WP/11/47

IMF Working Paper

Additions to Market Indices and the Comovement of Stock Returns Around the World

Stijn Claessens and Yishay Yafeh

INTERNATIONAL MONETARY FUND

 WP/11/47

IMF Working Paper

Research Department

Additions to Market Indices and the Comovement of Stock Returns Around the World

Prepared by Stijn Claessens and Yishay Yafeh[1]

March 2011

Abstract

Using newly-constructed data covering the last decade, we document that, in most of forty markets, when added to the main index, firms' returns experience an increase in comovement with the rest of the index, reflected in higher *beta* and greater explanatory power of the market return. Stock turnover and analyst coverage also typically increase upon inclusion. Using various tests, we find the demand-based view of comovement (the category/habitat theories of Barberis, Shleifer and Wurgler, 2005) to provide a good explanation for many of our findings. Some results, though, suggest that information-related factors are also important in explaining the increased comovement.

JEL Classification Numbers: G11; G12; G14; G15

Keywords: Index inclusion; stock price comovements; category, habitat and information theories; index-based investment

Author's E-Mail Address: SClaessens@imf.org; Yishay.Yafeh@huji.ac..il

[1] We thank Doron Avramov, Eugene Kandel, Luc Laeven, Shiki Levi, Randall Morck, seminar participants at the IMF, Korea University, and the University of Alberta and two anonymous referees for very helpful comments and suggestions. We would also like to thank Zeynep Elif Aksoy and Mohsan Bilal for extensive and excellent research assistance and to Gregorio Impavido for sharing data on institutional investors. This project was initiated while Yishay Yafeh was Resident Scholar at the IMF Research Department and their hospitality is gratefully acknowledged. Yafeh also acknowledges financial support from the Krueger Center at the Hebrew University School of Business.

Contents Page

I. Introduction

Empirical evidence, focused primarily on the U.S., suggests that inclusion in a major stock market index (e.g., the S&P 500) is typically associated with two phenomena: a positive price response, and increased comovement between newly-added companies and the rest of the index. The first phenomenon–the price effect–has been discussed extensively for over twenty years in the context of a debate on whether or not demand curves for stocks slope downwards.[2] The second phenomenon – the increased post-inclusion comovement – has been studied more recently, but only in a few, developed financial systems so far. Importantly, the reasons for this second phenomenon are still being debated, with various alternative theories being proposed.[3] Shedding light on the prevalence of this phenomenon around the world and on its causes are the two objectives of this paper.

To do so, we proceed in two steps. First, we construct a new and comprehensive data set on additions to stock market indices in forty countries over a ten year period. While the extent to which index inclusion effects occur has already been documented for markets like the U.S. and, to a lesser extent, the U.K., Canada and Japan, the prevalence of this phenomenon is virtually unknown for other countries. We thus contribute to the literature by documenting the degree to which increased post-index inclusion comovement is present in a large sample of developed and emerging markets.

Second, we use the variation in index inclusion phenomena, both across countries and over time, to shed light on the validity of the various explanations proposed for the post-index inclusion increase in comovement. Specifically, we build our tests of the various explanations on the paper of Barberis, Shleifer and Wurgler (2005, hence BSW). Their starting point is that, if stock prices are driven by fundamentals only, then comovement in stock returns should not change after a company is added to a major stock market index, provided that inclusion itself is an information-free event.[4] BSW show, however, that stocks added to the S&P 500 index do experience increased comovement of returns with the rest of the index. They propose two main, non-fundamentals based explanations for this phenomenon.

According to the first explanation, comovement in stock returns is driven by correlated shocks to investor demand for a particular group of securities. Investors may group assets into categories and, as they move assets between categories, comovement is generated among the underlying assets within a category (BSW call this the "category" view). Another

---

[2] Some of the early studies on this phenomenon are Shleifer (1986) and Harris and Gurel (1986). See Eliott et al. (2006) for a survey of this literature.

[3] The two phenomena are obviously related; however, we are not aware of any study documenting the extent to which the stock price response to the announcement of inclusion in an index is related to the subsequent increase in comovement. Data constraints (and in particular, unknown announcement dates) for most countries in our sample prevent us from pursuing this direction in the present study.

[4] The assumption that index inclusions contain no information is standard in the literature, although studies such as Denis et al. (2003) or Cai (2007) challenge it. However, Kaul et al. (2000) and Boyer (2008) provide convincing evidence that changes in the structure of stock indices elicit changes in stock prices without conveying new information.

example of a demand-driven theory of comovement is what BSW call the "habitat" view, whereby investors, for a variety of reasons, trade only in a subset of assets. As they change their exposure to the securities in the "habitat," comovement is generated among these assets. Index-based investment could fit into either one of these views. Because the "category" view and the "habitat" view have similar empirical implications, we follow Greenwood (2008) and treat both as manifestations of a single "demand-based" theory of return comovement.

The second main theory proposed by BSW relates the comovement of index-included stocks to "information diffusion." Because stocks included in a major index can be expected to have lower trading costs and be more liquid, their prices may reflect aggregate information more quickly compared to other stocks not included in the index. Consequently, after inclusion, newly added stocks would tend to co-move (more) with the rest of the index.[5]

Both theories can account for the observed increase in post-index inclusion comovement, but they have very different implications. The demand-based explanation interprets the increased comovement following inclusion in a major index as "excess" comovement, i.e., beyond what is warranted by fundamentals. By contrast, the information diffusion explanation implies that prior to inclusion in an index some stocks prices did not reflect fully all the available information and comoved "too little," so that the post-inclusion increase in comovement is because prices better reflect information. Empirically, variation in the effects across stocks, countries and time periods can be used to identify which one of the two theories is more important in practice. And, besides the patterns in comovement, other patterns in returns can be studied as well, since only the information diffusion view offers predictions on the cross-auto correlations of returns.[6]

In this paper, we investigate the two explanations proposed by BSW using data for forty developed and emerging countries over a period of about ten years. We first document a set of stylized facts on the prevalence and extent of index inclusion effects around the world, providing broad evidence on a phenomenon which has so far been documented only for the US and a few other developed economies. Consistent with the existing literature, we find that in the majority of countries, both developed and emerging, inclusion in a major stock market index is associated with increased comovement between the newly added stock and the rest of the market (reflected in higher *beta*s and R^2). This result is difficult to reconcile with the view that stock prices are determined by fundamentals only. In addition, included stocks typically experience a significant increase in turnover and analyst coverage.

Next, we analyze differences in post-index inclusion comovement across stocks, countries and time periods to try to understand better why the index inclusion effect arises. We find three patterns. First, the increase in post-inclusion comovement tends to be more

---

[5] This idea is related to earlier work by Pindyck and Rotemberg (1993) who examine if stocks co-move in response to macroeconomic news.

[6] The two BSW comovement theories are not exhaustive of course; other possible reductions in market frictions and trading inefficiencies may accompany index inclusion and lead to increased comovement. Some technical factors could also account for this phenomenon. We explore some of these below.

pronounced in countries where the market index is dispersed (i.e., with many firms included). Second, the magnitude of the index-inclusion effect is larger in countries with a greater presence of institutional (and individual) investors. Third, the magnitude of the index-inclusion effect has been increasing over the last decade, albeit not monotonically. All these findings control for stock market and economic development and are robust to a number of extensions and additional empirical tests.

We argue that, collectively, these results provide more support for the demand-based than for the information-based explanation of comovement. First, the fact that the post-inclusion increase in comovement is more pronounced in countries where the index consists of more stocks is consistent with index-based investment – there is less point in tracking an index when a small number of shares can mimic the index's returns (or when a country's economy is driven by several large firms). Second, the evidence that the inclusion effect is larger in markets with greater institutional investors is in line with the demand-based view since considerable anecdotal and some systematic evidence indicates that institutional investors tend to invest in ways which mimic major indices (or are benchmarked against them), thereby generating comovement among the underlying stocks. And third, the fact that the post-inclusion increase in comovement has been increasing over time is consistent with the rising popularity of benchmark-based investment and index-based instruments around the world.

The information diffusion theory seems less capable of accounting for many of our results. It cannot account for the relation between the post-inclusion increase in comovement and index concentration. In addition, it cannot easily account for the time trend in inclusion effects – there are no strong reasons to think that the speed at which new information is incorporated has increased for index included companies more than for other firms.[7] We do find, however, that lagged *betas* decline following inclusion in an index, in line with one of the predictions of the information diffusion view. And, we document a positive, although not statistically significant, relation between the post-inclusion increase in comovement and country-specific stock price synchronicity, another proxy for stock price responsiveness to aggregate information (Morck et al., 2000). Consequently, we cannot reject that, at least in some countries, index inclusion leads to increased comovement for both demand and information diffusion reasons.

We also document some patterns which cannot be easily accounted for by either the demand- or the information-diffusion based theories. Specifically, in our data set, the increase in comovement occurs in particular for companies with pre-inclusion *beta*s which are below one, whereas companies with high pre-inclusion *beta*s often experience a post-inclusion decline in their *beta*, suggesting a convergence of *beta*s to one. This result seems is unrelated to either of the two theories, both of which predict an increase in comovement regardless of its current level.

[7] De Nicolo, Laeven and Ueda (2008) for example, report declines in the degree of stock price synchronicity for most countries in recent years, which they view as suggestive evidence of better incorporation of information.

