Fundamental indexation in Europe

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Julius Hemminki
graduated as MSc (Econ) from Helsinki School of Economics (major in finance). He works as a project controller at ABB.

Vesa Puttonen*
is Professor of Finance at the Helsinki School of Economics. His areas of expertise include topics such as risk management, derivatives, mutual funds and behavioural finance. He acts as Chairman of the Board of Arvo Asset Management Ltd.

*Helsinki School of Economics, Runeberginkatu 22-24, FI-00100 Helsinki, Finland.
Tel: +358 9 43138405; Fax: 358 9 43138678; E-mail: vesa.puttonen@hse.fi

Abstract We examine the benefits of fundamental indexation using European data. Our findings suggest that by re-weighting a capitalisation-weighted market index by certain fundamental values, it is possible to produce consistently higher returns and higher risk-adjusted returns. Some of these fundamental portfolios produce consistent and significant benefits compared to the capitalisation-weighted portfolio. Thus, our results are in line with Arnott *et al.* (2005) from the US markets.

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Introduction

According to the Capital Asset Pricing Model (CAPM), a capitalisation-weighted market portfolio is mean–variance optimal. From this, one could conclude that an average investor could not do better than just hold a market portfolio. Arnott *et al.* (2005) demonstrate that investors can do much better than capitalisation-weighted market indexes. Their paper provides evidence on fundamental equity market indexes that deliver superior mean–variance performance. The study was conducted with US companies and the returns were compared to the S&P 500 index. Arnott *et al.* suggest four reasons for the excess return of the fundamental index portfolios over the S&P 500; superior market portfolio construction, price inefficiency, additional exposure to distress risk, or a combination of the three[1].

Hsu (2006) shows that if stock prices are inefficient in the sense that they do not fully reflect firm fundamentals, market capitalisation-weighted portfolios are sub-optimal. This is because under-prices stocks will have smaller capitalisations than their fair equity value, and similarly, over-prices stocks will have larger capitalisations than their fair value. Treynor (2005) also shows that as prices are noisy and do not fully reflect firm fundamentals, traditional capitalisation-weighting schemes are likely to be sub-optimal.

We examine the benefits of fundamental indexation using European data. The fundamental values are book value of equity, total employment, sales, cash flow, and dividend. The results indicate that these fundamental indexes are more mean–variance efficient than the traditional capitalisation-weighted index. Some of these fundamental portfolios produce consistent and significant benefits compared to the capitalisation-weighted portfolio.

Data

The period under review in this study is from January 1996 to December 2006, an

11-year period covering both bear and bull markets. The Dow Jones Euro Stoxx 50 index data would have been available starting from 1986, but the necessary company data were insufficient prior to 1996. The company-level data include financial statement information as well as market information.

All DJ Stoxx indexes are derived from one original source: the Dow Jones World index. This world index is a global stock universe currently comprising about 6,500 components representing 95 per cent of the worldwide free float market capitalisation. The DJ Euro Stoxx 50 is derived from the DJ Euro Stoxx Total Market index, which covers approximately 95 per cent of the free float market capitalisation of the 12 Eurozone countries, namely, Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. The DJ Euro Stoxx 50 index provides a blue-chip representation of supersector leaders in the Eurozone. The index covers 50 stocks from the Eurozone countries and it captures approximately 60 per cent of the free float market capitalisation of the DJ Euro Stoxx Total Market index (www.stoxx.com). This means that the DJ Euro Stoxx 50 represents the total market quite well although it covers only 50 companies.

The DJ Euro Stoxx 50 index includes shares from 50 of the largest companies by capitalisation in the Eurozone. The index is licensed to financial institutions to serve as an underlying asset for a wide range of investment products such as exchange-traded funds (ETF). It is weighted by market capitalisation and each component's weight is capped at 10 per cent of the index's total free float market capitalisation. The composition of the index is reviewed annually in September. The DJ Euro Stoxx 50 index was first introduced in 1998, and there are daily historical data available dating back to 1986. The historical data include component lists, price and return data of the index, and change logs of the components.

In order to construct a corresponding portfolio by using fundamental values as weights, and to calculate the required risk and return figures, financial statements information and market information was needed. This information was retrieved from Worldscope database by using Thomson ONE Banker-Analytics.

