

Parametric Portfolio Associates

Research Brief

Cap-Weighted Indexing Revisited: Indexing is Not a Momentum Play

1. Introduction

The subject of cap-weighted indexing still appears to be misunderstood by many journalists and active portfolio managers. It is often argued, for example, that indexing is a momentum strategy, a large cap strategy, or even a style of investing that is sometimes in fashion and sometimes out of fashion. These arguments are misleading.

We want to counter these arguments with a careful, non-standard definition of cap-weighted indexing. This definition, which is equivalent to standard definitions, distinguishes between the amount of the company being purchased and the amount of money that this purchase costs. This distinction clarifies the subject, and enables us to make our arguments very simply.

In Section 2, we introduce our definition and relate it to the more standard one. We present a simple two-stock example in Section 3. In Section 4 we address directly the topics of momentum, size and style, and show that a suitably defined index is neutral with respect to these factors. Finally, in Section 5 we address other aspects of indexing, and discuss why the cap-weighted index is an important benchmark that investors should take seriously.

2. The Basics

Let us begin by clarifying a few points. An index defines a set of securities and specifies how they are to be weighted. We will refer here only to cap-weighted indexes (e.g., S&P500 or RU3000). For simplicity's sake, we will think of the constituents of the index as being static: no new companies are born, no defunct companies disappear, and there are no confusing corporate actions or takeovers. This simplification makes our arguments easier, but does not alter the main points and conclusions.

For a cap-weighted index, we want to focus on diversification without emphasizing prices. We introduce the following definition:

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Definition 1

**The indexing investor buys a fixed fraction f of each company in the index.
The fraction f bought of each company is the value of the investment divided by the total market capitalization.**

For example, if the market size is \$17 trillion and the Seattle Billionaires' Club had \$17 billion to invest they would direct their portfolio manager to buy $f = 1/1000$ or .1% of each stock in the index. They would buy $f = .1\%$ of Microsoft as well as .1% of General Motors, etc. Similarly, if they had \$17 million they would buy $f = .001\%$ of each company. With \$17,000 I am able to own .0000001% of each company.

It is important to note that Definition 1 does not directly specify the weights of each company in the investor's portfolio. Our definition is not the same as spending the same money on or having the same portfolio weight in, each company -- this would be an "equal-weighted" portfolio.

Our definition differs from the more common one:

Definition 2

The indexing investor buys each company in the index, and weights the investments in his portfolio to match their capitalization weights in the index.

Definitions 1 and 2 are mathematically equivalent (see the Appendix for a proof). In both, for example, the amount spent on a large cap company is more than that spent on a small cap company; in both, the investor owns the same fraction f of each company.

The result of a decision to buy an identical fraction of each company is a capitalization weighted portfolio. For example, if Microsoft has a market capitalization of \$400 billion and General Motors of \$100 billion, the portfolio dollar value in Microsoft would be four times that of General Motors.

By focusing on Definition 1, we are able to make certain properties of the index more transparent. In particular, we have the following key observation. *In an indexed portfolio, the fraction f of each company owned remains the same until the amount of money invested changes.* The fraction f does not depend on the stock-specific characteristics of any individual security. It does not depend on their style, on the level of the market nor on how prices move relative to one another; it does not depend on where previous prices have been nor where they are headed.

It is important to clarify a common error. Our definitions relate to the notion of cap-weighted indexing in general. There are numerous specific examples of cap-weighted indexing, e.g. indexing to the S&P500 or to the RU3000. The points we make about indexing apply to these examples, as long as we keep in mind two qualifications:

- a) Our comments apply to the set of securities included in the specific index, and not to securities excluded.
- b) Our comments hold as long as the constituents of the index remain unchanged.

