

Wolf in sheep's clothing: the active investment strategies behind index performance

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Abstract

This paper argues that the commonly used market indices imply forms of active investment management in disguise. The selection and rebalancing rules make these indices highly exclusive and dynamic regarding their underlying components and significantly bias their performance. Any passive investment tracking these indices turns into an active strategy characterised by market timing and state-dependent performance. Evidence is provided that exclusive indices outperform (underperform) more inclusive peer indices in upward (downward) markets. The constitution and maintenance rules of exclusive indices correspond to a set of active trading and investment rules similar to momentum strategies.

Keywords: index performance, active / passive investment management, momentum strategies, index constituents; selection and rebalancing rules; performance measurement; “buy-and-hold” strategy.

JEL codes: G11

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1. Introduction

It is a widely held assumption that stock indices represent markets. The widespread use of indices in the public, by investors and within the financial industry, is related to this perception of an index in one way or another. The practice of benchmarking against indices as well as using indices replicating 'passive' investment management does indeed confirm this perception. This paper argues that – rather than offering passive market performance – the vast majority of all indices – and so-called passive investment management based on them – simply offer a different form of active investment management in disguise, albeit at times a quite successful one. Indeed, the most widely used indices tend to be highly exclusive (i.e. selective) and dynamic with regard to their underlying assets. The difference in performance between an exclusive index and its more inclusive peer is explained by the selection and exclusion rules underlying their constitution. These rules do in fact correspond to a set of active trading rules and active investment approach.

The thesis of this paper is twofold: first, exclusive indices embody a set of selection, rebalancing and maintenance rules that prevent them from being passive. In fact, this set of rules is a form of *active* investment and trading rules. The automatic inclusion in an exclusive index of "rising stars" and the exclusion of "fallen angels" is a straightforward example. A purely passive investment approach would imply that the stocks underlying an index are merely bought and held. There should be no substantial change in the underlying assets of an index except for technical reasons, such as initial public offerings (IPOs), mergers, capital increases, changes in the free float, etc. With all-inclusive indices, the question of inclusion or exclusion does not arise by definition, and the related effects of under or overperformance of index constituents after their inclusion or exclusion do not exist. Although all-inclusive or more comprehensive indices are better candidates for passive investments, index tracking is generally based on *exclusive, i.e. selective* types of indices.

Second, the set of rules determining the index construction in selective types of indices are conformable to momentum strategies. The timing and methods implied by the selection and rebalancing rules of the most widely used selective equity indices are consistent short-run momentum strategies which consider the continuation effect of recent winners and losers or dynamic trading with respect to reference levels, such as stop-loss strategies. As a corollary, any benchmarking based on exclusive indices embarks momentum effects and compares one form of active investment management with another.

To our knowledge, no previous work in the literature has dealt with precisely the issues raised in this paper. Market indices have mostly been studied in two ways: first, considering a market index as a proxy for the market portfolio; second, looking at the effect of index inclusion or exclusion on index components. The relevance of defining a market portfolio as a reliable indicator for the market as a whole is an issue that has been widely debated. Roll (1977) argues that the CAPM may appear to be rejected in tests not because it is wrong but because the proxies for market return are not close enough to the true market portfolio available to investors. Following this line of reasoning, Lehmann and Modest (1987), among others, find that the measurement of mutual fund performance is sensitive to the benchmark chosen. Our study, however, examines a slightly different research area. We investigate how and to what extent index rules characterise index behaviour. We look into the “microstructure” of market indices and examine whether specific index rules characterise their performance.

The second research area relates to the effects of including individual shares in indices and/or excluding them. Most studies in this field show that the inclusion or exclusion of shares has significant price and volume effects on the shares in question,¹ and proffer a

¹ E.g. Beneish and Gardner (1995); Beneish and Whaley (1996); Dhillon and Johnson (1991); Harris and Gurel (1986); Lynch and Mendenhall (1997); Pruitt and Wei (1989); Shleifer (1986).

variety of hypotheses to explain these performance effects.² While these studies concentrate on index constituents, we are interested in the indices themselves. We investigate how the inclusion or exclusion of individual stocks in an index affects the index performance on an *aggregated* basis.³ It is indeed surprising that most of the literature in this field focuses on individual rather than aggregated effects. After all, if there is evidence that stocks included in an index outperform (underperform) the index after their inclusion (exclusion), should not the index itself also outperform its reference market?⁴

The empirical analysis supporting our hypotheses is organised as follows. We search for peer indices based on the same construction and rebalancing rules but consisting of a different range of components. We compare the performance of the most exclusive and inclusive of these index twins. We then provide compelling evidence that the performance reported by exclusive indices is biased. Exclusive indices tend to outperform (underperform) more inclusive indices over bull (bear) periods. This comparative analysis is performed on international, national and sector indices and across diverse sample periods.

To better understand whether this bias is attributable to construction and rebalancing index rules, we attempt to build a truly *ad hoc* passive index. The comparison between an exclusive index and a pure passive benchmark should shed some light on the additional performance attributable to the active component. Using the Morgan Stanley Capital International Inc. index components (hereafter MSCI) for several countries, we construct a passive portfolio in which the underlying assets tend to remain unchanged over time. We thereby compare the performance of the MSCI indices with the related static and passive ‘buy

² E.g. Bechmann (2002); Jessop (2002).

³ The research by Hill et al. (2001) is one of the few studies in this context not to focus on index constituents. It shows that the outperformance of the DJIA in comparison to the S&P 500 or NASDAQ during 2000/ 2001 was not due to the selection of index constituents but to its price-weighted nature. Treynor (2003) compares the index performance on the basis of different construction rules.

⁴ As a further illustration of how dynamic the constituents of exclusive indices are, Foster and Kaplan (2001) found that, in 1997, only 74 companies out of 500 had remained in the S&P 500 over the preceding 40 years. Moreover, only two of the numerous stocks included in the index for a number of decades performed better than the average, these being General Electrics and Eastman Kodak.

and hold' portfolios. The empirical findings show that the implicit active investment strategy of MSCI indices strongly characterises their performance. Evidence is provided that dynamic indices outperform passive indices in equity markets with a positive trend.

The paper proceeds as follows. We briefly survey the factors determining the demand and supply for indices. Second, we compare the performance of inclusive and exclusive types of indices. Third, we construct a passive index and measure its performance using the respective dynamic index. Fourth, we analyse the reasons explaining the different behaviour of passive and active indices. We then discuss the main implications for asset management. Some conclusive remarks follow thereafter.

2. The market for market indices

In general, a market index is supposed to represent *prima facie* a stock market as a whole. The way to achieve this would be to include all traded shares in a given market in the index. Ignoring the various technicalities linked to the way indices are calculated, such an all-inclusive index would represent the publicly traded and investible market as a whole. If this is true, one might wonder why the vast majority of equity market indices are highly exclusive.

The explanation is essentially rooted in practical reasons. In defining a benchmark, an asset manager faces the trade-off between wider diversification and market liquidity. On the one hand, all-inclusive indices are more representative of the whole market and allow a higher degree of diversification. On the other hand, all-inclusive indices are composed of a large number of constituents, and a considerable number of them are illiquid assets. This undoubtedly increases transaction costs, especially over short investment horizons. To summarise, exclusive indices are more attractive because they imply lower transaction costs and higher liquidity. Moreover, information on underlying stocks is more readily available

(e.g. analyst coverage). Hence, there could be objective disadvantages for investors wishing to replicate market index performance. Further arguments in favour of exclusive indices are the availability of derivative instruments, typically options and futures contracts. In fact, index derivatives are widely available only for exclusive types of indices.⁵ This availability allows for hedging and arbitrage strategies that make exclusive indices more attractive than all-inclusive ones.

As a result of the popularity of passive investment strategies, there has been a strong increase in the demand for such exclusive indices. The widespread use of 'passive investment management' in the last few years is impressive. A range of different forms of index replication are used, and these now account for around 30% of institutional equity investments under management in the US (Clarkson et al., 2002). The estimates for index investment management in Europe are somewhat lower and vary from 3% (Ireland) to 30% (UK) (Tinker et al., 2002). Remaining investment, i.e. the share of the market that is actively managed, is often benchmarked against the same indices as those used for passive management. Assuming that maximum deviations from the benchmark amount to 20%, this would imply that 86% of all institutional equity investment is managed according to indices and, as a consequence, is driven by the composition of these indices. While the figures for privately held equity investments might be somewhat lower, there is a clear general trend towards index-linked investment management and benchmarking.

The supply of 'passive' placements is offered through index-based investment vehicles, such as index replicating open-end funds, exchange traded funds, or index performance certificates. It is worth pointing out, however, that these funds are generally issued on selective or exclusive indices that can be replicated with relative ease and at low cost. The constitution of the most widely used indices is, therefore, not guided by the aim of reflecting

⁵ Examples of such indices are the DJIA, S&P 100, S&P500, FTSE 100, Nikkei 225, CAC 40, DAX 30, just to mention few.

the performance of a given stock market as closely as possible, but rather by the aim of offering “economical indices because they are correctly sized for cost-efficient replication and trading”.⁶ Thus, a large variety of exclusive index families have been created in order to meet the demand for so-called ‘passive’ investment management.