The fundamental values were retrieved for each company for every year. The book value of equity, sales, dividend, and total employment figures were available directly from the database. Cash flow information needed to be calculated from the cash flow for each set of share figures. These fundamental values were used to construct and weight different portfolios. In addition, the market cap value was retrieved yearly for each company. This was necessary to reproduce a reference portfolio that corresponds to the DJ Euro Stoxx 50 index.

Construction of portfolios

Eight different portfolios are investigated in this study, including, of course, the DJ Euro Stoxx 50 index portfolio and one that we call the Reference portfolio. The remaining portfolios are weighted according to the fundamental values: book value of equity, cash flow, sales, dividend, and total employment. In addition, a composite portfolio is constructed. Arnott *et al.* (2005) state that adopting fundamental indexation is more than simply changing the basis for weighting the stocks in an index. They argue that if stocks are simply re-weighted in the index, a large number of companies with substantial book value that are trading at a low price-to-book ratio are missed. This would lead to a portfolio that is concentrated primarily in stocks that are large in both capitalisation and book value.

The DJ Euro Stoxx 50 index portfolio and the Reference portfolio are both capitalisation-weighted portfolios. In principle, these two portfolios should be identical in weighting and in performance,

but as we show, they are not in fact exactly identical. The reason for this is that the composition of the DJ Euro Stoxx 50 index is reviewed annually in September. All the re-weighted portfolios, including the Reference portfolio, are weighted according to the information at year end and these weights are retained for the following year. Therefore, it is more accurate to compare the fundamental value-weighted portfolios to the Reference portfolio than to the DJ Euro Stoxx 50 index portfolio. The reason why re-weighted portfolios are not weighted simultaneously with the DJ Euro Stoxx 50 index portfolio in September is simply that most of the necessary data are available only on an annual basis.

In the Book Value portfolio, the components are re-weighted on the last trading day of each year according to their book value of equity at year end. The portfolio is kept untouched the following year until at year end a new set of components are chosen according to the DJ Euro Stoxx 50 index portfolio and these components are re-weighted again.

Every component in the employment portfolio is re-weighted on the last trading day of each year according to its average yearly number of employees. This means that if a company had 100 employees for the first six months and 80 employees for the second six months of the year, the average yearly number of employees would be 90.

The Cash Flow portfolio is re-weighted on the last trading day of each year according to the components trailing three-year average cash flow. This means that the re-weighting of the portfolio for example for the year 1996 is done according to an average cash flow of the years 1993, 1994, and 1995. When fewer than three years of data are available, the years of data that are available are averaged. Using the three-year average cash flow instead of year-to-year data reduces rebalancing turnover and it should not affect the performance of the portfolio (Arnott *et al.*, 2005).

The Dividend portfolio is re-weighted the same way as the Cash Flow portfolio. It also uses three-year average figures instead of year-to-year data. The dividend payment amount of each company is taken from the company cash flow statement figures.

The Sales portfolio is also re-weighted using the three-year average figures to reduce rebalancing turnover. Sales figures are retrieved from the database and, with very few exceptions, the data received are complete.

The Composite portfolio is weighted by using all of the five fundamental value portfolios. The weights of each company in the five fundamental portfolios are combined in equal proportions and each company is re-weighted in the Composite portfolio by this combined weight.

Analysis and results

The reference portfolio versus the DJ Euro Stoxx 50 index

The capitalisation-weighted Reference portfolio is first constructed to represent the performance of the DJ Euro Stoxx 50 index. The returns are compared for the

Table 1 The comparison of performance of the Reference Portfolio and the DJ Euro Stoxx 50 index

January 1996–December 2006					
Portfolio	**Ending value of €100**	**Geometric return (%)**	**Volatility (%)**	**Excess return versus reference (%)**	**Tracking error**
Reference Portfolio	348.13	12.01	24.00	0.00	0.00
Euro Stoxx 50 Index	342.82	11.85	24.28	−0.16	2.54

observation period from 1996 to 2006. As expected, the returns of the DJ Euro Stoxx 50 index and the Reference portfolio are almost identical. Table 1 presents the performance of the two portfolios.

The Reference portfolio has a slightly higher ending value: 348.13 EUR versus 342.82 EUR. This gives a geometric return of 12.01 per cent for the Reference portfolio and 11.85 per cent for the DJ Euro Stoxx 50 index over the sample period. As a contrary to the ending value, the Reference portfolio has a slightly lower standard deviation (24.00 per cent versus 24.28 per cent). The tracking error, which represents the difference between a DJ Euro Stoxx 50 index return and the Reference portfolio return, is naturally very low.

