Figure 6: Morningstar Market Barometers



July 1999 – June 2000

Market	8.8 %
Collared	0.8
Fundamental	-4.7

July 2000 – June 2001

Market	-14.2 %
Collared	5.1
Fundamental	15.5

In the following 12 months ending June 2001, value stocks rebounded while growth stocks plummeted. This allowed the fundamental portfolio to post a strong 15.5% gain, compared with a 14.15% slide for the market-weighted portfolio, which by definition is heavily weighted in the market's largest, most expensive stocks. In both periods, the collared weighting system produced moderate results that landed in between the extremes of the market and fundamental portfolios.

The performance-moderating effect of the collared weighting system is also evident in the standard deviation data. During the time period examined, collared weighting produced a standard deviation of 16.76, compared with 17.11 for fundamental and 17.43 for market cap.

Turnover and Impact Costs

To study the effects of the various weighting schemes on turnover and costs, we partnered with Quantitative Services Group (QSG)[2] to simulate the costs of reconstituting and rebalancing each of the three indexes, assuming that each begins with $10 billion on June 30, 1997. Every six months, we add enough money to each portfolio to pay for the impact costs of the trades required for portfolio maintenance, as computed by QSG. These impact costs account for the price movements that occur when securities are bought or sold, but do not include any fees or taxes associated with trading. The resulting average annual turnover and after-cost total returns are shown in Table 3.

Table 3: Summary Statistics for the Three Indexes: July 1997 – December 2005

	Total Return Before Costs	Total Return After Costs	Annual Cost Forfeiture	Annual Turnover
Market	6.08	5.65	0.43	7.08
Collared	8.01	7.19	0.82	19.98
Fundamental	9.07	7.81	1.26	28.44

As expected, the self-rebalancing cap-weighted portfolio had the lowest turnover, 7.08% over the 1997 – 2005 time frame. The fundamental weighting scheme had the highest turnover, 28.44%, while the collared weighting scheme again posted moderate results, with turnover of 19.98%. After-cost returns corresponded to the turnover data, with the cap-weighted portfolio forfeiting 41 basis points on an annualized basis to costs, compared with 126 basis points for the fundamental portfolio and 82 basis points for the collared portfolio.

These cost differences may not be as pronounced going forward, since trading costs have been declining in recent years. Nonetheless, the pattern of fundamental weighting being the most

2 QSG is an independently owned consulting firm and a leading provider of sophisticated equity analytics. QSG's products include Pre-Trade Analyst (R), T-Cost Pro(R) and T-Cost Analyst(R) Trading Services, Factor Analyst(R), Virtual Research Analyst(R), as well as Quant Manager Sentinel(R). The details of QSG's client relationships are kept strictly confidential. QSG maintains an independent ownership structure to avoid conflicts of interest and limits access to many of its most desirable product offerings. For more information, visit http://www.qsg.com.

expensive, market weighting being the least expensive and collared weighting falling in the middle, has continued each year even as overall costs have declined.

Conclusion

Our results suggest that collared weighting can bridge the gap between market-cap and fundamental weighting. On the one hand, collared weighting can help investors avoid the exaggerated stakes in overvalued growth stocks that can occur with market-cap weighting, thereby tempering volatility. At the same time, collared weighting moderates the value bias, higher turnover and higher cost associated with fundamental weighting. By keeping volatility, turnover and costs in check, collared weighting should result in a better indexing experience for investors.

Appendix A: The Mathematics of Collar Weighting

Let

N = the number of stocks in the index

x_i = the market weight of stock i, $\sum_{i=1}^{N} x_i = 1$

w_i = the fundamental weight stock i, $\sum_{i=1}^{N} w_i = 1$

L = the lower bound on the ratio of a stock's collar weight to its fundamental weight

U = the upper bound on the ratio of a stock's collar weight to its fundamental weight

$z_i(L,U)$ = the collar weight of stock i for given values of L and U as defined in equation (.1) below