3. Inclusive versus exclusive indices

The first objective of this research is to test whether there is a systematic difference in the performance of exclusive and inclusive indices. This analysis follows a two-step approach. First, we compare the performance of index twins. To do this, we examine the wide range of equity market indices to identify those index families that consist of exclusive and more inclusive definitions of the same index. The comparison of these index twins enables us to determine whether there is any systematic difference in the performance of indices based on the same principles but with diverse market coverage. Second, we conduct a regression analysis to find out whether this difference in performance is due to an implicit active strategy on the part of selective indices. More precisely, the regression analysis permits us to determine the existence of market timing driven by constitution and rebalancing rules.

3.1 Performance comparison of exclusive and inclusive indices

Table 1 summarises the main construction principles and maintenance rules of a selective sample of the major stock market indices worldwide. The most frequently used technique is to weight indices on the basis of market capitalisation, with some adjustment for liquidity. The common adjustment is the free-float (the proportion of shares outstanding that are deemed available for trading in the public security market). However, many other liquidity

⁶ From Dow Jones STOXXTM indexes, www.stoxx.com/info/development.html (as of 29.8.02)

proxies are also used (cf. for example the broad set of liquidity indicators used by the Paris Bourse). There is a significant degree of discretion among index providers. In a few cases, the rules governing the index construction are transparent and predefined. In many other circumstances, index committees benefit from wide discretionary scope. Probably the most representative case is that of the Dow Jones Averages indices, for which the editors of *The Wall Street Journal* select the index components purely on the basis of their good judgement. Discretionary power manifests itself in at least two other aspects of the life of an index, namely its size and reconstitution timing. Some indices have no fixed number of index components. For instance, the Swiss Market Index is a blue-chip index made up of a maximum of the 30 largest stocks. Nevertheless, its effective number of constituents varies considerably across time. Several index providers have an annual deadline for defining the universe of securities underlying their indices (e.g. MSCI and Russell). However, the effective dates when index components are added or deleted are much more frequent and irregular. For example, changes in the components of the S&P US indices are made as needed. Changes in companies' shares (where 5% or more are outstanding) take place at the effective date. Otherwise, weekly changes apply. In general, changes to the make-up and weighting of the index are made monthly or quarterly (cf. Table 1).

Looking at the major stock markets, Table 2 provides an initial comparison between the most exclusive and the more inclusive type of index over different sample periods. The beginning of the sample period is determined by the most recent inception of the twin indices. The indices relate to the US as well as to the other major markets.⁷ Throughout this paper, performance is calculated on the basis of compounded logarithmic returns. An upward or bull market is when the more-inclusive market index experiences a monthly⁸ positive return; vice versa for a downward, or bear, period. Of the 14 performance comparisons, there are 11 cases

⁷ The representative indices for the Canadian stock market in Table 2 are the TSE 35 and 100. However, the S&P/TSE 60 Index has recently replaced these indices.

⁸ We also tested the quarterly definition of bear and bull periods. The results remain essentially unchanged.

in which the more exclusive type of index outperforms (underperforms) the more inclusive type of index over upward (downward) markets. These results also hold when a risk adjusted measure of performance is used. More precisely, we calculate the Sharpe ratio (SR) as follows:

$$SR_T = \frac{\frac{12}{T} \sum_{t=1}^T r_t}{\left(\frac{12}{T-1} \sum_{t=1}^T (r_t - E[r_t])^2 \right)^{1/2}} \quad (1)$$

where $t=1, \dots, T$ represents the investment horizon on a monthly basis, r_t are continually compounded logarithmic returns; hence, the numerator and denominator are the annualised return and return volatility over the period T , respectively.

Table 3 compares the performance of exclusive and less exclusive indices from different index providers for the US market in the context of a bull and bear market period. We repeated these tests using other definitions of bull and bear markets, in particular the definition laid down by the National Bureau of Economic Research (NBER) with respect to expansion and recession periods. The results remain essentially unchanged. During the bull market period it is always the more exclusive index within the index family that has the higher return (and the higher risk-adjusted performance in terms of the Sharpe ratio). During the bear market period the more exclusive indices display higher losses than the more inclusive indices.⁹ These results suggest that exclusive indices are more exposed to both the upside and downside momentum of the market. Figure 1 provides a clear graphical representation of outperformance (underperformance) of the main selective US indices in expansion (recession) periods. Using monthly returns, Table 4 documents the significance

⁹ In Table 3, we compare the Russell 1000 with the Russell 3000. It is worth noting that a more selective index has been recently introduced, namely the Russell Top 50 and 200 Index. The data for this index are available from 1 June 1995 to date. If we compare the Russell 200 and 3000 indices over the bull period (June 1995 to February 2000) and the bear period (March 2000 to March 2003), we find that the Russell 200 outperformed the 3000 index by 10% during the bull market and underperformed it by 7% during the bear market. These

levels of the two-tailed t -statistics to assess whether there is a significant difference in performance patterns between pairs of US stock market indices. The non-parametric tests using the Wilcoxon-Mann-Whitney method are perfectly in line with the t -statistics.¹⁰ Overall, the results show that returns on the exclusive and inclusive versions of US market indices diverge significantly. The difference appears slightly smaller during bear markets.

The S&P/Citigroup index family represents a straightforward case in which exclusive and inclusive indices can be compared. For a wider set of countries or regions, S&P/Citigroup¹¹ provide a couple of indices. The exclusive type of index is called the Primary Market Index (PMI) and the more inclusive one is the Broader Market Index (BMI). A PMI index covers the large capitalisation stock universe (top 80% of available capital of the BMI in each country). The BMI is considered the flagship all-share index.¹² As Table 5 shows, in 27 (26) out of 34 cases, the exclusive type of index outperforms (underperforms) the inclusive one in bull (bear) markets. Comparing the performance on a risk-adjusted basis, the PMI still basically outperforms the BMI to the same extent. Consistent with the notion of active management performance, the risk-adjusted performance measure used in this case is the Information Ratio (IR). IR is defined as

$$IR_t = \frac{\frac{12}{T} \sum_{t=1}^T (r_t^E - r_t^I)}{\sqrt{\frac{12}{T-1} \sum_{t=1}^T (r_t^E - r_t^I)^2}} \quad (2)$$

The terminology used for the IR is consistent with that of the Sharpe ratio. Here, r_t^E and r_t^I mean the return in month t of the exclusive and inclusive index, respectively. Thus, IR

differences in performance are even stronger if we add dividends to the index values. The same conclusion holds for the Russell Top 50 index.

¹⁰ These additional tests are available upon request.

¹¹ S&P/Citigroup indices were formerly provided by Salomon Smith Barney under the name Salomon Smith Barney World Equity Indices (SSBWEI).

¹² More specifically, all companies in applicable markets are included, provided they have available (float) market capitalisation greater than USD 100 million. Only issues that a non-domiciled investor may purchase are included. Each issue is weighted by the proportion of its available equity capital.

represents the annualised outperformance of the exclusive index divided by the annualised tracking error.

The Dow Jones super-sector indices constitute another interesting case. Dow Jones & Company keeps track of the behaviour of the international sectors on the basis of two index definitions: the Dow Jones Titans, which are very exclusive indices, and the Dow Jones World Indices, which are their less exclusive cousins.¹³ As shown in Table 6, out of the 18 comparisons, there are 13 (11) cases where the more exclusive index outperforms (underperforms) the more inclusive index in upward (downward) markets.

While all these comparisons may not appear exhaustive, a clear picture emerges: exclusive indices perform better during rising markets and tend to perform worse during falling markets. One possible explanation for these results could be the existence of a large cap effect. Indeed, with the increasing international diversification and a general preference for liquid stocks, a case for a large cap effect could be made.¹⁴ But this interpretation would be in contradiction to Banz's (1981) findings of a small cap effect and all subsequent literature on the size effect (e.g. Fama and French (1992)). According to this literature, stocks with low market capitalisation provide higher average returns, and not the opposite. Our interpretation of these results, however, is a different one. We argue instead that the outperformance of exclusive indices – which are admittedly large cap-type indices – is not due to a large cap effect but to the selection and exclusion rules behind the constitution of these indices.

¹³ Dow Jones & Company supplies four sector decomposition methods of the equity markets, namely industry, supersector, sector, and subsector. The supersector level lends itself to a clear comparison between a selective and more inclusive equity market performance by sectors. Dow Jones Titans supersector indices encompass only the 30 largest companies in the world, which correspond to around 50% of world market value coverage. Dow Jones Supersector World indices, however, cover a broader market value that on average is 30-40% larger than the Titans definition.

¹⁴ Another argument in favour of large capitalisations can be the preference of "quality" stocks, especially over unsafe markets.

To provide further support for this argument, we perform a regression analysis to test for a market-timing component characterising the exclusive index performance (cf. next section).