One might expect the returns of the DJ Euro Stoxx 50 index and the Reference Portfolio to be identical. The reason for the differences is that the composition of the DJ Euro Stoxx 50 index is reviewed annually in September, whereas the Reference portfolio is weighted according to the information at year end. During the four-month difference in reviewing the portfolio, capitalisation values of the companies may change so that they lead to differences in weighting the companies. These differences are, however, small and we use the capitalisation-weighted Reference portfolio as the benchmark for the fundamental portfolios.

Relative performance of fundamental portfolios

Table 2 shows the return attributes of the fundamental indexes. All fundamental portfolios are able to produce higher returns than the capitalisation-weighted market index. The fundamental portfolios outperform the capitalisation-weighted market index by an average of 1.76 percentage points a year.

The evidence for the excess returns is positive but not statistically significant for all fundamental portfolios. This can be

Table 2 This table shows the comparison of returns for the observation period from 1996 to 2006. The returns show a theoretical growth in value of the portfolio, assuming that dividends are re-invested to purchase additional units of equity at the closing price applicable on the ex-dividend date. The Reference portfolio is a capitalisation-weighted portfolio based on the DJ Euro Stoxx 50 index

Portfolio	Ending value of €100	Geometric return	Volatility	Excess return vs. reference	Sharpe ratio	Tracking error vs. Ref.	t-statistic for Excess Return
Book value	415.92	13.83	24.51	1.83%	0.546	2.57%	2.41
Employee	368.25	12.58	24.30	0.57	0.501	3.53	0.63
Sales	403.76	13.63	23.07	1.52	0.555	4.14	1.04
Cash flow	414.81	13.81	24.47	1.80	0.548	5.72	1.09
Dividend	461.69	14.92	22.67	2.91	0.614	3.39	2.33
Composite	413.45	13.77	23.62	1.76	0.556	2.60	2.06
Reference	348.13	12.01%	24.00%	–	0.477	–	–

explained by the relatively short observation period compared with the 43-year period of Arnott *et al.* (2005).

Robust evidence shows that the Book Value portfolio, the Dividend portfolio, and the Composite portfolio produce higher returns than the capitalisation-weighted market index. The evidence also indicates that the Sales portfolio and the Cash Flow portfolio produce higher returns, but the findings are not statistically significant. The Employee portfolio is able to produce only slightly higher returns than the capitalisation-weighted index.

The risk level of the portfolios is measured by a standard deviation of returns. Three of the fundamental portfolios have a lower risk level than the capitalisation-weighted market index. These are the Sales portfolio, the Dividend portfolio, and the Composite portfolio. The Book Value portfolio, the Employees portfolio, and the Cash Flow portfolio have slightly higher risk levels than the capitalisation-weighted market index. All fundamental portfolios yield higher risk-adjusted returns (Sharpe ratio) than the Reference portfolio.

Conclusions

We provide further evidence that by practicing fundamental indexation, an investor could realise superior performance than by investing in a capitalisation-weighted market portfolio. Six different fundamental portfolios were constructed by using various fundamental values as weights. The performances of these fundamental portfolios were compared to a capitalisation-weighted market portfolio based on the DJ Euro Stoxx 50 index.

In conclusion, we show that by re-weighting a capitalisation-weighted market index by certain fundamental values, it is possible to produce consistently higher returns and higher risk-adjusted returns. Our findings are very similar to those of Arnott *et al.* (2005), suggesting that if market prices are noisy, traditional capitalisation-weighting leads to sub-optimal portfolios. Arnott *et al.* (2005) report statistically more significant findings that can be explained with a longer observation period (43 years of US data versus 10 years of European data).

Our findings suggest that in fundamental indexation, an investor should use the book value of equity or the dividend amount as fundamental values, or construct a composite portfolio. When managing fees and transaction costs are expected to be the same, whether an index fund is based on a traditional capitalisation-weighted market index or a fundamental-weighted index, the fundamental-weighted index fund should consistently outperform its capitalisation-weighted benchmark in net returns.

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Note

1. Arnott *et al.* (2005) provide an extensive list of relevant literature on the topic. There is a vast stream of literature on 'Value' strategies that call for buying stocks with a low price relative to earnings, dividends, book assets, cash flow, or other measures of fundamental value. In addition to the literature in Arnott *et al.* (2005), one may add Chan and Lakonishok (2004), Lakonishok *et al.* (1994), and Fama and French (1998, 2004) as cornerstone articles in the field.

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