We conduct a number of robustness tests. Throughout, we use several measures of comovement calculated at different frequencies, all of which confirm the main findings. We also examine alternative explanations for the post-inclusion increase in comovement related to changes in analyst coverage and liquidity. Although the increase in post-inclusion comovement is positively correlated with the increase in analyst coverage[8] and liquidity, controlling for post-inclusion changes in analyst coverage and liquidity does not overturn any of the other results.

In addition to BSW, the present study relates to a small number of other studies for the U.S. and some other developed countries documenting, following inclusion in a major index, increased comovement of the added stocks with the index. Vijh (1994), which predates BSW, documents post-inclusion comovement in the U.S. and develops a methodology to distinguish between "price pressure effects" and increased liquidity.[9] Also for the US, Kaul et al. (2008) find that companies switching from NASDAQ to the NYSE exhibit increased comovement with the NYSE (and decreased comovement with the NASDAQ) following the change. Boyer (2008) documents comovement across stocks belonging to the same category (e.g., growth stocks) and shows striking evidence that exogenous reclassification of stocks into different categories leads to increased comovement with the group to which the stock is assigned and decreased comovement with the group from which the stock is removed.

The much more limited non-US evidence on this subject includes Coakley and Kougoulis (2004) and Mase (2008), who present evidence of increased post-inclusion comovement in the U.K., and Greenwood and Sosner (2007) who study the Japanese market. Greenwood (2008) does not focus exclusively on index additions or deletions, but uses variation in over-weighting of certain stocks in the Nikkei index to find support for the demand-based theory of comovement rather than the information diffusion view.[10]

Taking a cross-country perspective, the paper relates to Morck et al. (2000) and to Jin and Myers (2006), who study synchronicity in stock prices in different countries, finding higher synchronicity in less developed markets. Although synchronicity can have more than one interpretation, Morck et al. (2000) view low stock price synchronicity as a proxy for the prevalence of extensive firm-specific information. Also related is Bhattacharya and Galpin (2010) who study synchronicity in stock trading volumes (rather than prices) and attempt to construct measures of the prevalence of index-based investments. Finally, as we relate the extent of index inclusion effects to the presence of investors who may be prone to follow indices or invest in certain categories of stocks, the present study relates indirectly to studies documenting the investment preferences of institutional (and other) investors such as Gompers and Metrick (2001), Kumar and Lee (2006), and Zun (2008).

---

[8] One interpretation of this is that, in some countries, analysts generate aggregate (rather than firm-specific) information (e.g., Chan and Hameed, 2006) and this aggregate information is incorporated more quickly into the prices of index-included stocks, resulting in increased comovement.
[9] See also Harford and Kaul (2005) on common order flows as a cause for intra-day return comovement.
[10] See also a short study by Coakley et al. (2008) documenting changes in comovement following inclusion in (deletion from) the MSCI Canada index.

The remainder of the paper is organized as follows. Section II describes the construction of the data base used in the analysis and presents a set of stylized facts on index inclusion effects around the world. In Section III we conduct a series of tests relating the post-inclusion increase to several possible theoretical explanations. Section IV provides series of robustness tests. Section V concludes.

II. The Data Set, Empirical Approach and Basic Statistics

Table 1 describes the data set of inclusions used for this study, which is, as far as we know, the largest of its kind. It includes over 2000 additions to forty national stock market indices over a ten-year period corresponding roughly to the last decade (2001-2010, although for some countries coverage starts later).[11]

In order to focus on additions to major indices, we choose indices corresponding as much as possible to the indices tracked by *The Economist* magazine as important and official indicators of national stock market performance. In some countries, there are several major indices and it is often hard to tell which one is most "important." We do know, however, that in countries where the index inclusion phenomenon has already been studied, the indices we use are the same as the ones tracked by *The Economist* (e.g., for the U.S., the U.K. and Japan, *The Economist* tracks the S&P 500, the FTSE 100, and the Nikkei 225, respectively, which are the indices used in several U.S., U.K. and Japan-based inclusion studies). Furthermore, to the extent that the index chosen is not the major index in a country (i.e., the index which constitutes the most natural "category" or "habitat" for investors), our tests will be biased against finding significant post-inclusion effects.[12]

We collect (from Bloomberg) information on the number of firms included in each index and its concentration (specifically, the weight of the largest five firms in the index). Firm-specific information (total assets, leverage, trading volume) is obtained from Datastream and analyst-coverage from I/B/E/S. Several sources are used to collect country-specific information (e.g., economic and financial system characteristics) and data on the extent of institutional investor involvement in equity markets. The variable definitions, their sources, and basic sample statistics are all presented in Table 2.

---

[11] Data constraints prevent further broadening of the sample both across countries and over time. For many stock markets, data are not available on index composition, especially in early years. Sometimes, the number of stocks included over the sample period is too small for country analysis. In some countries, stocks appear to be included and excluded multiple times within a short period, so that the calculation of pre- and post-inclusion statistics is impossible.

[12] One example is India where, because of data availability constraints, we use the NIFTY index whereas the largest exchange traded funds (and probably institutional investors) may track the MSCI India index. If the NIFTY is not the most natural or popular "habitat" for investors in India, then our tests would be biased against finding post-inclusion increases in comovement. We do find, however, that the weight of an index in total market capitalization has no clear association with the increase in comovement, suggesting that there is no systematic bias due to the overall coverage of the index we use. In passing, we note that the popular MSCI indices are published by Morgan Stanley and are not official publications of any stock exchange. Therefore, changes in the composition of these indices are not as widely announced as changes in the composition of "official" indices.

Methodologically, we follow BSW and other country-specific studies and calculate univariate *betas* between each newly included firm and the rest of the index to which it is added (excluding the added firm from the index, so that its weight does not affect the calculated *beta*).[13] Pre-inclusion *betas* are calculated using daily data for the three months ending 90 days prior to the inclusion date (to avoid contaminating effects of inclusion announcement or rumors about it). Post-inclusion *betas* are calculated using daily data for the three months after the inclusion date. Our measures of increased co-movement are the changes in *beta* and the corresponding R^2 between the pre-inclusion and post-inclusion periods.

The advantage of using daily data within a relatively short window around the inclusion event is that this maintains sample size, as it requires shorter series of data. The disadvantages are the potential lower precision of the estimates and the possibility of higher volatility around the inclusion event affecting the measurement of the *betas* (see, for example, Madhavan, 2003). As a further test, we therefore calculate *betas* and R^2 using weekly data for the year (52 weeks) preceding, and the year following, the inclusion date. These calculations should be less sensitive to short-run events taking place around the inclusion date. Comparing the results across different frequencies is also useful in testing some of the implications of theories on the post-inclusion rise in comovement.

In addition to measuring pre- and post-inclusion comovement, we study how the information and trading environments may have changed around the inclusion date. For this purpose, we collect data on the number of analysts covering the firm and on stock turnover (defined as the number of shares traded over the number of shares outstanding) for the year before and after the index inclusion.

After presenting some basic statistics, we use multivariate regressions to estimate the relation between changes in the estimated comovement measures following index inclusion and a number of country-specific and firm-specific variables described below. We use these and a series of additional empirical tests to distinguish between various theories and explanations of the post-inclusion comovement phenomenon.

A. Basic Statistics on Post-inclusion Comovement across Countries

Table 3 presents the average effects of index inclusion by individual country. For some countries, the results should be interpreted with caution since the number of observations is small. Nevertheless, the four main comovement measures – the increase in *beta* and the change in the explanatory power of market returns (as reflected in the increase in R^2) using both daily and weekly data — all suggest that in most countries inclusion in a

[13] Some studies, including BSW, estimate also bivariate *betas* between the added firm's stock returns and those of the main index and of non-index stocks (e.g., non-S&P 500 returns in the US). This is not feasible for most countries in our sample (except the financial centers of the US, UK and Japan) because the "non-index" component of the stock market is typically small and data on non-index returns are often not available. Another feature of some studies is the use of index exclusions (deletions) data; we discuss this issue briefly towards the end of the paper.

major index is associated with increased comovement. In 30 (of the 40) countries, newly included companies experience an increase in their daily *beta* with the rest of the index to which they are added. And in 26 countries, the weekly *beta* increases. Similarly, the R^2 increases for 32 (in the daily data) or 34 (in the weekly data) countries. In the vast majority of countries there is also an increase in stock turnover and in analyst coverage following index inclusion. These results indicate that a null hypothesis of zero increase in comovement following inclusion in an index can be rejected.[14] As such, the results extend the findings for the U.S., the U.K., Canada and Japan to many other countries and confirm that index inclusion increases comovement.

For a large number of countries (especially where the sample of index inclusions is sufficiently large), Table 3 shows fairly consistent patterns across the comovement measures. For example, in Canada, Australia, or Japan, index inclusion is associated with a substantial (and statistically significant) increase in all measures of comovement. Among emerging markets, an increase in post-inclusion comovement is also common, with some countries such Brazil, Malaysia and Poland exhibiting fairly consistent positive index inclusion effects, whereas in others the effects are weaker.[15] The group of countries with zero or negative comovement effects across the various measures consists primarily of Scandinavian countries — Finland, Norway and Sweden — although there are nevertheless increases in turnover in these countries as well. We now turn to the determinants of this phenomenon and its differing extent across countries.