3.2. Market timing of selective indices

The first step is to observe whether there is a systematic difference between the exclusive and inclusive index performance across time. To do this, we use the S&P/Citigroup indices since they allow for an international and consistent comparison over a significant investment horizon. A simple way to analyse whether the risk-return payoffs for exclusive and inclusive indices are dissimilar across time is to use the market model.

$$(r_t^E - r_t^F) = \alpha + \beta(r_t^I - r_t^F) + \varepsilon_t \quad (3)$$

where r_t^E and r_t^I are the returns in t of the exclusive and inclusive index, respectively, r_t^F is the riskless asset return, ε_t is the residual term, and α and β are the regression coefficients. Residuals of these OLS regressions have been adjusted for heteroskedasticity and correlation using the Newey-West (1987) method. The first hypothesis we can test is the following:

Hypothesis 1: if there is a systematic difference in the exclusive and inclusive index performance, then we should observe a beta significantly different from 1 in the market model equation.

Table 7 reports the estimated betas for the 34 countries or regions covered by the S&P/Citigroup indices. Estimating the Wald test for the null hypothesis that beta is equal to 1, we can reject the hypothesis that exclusive and inclusive portfolios are equivalent in 19 cases, at a 5% significance level.

The simple estimation of the market model does not allow us to detect any selection or timing ability in a managed portfolio. Elton et al. (2003, pp. 640-641) suggest a method for analysing market timing. The intuition behind this method is simply to evaluate manager performance in two separate domains: a manager's outperformance in upward markets and his underperformance in downward markets. Following this line of reasoning, a manager with market timing should have a high upward market beta and low downward market beta. In this setting, the exclusive and inclusive indices represent the managed and market portfolio, respectively. In terms of the regression analysis, that is:

$$(r_t^E - r_t^F) = \alpha + \gamma(r_t^I - r_t^F) - \lambda d_t(r_t^I - r_t^F) + \varepsilon_t \quad (4)$$

the same notation as in the previous equation applies. The new terms here are γ and λ , which are regression coefficients, and d_t which is a dummy variable; $d_t = 0$ if $r_t^I - r_t^F \geq 0$, and $d_t = 1$ otherwise. The regression analysis in (4) allows us to test the following hypotheses: If market timing exists inherently in exclusive indices, then we will observe that the exclusive index performance breaks down into two components: its outperformance in upward markets ($\gamma > 1$) and its underperformance in downward markets ($\lambda > 0$). More precisely, we can set out the two following hypotheses:

Hypothesis 2: If there is market timing in exclusive indices that makes it possible to profit from an upward market, we should observe a γ significantly greater than 1. In fact, γ represents the upward market beta.

Hypothesis 3: If there is market timing in exclusive indices that makes it possible to reduce the exclusive index exposure to a downward market, we should observe a λ significantly higher than zero. In fact, $(\gamma - \lambda)$ represents the downward market beta.

To test these hypotheses, we estimate the Wald test for the null hypothesis that γ is equal to 1 (hypothesis 2), and γ is equal to 1 *and* λ equal to zero (hypothesis 3). The results in

Table 7 provide only weak support to hypothesis 2. In 14 out of 34 cases, γ is significantly higher than 1 at a 5% significance level. There is also some weak support for Hypothesis 3. In 7 cases, t -statistics indicates that λ is significantly positive at a 5% significance level. This means that only for few indices does the market-timing component significantly mitigate the negative performance of exclusive indices during downward markets. Since it is more likely that either upward and downward market-timing components exist, the rejection of hypothesis 3 is more stringent. In fact, in 23 cases the Chi-square values from the Wald tests suggest that the hypothesis that there is no market timing in upward and downward markets should be rejected. Although the regression analysis provides more mixed results, overall there is clear evidence that exclusive indices outperform (underperform) more inclusive peer indices in rising (descending) markets.

Now, the main question is what kind of investment strategy is disguised in exclusive indices? As we will discuss below, because of implicit stop losses, the exclusive index rules implicitly mirror recognised investment strategies such as momentum, autocorrelation and the limitation of tail risks.

4. Passive versus active indices

The results presented above show that exclusive indices are to a large extent at odds with the definition of passive investments. We have observed that exclusive indices incorporate market timing, making their performance state-dependent and variable over time. In this part of the paper, we attempt to construct a truly passive index. Such an index can then be used as a pure benchmark to measure the contribution to market performance attributable to the implicit trading strategy with respect to construction and rebalancing rules. To do this, we take the MSCI country indices – an exclusive, large cap type of index family whose

historic index components are readily available for a period of six years and five months. We use this sample period for two reasons. First, Datastream makes data on the MSCI components available from January 1995 on. Second, in June 2001 MSCI announced an important change: a new 'MSCI Enhanced Methodology' (MSCI, 2001A) based, amongst others, on free-float instead of market capitalisation, wider coverage and more emphasis on sector representation (for more details, see MSCI, 2001B). By using a sample period from January 1995 to May 2001, any influence or bias due to this methodology change is avoided. It is worth noting that this sample period is mostly a well-defined and prolonged bull period. We thus expect an active index to outperform its corresponding passive index.

We first analyse how the index components of the MSCI country indices have changed over time. Table 8 shows the total number of components per country and, given the limited number of stocks, the high degree of exclusiveness of this index family. Also, Table 8 shows the proportion of stocks that has remained in the index throughout the investment horizon analysed. This proportion varies from 43% (Argentina) to 74% (Japan) or, in terms of capitalisation, from 52% (Brazil) to 93% (Switzerland). We then look into the reasons behind the exclusion of stocks from the index. Technical factors such as delistings, conversions or mergers can lead to the exclusion of stocks – factors that would also reasonably apply to a passive index.¹⁵ We find that between 12% (Switzerland) and 75% (Japan) of all exclusions are due to index selection rules rather than technical factors.

We then constitute *ad hoc* passive indices where the initial index constituents are held constant over time. The resulting country indices are still very exclusive, but now passive indices that follow a buy and hold strategy.¹⁶ Table 9 compares the index performance of the dynamic MSCI country index as published by Morgan Stanley against the newly calculated

¹⁵ One can argue that delisting is often due to depreciation in a company's market value. This claim would further strengthen our argument.

¹⁶ By definition, a truly all-inclusive index will follow a similar passive buy-and-hold strategy, as all assets that form part of a market are included and held at all times, from the IPO of a company to its disappearance.

passive index with constant constituents. For all of the 10 countries, the original dynamic MSCI has outperformed the *ad hoc* passive index. While the average MSCI return for the period analysed was 74% for the dynamic indices, it was only 50% for the passive indices. It is also interesting to note that where dynamic asset selection is the lowest (Switzerland), the outperformance of the dynamic index in comparison to the passive index is also the lowest. Conversely, the highest proportion of dynamic asset selection (Japan, Brazil) is associated with some of the strongest outperformance.

To check the sensitivity and robustness of our results with respect to the definition of passive portfolio, two main definitions of passive index are considered. The former is a more conservative definition since it holds the initial index components and weights constant. The latter is known as the 'passive with reinvestment' performance. This strategy is calculated by reinvesting the amounts corresponding to the last traded prices of the excluded components in the subsequent year, in proportion to the market capitalisation weights. Table 10 shows that the performance of a 'passive with reinvestment' index component is comparable overall to a pure 'passive' index performance. In some cases, the dynamic selection and rebalancing procedure driving the original MSCI indices has largely outperformed the passive index. The magnitude of this outperformance in annualised terms is 4.5% or 4.9%, depending on which definition of passive index is taken.

This strong general outperformance of the original dynamic indices is due not to the initial asset selection, which was identical, but to the active rebalancing of the index constituents over time. In other words, it is the stock selection (and exclusion) criteria applied over time which caused the outperformance of the dynamic indices.

5. Possible reasons behind the outperformance of exclusive and dynamic indices

As the degree of exclusiveness of an index is intrinsically linked to the dynamics of its underlying constituents, the general point can be made that the more exclusive an index, the more its constituents are subject to change. The relationship between exclusive and all-inclusive should also apply for dynamic versus passive indices. The performance comparisons above suggest that dynamic indices outperform (underperform) passive indices over upward (downward) periods.

The question now of course is why. Within the given market definition of an index (geographic or other), index constituents are largely determined by mechanistic or predefined criteria or principles. These relate in particular to market capitalisation or related factors such as free float, liquidity or price volatility around the threshold level of the market value at which a stock becomes eligible for inclusion or exclusion. Excluding technical events such as IPOs, mergers or capital increases, the market capitalisation depends directly on the performance of the stock itself. Falling relative stock prices can therefore lead directly to the exclusion of a stock from an exclusive index. In the same way, a good stock performance in relative terms can qualify a hitherto excluded stock for inclusion.

Because historic stock price performance becomes the decisive criterion for the dynamic rebalancing of index constituents, indices adopt investment and opportune disinvestment rules that are in line with current trends. They correspond to phenomena such as autocorrelation of returns, momentum and the limitation of tail risks through implicit stop-loss strategies.