3. Numerical Example

Think of a simple market in which there are two securities, Microsoft and GM, each with cap size \$1M. Suppose that I want to index with an investment of \$10,000. This means I buy the same

fraction f of each company, i.e. $f = \$10,000 / \$2M = .5\%$ of each, which will cost me \$10,000. Now suppose that, by time 2, Microsoft grows to a cap size of \$2M and GM remains at the same \$1M. The market cap is now \$3M. My investment will have increased in value to \$15,000, and 2/3 of my portfolio value will be in Microsoft and 1/3 in GM.

Now consider a second investor, my mother-in-law, at time 2. She too has \$10,000 to index, and did not take my advice at time 1. She will now buy a fraction $f = \$10,000 / \$3M = 1/3\%$ of each company; i.e., she will build a portfolio proportionally like mine, with \$6,667 in Microsoft and \$3,333 in GM. Because Microsoft has increased in price, she has to pay more for it than I did. She is spending more on Microsoft because it is more expensive, but she is not buying more of it. In fact, compared to my investment at time 1, when I was able to buy .5% of Microsoft, she is only able to buy .33%.

This example illustrates a number of general principles. By time 2, prices will have moved, both on the average and relative to one another. With an indexed portfolio at the start, I still have an indexed portfolio at the end. I have more money in the larger-cap companies than in smaller cap companies. However, I still own the same fraction f of each.

4. On Momentum, Size and Style

In thinking about portfolio biases, for example those to momentum, size and style, we need to be clear about what we mean. A bias must be *relative* to something, and the following are the two typical references points:

- Relative to a past average
- Relative to the market as a whole.

It is useful to think of any portfolio as taking two bets: by being in the asset class it is incurring a bias of the *market* relative to the past, and by stepping away from the market average it is incurring a bias relative to the market. By investing in a stock-market portfolio, you are implicitly accepting any biases in the market; if you do not want to accept these you should make your investments elsewhere. Once you have decided to invest in the stock market, you can talk of the bias in your portfolio relative to the market.

Is there a momentum bias to indexing?

The argument that investing in a cap-weighted index is an implicit momentum play goes as follows:

Momentum Argument:

When you invest in the cap-weighted index, you are buying more of companies that have increased in value and less of companies that have decreased in value. So, you are betting on the momentum of prices.

While intuitively true to some, we now see that this argument is flawed. It argues that indexing has a momentum bias relative to the market¹. By our observations above, the indexer does not buy more of companies that have increased in value recently. He buys the same proportion f of all companies. His future performance is affected by the fractional amount of each company that he is holding, not (directly) by the amount he spends on each. Of course, he has to *spend* more on companies that have increased in value because they are more expensive, and is able to spend less on companies that have decreased in value. But, he is not favoring any one company over any other. In the example, my mother-in-law bought a smaller fraction than I did of the company that had increased in value because her money did not go as far.

So, an indexed portfolio expresses nothing about a preference for momentum investing relative to the market. It is a neutral statement. On the contrary, a portfolio that invests less than index weights in stocks that have recently increased and more in stocks that have recently decreased, is expressing a belief in price reversal. If you believe in price momentum you will want to invest more than index weights in companies that have increased and less than index weights in companies that have decreased.

Is there a large cap bias to indexing?

A similar misleading argument relates to a cap bias in indexing: indexed investing is a bet on large companies, because you invest more (as a percentage of your portfolio) in large companies than in small companies.

This perspective distorts similarly to the momentum argument. An indexed investment is neutral as to whether large or small companies will out-perform the market, and it has no cap bias. To move away from this to an equal-weighted portfolio implies a bet that small companies will out-perform.

This point sometimes becomes more complex when there is confusion between indexing in general and S&P500 indexing. Because S&P500 stocks are relatively large cap stocks, the S&P500 has a bias towards large cap stocks compared to the market as a whole; but this does not mean that the S&P500 has a cap bias with respect to itself or that the total market index has a cap bias. If you do not want the large-cap bias of the S&P500, you can index to a broader universe; to discard the general notion of indexing because of this S&P500 bias is to throw out the baby with the bathwater.