III. Demand-based vs. Information-based Explanations for Comovement

Absent any real changes in firm behavior and performance in conjunction with inclusion in an index, increased post-inclusion comovement could be due to demand-based pressures along the lines of the category/habitat view; information diffusion and other information-related effects; and additional effects associated with inclusion in a major index, such as changes in liquidity, changes in analyst coverage and so forth. We explore the relative validity of these explanations in turn.

---

[14] Under the null hypothesis that, following inclusion in an index neither *beta* nor R^2 should change, and assuming that the sign of the change in comovement in the entire sample has a binomial distribution with a "success" probability of ½, the expected number of countries with a positive change in comovement is 20, with a variance (standard deviation) of 10 (3.16). The null hypothesis of no change in comovement is then rejected for the daily *beta* and both the daily and weekly R^2 at a 95% confidence level; for the weekly *beta* the level of confidence is slightly lower.

[15] Interestingly, unlike previous studies, the index inclusion effects in the US are manifest in an increase in R^2 and turnover, but not in an increase in *beta*. When we break down the sample period, we observe an increase in the daily *beta* following inclusions in the first half of the sample (up to 2005) but not in subsequent years (except for a small increase in 2009). These differences, however, are less pronounced in weekly data. One possible explanation could be that firms added to the S&P index in recent years had high pre-inclusion *beta*s, an issue we return to below. It is too early to tell whether the patterns we observe for the US are due to the specific properties of the sample we use or whether they signify a longer-lasting change.

A. The Determinants of Changes in Comovement – The Benchmark Regression

We begin with a benchmark regression specification designed to explore the main differences in index inclusion effects across countries, firms and time periods. Existing theories and intuition provide some guidance regarding which country- or firm-specific variables should determine the magnitude of the index inclusion effects. As dependent variables, we use the changes in the daily and weekly *betas* and the changes in the daily and weekly R^2. We include the following explanatory variables. To investigate the effect of attributes of the index to which a firm is added, we include index concentration (the weight of the largest five firms in the index). To explore the extent to which index inclusion effects has changed over the period, we include a time trend. Since effects may depend on the characteristics of the financial system and country, we include variables to control for financial development (market capitalization to GDP) and economic development (GDP per capita). At the firm level, we include pre-inclusion *betas* as well as leverage and firm size.

The results, reported in Table 4, indicate the existence of fairly consistent patterns, with results largely unchanged between daily and weekly frequencies and whether based on the post-inclusion change in *beta* (columns 1 and 2) or in R^2 (columns 3 and 4). Three results stand out.

First, the inclusion effect is weaker when a firm is added to a concentrated index, i.e., when a small number of firms accounts for a large fraction of index capitalization. This effect is especially pronounced for changes in *beta* – for example, if the weight of the largest five firms in an index is 10 percent higher, the post-inclusion increase in *beta* will be 0.03 lower, a large effect relative to the sample average increase in (daily) *beta,* which is about 0.07 (Table 2). This result is consistent with indexing behavior as a particular manifestation of the demand-view hypothesis – if an index is concentrated, there is no point in mimicking it; it is sufficient to buy the shares of a small number of companies. We interpret the fact that inclusion effects are stronger in more dispersed indices as supporting evidence that, in these markets, index-based investment is more common and therefore being added to such an index results in higher comovement.

Second, controlling for other factors which may influence post-inclusion comovement, there is a positive time trend in the index inclusion effect over the last decade. To further illustrate this, Figure 1 presents coefficients on individual year dummies estimated in a regression similar to the one presented in column 1 of Table 4, except that the time trend is replaced by year-specific dummy variables. We observe increasing coefficients over time, except for the crisis years of 2008 and 2009, when the rising trend seems to be broken.

Third, the effect seems to apply to counties with varying degrees of development, since we do not find statistically significant effects of economic development (GDP per capita) or financial development (market capitalization to GDP) on the extent of post-inclusion comovement in any specification (only in some tests reported later do we find economic development to be negatively related to the index inclusion effect).[16]

As for firm characteristics, size is positively and significantly associated with increased comovement in all specifications (and statistically significant in two) – note that this result cannot be due to the weight of the firm in the index because we calculate comovement between the added firm and the rest of the index excluding the added firm itself. Leverage has no statistically significant effect on the increase in comovement in any of the regressions. The negative and highly statistically significant coefficients on the pre-inclusion *beta* - in both daily and weekly data, indicate that the increase in comovement is larger for firms whose pre-inclusion *beta* is low. We return to this finding, which cannot easily be related to the two explanations for increased comovement, towards the end of the paper.

B. Tests of the Demand Based View of Comovement

In this section, we focus on specific tests of the validity of the demand-based and information-diffusion views of post-inclusion comovement. So far, two of our findings are consistent with the demand-based view. The tendency of the effects to increase over time is consistent with the rising popularity of index-tracking investment strategies and instruments over the last decade.[17] And the tendency for effects to be stronger for more dispersed indices (those including more firms) is also consistent with the role of index-tracking financial strategies and instruments as drivers of the inclusion effect.

We now conduct specific tests of the validity of the demand-based and information-diffusion views of comovement. These tests are performed using the change in the daily *beta* around the time of inclusion as the dependent variable, but the results are similar when using our other dependent variables. The validity of the demand-based view is explored by testing the relation between the presence of more indexing-prone investors and the post-inclusion change in comovement. The predictions of the information diffusion view of comovement are tested by exploring differences between low and high frequency *betas* and by observing how lagged *betas* change after inclusion.

C. Presence of Index-Oriented Investors

If increased post-inclusion comovement is driven by demand factors, index inclusion effects should be stronger where more investors regard an index as their “habitat.” Institutional investors are likely candidates to generate demand for stocks in certain categories. For example, there is considerable evidence that institutional investors tend to invest primarily in large stocks: Gompers and Metrick (2001) find that institutional investors in the U.S. tend to favor large stocks; and Kang and Stulz (1997) argue that foreign (presumably including mostly institutional) investors active in Japan tend to concentrate their

---

[16] In untabulated specifications, we find some evidence of higher index inclusion effects in financial systems which belong to the common law tradition, perhaps because of the larger presence of index-prone financial institutions in these markets, an effect we explore below more specifically.

[17] For example, global ETF assets have gone up from about $74 billion in 2000 to $1036 billion in 2010 (BlackRock, 2010).

investment in large stocks. With large stocks more likely to be included in indices, the investment strategies of institutional investors could presumably be driven by their focus on indexes. More specifically on index-related investment strategies, Bhattacharya and Galpin (2010) suggest that institutional investors tend to "value weigh" their portfolios; Zun (2008) finds that institutional investors often hold similar portfolios and constitute a "clientele" for certain stocks, generating comovement between them; Giannetti and Laeven (2009) report that Swedish pension funds are more likely to buy shares of companies included in the OMX 30 (leading) index; Greenwood (2008) cites reports of Nomura Securities according to which large amounts of institutional funds in Japan are benchmarked to major indices. And anecdotal evidence from Israel is also consistent with this view.[18]

We measure the extent to which potential index-oriented investors are present by collecting data on the importance of institutional investors in the markets we study. In particular, we obtain measures which are consistent across countries on the percent invested in equity out of all assets held by mutual funds, insurance companies and pension funds (collected by the World Bank from the OECD and country-specific sources, as of 2006). These proxies are inevitably imperfect: none includes all domestic institutional investors or covers foreign institutional investors; at the same time, they include the equity investments of domestic institutional investors outside the home country. And we cannot tell to what extent these institutional investors actually follow index-based investment strategies.[19] Nevertheless, if index inclusion effects are found to be stronger in markets where institutional investors play an important role, then, to the extent that these investor groups proxy for the tendency to invest in an index as a habitat or category, the results would be consistent with the demand-based view.

Table 5 presents the results of our multivariate regressions using, in addition to the earlier firm- and country-specific variables, our measures of institutional investor presence. Clearly, the index inclusion effect (measured by the increase in daily *betas*) is positively correlated with the country-specific equity stakes of institutional investors.[20] While we cannot

[18] We examine, for example, the meeting protocols of the investment committee of one Israeli institutional investor and find them consistent with the view that a large portion of the assets are allocated to firms in major indices, either directly or through exchange traded funds; the protocols clearly indicate also that the overall investment results are evaluated against benchmark indices. Further anecdotal support can be drawn from the time when Israel's stock market was reclassified and included in indices of developed (rather than emerging) markets. The shift was extensively covered in the financial press for its possible effects on changes in demand for Israeli stocks by foreign institutional investors (e.g., a special report published by *Bank HaPoalim*, Israel's second largest bank, on March 21, 2010).

[19] Information on the extent of index-based investment is not available even for the most sophisticated markets, largely due to the difficulty in defining index-following. Moreover, even information on the value of all exchange traded funds following a particular index is not available on a consistent basis for all countries and indices. Information on the presence of institutional investors in equity markets is also, surprisingly, incomplete. Ferreira and Matos (2008) generate a worldwide data set of holdings by various types of institutional investors; we do not use their data, however, because their figures for some of our main countries (e.g., Australia, Japan) seem very implausible.