The analogy with the empirical literature on returns characterised by momentum is straightforward. There are two main momentum effects documented in the literature, the 'contrarian' and 'continuation' effects. In the case of the contrarian effect, losers in the past 3 – 5 years have bigger average returns than past winners (see DeBondt and Thaler (1985)). In the case of the continuation, effect, recent winners (stocks with high returns in the past few

months) outperform recent losers (see Jagadeesh and Titman (1993)). These two patterns have been extensively analysed. The main findings are that the long-run contrarian patterns have disappeared over the past decade whereas the short-run 'continuation' effect still constitutes a significant market anomaly (see e.g. Schwert (2003)). Jegadeesh and Titman (2001) confirm the profitability of short-term momentum strategies in the 1990s and provide behavioural explanations for this evidence. Rouwenhorst (1998) shows that international equity markets also exhibit short-term return continuation and provides international evidence on the profitability of momentum strategies.

The short-run continuation effect is precisely the rationale underlying the implicit active strategy that characterises the selective indices. The timing of the short-run momentum and that of the maintenance index rules are also equivalent (i.e. monthly, quarterly or semi-annually). In the same spirit as the short-run continuation effect, selective indices dynamically adjust their composition by including and allocating more weight to the recent winners and penalising the recent losers. The momentum strategies can be also seen as an example of 'technical trading' focused on price trends that ignore company fundamentals and analyst recommendations.

To corroborate this idea, we construct a momentum portfolio to compare with the MSCI US index performance. We proceed as follows: At the end of each quarter, we rank stock returns for the MSCI constituents and select the top decile (i.e. the best performers) as our momentum portfolio over the next quarter. This corresponds to an equally-weighted portfolio of around 37 stocks that will be reconstructed each quarter. We repeat this exercise from January 1995 to end of May 2001 (25 quarters plus Q4 1994 to establish the initial portfolio allocation). In so doing, we obtain a momentum portfolio intended to capture the

upside market trends in the spirit of Jagadeesh-Titman.¹⁷ Table 10 shows the performance of this portfolio. While MSCI and passive indices have divergent patterns, the year-by-year performance of the momentum portfolio is largely comparable to that of the MSCI index. On a yearly basis, momentum portfolio performance is 13.8%, on average. This number is situated almost in the middle of the range between MSCI performance (15.8%) and passive portfolio performance (around 11%). This suggests that the momentum mechanism in the index construction accounts for a significant part of its performance.

The rules which define the composition of and dynamic changes to index constituents correspond to more than just momentum strategies. The inherent trading strategy in the construction of this index also has similarities with other trading strategies focused on risk protection. In fact, exclusive market indices embody minimum market capitalisation requirements. Such market capitalisation thresholds represent implicit stop-loss strategies that exclude falling stocks and replace them with rising ones. This is a much broader and more compelling effect than the survivorship bias. The exclusion of falling stocks can be seen as downside risk protection against severe price drops in individual index components. In short, exclusive indices do not only tend to buy the winners, they also cut their exposure to losers by adopting a market capitalisation-based stop loss strategy.

6. Implications for asset management

Asset managers and final investors should be aware of the implicit trading strategy hidden in some market indices. After all, all the main aspects of the investment process are affected by the implicit index strategy: client analysis (determination of risk-return profile,

¹⁷ We also analysed other definitions of momentum portfolios. In particular, we considered portfolio weighted by market capitalisation and portfolios that include upside and downside momentum. These additional tests provided similar results.

investment horizon, and other investment guidelines such as liquidity requirements, currency, tax aspects), benchmark construction (or strategic asset allocation), timing (or tactical asset allocation), selection (or stock picking), performance measurement and attribution, and risk management.

For final investors, the findings presented in this paper imply that index-based investment is not necessarily what it appears to be, and that many indices used for replication and benchmarking embody a much more active investment style than is apparent. Investors seeking a truly passive investment strategy should therefore aim to replicate an all-inclusive type of index such as the Wilshire 5000 – and accept the higher replication costs. Investors who are only seeking a benchmark for an active investment mandate might also be better served by such an index – which, in this case at least, would entail no additional cost. In general, much more attention should be paid to index rules. For instance, the timing of the reconstitution and rebalancing of market indices should be consistent with the length of the investor's investment horizon.

The hidden but implicit active strategy of some indices can also pose agency problems for the asset manager-client relationship. A vague definition of a benchmark may have a significant impact on final performance. As shown above, index twins may provide different performances, depending on which index twin is used. This argument applies for both ex-ante and ex-post performance.

Tactical asset allocation and stock picking are also considerably affected by inherent active strategies. One of the main implications for portfolio managers is that momentum strategies are directly or indirectly an integral part of the asset selection, exclusion and weighting decision. For enhanced index strategies, these might not only apply to the marginal stocks which are about to be included or excluded but also to the entire investment universe. Moreover, in order to enhance stock picking performance, an asset manager could be tempted

to anticipate index rebalancing. Asset managers with a top-down approach typically have access to macroeconomic forecasts. It would be easy for these managers to use exclusive / inclusive indices from an opportunistic viewpoint. Within the context of bull (bear) markets, an inclusive (exclusive) index may be conceived more as the benchmark and the exclusive (inclusive) index as an active strategy.

The presence of hidden active strategies highlights the advantage of measuring investment performance in absolute instead of relative terms. Performance decomposition (or performance attribution) plays an important role for active managers. In this respect, it is worth noting that these hidden strategies primarily affect selection or stock picking. Brinson, Hood and Beebower (1986) propose a simple method for decomposing an asset manager's performance relative to the benchmark used. Brinson et al. show that the main performance contribution comes from strategic asset allocation (80-90%) and only a minor part from tactical asset allocation and selection (10-20%). Our results suggest that tactical asset allocation and selection are even less important since their contribution is largely affected by the index 'active' strategy.

Finally, the use of derivatives can be helpful for immunising or leveraging the hidden active strategy used in selective indices. The theory on derivatives suggests that a long (short) position on a selective index can be offset with a short (long) position on its derivatives, typically futures contracts. Other derivatives could also be employed, typically options and swaps.

7. Conclusion

With the ever-increasing popularity of so-called passive investment management and the all-pervasive use of equity market indices as benchmarks, major index providers such as

Standard and Poors, Dow Jones or Morgan Stanley have become – indirectly – the world’s biggest investment managers. Given the way the most widely used indices are constituted, however, it would be a mistake to consider investments which replicate the performance of those indices as a form of passive investment management.

The easier replication of exclusive indices magnetizes passive investment to a significant extent. Our research digs more deeply into the index construction and rebalancing methodology and finds that an exclusive index should not be regarded as synonymous with passive investment. Not only do exclusive indices systematically differ from their more inclusive peers, but their performance is biased by a market-timing component. Thus, exclusive indices tend to outperform (underperform) inclusive ones in upward (downward) markets. This bias is due to the set of rules governing the selection of constituents and the rebalancing procedure. These rules act in the same way as momentum and stop-loss strategies.

At an aggregate level, exclusive indices appear to behave in a time-varying and procyclical fashion. Inherent active rules can be shown to have boosted market performance (as reported by the most popular indices) during bull periods and to have exacerbated losses during negative trends. Here, we have discussed the main implications for asset managers. However, this issue may also warrant the attention of macroeconomists.

Figure 1: Outperformance and under performance of selective indices in bull and bear markets.

This graph shows the cumulative outperformance of three selective US stock market indices with respect to more inclusive indices. The three index pairs are the S&P 100 and 500 indices, the Russell 200 and 3000 indices, and the Wilshire 750 and All-Share indices. The selective indices include only the 100, 200, and 750 largest companies listed on the US stock markets, for the S&P 100, Russell 200, and Wilshire 750 respectively. The more inclusive indices comprise the 500, 3000 and all securities covered by the S&P, Russell, and Wilshire index providers, respectively. Returns are calculated on a logarithmic and continuously compounded basis. The cumulative performance over the bull (bear) period is the sum of monthly returns from 1/1/1996 to 3/31/2000 (4/1/2000 to 12/31/2003).