A related question is whether there is a style bias to indexing. If style is defined by a value/growth partition of the securities into two equal-cap portions (e.g., a book/price or E/P ranking) we are driven to the conclusion, again, that the index is style-neutral. If the cap-weighted average P/E increases, then the index (or the market) becomes more expensive relative to the past, but there is no style bias relative to itself. And, again, the S&P500 may develop a style bias relative to the total stock market, but it does not have a style bias relative to itself.

Can active managers out-perform the index?

Some argue that at times active managers out-perform the index, and at times they under-perform. They argue that indexing is a style of investing that is sometimes in favor, sometimes out of favor.

¹ This is surely not arguing that indexing has a momentum bias relative to the past – a clearly false notion.

It is clear, however, that *before costs the average actively managed dollar invested in the index behaves like the average passively managed dollar*, i.e., the index average. This is a mathematical tautology. It holds true regardless of the time period under consideration.²

The average of all investments (that of all managers and individuals, etc.), weighted by asset size, will behave like the cap-weighted index average before costs. Half of all the money invested will out-perform the index, and half will under-perform. In particular, the universe of active investors cannot out-perform the total market average.

This point is sometimes confused by:

- a) Equal-weighting the performance statistics of managers without regard to the size of their assets under management, and the fact that many specialized managers tend to emphasize smaller cap stocks.
- b) Choosing an incorrect benchmark, for example using the S&P500 as a benchmark for managers who invest beyond this universe.

4. Indexing, Risk, and Prices

Indexing is a concept that was developed to manage risk. Each company shares (to a varying degree) common risk to such factors as yield, price to book, price to earnings, size, liquidity, exposure to growth and/or value, industry sector, etc. Each company also has its own peculiar level of risk based on issues related solely to its situation: its management, capital structure, market share, etc. The ownership of a large number of positions in a portfolio enables the investor to diversify and minimize company-specific risk. Owning 500 companies (for example) reduces the impact of company-specific risk to a very small fraction of the portfolio performance. To construct a portfolio that has no common factor risk relative to the market index requires the investor to own the same fraction of each stock.

With indexing you are buying each asset (stock) at its current market value. A decision to do this allows you to diversify all risk except market risk. When you buy the same fraction of each company, you do not prefer any one company to any other. You imply that you are agnostic with respect to the relative prices of individual companies. You are expressing an acceptance of pricing mechanisms implicit in the market, that prices are based on complete information and express the consensus judgment of all investors. In particular, you rely on decisions of the substantial market intelligence that arbitrages prices. You accept these prices perhaps because you do not have an independent point of view, because you do not think the cost of an independent view (in fees, taxes, or time) can be justified, or because you do not want to incur the extra risks of doing so.

If all people index, prices will change based on flows into or out of the market, but prices will not change relative to one another. Relative price movements are caused by the actions of non-indexed investors.

5. Conclusion

When you mix a martini, you concern yourself with the proportions of the ingredients, not the amount of money you spend on each. If the price of gin increases, you make a smaller martini.

² See the excellent article by W.F. Sharpe “The Arithmetic of Active Management” *Financial Analysts Journal*, Jan-Feb 1991.

The argument that cap-weighted indexing is a momentum play is false. It fails to distinguish between the *amount* of the company being purchased and the *cost* of this purchase. And, it fails to distinguish between a bet that a portfolio is making *relative to the market*, and one that is made by the market as a whole.

By defining indexing as the purchase of the same fractional amount of each company, it becomes apparent that indexing is not a momentum play, a size play, nor a style play.

Appendix:

Let: \underline{c} = cap sizes of companies (a vector)
 M = total market capitalization
 \underline{w} = index weights
 I = Investment value

Then, $\underline{w} = \underline{c}/M$, so that $\Sigma \underline{w} = 1$.

Using Definition 1, the investor invests $f\underline{c} = (I/M)\underline{c}$ in the vector of stocks.

Using Definition 2, the investor invests $I\underline{w} = (I/M)\underline{c}$ in the stocks, and the definitions result in the same portfolios.