[20] The coefficients are also positive, significant and very similar in magnitude when using the change in weekly *beta* as the dependent variable. They remain positive, but less statistically significant, when the dependent variable is the daily or weekly change in R^2. Bhattacharya and Galpin (2010) try to derive measures of the prevalence of what they call "value-weighted" investment across countries, although they readily admit that

(continued…)

tell from these results that institutional investors actually “cause” the post-inclusion increase in comovement, the fact that their presence is so closely correlated with it suggests that the demand-based theory is probably one of the drivers of this phenomenon.

Further support for the conjecture that institutional investors behave in accordance with the demand-based view of comovement can be found for individual countries. In the UK, following the Myners report, which questioned the appropriateness of equity investments for pensions funds, there was a marked decline in equity investments by pension funds (from about 70 percent in 1999 to under 60 percent in 2005, see NAPF, 2007). In our sample, the average increase in *beta* in the U.K. is indeed smaller in the second half of the sample than in the first half. In Poland, in contrast, new legislation made equity investment by pension funds more common after 2005 (e.g., *Financial Times*, April 26, 2005) and, indeed, the average increase in *beta* for firms included in the Polish WSE WIG index is much higher in the second half of the sample than in the first.

It is possible that not (only) institutional investors are behind the demand-based increase in comovement. Kumar and Lee (2006) argue that retail (rather than institutional) investors are the ones who share a common “sentiment” and their correlated trades then generate comovement across stocks (especially when arbitrage is costly). Countries with a large equity market presence of institutional investors tend to have high rates of equity market participation by individuals as well. According to Guiso et al. (2008), the countries with the highest rates of individual participation in equity markets are Australia, New Zealand, the U.K. and Japan, followed closely by the U.S., Canada and Sweden. This list overlaps closely with that of countries with high levels of stock market participation by institutional investors. And, indeed, the correlation between the measures of actual institutional and individual investor presence is high in our sample as well. It is therefore quite possible that demand driven increases in *beta* come from index-based investment strategies of individual as well as institutional investors.

To further address this possibility, we use the (preliminary) data set developed by Grout et al. (2009) of estimates of individual shareholding patterns around the world in 2005-2006 and run a similar regression as the one with the institutional investor data. The result (fourth column of Table 5) suggests that there is a positive and statistically significant correlation between individual shareholding and the index inclusion effect (the effect is also positive and highly significant when the dependent variable is the change in weekly *beta* or daily and weekly R^2; not reported). We conclude that indexing-prone investors — be they institutional or individual — are associated with the index inclusion effects we observe, probably through the channels identified in the demand-based theory.

---

their estimates for countries other than the US are very imprecise. When we use their measures instead of the measures of institutional investor presence, we find positive coefficients as well but a much lower level of significance.

D. Tests of the Information-Diffusion View of Comovement

The information diffusion theory of comovement makes several predictions which are distinct from those of the demand-based approach, in particular with respect to the levels and post-inclusion changes in contemporaneous and lagged *beta* at different frequencies. If comovement is driven by a common response of index-included stocks to aggregate information, one would expect the contemporaneous pre-inclusion high frequency (daily) *beta* to be relatively low; and the lagged daily *beta* (i.e., the correlation between index returns at time *t* and firm-specific pre-inclusion stock return at time *t+1*) to be positive and large, but to decline substantially after the stock is added to the index. The information diffusion theory also predicts that the low frequency (weekly) *beta* should be high relative to the high frequency *beta* (because at low frequencies, the common information is already incorporated in stock prices) and the post-inclusion change in comovement should therefore be more pronounced in daily (high frequency) measures of comovement than in weekly (lower frequency) *beta* measures.

While we find some support for these conjectures, the overall evidence is mixed. The pre-inclusion contemporaneous daily *betas* are not so small (0.82 on average, see Table 2), although somewhat lower than the weekly *betas* (which are, on average, 0.93). The second conjecture, on lagged *betas*, is partially borne out – the average magnitude of one-day lagged *beta* in the sample is about 0.09 and it falls to about 0.07 after inclusion (25 of the 40 countries in the sample experience a decline in lagged *beta*). For lags of two or three days, the pre-inclusion *beta* is low to begin with (about 0.02 on average) and it falls to zero after inclusion. The information diffusion view of comovement also predicts a larger change in high frequency *betas* following index inclusion than the change in low frequency *betas*. Although this is the case for some countries (e.g., Australia, Brazil or Canada, see Table 3), we do not find this for the full sample (the average increase in daily and weekly *betas* is roughly equal, see Table 2). Overall, it is not clear whether the countries for which the increase in daily *betas* is higher than the increase in weekly *betas* have any common features.[21]

It is possible that other information-related theories are behind the post-inclusion increase in comovement. Morck et al. (2000) argue that in less developed financial systems, firm-specific information is scarcer, and stock prices therefore respond mainly to aggregate information and move jointly. It is possible that in markets with such high synchronicity, the added stock begins to respond, like other stocks in the index, primarily to macroeconomic news, thus increasing its comovement with the rest of the index. We therefore examine the relation between the post-inclusion increase in comovement and the market-wide stock price

[21] It is possible that the demand-based view of comovement also predicts a smaller increase in comovement at sufficiently low frequencies because of arbitrage across non-fundamentals-based stock prices. If this is the case, this test cannot distinguish between the two views. BSW write that both the demand-based view and the information-diffusion view "predict that the shifts in *beta* after inclusion should become weaker at sufficiently low frequencies. Since we expect noise trader sentiment to revert eventually, and even slowly diffusing information to be incorporated eventually, lower-frequency returns, and therefore also lower frequency patterns of comovement, will be more closely tied to fundamentals" (p. 296).

synchronicity measure of Morck et al. (2000). We find that high (above the sample median) stock price synchronicity is associated with a larger post-inclusion increase in daily and weekly *beta*, but not in R^2: the average increase in daily *beta* is about 0.09 for high synchronicity countries versus 0.06 for low synchronicity countries. However, this result is not very robust (e.g., when added to the benchmark regression, the measure of synchronicity is positive but not significant).

Overall, although some of the tests reported here (summarized in Table 6) are consistent with the predictions of the information-diffusion view of comovement, the magnitudes of the effects seem small enough to suggest that this theory is unlikely to be the sole driver of post-inclusion comovement around the world.

IV. Robustness Tests and Extensions

A. Other Possible Determinants of Post-Inclusion Increased Comovement

Analyst Coverage

Inclusion in a major index is typically associated with an increase in analyst coverage for the added company. To the extent that analysts generate market-wide rather than firm-specific information and such information is more quickly incorporated in stock prices after inclusion, comovement (or synchronicity) may increase (Chan and Hameed, 2006, argue that this is the case in emerging markets). Data on the number of analysts covering firms in our sample (that is, those publishing earnings forecasts) is incomplete (it is available for only about half the firms in the sample). However, when data are available, analyst coverage increases from a median of eight analysts per firm before inclusion to ten analysts per firm after inclusion (Table 2). For those firms where the number of analysts increases with inclusion, the increase in (daily) *beta* is about 0.08 following inclusion vs. 0.05 for those firms whose coverage does not increase, in line with the results of Chang and Hameed (2006).

The data so far suggest that both analyst coverage and *beta* increase upon inclusion. They do not, however, tell whether the increased coverage "causes" the increase in *beta*. To further study this, we include analyst coverage in a regression specification similar to the previous ones, to see whether any of the other results are affected. Although coverage is possibly affected by index inclusion as well, the main regression results supporting the demand-based view (the time trend, the effect of institutional investor presence etc.) hold even when the post-inclusion change in the number of analysts covering the firm (reported in column 1 of Table 7) or the number of analysts (in absolute numbers or in logs, not reported) are included in the regression. Since the other effects largely remain unchanged, we conclude that the common increase in analyst coverage upon inclusion is not the sole reason for the observed increased comovement in *beta*.

Changes in Liquidity

Inclusion in a major index is typically associated with increased liquidity (e.g., Hegde and McDermott, 2003). In our sample, about two thirds of the firms experience an increase in stock turnover following index inclusion. US-focused studies, especially Vijh (1994), but also BSW, attempt to distinguish between the effect of added liquidity on stock price comovement following index inclusion and added comovement due to “price pressures” by index-oriented investors. While comovement due to price pressures may imply that markets are inefficient (to the extent that there is excess comovement beyond the comovement of fundamentals), increased liquidity (just like increased comovement in the information diffusion view) may be welfare improving if stocks which are thinly traded before inclusion (and therefore have less informative prices) become more liquid after inclusion, and move more together with other stocks, presumably in response to aggregate news.[22]

Detailed turnover data are difficult to obtain for our international sample. For those stocks where we have data, the increase in *beta* is much bigger when turnover increases as well – an average increase in daily *beta* of about 0.09 when turnover increases, compared to a much smaller change (0.03 on average) when turnover declines. To some extent, this also holds within-countries. For example, in Canada (where the sample is sufficiently large), the average increase in daily *beta* for firms with a positive increase in turnover is nearly 0.20, whereas it is close zero for firms with no turnover increase.

Increased liquidity and increased *beta* could, much like increased analyst coverage, mean that the increase in *beta* is due to the greater liquidity. Nevertheless, when we include in the benchmark regression the change in turnover (column 2 of Table 7) or the level of turnover (not reported), we find that all effects (the time trend, index concentration, institutional investor presence) remain the same. Since these results remain unchanged, we conclude that any increase in liquidity upon inclusion is not the sole reason for the observed increase in comovement.