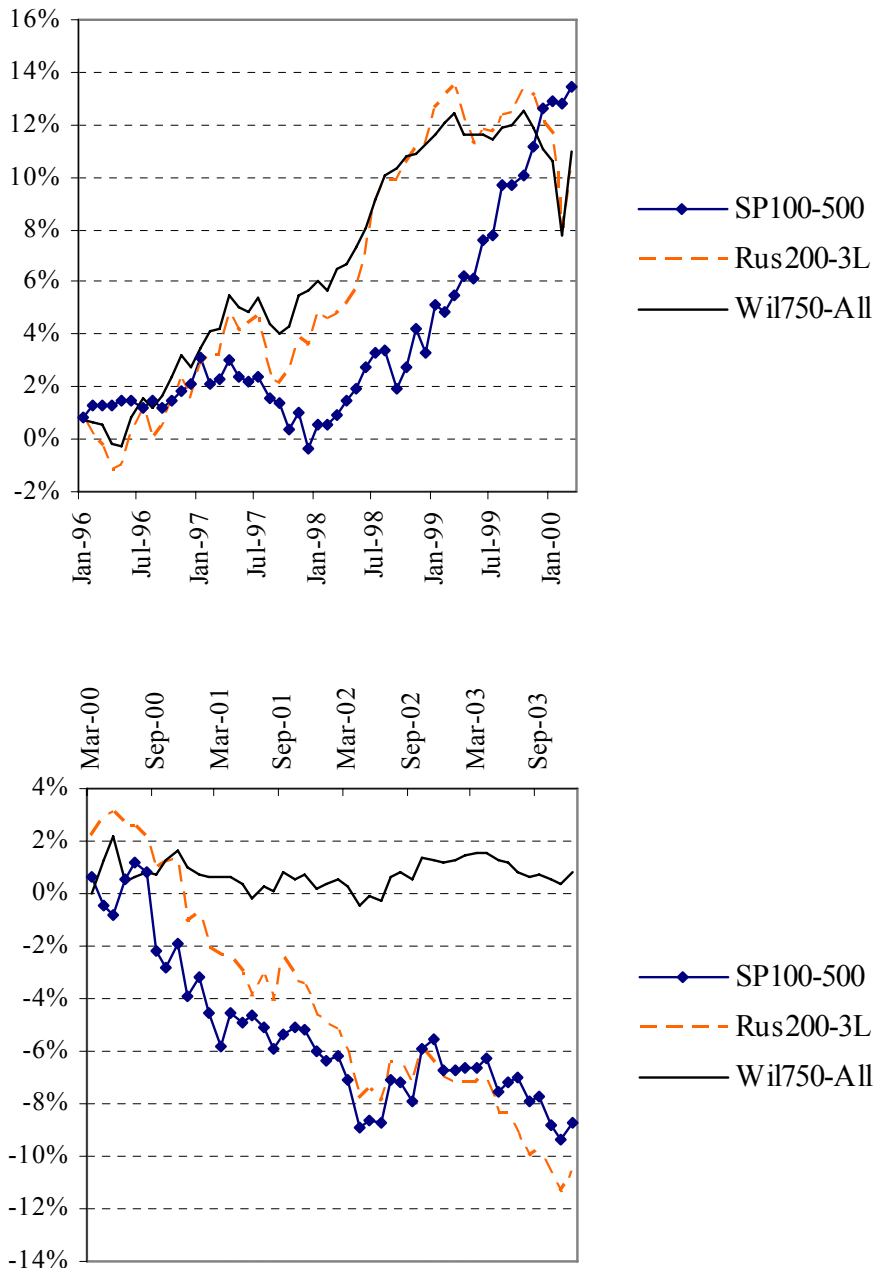


Table 1: Main characteristics of a selective sample of equity market indices.

This table summarises the main characteristics of a selective sample of the major equity market indices. It shows the names and characteristics (where applicable) of the exclusive and inclusive definitions of these indices. No style indices are considered. The first column shows the name of the index provider. The other columns show the main characteristics of the index construction and maintenance rules.

| Index provider | Types | Criteria | Membership | Weighting | Adjustments |
|--|--|---|---|--|---|
| Dow Jones Averages Indices | Highly selective sector indices | U.S. companies that are leaders in their industries | Components are selected at the discretion of the editors of <i>The Wall Street Journal</i> . | Price weighted method adjusted for corporate events (e.g. splits, spin-offs) | Discretionary |
| Dow Jones Global Indices | Global Indices: World, Region, Country, and Sector Indexes | Constructed to cover 95% of market capitalisation | Geographical or sector classification | Float-adjusted market capitalisation | Systematic and predefined rules |
| Dow Jones Titans Indices | Highly selective indices | The world's 30 biggest and best-known companies | Largest and most-trusted market leaders in 18 sectors (ICB classification). | Designed to incur minimal expenses, high liquidity and low turnover. | Discretionary – chosen by the index committee |
| Dow Jones Wilshire | Wilshire 750 and All-Equities | Market capitalisation, trading volume, institutional holdings | US-headquartered companies; common stocks, REIT or limited partnership | Weighted by float-adjusted market capitalisation | Universe defined in June, but stocks are added and deleted on the 3rd Friday of each month. |
| Morgan Stanley Capital International Inc. (MSCI) | Country, Region, Sector indices | Market capitalisation; liquidity; length of trading; free-float | All listed equity securities classified in broad, investible, prime and small markets. GICS [®] applies. | Float-adjusted market capitalisation. | Semi-annual revisions to reconstitute the index universe (end of May and November); quarterly changes of the investible market index. Immediate implementation of event-related changes |
| Paris Bourse | CAC 40; SBF 120 and 250 | Market capitalisation and liquidity (measured by turnover, volume, bid-ask spread and volatility) | 40 or 250 French companies listed on the Paris Stock Exchange | Weighted by capitalisation-weighted value ratio | A committee with discretionary power decides at scheduled meetings using pre-defined rules. |
| Russell | Russell 50, 200, 1000, 2000, and 3000. | Market capitalisation and minimum requirements such as stocks trading above \$1.00 | Stocks incorporated in the United States | Weighted by market capitalisation. | The universe is defined by the end of May. Final membership list disclosed on 1 July. |

| | | | | | |
|----------------------------------|--|---|--|---|---|
| S&P / Citigroup | Primary Market Index (PMI) and Broad Market Index (BMI) for 26 regions or countries | BMI is the flagship All-Share index; PMI includes the top 80% of the BMI in each country | Market capitalisation greater than USD 100 million | Float-adjusted market capitalisation | Annual re-construction in June but additions / deletions monthly. Immediate implementation of event-related changes |
| Standard & Poor's Global Indices | 29 countries; among others: S&P Global 100 and 1200 | Capitalisation; float adjustments; liquidity; company analysis | Number of constituents is fixed. Sector classification based on GICS®. Several criteria determine domicile. | Weighted by float-adjusted market capitalisation | Index committee decides. All share changes over 5% are carried out on the effective date. Otherwise, on the 3rd Friday of March, June, September and December |
| Standard & Poor's US Indices | S&P 100, 500, 1000, Composite 1500, Mid-Cap 400, Small-Cap 600, and Equal Weight Index | Capitalisation (given thresholds); float adjustments; liquidity; company analysis. | Fixed number of constituents. GICS® Sector classification. US companies. "Adequate liquidity and reasonable per-share price" | Weighted by float-adjusted market capitalisation | When needed. There is no annual reconstitution. All share changes over 5% are carried out on the effective date. Otherwise, weekly changes apply |
| Swiss Stock Exchange | Swiss Market Index (SMI) and Swiss Performance Index (SPI) | SMI is a blue-chip index. It is made up of a maximum of the 30 largest stocks. SPI contains large-cap and mid-cap stocks. SMI is not adjusted for dividends | All SWX traded equity securities of companies domiciled in Switzerland or the Principality of Liechtenstein | Market capitalisation with a minimum free-float requirement | Index committee decides index adjustments in April and October. Extraordinary changes immediately apply. |
| Tokyo Stock Exchange | Topix 30, 100, 500 and 1000 | Domestic common stocks listed on the 1 st section of TSE | Most liquid and largest capitalisation | Price weighted with adjustments for liquidity | In April (additions), in October (additions and deletions) |

Table 2: Comparative performance of more exclusive indices and inclusive equity indices.

This table shows the comparative performance of more exclusive indices and inclusive equity indices, for various index providers. The performance is measured in terms of total returns and annualised Sharpe ratio. Returns are calculated in local currencies. The index providers are listed in the first column. The second column shows the reference region or country of the market indices. The third column refers to the beginning of the investment horizon, which is determined by the inception date of either the exclusive index or the inclusive index, depending on which is more recent. The end of the investment horizon is homogenously set at the end of 2004. Columns five and six (seven and eight) show the performance over bull (bear) periods. A bull (bear) period occurs when the monthly return is greater than (less than or equal to) zero.

| Index Provider | Region / Country | Inception | | Bull Periods | | Bear Periods | |
|------------------|------------------|-----------|--------------|-----------------------|--------------------------------|------------------------|---------------------------------|
| | | | | Exclusive Index | Inclusive Index | Exclusive Index | Inclusive Index |
| Standard & Poors | Global | Dec-89 | Performance | S&P 100 39.4% | S&P 1200 37.3% | S&P 100 -44.9% | S&P 1200 -43.0% |
| | | | Sharpe ratio | 4.81 | 4.93 | -4.20 | -4.12 |
| Wilshire | USA | Jun-78 | Performance | Wilshire 750 43.9% | Wilshire All Equities 41.9% | Wilshire 750 -40.7% | Wilshire All Equities -44.9% |
| | | | Sharpe ratio | 5.01 | 4.98 | -3.33 | -3.51 |
| FTSE | UK | Dec-78 | Performance | FTSE 100 43.3% | FTSE All Share 42.0% | FTSE 100 -47.0% | FTSE All Share -48.6% |
| | | | Sharpe ratio | 4.74 | 4.70 | -3.37 | -3.35 |
| SWX | Switzerland | Dec-93 | Performance | SMI* 45.0% | SPI* 42.3% | SMI* -56.7% | SPI* -54.1% |
| | | | Sharpe ratio | 4.68 | 4.84 | -3.74 | -3.76 |
| Tokyo S.E. | Japan | Dec-90 | Performance | Topix 30 58.0% | Topix 500 47.6% | Topix 30 -54.9% | Topix 500 -49.2% |
| | | | Sharpe ratio | 3.59 | 4.64 | -4.49 | -5.11 |
| Toronto S.E. | Canada | Aug-88 | Performance | TSE 35 42.2% | TSE Compos. 39.2% | TSE 35 -38.3% | TSE Compos. -41.2% |
| | | | Sharpe ratio | 4.92 | 4.91 | -3.31 | -3.34 |
| Paris Bourse | France | Dec-90 | Performance | CAC 40 51.0% | SBF 250 47.8% | CAC 40 -63.0% | SBF 250 -54.7% |
| | | | Sharpe ratio | 4.59 | 4.58 | -4.73 | -4.09 |

*The SMI has outperformed the SPI despite the fact that the former is a price index and the latter a total return index.