$Z(L,U)$ = the sum of the collar weights given values of L and U

We have

$$z_i(L,U) = \begin{cases} Lw_i, & \text{if } x_i < Lw_i \\ x_i, & \text{if } Lw_i \le x_i \le Uw_i \\ Uw_i & \text{if } x_i > Uw_i \end{cases} \qquad (.1)$$

and

$$Z(L,U) = \sum_{j=1}^{N} z_i(L,U) \qquad (.2)$$

We need for

$$Z(L,U) = 1 \qquad (.3)$$

Let

L_0 = proposed value for L

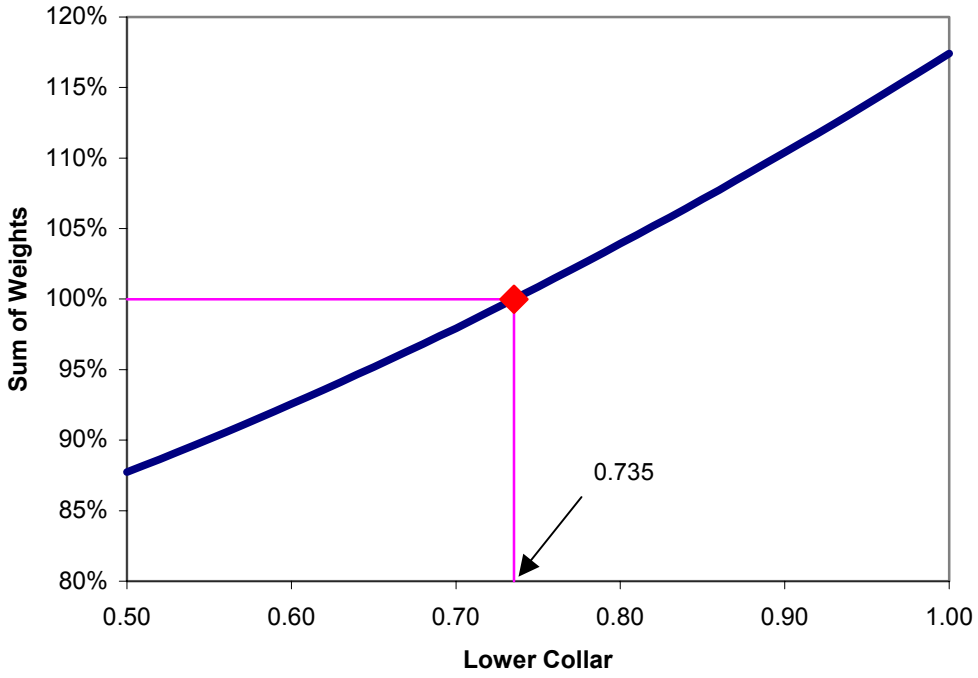
U_0 = proposed value for U

We select a value for $U_0 > 1$ and set

$$L_0 = \frac{1}{U_0} \qquad (.4)$$

If $Z(L_0,U_0)<1$, we set $U=U_0$ and solve equation (.3) for L. If $Z(L_0,U_0)>1$, we set $L=L_0$ and solve equation (.3) for U. In either case, we solve equation (.3) using the bisection method described in Gerald and Wheatley [2003]. For example, at the June 2000 reconstitution our collared version of the Morningstar Index, $Z(0.5,2) = 0.877$. Hence we fix $U=2$, but need to find the value of L such that $Z(L,2) = 1$. Figure A.1 plots Z(L,2) for value of L between 0.5 and 1.0. Since $Z(0.735,2) = 1$, we set $L = 0.735$.

Figure A.1: Plot of Z(L,2) for the June 2000 Reconstitution



Appendix B: Fundamental Measures of Company Size

We use the following three measures of size to form the weights for the fundamental indexes:

- Annual Revenue

- Expected Available Invested Capital (EAIC)

  The total book value of the company (equity plus debt) times one plus the return on invested capital. We constructed this variable as a forecast of the future book value of the company.

- Indicated Dividends

  The most recent total dividend distribution to shareholders (dividends per share times number of shares outstanding) times the annual frequency of dividend payments (typically four times per year

We use EAIC rather than book value so that the fundamental weights have a forward-looking component and are not solely a reflection on the past year. Similarly, we use indicated dividends rather than the past year of dividends to provide a more forward-looking measure of dividend payout. These are refinements of the fundamental size measures used in other studies. Any similar set of fundamental size measures should produce similar results.

While we can obtain annual revenue for all stocks in our indexes, we cannot calculate EAIC for all stocks. Also, not all stocks pay dividends. To include stocks that do not have values of EAIC or did not pay a dividend, at each reconstitution we divide the stocks into portfolios based on which variables are available and equally weight the weights derived from the available variables within each portfolio. We then take a revenue weighted average of the resulting portfolios to form the overall portfolio.

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