Another approach to measuring the effect of changes in liquidity on post-inclusion comovement is proposed by Vijh (1994). He divides his sample of additions to the S&P 500 into four categories according to the expected effects of changes in liquidity on changes in *beta*. Group 1 includes firms whose liquidity before and after inclusion is below the average for the index, but whose liquidity increases after inclusion – in this case, *beta* should increase as well because liquidity becomes closer to the index average; Group 2 includes firms whose liquidity before and after inclusion is below the average for the index, but whose liquidity decreases after inclusion – in this case, *beta* should decline because post-inclusion liquidity is farther away from the index average; Group 3 includes firms whose liquidity before and after inclusion is above the average for the index, but whose liquidity increases even more after inclusion – in this case too, *beta* should decline (for the same reason); and Group 4 includes

[22] Interestingly, institutional investors and indexing may generate comovement not only through the channels of the demand-based view but also by generating added liquidity: Kamara et al. (2008) find that institutional investors increase what they call the “liquidity beta” (i.e., when institutional investors are present, firm-specific liquidity tends to co-move with average liquidity).

firms whose liquidity before and after inclusion is above the average for the index, but whose liquidity decreases after inclusion – in this case, *beta* should increase (liquidity becomes closer to average).[23]

Inevitably, our ability to replicate this exercise for our international sample is limited given the data we have to work with. Nevertheless, we find support for Vijh's predictions (Table 8). Specifically, in line with Vijh's predictions, we find a substantial increase in daily and weekly *betas* in Groups 1 and 4; in Group 2 daily *betas* remain unchanged but weekly *betas* decline, as predicted. In contrast with the predictions of Vijh's model, however, both daily and weekly *betas* actually go up rather than down in Group 3. These results should be interpreted with caution due to the limited number of observations (especially from less developed countries). Nevertheless we can conclude that while increased liquidity seems to play a role in the effects we observe, it is probably not the only force at play.

Post-inclusion Convergence of Beta to One

In addition to documented effects driving comovement, our results point to another comovement-related phenomenon, the convergence of the added firm's *beta* to one. Specifically, for firms whose pre-inclusion *beta* is below one, the average increase in the daily *beta* is large and positive (0.20 on average) whereas for firms whose pre-inclusion daily *beta* is above one, the change in *beta* is actually negative (-0.23 on average). The results are qualitatively very similar when using weekly *beta*s or changes in R^2. This implies that an important feature of the post-inclusion change in comovement is the convergence of *betas* to one (and possibly of R^2 to some norm). This issue is not addressed in the standard theories of comovement, all of which predict a post-inclusion increase in comovement regardless of its current level.[24]

A Postscript on Deletions

BSW (as well as Greenwood and Sosner, 2007) examine deletions from stock market indices in addition to inclusions. They treat deletions as mirror images of inclusions and therefore expect (and obtain) results indicating a decline in comovement following exclusion from an index. However, the effect of being excluded from an index need not be symmetric to the effect of inclusion. Chen et al. (2004), for instance, report a positive and "permanent" stock price response to index inclusions, but no permanent negative price change in response to deletions. They attribute this result to "investor awareness," which pushes stock prices upwards for an included firm, but as awareness does not dissipate when a stock is excluded, its price does not always fall. Another reason for possible differences between inclusions in and exclusions from stock market indices is that exclusions are sometimes related to prior

---

[23] As in the original Vijh (1994) paper, we exclude the two cases where pre-inclusion liquidity is higher than the market average and post-inclusion liquidity is lower, or vice versa, because the theoretical predictions about them are ambiguous.

[24] An early study by Blume (1975) proposes possible mechanical reasons for the convergence of *betas* to one over time, not necessarily in the context of inclusion in an index.

stock price movement or are not information-free, for example, as they may be due to corporate events, such as mergers or financial distress. Furthermore, the empirical tests may only be feasible for a subset of all deletions (for example, if a deletion is due a merger or bankruptcy, there may not be any post-deletion stock return data from which to calculate *beta*). This may create some biases.

In our sample, companies deleted from various stock market indices experience a decline in their (daily) *beta* upon exclusion of -0.15 on average (the median is -0.12), which is actually larger in absolute value than the average increase in daily *beta* upon inclusion (Table 2). Interestingly, the change in R^2 is not always in the same direction as the change in *beta*: the average (median) change in R^2 upon exclusion is in fact positive, 0.04 (0.02). Whereas 60% of the firms in the whole sample experience a decline in their *beta* when removed from an index, only 43% experience a decline in their R^2 (these results are summarized in Table 9). At the country-level, the average change in *beta* is negative in 31 countries, but for R^2 this is the case for only half the sample (20 countries). The variation is not obviously related to country characteristics. In some highly developed financial systems (e.g., Australia or Canada), the average change in *beta* upon exclusion is negative, but the average change in R^2 is positive. In other developed countries (e.g., Japan or the US), the changes in *beta* and R^2 are both negative.

The results imply that, upon exclusion from an index, comovement often goes down, but so does idiosyncratic volatility. While both the demand-based and the information-diffusion views of comovement predict a decline in comovement upon exclusion, neither one makes clear predictions about the expected change in total or idiosyncratic volatility. What could account for these findings? Leaving aside implausible explanations,[25] one possible explanation is that both changes in *beta* and changes in R^2 are related to the dynamics of stock prices before exclusion. For example, a stock which ends up being deleted may have experienced high volatility beforehand (keeping R^2 low), but upon deletion reverts to a normal, less idiosyncratic pattern. As noted above, another, related explanation is that exclusions are not always information-free events — firm restructuring upon deletion, for instance, could lead to reduced volatility (various related theories are discussed in Avramov et al., 2006).

V. Concluding Remarks

Using a new and extensive dataset on company inclusions in stock market indices around the world, we show that the post-inclusion increase in return comovement is a global phenomenon which has increased in magnitude over the last decade. Thus, the findings of BSW and others documenting the existence of a similar phenomenon in a small number of developed markets can be generalized to a large number of countries, both developed and emerging; moreover, this phenomenon still prevails in the recent time-period.

---

[25] For instance, if *beta* is negative and becomes more negative upon exclusion from an index, R^2 may well increase (i.e. move in the opposite direction from *beta*), but these cases are rare in the sample.

We test for the validity of several possible explanations for the post-inclusion rise in comovement we document. Many of our findings are consistent with the predictions of BSW's demand-based theory according to which increased post-inclusion comovement is related to the tendency of certain investors to invest by category/habitat. Specifically, the increase in comovement is larger later in the period, and more pronounced in countries where the index is more dispersed and where the presence of investors who are prone to index-based investment is greater. These findings hold when controlling for various other country and firm characteristics.

We also find some support for the information-diffusion view of comovement, although the magnitudes of the supporting effects for this view are small. In addition, although we find that post-inclusion comovement is also related to increases in post-inclusion analyst coverage and liquidity, controlling for these effects does not alter the main conclusions on the importance of factors such as the degree to which the index is concentrated or the presence of indexing-prone investors.

We conclude that the phenomenon of higher comovement following index inclusion is widespread and rising. While probably driven by a combination of factors rather than one specific theory, the greater support we find in the data for the demand-based view has some implications. One possible implication is that in many financial markets around the world there is more stock price comovement than what is warranted by fundamentals. This in turn implies that there are limited diversification opportunities for investors and possibly also too little production of stock-specific information, all of which may result in a less than perfectly efficient allocation of capital. These are, however, issues that deserve further research before drawing any firm conclusions.

Table 1: Sample Composition

Country	Index Name	Year of 1st Inclusion	Number of Inclusions
Argentina	MERVAL	2002	20
Australia	S&P/ASX 200	2002	147
Austria	TRADED ATX	2001	14
Belgium	BEL20	2001	10
Brazil	BOVESPA	2001	38
Canada	S&P/TSX COMPOSITE	2001	201
Colombia	IGBC GENERAL	2003	35
Egypt	EGX 30	2006	14
Finland	OMX HELSINKI	2001	45
France	CAC 40	2001	14
Germany	DAX	2001	12
Greece	ATHENS COMPOSITE	2001	60
Hong Kong	HANG SENG INDEX	2001	28
Hungary	BUDAPEST STOCK EXCHANGE INDEX	2004	11
India	NSE S&P CNX NIFTY	2002	77
Ireland	IRISH OVERALL INDEX	2005	7
Israel	Tel Aviv 100	2001	106
Italy	MILAN MIB30	2003	20
Japan	NIKKEI 225	2001	50
Korea	KOSPI	2002	31
Latvia	OMX RIGA	2005	14
Malaysia	KUALA LUMPUR COMPOSITE	2001	67
Mexico	MEXICO BOLSA IPC	2002	27
Netherlands	AMSTERDAM AEX	2002	17
New Zealand	NZX 50 FF GROSS	2003	23
Norway	OSE ALL SHARE	2002	11
Pakistan	KARACHI 100	2006	38
Peru	PERU LIMA GENERAL	2003	42
Philippines	PSEi - PHILIPPINE SE	2005	17
Poland	WSE WIG	2002	157
Portugal	PSI GENERAL	2002	53
Russia	RUSSIAN RTS $	2002	44
S. Africa	FTSE/JSE AFRICA ALL SHR	2002	86
Spain	SPAIN MA MADRID	2002	38
Sweden	OMX STOCKHOLM	2002	35
Taiwan	TAIWAN TAIEX	2002	185
Thailand	THAI INDEX	2002	56
Turkey	ISE NATIONAL 100	2004	56
UK	FTSE100	2001	44
USA	S&P 500	2002	192