Table 3: Performance comparison of different index families for the US stock market. The upper part of this table shows the index performance over a representative bull market period (January 1995 to March 2000) while the lower part shows the index performance over a representative bear market period (March 2000 to March 2003). The columns headed “Performance” and “Return p.a.” show the total returns over the sample periods and on an annual basis. The column headed “Return SD annualised” shows the standard deviation of returns on an annual basis. The column headed “Sharpe ratio” shows the investment performance adjusted for risk, i.e. return divided by return standard deviation. Index numbers for bull (bear) market performance are listed by performance, ranging from the highest (lowest) to the lowest (highest) performance.

| BULL MARKET | | | | |
|--------------------|-------------|-------------|----------------------|--------------|
| Index | Performance | Return p.a. | Return SD annualised | Sharpe ratio |
| S&P 100 | 133.60% | 25.00% | 15.30% | 1.641 |
| WILSHIRE 750 | 129.80% | 26.00% | 14.60% | 1.775 |
| WILSHIRE 2500 | 125.10% | 25.40% | 14.60% | 1.744 |
| MSCI USA | 122.30% | 25.30% | 14.70% | 1.726 |
| S&P 500 | 118.30% | 22.50% | 14.50% | 1.549 |
| RUSSELL 1000 | 118.20% | 22.90% | 14.50% | 1.582 |
| S&P 1500 | 115.50% | 22.00% | 14.50% | 1.514 |
| RUSSELL 3000 | 114.30% | 22.50% | 14.40% | 1.563 |
| DJIA | 104.70% | 22.00% | 15.60% | 1.408 |
| BEAR MARKET | | | | |
| Index | Performance | Return p.a. | Return SD annualised | Sharpe ratio |
| S&P 100 | -64.20% | -20.80% | 19.30% | -1.076 |
| MSCI USA | -61.00% | -23.60% | 17.80% | -1.328 |
| RUSSELL 1000 | -57.20% | -19.60% | 18.20% | -1.081 |
| S&P 500 | -56.90% | -19.00% | 17.80% | -1.066 |
| RUSSELL 3000 | -55.90% | -19.70% | 18.20% | -1.081 |
| WILSHIRE 750 | -55.20% | -20.10% | 18.30% | -1.096 |
| WILSHIRE 2500 | -53.30% | -20.00% | 18.40% | -1.088 |
| S&P 1500 | -53.00% | -17.70% | 17.70% | -0.997 |
| DJIA | -31.20% | -12.50% | 18.20% | -0.687 |

Table 4: Differences in performance among different US stock market indices. This table shows the significance levels of the two-tailed *t*-statistics to assess a similar performance between pairs of US stock market indices. The upper part of this table shows the *t*-stat for the index performance over a representative bull market period (January 1995 to March 2000) while the lower part shows the index performance over a representative bear market period (March 2000 to March 2003). A significant confidence level equal to or worse than 1% is marked in bold.

BULL MARKET

| T-stat | S&P100 | S&P500 | S&P1500 | RUSSEL1000 | RUSSEL3000 | WILT750 | WILT2500 | MSCI US | DJ INDUS |
|------------|--------|-----------|-----------|------------|------------|-----------|-----------|---------|----------|
| S&P100 | | 1% | 1% | 4% | 4% | 58% | 35% | 4% | 4% |
| S&P500 | 1% | | 35% | 99% | 49% | 0% | 25% | 8% | 35% |
| S&P1500 | 1% | 35% | | 12% | 70% | 0% | 1% | 12% | 47% |
| RUSSEL1000 | 4% | 99% | 12% | | 16% | 0% | 4% | 36% | 39% |
| RUSSEL3000 | 4% | 49% | 70% | 16% | | 0% | 0% | 24% | 57% |
| WILT750 | 58% | 0% | 0% | 0% | 0% | | 19% | 5% | 11% |
| WILT2500 | 35% | 25% | 1% | 4% | 0% | 19% | | 68% | 23% |
| MSCI US | 4% | 8% | 12% | 36% | 24% | 5% | 68% | | 23% |
| DJ INDUS | 4% | 35% | 47% | 39% | 57% | 11% | 23% | 23% | |
| Mean | 14% | 31% | 22% | 26% | 27% | 12% | 22% | 23% | 30% |

BEAR MARKET

| T-stat | S&P100 | S&P500 | S&P1500 | RUSSEL1000 | RUSSEL3000 | WILT750 | WILT2500 | MSCI US | DJ INDUS |
|------------|--------|--------|---------|------------|------------|---------|----------|---------|----------|
| S&P100 | | 25% | 15% | 40% | 33% | 21% | 21% | 57% | 2% |
| S&P500 | 25% | | 3% | 93% | 77% | 50% | 39% | 4% | 3% |
| S&P1500 | 15% | 3% | | 15% | 25% | 52% | 95% | 2% | 6% |
| RUSSEL1000 | 40% | 93% | 15% | | 53% | 28% | 15% | 41% | 3% |
| RUSSEL3000 | 33% | 77% | 25% | 53% | | 57% | 4% | 28% | 6% |
| WILT750 | 21% | 50% | 52% | 28% | 57% | | 41% | 13% | 7% |
| WILT2500 | 21% | 39% | 95% | 15% | 4% | 41% | | 15% | 10% |
| MSCI US | 57% | 4% | 2% | 41% | 28% | 13% | 15% | | 2% |
| DJ INDUS | 2% | 3% | 6% | 3% | 6% | 7% | 10% | 2% | |
| Mean | 27% | 37% | 27% | 36% | 35% | 34% | 30% | 20% | 5% |

Table 5: Returns on S&P/Citigroup indices for several countries. The S&P/Citigroup provides pairs of equity market indices for various countries and regions. The exclusive index is called the Primary Market Index (PMI). It represents the largest capitalisations, i.e. the top 80% of the available capital in a given market. The more inclusive index is called the Broader Market Index (BMI) and represents all the quoted shares. The first column shows the reference country for the market index. The second column refers to the inception date of the index. The end date of the sample period is 31.12.2004 for all indices. The third (fifth) column shows the annualised outperformance of the PMI with respect to BMI in bull (bear) markets. A positive (negative) return on the BMI defines a monthly bull (bear) period. Returns are calculated in local currencies apart from in those regions labelled as \$ and €. The fourth (sixth) column shows the PMI outperformance in terms of the annualised information ratio over bull (bear) periods. The last row shows the frequency in % with which the PMI outperforms the BMI.

| Country | Inception date | Outperformance PMI in bull markets | | Outperformance PMI in bear markets | |
|-----------------------|----------------|---|-------|---|-------|
| | | Return | IR | Return | IR |
| AUSTRALIA | 30.06.89 | 1.1% | 9.2 | -2.6% | -67.4 |
| AUSTRIA | 30.06.89 | 2.2% | 6.5 | -2.2% | -15.2 |
| BELGIUM | 30.06.89 | -0.3% | 8.2 | -2.4% | -6.3 |
| CANADA | 30.06.89 | 0.8% | 2.6 | -0.9% | -1.7 |
| CZECH REPUBLIC | 31.08.01 | 5.3% | 6.7 | -13.5% | -4.7 |
| DENMARK | 30.06.89 | 1.7% | 2.1 | -4.3% | -18.7 |
| FINLAND | 30.06.89 | 3.7% | 1.5 | -17.3% | -3.7 |
| FRANCE | 30.06.89 | 1.4% | 4.5 | -2.5% | -30.3 |
| GERMANY | 30.06.89 | 2.8% | 2.4 | -5.3% | -5.5 |
| GREECE | 30.04.00 | -1.4% | -5.0 | 0.0% | 0.0 |
| HONG KONG | 28.02.91 | 3.2% | 4.0 | -1.1% | 18.5 |
| HUNGARY | 31.01.97 | 12.6% | 37.1 | 3.3% | -8.1 |
| IRELAND | 30.06.89 | 2.7% | 3.1 | -3.7% | -4.8 |
| ITALY | 30.06.89 | 4.8% | -7.1 | 0.8% | 3.0 |
| JAPAN | 30.06.89 | 0.2% | -1.2 | -1.5% | -8.3 |
| ASIA PAC. (\$) | 30.06.89 | 1.3% | -5.0 | -0.1% | -0.3 |
| EMERGING MARKETS (\$) | 31.01.95 | 2.1% | 6.7 | 0.7% | 1.2 |
| EMU COUNTRIES (€) | 28.02.99 | 0.1% | 0.2 | -3.8% | -7.9 |
| EUROPE (€) | 28.02.99 | 0.5% | 3.8 | 0.0% | 0.6 |
| NORTH AMERICA (\$) | 30.06.89 | -0.7% | -1.6 | 0.3% | -3.1 |
| NORWAY | 30.06.89 | -0.7% | -10.9 | -0.1% | 0.7 |
| NETHERLANDS | 30.06.89 | 1.5% | 4.2 | -1.5% | -3.9 |
| NEW ZEALAND | 30.06.89 | 2.3% | 3.3 | -3.7% | -3.7 |
| PORTUGAL | 31.08.98 | -0.2% | -0.8 | -2.9% | -2.8 |
| SCANDINAVIA (€) | 28.02.99 | 5.9% | 3.7 | -9.7% | -4.7 |
| SOUTH KOREA | 31.08.01 | 9.7% | -8.7 | 8.0% | 15.6 |
| SLOVENIA | 31.01.01 | 8.9% | 9.6 | 0.1% | 0.1 |
| SINGAPORE | 30.06.89 | -1.2% | -32.6 | -7.5% | -11.3 |
| SPAIN | 30.06.89 | 2.9% | 4.8 | -1.9% | -2.0 |
| SWITZERLAND | 30.06.89 | 1.5% | 2.4 | -0.4% | 1.2 |
| SWEDEN | 30.06.89 | 2.5% | 3.2 | -4.3% | -3.0 |
| UNITED KINGDOM | 30.06.89 | 2.0% | 13.2 | 1.9% | -5.2 |
| UNITED STATES | 30.06.89 | -0.7% | -1.6 | 0.3% | -2.6 |
| WORLD (\$) | 30.06.89 | 0.4% | 3.4 | 0.0% | 0.2 |
| Mean | | 2.4% | 1.4 | -2.2% | -5.2 |
| No. of times PMI>BMI | | 80% | 71% | 26% | 26% |