Table 2: Variable Definitions and Sample Statistics

Panel A: Firm-specific Variables

Variable	Definition/ Source	Mean	Std	25%	Median	75%	Obs
Pre-inclusion daily *beta*	*Beta* calculated using daily data for the three months ending 90 days prior to the inclusion date/Bloomberg	0.82	0.54	0.47	0.77	1.10	2094
Post-inclusion daily *beta*	*Beta* calculated using daily data for the three months after the inclusion date/Bloomberg	0.89	0.52	0.56	0.85	1.17	2094
Pre-inclusion weekly *beta*	*Beta* calculated using weekly data for the 52 weeks prior to the inclusion date/Bloomberg	0.93	0.56	0.58	0.87	1.21	2100
Post-inclusion weekly *beta*	*Beta* calculated using weekly data for the 52 weeks after the inclusion date/Bloomberg	1.00	0.51	0.66	0.94	1.28	2100
Pre-inclusion daily R^2	R^2 from the regression in which pre-inclusion *beta* is estimated using daily data/ Bloomberg	0.22	0.19	0.06	0.17	0.34	2094
Post-inclusion daily R^2	R^2 from the regression in which post-inclusion *beta* is estimated using daily data / Bloomberg	0.26	0.19	0.09	0.22	0.39	2094
Pre-inclusion weekly R^2	R^2 from the regression in which pre-inclusion *beta* is estimated using weekly data/ Bloomberg	0.25	0.18	0.10	0.23	0.37	2100
Post-inclusion weekly R^2	R^2 from the regression in which post-inclusion *beta* is estimated using daily data / Bloomberg	0.31	0.19	0.16	0.30	0.44	2100
Turnover_ Pre	Number of shares traded divided by the number of shares outstanding in the year before inclusion/ Bloomberg	1.00	2.07	0.13	0.41	1.05	1825
Turnover_ Post	Number of shares traded divided by the number of shares outstanding in the year after inclusion/ Bloomberg	1.24	2.37	0.25	0.63	1.44	1670
Analyst_pre	Number of analysts covering the firm in the year before inclusion/IBES	11.5	11.1	3	8	17	1128
Analyst_post	Number of analysts covering the firm in the year after inclusion/IBES	12.9	11.9	4	10	19	1297
Total Assets	Total firm assets in billion US dollars, FY before inclusion/ Datastream	7.395	53.184	0.05	0.267	1.802	2128
Leverage	Firm liabilities to assets (percent), FY before inclusion / Datastream	20.7	20.9	1.4	17.6	32.5	2128

Panel B: Country Characteristics

Variable	Definition/ Source	Mean	Std	25%	Median	75%	Observations/ (No. of countries)
Index concentration	Weight of the largest five firms in the index	0.39	0.18	0.23	0.39	0.55	2142 (40)
Legal Origin	Dummy for common law countries/Djankov et al. (2007)	0.50	0.50	0	1	1	2142 (40)
GDP per capita 2003	Thousand US $/ Djankov et al. (2007)	15.66	11.84	3.78	13.72	23.93	2142 (40)
Market capitalization to GDP 2003	In percent / Djankov et al. (2007)	85.2	56.7	38.3	91.4	106.2	2142 (40)
Equity mutual funds	Percent of all mutual fund assets invested in equity in 2006/Data collected at the World Bank from various sources	44.9	18.5	27.9	53.4	56.2	1259 (21)
Life insurance equity	Percent of all life insurance assets invested in equity in 2006/ Data collected at the World Bank from various sources	21.5	16.9	10.7	17.7	36.7	1276 (23)
Pension fund equity	Percent of all pension fund assets invested in equity in 2006/ Data collected at the World Bank from various sources	48.7	24.7	32.8	51.7	67.8	1329 (25)
Direct Individual Shareholding	Percent of the population holding shares directly in 2005-2006/ Grout et al. (2008)	15.5	13.8	2.6	8.4	28.1	1852 (34)
Comovement	Country-specific R-squared (synchronicity of stock prices) / Morck et al. (2000)	0.21	0.16	0.06	0.18	0.29	1888 (34)

Table 3: Index Inclusion Effects – Univariate Regressions

The table summarizes the average post index inclusion change in *beta*, R^2, turnover and analyst coverage by country. For changes in *beta* and R^2, estimates are from firm-specific regressions using daily data for the 90-day period ending 90 days before inclusion in the index and for the period 90 days after inclusion, or using weekly data for the 52 week period preceding inclusion and the 52 week period after inclusion. The estimated equation is:

$$R_{jt} = \alpha_j + \beta_j \text{Country\_Index}_t + v_{jt}$$

where j denotes firms and t denotes time. The country-specific indices and number of observations are described in Table 1. The table also presents the change in turnover, defined as number of shares traded divided by total number of shares outstanding in the year before inclusion and the year after inclusion, and change in analyst coverage, defined as the change in the absolute number of analysts per firm in the year before and the year after inclusion. Statistical significance of a one sided test of a positive change at the 1, 5 and 10 percent levels are denoted by ***, **, and *, respectively.

	1 Average change in daily *beta*	2 Average change in weekly *Beta*	3 Average change in daily R^2	4 Average change in weekly R^2	5 Average change in turnover	6 Average change in analyst coverage
Argentina	0.00	0.20**	0.035	0.16***	0.26***	1
Australia	0.15***	0.08**	0.07***	0.05***	0.40***	4.5***
Austria	-0.17	0.28*	-0.05	0.14**	0.36**	2**
Belgium	0.02	-0.17	0.01	0.02	0.17***	1.5
Brazil	0.14***	0.10**	0.10**	0.14***	0.61***	4.2**
Canada	0.13***	0.08**	0.05***	0.11***	0.36***	2.9***
Colombia	-0.05	0.04	0.03	0.02	0.10**	0
Egypt	0.03	-0.23	0.13***	0.14***	1.3***	-0.7
Finland	-0.16	-0.05	-0.09	-0.03	0.14**	2.3***
France	0.10*	0.03	0.06*	0.06*	0.73*	-1.8
Germany	0.02	0.14*	0.08	0.08	-0.00	5.7
Greece	0.07*	0.04	-0.01	0.06**	-0.06	3.9***
HK	0.03	-0.01	0.05*	0.11***	0.46***	0.7
Hungary	0.12	-0.06	0.07	-0.03	0.45	-2.2
India	0.05	-0.05	0.07***	-0.01	-0.22	5.3***
Ireland	-0.62	-0.31	-0.01	-0.04	-0.14	3
Israel	0.10**	-0.03	-0.01	0.02*	0.99	N/A
Italy	0.10	-0.05	0.08**	0.05*	1.21***	-0.7
Japan	0.11**	0.11**	0.08**	0.10***	0.21**	2
Korea	-0.03	0.10*	0.01	0.05*	-0.81	2.8
Latvia	-0.18	0.16	-0.08	0.13**	N/A	N/A
Malaysia	0.27***	0.07	0.07***	0.06***	0.12**	1.7
Mexico	0.06	0.04	0.04	0.10**	-1.05	2.9**
Netherlands	0.14	0.19**	0.11**	0.15***	0.57***	1.5
New Zealand	0.17**	0.01	0.04*	0.05	0.01	2.1**
Norway	-0.03	-0.37	0.06	-0.03	0.93*	-1.1

	1 **Average change in daily *beta***	**2** **Average change in weekly *Beta***	**3** **Average change in daily R^2**	**4** **Average change in weekly R^2**	**5** **Average change in turnover**	**6** **Average change in analyst coverage**
Pakistan	0.16**	0.43***	0.07**	0.11***	-0.02	10.25**
Peru	0.09	0.13	0.05**	0.19***	0.16	1.5*
Philippines	0.05	0.11	-0.01	0.09*	0.19***	0.6
Poland	0.14**	0.24***	0.05***	0.06***	-0.58	N/A
Portugal	0.01	-0.04	0.02*	0.01	-0.13	-0.3
Russia	0.09	0.26***	0.08***	0.10***	0.10***	-10.5
S. Africa	0.06*	0.04	0.03*	0.04**	0.23**	-1.5
Spain	0.17**	0.29***	0.06**	0.08***	0.84***	3.5
Sweden	-0.09	-0.10	-0.04	-0.01	0.17	0
Taiwan	0.01	0.07**	-0.01	0.03**	0.77***	2.9**
Thailand	0.11	0.11	0.02	0.07***	0.75	-2.6
Turkey	0.04	0.01	0.05*	0.09***	1.45***	3.2***
UK	0.13**	-0.07	0.10***	0.05**	0.25*	1.9
US	-0.01	-0.00	0.07***	0.07***	1.24***	-0.5

Table 4: Index Inclusion Effects – Benchmark Multivariate Regressions

The dependent variables are the change in firm-specific *beta* or the change in R^2 (daily or weekly). Explanatory variables include pre-inclusion *beta* (daily or weekly), a time trend, per capita GDP (2003), the ratio of market capitalization to GDP (2003), index concentration (weight of the largest five firms in the index), firm-specific leverage (debt to asset) and total assets (see Table 2 for variable definitions). Regressions are OLS with standard errors clustered by country in parentheses. ***, ** and * denote coefficients significant at the 1, 5 and 10 percent, respectively. The coefficients on per capita GDP and total assets are multiplied by 1000.