Table 6: Sector analysis

This table shows the comparative performance of global Dow Jones (DJ) super-sector indices from 1 January 1992 to 31 December 2004. The first and second columns list the DJ Titans (DJT) and DJ Total Market (DJTM) global indices according to the super-sector classification (GICS[®] system). The DJT indices include only the 30 largest international companies. The DJTM indices are calculated on the same basis as the DJT but are more comprehensive. Performance is measured in terms of the total amount by which DJT returns exceed those on the DJTM indices, as well as the annualised information ratio. Columns 3-4 (5-6) refer to bull (bear) periods. A positive (negative) return on the DJTM indicates a monthly bull (bear) period. The last row shows the sum of the total DJT excess returns and the sum of annualised information ratios.

| Name | Name | Bull Markets | | Bear Markets | |
|--------------------|---------------------|--------------|--------|--------------|--------|
| | | Return | IR | Return | IR |
| DJT AUTO & PARTS | DJTM AUTO & PARTS | 10.7% | 0.316 | 6.7% | 0.264 |
| DJT BANKS | DJTM BANKS | 53.1% | 0.353 | -106.8% | -0.432 |
| DJT BASIC RESOUR | DJTM BASIC RESOUR | 17.8% | 0.310 | -20.6% | -0.386 |
| DJT TRAVEL & LEIS | DJTM TRAVEL & LEIS | -57.9% | -0.315 | 74.2% | 0.415 |
| DJT CHEMICALS | DJTM CHEMICALS | 14.8% | 0.343 | -1.3% | -0.067 |
| DJT CON & MAT | DJTM CON & MAT | 27.1% | 0.369 | -14.6% | -0.335 |
| DJT OIL & GAS | DJTM OIL & GAS | -10.3% | -0.345 | 11.3% | 0.378 |
| DJT FOOD & BEV | DJTM FOOD & BEV | 16.3% | 0.332 | -1.3% | -0.073 |
| DJT FINANCIAL SVS | DJTM FINANCIAL SVS | 40.8% | 0.348 | -24.8% | -0.411 |
| DJT HEALTH CARE | DJTM HEALTH CARE | 22.2% | 0.325 | -24.0% | -0.419 |
| DJT INDS GDS & SVS | DJTM INDS GDS & SVS | 10.7% | 0.258 | 3.0% | 0.109 |
| DJT INSURANCE | DJTM INSURANCE | 25.1% | 0.356 | -29.5% | -0.420 |
| DJT MEDIA | DJTM MEDIA | -7.3% | -0.237 | 6.3% | 0.308 |
| DJT PERS & H/H GDS | DJTM PERS & H/H GDS | -40.6% | -0.265 | 55.0% | 0.413 |
| DJT RETAIL | DJTM RETAIL | 13.7% | 0.280 | -5.2% | -0.153 |
| DJT TELECOM | DJTM TELECOM | 6.3% | 0.265 | -6.7% | -0.317 |
| DJT TECHNOLOGY | DJTM TECHNOLOGY | 4.5% | 0.132 | 31.5% | 0.406 |
| DJT UTILITIES | DJTM UTILITIES | -5.2% | -0.178 | -32.0% | -0.409 |
| | Sum | 141.8% | 2.647 | -78.7% | -1.130 |

Table 7: Regression analysis for market timing. Using the S&P/Citigroup index data, we estimate the market model (columns 3-6) and market timing (columns 7-11), assuming that the Primary Market Index (PMI) is the managed portfolio and the Broader Market Index (BMI) is its benchmark or market portfolio. The (log) excess returns on the PMI and BMI with respect to the riskless asset in month t are denoted as $r_{t,PMI}$ and $r_{t,BMI}$. The OLS regressions are the following:

$$\text{Market Model: } r_{t,PMI} = \alpha + \beta r_{t,BMI} + \varepsilon_t$$

$$\text{Market Timing: } r_{t,PMI} = \alpha + \gamma r_{t,BMI} - \lambda d_t r_{t,BMI} + \varepsilon_t$$

where d_t is a dummy variable, $d_t = 1$ if $r_{t,BMI} > 0$, zero otherwise. The first and second columns show the reference country and number of observations. The sixth, eleventh and twelfth column show the Chi-square value of the Wald test for the null hypothesis that beta is equal to 1, $\gamma=1$, and $\gamma=1$ and $\lambda=0$, respectively. ***, **, * indicate a significance level of 1, 5, and 10%.