	(1) Absolute change in daily *beta*	(2) Absolute change in weekly *beta*	(3) Absolute change in daily R^2	(4) Absolute change in weekly R^2
Index concentration	-0.31*	-0.29**	-0.08	-0.06
	(0.16)	(0.13)	(0.06)	(0.06)
Time trend	0.023***	0.019***	0.013***	0.015***
	(0.005)	(0.005)	(0.003)	(0.002)
Per capita GDP (2003)	-0.0004	-0.005	0.0005	0.0002
	(0.0028)	(0.0020)	(0.0008)	(0.0007)
Market Cap / GDP (2003)	-0.0004	-0.0004	-0.0001	-0.0000
	(0.0006)	(0.0005)	(0.0002)	(0.0001)
Pre-inclusion *beta*	-0.61***	-0.56***	-0.10***	-0.07***
	(0.05)	(0.02)	(0.01)	(0.001)
Firm leverage (year before inclusion)	-0.0006	-0.0009	-0.00002	0.00005
	(0.0010)	(0.0009)	(0.00029)	(0.00024)
Firm total assets (year before inclusion)	0.00041***	0.00023	0.00011	0.00020**
	(0.00016)	(0.00021)	(0.00008)	(0.00010)
Observations	2,080	2,086	2,080	2,086
R-squared	0.33	0.33	0.09	0.08

Table 5: Post Inclusion Change in Firm-specific Daily *Beta* and the Presence of (Index-Prone) Institutional and Individual Investors

The dependent variable is the change in firm-specific daily *beta*. The explanatory variables are the same as in Table 4, supplemented by measures of presence of institutional investors – the fraction of all assets held by mutual funds, pension funds and insurance companies invested in equity (from the World Bank, 2008), and a measure of stock market participation by individual investors (as a fraction of market capitalization) drawn from Grout et al. (2009). Regressions are OLS with standard errors clustered by country in parentheses. ***, ** and * denote coefficients significant at the 1, 5 and 10 percent, respectively. The coefficients on per capita GDP and total assets are multiplied by 1000.

	(1)	(2)	(3)	(4)
Index concentration	-0.72***	-0.59**	-0.51***	-0.16*
	(0.22)	(0.18)	(0.18)	(0.09)
Time trend	0.02**	0.02**	0.03***	0.02***
	(0.007)	(0.007)	(0.007)	(0.06)
Per capita GDP (2003)	-0.009***	-0.002	-0.009**	-0.003
	(0.002)	(0.003)	(0.004)	(0.002)
Market Cap / GDP (2003)	-0.001	-0.001	0.001	0.0000
	(0.001)	(0.001)	(0.001)	(0.000)
Pre-inclusion *beta*	-0.60***	-0.59***	-0.62***	-0.61***
	(0.07)	(0.07)	(0.06)	(0.05)
Firm leverage (year before inclusion)	-0.001	-0.002	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Firm total assets (year before inclusion)	0.0047**	0.00048**	0.0030	0.0042***
	(0.0021)	(0.00018)	(0.0019)	(0.0015)
Equity mutual funds	0.004**			
	(0.002)			
Insurance fund equity		0.002*		
		(0.001)		
Pension fund equity			0.003**	
			(0.001)	
Direct Individual Shareholding				0.006***
				(0.001)
Observations	1259	1276	1329	1838
R^2	0.33	0.33	0.33	0.35

–

Table 6: Summary of Tests of the Information-Diffusion Theory of Comovement

Prediction	**Results**	**Consistent with the theory?**
Contemporaneous pre-inclusion low frequency *beta* > contemporaneous pre-inclusion high frequency *beta*	The sample average for: Pre-inclusion weekly *beta* is 0.93 and for pre-inclusion daily *beta* is 0.82. The difference is statistically significant	Yes
Lagged pre-inclusion high frequency *beta* should be high	The sample average for pre-inclusion one-day lagged *beta* is 0.09	Yes
Lagged pre-inclusion high frequency *beta* should decline after inclusion	The sample average for post-inclusion one-day lagged *beta* is 0.07, a decline of 0.02	Yes, but the magnitude is small
Post-inclusion increase in high frequency *beta* > Post-inclusion increase in low frequency *beta*	The sample average for the increase in daily *beta* is 0.07 vs. 0.06 for weekly *beta*. The difference is not statistically significant	No

Table 7: Post Inclusion Change in Firm-specific *Beta*, Analyst Coverage and Changes in Liquidity

	(1)	(2)
Index concentration	-0.52**	-0.56**
	(0.19)	(0.20)
Time trend	0.02***	0.04***
	(0.007)	(0.001)
Per capita GDP (2003)	-0.010***	-0.010**
	(0.003)	(0.004)
Market Cap / GDP (2003)	0.0006	0.0004
	(0.0004)	(0.0006)
Pre-inclusion *beta*	-0.53***	-0.62***
	(0.04)	(0.06)
Firm leverage (year before inclusion)	-0.001	-0.002
	(0.002)	(0.002)
Firm total assets (year before inclusion)	0.00036	0.0049
	(0.00031)	(0.0032)
Pension fund equity	0.003**	0.004**
	(0.001)	(0.001)
Change in log(number of analysts covering the firm)	0.037	
	(0.024)	
Change in Turnover		0.012
		(0.007)
Observations	744	999
R^2	0.28	0.35

The dependent variable is the change in firm-specific daily *beta*. Explanatory variables are the variables included in Table 4, and in addition, a measure of presence of pension funds in equity markets (from Table 5), the change in the log of the number of analysts covering the firm after inclusion (column 1) and the change in stock turnover after inclusion (column 2). Regressions are OLS with standard errors clustered by country in parentheses. ***, ** and * denote coefficients significant at the 1, 5 and 10 percent, respectively. The coefficients on per capita GDP and total assets are multiplied by 1000.

Table 8: Vijh's Liquidity Groups

The table presents changes in *beta* following index inclusion for four groups of firms as identified by Vijh (1994). Group 1 includes firms whose liquidity before and after inclusion is below the average for the index and whose liquidity increases after inclusion – according to Vijh (1994), in this case, *beta* should increase; Group 2 includes firms whose liquidity before and after inclusion is below the average for the index and whose liquidity decreases after inclusion – in this case, *beta* should decline; Group 3 includes firms whose liquidity before and after inclusion is above the average for the index and whose liquidity increases even more after inclusion – in this case too, *beta* should decline; and Group 4 includes firms whose liquidity before and after inclusion is above the average for the index and whose liquidity decreases after inclusion – in this case, *beta* should increase. The two cases where pre-inclusion liquidity is higher than the market average and post-inclusion liquidity is lower, or vice versa, are excluded because Vijh's theory makes ambiguous predictions about them.

Group	**Prediction**	**Average Change in daily /weekly *beta***	**Observations daily/weekly**
1	Positive change	0.07 /0.09	474 /478
2	Negative change	0.00 / -0.04	248 / 247
3	Negative change	0.04 /0.06	193 /195
4	Positive change	0.10 / 0.09	143 /142

Table 9: Selected Summary Statistics on Deletions from Indices around the World

The table presents statistics on changes in daily *beta* and R^2 following exclusion from stock indices for the full sample and for selected countries. A full set of country-specific results are available upon request. The number of exclusions does not match precisely the number of inclusions because of various data constraints, importantly the lack of post-deletion rates of return data to estimate *beta*. Estimates are from firm-specific regressions using daily data for the 90-day period ending 90 days before inclusion in the index and for the period 90 days after inclusion. The estimated equation is:

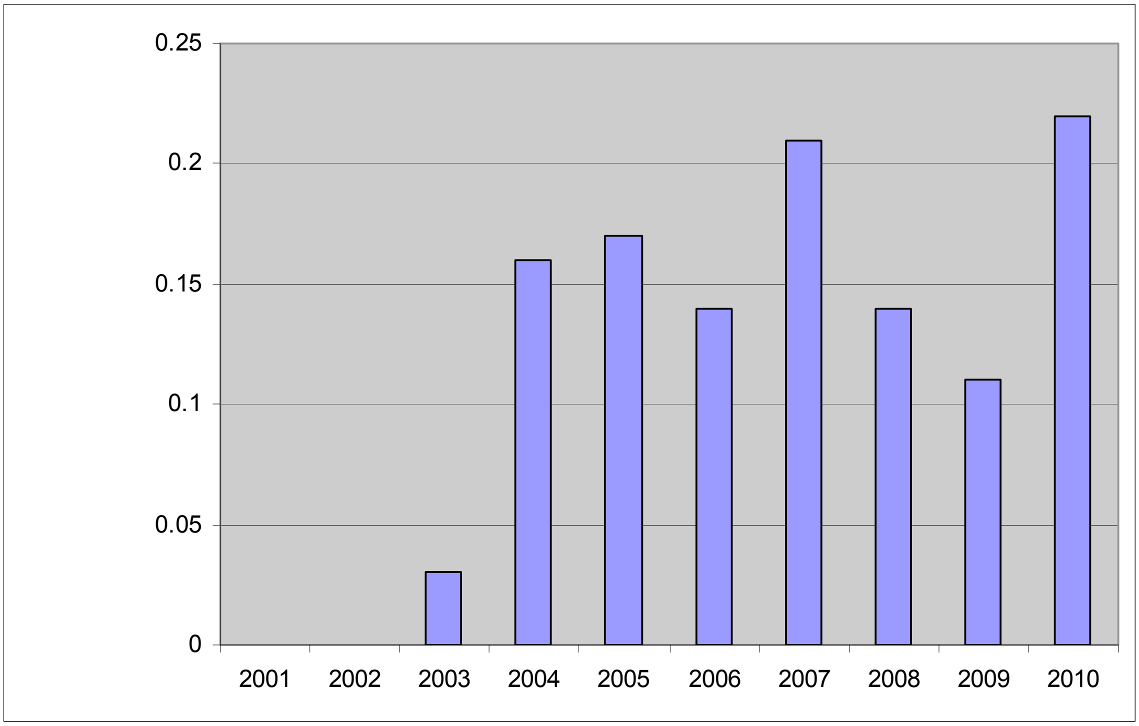
$$R_{jt} = \alpha_j + \beta_j \text{Country\_Index}_t + v_{jt}$$

where *j* denotes firms and *t* denotes time. The country-specific indices are described in Table 1. Statistical significance of a one-sided test of a negative change at the 1, 5 and 10 percent levels are denoted by ***, **, and *, respectively.

	Full Sample	**Australia**	**Canada**	**Japan**	**Brazil**
Average change in daily *beta*	-0.15***	-0.20***	-0.18***	-0.47***	-0.43***
Average change in daily R^2	0.04	0.08	0.05	-0.13***	-0.06
% observations with a decline in *beta*	60%	68%	62%	92%	89%
% observations with a decline in R^2	43%	42%	40%	73%	57%
Observations	2432	158	267	52	35

Figure 1: Regression Coefficients on Year Dummies

The figure shows coefficients on year-specific dummy variables in a regression similar to that of column 1 in Table 4 where the dependent variable is the post-inclusion change in daily *beta* and the time trend is replaced by year-specific dummies measuring the effect relative to 2001 which is omitted.



References

Avramov, D. T. Chordia, and A. Goyal, 2006, "The Impact of Trades on Daily Volatility," *Review of Financial Studies*, Vol. 19, pp. 1241-277.

Barberis, N., A. Shleifer, and J. Wurgler, 2005, "Comovement," *Journal of Financial Economics*, Vol. 75, pp. 283-317.

Bhattacharya, U., and N. Galpin, 2010, "The Global Rise of the Value-Weighted Portfolio," *Journal of Financial and Quantitative Analysis,* forthcoming.

BlackRock (various issues), *ETF Landscape*.

Blume, M., 1975, "Betas and their Regression Tendencies," *Journal of Finance*, Vol. 10, pp. 785–95.

Boyer, B., 2008, "Style-related Comovement: Fundamentals or Labels?" forthcoming, *Journal of Finance*.

Cai, J., 2007, "What's in the News? Information Content of S&P 500 Additions," *Financial Management*, Vol. 36, pp. 113-24.

Chan, K., and A. Hameed, 2006, "Stock Price Synchronicity and Analyst Coverage in Emerging Markets," *Journal of Financial Economics*, Vol. 80, pp. 115-47.

Chen, H., G. Noronha, and V. Singal, 2004, "The Price Response to S&P 500 Index Additions and Deletions: Evidence of Asymmetry and a New Explanation," *Journal of Finance*, Vol. 59, pp. 1901-929.

Coakley, J., and P. Kougoulis, 2004, "Comovement and FTSE 100 Index Changes," unpublished manuscript, University of Essex.

Coakley, J., P. Kougoulis, and P. Nankervis, 2008, "The MSCI-Canada Index Rebalancing and Excess Comovement," *Applied Financial Economics*, Vol. 18, pp. 1277-287.

De Nicolo, G., L. Laeven, and K. Ueda, 2008, "Corporate Governance Quality: Trends and Real Effects," *Journal of Financial Intermediation*, Vol. 17, pp. 407-38.

Denis, D. J. Mcconnell, A. Ovtchinnikov, and Y. Yu, 2003, "S&P Index Additions and Earnings Expectations," *Journal of Finance*, Vol. 58, pp. 1821-840.

Djankov, S., C. McLiesh, and A. Shleifer, 2007, "Private Credit in 129 Countries," *Journal of Financial Economics*, Vol. 84, pp. 299-329.

Eliott, W., B. Van Ness, M. Walker, and R. Warr, 2006, "What Drives the S&P Inclusion Effect? An Analytical Survey," *Financial Management*, Vol. 35, pp. 31-48.

Ferreira, M., and P. Matos, 2008, "The Colors of Investors' Money: The Role of Institutional Investors around the World," *Journal of Financial Economics*, Vol. 88, pp. 499–533.

Giannetti, M., and L. Laeven, 2009, "Pension Reform, Ownership Structure, and Corporate Governance: Evidence from Sweden," *Review of Financial Studies*, Vol. 22, pp. 4091-127.

Gompers, P., and A. Metrick, 2001, "Institutional Investors and Equity Prices," *Quarterly Journal of Economics*, Vol. 116, pp. 229-59.

Greenwood, R., 2008, "Excess Comovement and Stock Returns; Evidence from Cross-sectional Variation in Nikkei 225 Weights" *Review of Financial Studies*, Vol. 21, pp. 1153-186.

Greenwood, R., and N. Sosner, 2007, "Trading Patterns and Excess Comovement of Stock Returns," *Financial Analysts Journal*, Vol. 63, pp. 69-81.

Grout, P., W. Megginson, and A. Zalewska, 2009, "One Half-Billion Shareholders and Counting—Determinants of Individual Share Ownership around the World," unpublished manuscript, University of Oklahoma.

Guiso, L., P. Sapienza, and L. Zingales, 2008, "Trusting the Stock Market," *Journal of Finance*, Vol. 63, pp. 2557-600.

Harford, J., and A. Kaul, 2005, "Correlated Order Flow: Pervasiveness, Sources and Pricing Effects," *Journal of Financial and Quantitative Analysis*, Vol. 40, pp. 29-55.

Harris, L., and E. Gurel, 1986, "Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures," *Journal of Finance*, Vol. 41, pp. 815-29.

Hegde, S., and J. McDermott, 2003, "The Liquidity Effects of Revisions to the S&P 500 Index: An Empirical Analysis," *Journal of Financial Markets*, Vol. 6, pp. 413–459.

Jin, L., and S. Myers, 2006, "R^2 around the World: New Theory and New Tests," *Journal of Financial Economics*, Vol. 79, pp. 257–92.

Kamara, A, X. Lou, and R. Sadka, 2008, "The Divergence of Liquidity Commonality in the Cross-section of Stocks," *Journal of Financial Economics*, Vol. 89, pp. 444–66.

Kang, J. K., and R. Stulz, 1997, "Why Is There a Home Bias? An Analysis of Foreign Portfolio Equity Ownership in Japan," *Journal of Financial Economics*, Vol. 46, pp. 3-28.

Kaul, A., V. Mehrotra, and R. Morck, 2000, "Demand Curves for Stocks *Do* Slope Down: New Evidence from an Index Weights Adjustment," *Journal of Finance*, Vol. 55, pp. 893-912.

Kaul, A., V. Mehrotra, and C. Stefanescu, 2008, "Do Stock Exchanges Corral Investors into Herding?" unpublished manuscript, University of Alberta.

Kumar, A., and C. Lee, 2006, "Retail Investor Sentiment and Return Comovements," *Journal of Finance*, Vol. 61, pp. 2451-486.

Madhavan, A., 2003, "The Russell Reconstitution Effect," *Financial Analysts Journal*, Vol. 59, pp. 51-64.

Mase, B., 2008, "Comovement in the FTSE 100 Index," *Applied Financial Economics Letters*, Vol. 4, pp. 9-12.

Morck, R., B. Yeung, and W. Yu, 2000, "The Information Content of Stock Markets: Why Do Emerging Markets Have Synchronous Stock Price Movements?" *Journal of Financial Economics*, Vol. 58, pp. 215-60.

NAPF (National Association of Pension Funds, 2007), *Institutional Investment in the UK Six Years On*, www.napf.co.uk .

Pindyck, R., and J. Rotemberg, 1993, "The Comovement of Stock Prices," *Quarterly Journal of Economics*, Vol. 108, pp. 1073-104.

Shleifer, A., 1986, "Do Demand Curves for Stocks Slope Down?" *Journal of Finance*, Vol. 41, pp. 579-90.

Vijh, A., 1994, "S&P Trading Strategies and Stock Betas," *Review of Financial Studies*, Vol. 7, pp. 215-51.

World Bank, 2008, *World Bank Financial Policy Unit - Institutional Investor Database*.

Zun, S., 2008, "Clustered Institutional Holdings and Stock Comovement," unpublished manuscript, University of California, Irvine.