| Country | Obs | Market Model | | | | Market Timing | | | | | |
|------------|-----|--------------|----------|-------|----------------|---------------|----------|-----------|-------|-----------------|----------------------------|
| | | α | β | Ad R2 | $H_0: \beta=1$ | α | γ | λ | Ad R2 | $H_0: \gamma=1$ | $H_0: \gamma=1, \lambda=0$ |
| AUSTRALIA | 186 | 0 | 1.036*** | 0.99 | 15.96*** | -0.001 | 1.054*** | 0.038 | 0.99 | 11.09*** | 19.28*** |
| AUSTRIA | 186 | 0.001 | 1.020*** | 0.99 | 1.09 | 0 | 1.026*** | 0.011 | 0.99 | 3.64* | 4.2 |
| BELGIUM | 186 | 0 | 1.021*** | 0.99 | 5.54** | -0.001 | 1.030*** | 0.016 | 0.99 | 2.83* | 2.93** |
| CANADA | 186 | 0 | 1.023*** | 0.98 | 5.09** | 0 | 1.008*** | -0.026 | 0.98 | 0.15 | 2.87** |
| CZECH REP. | 40 | -0.002 | 1.122*** | 0.96 | 16.73*** | -0.001 | 1.115*** | -0.02 | 0.96 | 9.04*** | 16.23*** |
| DENMARK | 186 | -0.001 | 1.048*** | 0.98 | 19.40*** | -0.002* | 1.074*** | 0.051 | 0.98 | 12.83*** | 20.52*** |
| FINLAND | 186 | -0.002* | 1.123*** | 0.98 | 34.53*** | 0.002 | 1.071*** | -0.106** | 0.99 | 11.85*** | 42.56*** |
| FRANCE | 186 | 0 | 1.026*** | 0.99 | 7.66*** | -0.001 | 1.037*** | 0.021 | 0.99 | 7.13*** | 12.64*** |
| GERMANY | 186 | 0 | 1.063*** | 1.00 | 88.55*** | 0 | 1.081*** | 0.032 | 1.00 | 33.30*** | 100.54*** |
| GREECE | 57 | 0.002 | 0.976*** | 0.99 | 2.75* | 0 | 1.012*** | 0.061* | 0.99 | 0.21 | 6.53** |
| HONG KONG | 167 | 0 | 1.006*** | 0.99 | 0.3 | -0.001 | 1.023*** | 0.035** | 0.99 | 3.29* | 4.38 |
| HUNGARY | 96 | 0.002* | 1.029*** | 0.99 | 5.99*** | 0 | 1.059*** | 0.055** | 0.99 | 8.97*** | 12.47*** |
| IRELAND | 186 | -0.001 | 1.050*** | 0.97 | 14.20*** | -0.002 | 1.071*** | 0.041 | 0.97 | 10.89*** | 17.68*** |
| ITALY | 186 | 0 | 1.008*** | 0.99 | 0.7 | 0.001 | 0.992*** | -0.037 | 0.99 | 0.19 | 3.6 |
| JAPAN | 186 | 0 | 1.004*** | 0.99 | 0.16 | 0.001 | 0.990*** | -0.026 | 0.99 | 0.44 | 0.9 |
| ASIA PAC. | 186 | 0 | 1.004*** | 0.99 | 0.28 | 0.001 | 0.988*** | -0.032 | 0.99 | 0.91 | 1.78 |
| EMERG. M. | 120 | 0 | 1.021*** | 1.00 | 8.12*** | 0 | 1.018*** | -0.005 | 1.00 | 1.71 | 8.68*** |
| EMU | 71 | 0 | 1.035*** | 1.00 | 9.58*** | -0.001 | 1.042*** | 0.012 | 1.00 | 5.46** | 10.26*** |
| EUROPE | 71 | -0.001* | 1.004*** | 0.99 | 0.09 | -0.002* | 1.030*** | 0.043 | 0.99 | 2.43 | 2.46 |
| N. AMERICA | 186 | 0 | 0.993*** | 0.98 | 0.61 | -0.001* | 1.023*** | 0.058** | 0.98 | 1.64 | 4.72* |
| NORWAY | 186 | 0 | 0.986*** | 0.98 | 1.17 | 0 | 0.991*** | 0.009 | 0.98 | 0.21 | 1.17 |
| NETHERL. | 186 | 0.001 | 1.024*** | 0.99 | 6.88*** | 0.001 | 1.020*** | -0.007 | 0.99 | 0.66 | 7.47** |
| N. ZEALAND | 186 | 0 | 1.052*** | 0.98 | 9.18*** | 0 | 1.037*** | -0.03 | 0.98 | 1.81 | 9.27*** |
| PORTUGAL | 77 | -0.001 | 1.026*** | 0.98 | 1.21 | 0 | 0.989*** | -0.065 | 0.98 | 0.05 | 5.67** |
| SCANDIN. | 71 | -0.002* | 1.100*** | 0.99 | 64.58*** | -0.001 | 1.092*** | -0.016 | 0.99 | 44.21*** | 76.32*** |
| S. KOREA | 41 | 0 | 1.011*** | 0.99 | 0.4 | -0.002 | 1.038*** | 0.056 | 0.99 | 2.04 | 2.05 |
| SLOVENIA | 27 | 0 | 1.108*** | 0.98 | 23.62*** | 0.001 | 1.096*** | -0.041 | 0.98 | 4.98** | 28.60*** |
| SINGAPORE | 186 | 0 | 1.024*** | 0.99 | 6.93*** | 0.001 | 1.007*** | -0.031 | 0.99 | 0.28 | 10.14*** |
| SPAIN | 186 | 0 | 1.043*** | 0.99 | 7.61*** | 0 | 1.039*** | -0.008 | 0.99 | 4.21** | 8.96*** |
| SWITZER. | 186 | 0.001 | 1.010*** | 0.98 | 0.6 | -0.001 | 1.057*** | 0.085*** | 0.99 | 12.74*** | 13.07*** |
| SWEDEN | 186 | 0 | 1.051*** | 0.99 | 22.52*** | 0.001 | 1.035*** | -0.031 | 0.99 | 5.15*** | 23.06*** |
| UK | 186 | 0 | 0.996*** | 0.98 | 0.08 | -0.001* | 1.035*** | 0.071** | 0.98 | 2.29 | 4.27 |
| US | 186 | 0 | 0.992*** | 0.98 | 0.64 | -0.001* | 1.025*** | 0.062** | 0.98 | 1.84 | 5.33** |
| WORLD | 186 | 0 | 1.001*** | 0.99 | 0.02 | -0.001 | 1.017*** | 0.029 | 0.99 | 0.21 | 1.7 |

Table 8: Changes in the MSCI index components from January 1995 to May 2001.

This table shows the changes in the index components of the MSCI country indices. The first column shows the reference country for each index. The second and third columns show the total number of components in January 1995 and May 2001. The fourth and fifth columns show the number of original components still included in May 2001 and the number of new index members, respectively. The sixth column shows the total market capitalisation of the original index components in May 2001. The last four columns on the right-hand side show the reasons for the index component exclusions. These include delisting, conversion, M&A or takeover, or an MSCI decision (see 7th to 10th columns respectively).

| MSCI Index | Number of components 1995 | Number of components 2001 | Original components | New Components | Market Cap of original components in MSCI of 2001 | Delisted | Conversion | Merger & takeover | MSCI decision |
|------------|---------------------------|---------------------------|---------------------|----------------|---|----------|------------|-------------------|---------------|
| USA | 366 | 328 | 218 | 148 | 76% | 4 | 0 | 90 | 54 |
| | | | 60% | 40% | 3% | 0% | 61% | 36% | |
| BRAZIL | 54 | 46 | 25 | 29 | 52% | 11 | 0 | 2 | 16 |
| | | | 46% | 54% | 38% | 0% | 7% | 55% | |
| ARGENTINA | 23 | 17 | 10 | 13 | 57% | 6 | 1 | 1 | 5 |
| | | | 43% | 57% | 46% | 8% | 8% | 38% | |
| SWITZER. | 42 | 35 | 25 | 17 | 93% | 3 | 8 | 4 | 2 |
| | | | 60% | 40% | 18% | 47% | 24% | 12% | |
| FRANCE | 61 | 52 | 37 | 24 | 84% | 12 | 1 | 1 | 10 |
| | | | 61% | 39% | 50% | 4% | 4% | 42% | |
| GERMANY | 65 | 48 | 32 | 33 | 81% | 3 | 5 | 7 | 18 |
| | | | 49% | 51% | 9% | 15% | 21% | 55% | |
| UK | 136 | 112 | 73 | 63 | 85% | 28 | 0 | 14 | 21 |
| | | | 54% | 46% | 44% | 0% | 22% | 33% | |
| CANADA | 82 | 68 | 42 | 40 | 80% | 2 | 2 | 24 | 12 |
| | | | 51% | 49% | 5% | 5% | 60% | 30% | |
| AUSTRALIA | 47 | 56 | 29 | 18 | 59% | 12 | 0 | 0 | 6 |
| | | | 62% | 38% | 67% | 0% | 0% | 33% | |
| JAPAN | 311 | 277 | 230 | 81 | 81% | 11 | 0 | 9 | 61 |
| | | | 74% | 26% | 14% | 0% | 11% | 75% | |

Table 9: MSCI index performance compared with a purely passive index performance (January 1995 – May 2001).

This table compares the index performance of some MSCI country indices, as published by Morgan Stanley, with a newly calculated passive index. The first column shows the list of MSCI indices. The second and third columns show the performance in terms of total returns. The passive index is constructed with constant constituents, i.e. by holding the original components over time.

| MSCI Index | MSCI Index Return | Passive Index Return |
|--------------------------|-------------------|----------------------|
| MSCI USA | 99% | 72% |
| MSCI BRAZIL | 101% | 50% |
| MSCI ARGENTINA | 17% | -22% |
| MSCI SWITZERLAND | 106% | 92% |
| MSCI FRANCE | 116% | 88% |
| MSCI GERMANY | 97% | 85% |
| MSCI UK | 64% | 49% |
| MSCI CANADA | 88% | 65% |
| MSCI AUSTRALIA | 58% | 48% |
| MSCI JAPAN | -6% | -23% |
| Equally weighted average | 74% | 50% |

Table 10: MSCI US index performance compared with the performance of purely passive indices.

This table shows the total returns of the MSCI US index, two alternative definitions of passive index and a momentum portfolio. The investment horizon extends from January 1995 to May 2001. This time horizon is decomposed in seven sub-periods (six 1-year periods and one 5-month period; dd/mm/yyyy). The first passive strategy in the fourth column holds the initial index components and weights constant. The second passive strategy in the fifth column is headed “Passive with Reinvestment” performance. This strategy is calculated by reinvesting the amounts corresponding to the last traded prices of the excluded components in the subsequent year in proportion to market capitalisation weights. The momentum portfolio is constructed by investing in the stocks with top decile performance in the previous quarter.

| From | To | MSCI US | Passive | Passive with Reinvestment | Momentum |
|------------|---------------------------|---------|---------|---------------------------|----------|
| 01.01.1995 | 31.12.1995 | 29.8% | 25.9% | 25.9% | 27.2% |
| 01.01.1996 | 31.12.1996 | 19.4% | 13.6% | 14.3% | 16.2% |
| 01.01.1997 | 31.12.1997 | 27.6% | 18.2% | 18.3% | 18.1% |
| 01.01.1998 | 31.12.1998 | 25.3% | 16.2% | 16.3% | 12.4% |
| 01.01.1999 | 31.12.1999 | 18.9% | -1.0% | -1.1% | 14.1% |
| 01.01.2000 | 31.12.2000 | -14.6% | 0.3% | -1.1% | 6.1% |
| 01.01.2001 | 31.05.2001 | -4.8% | -0.9% | -2.3% | -5.5% |
| | Total | 101.6% | 72.2% | 70.2% | 88.6% |
| | Average annualised return | 15.8% | 11.3% | 10.9% | 13.8% |

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