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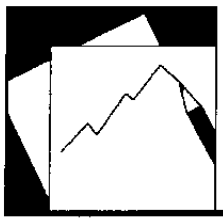

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The Rise in Comovement Across National Stock Markets: Market Integration or Global Bubble?

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The Rise in Comovement Across National Stock Markets: Market Integration or Global Bubble?

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Abstract

The degree of comovement across national stock markets has increased dramatically since the mid-1990s. This has overturned a stylized fact in the international portfolio diversification literature that diversifying across countries is more effective for risk reduction than diversifying across industries. We investigate if this rise in comovement is a permanent phenomenon driven by greater economic and financial integration, or a temporary effect associated with the recent stock market bubble. At the global level, our results point to the bubble. At a regional level, we find evidence of a significant rise in market integration within Europe, possibly a reflection of institutional changes such as the EMU.

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I. INTRODUCTION

One of the most pronounced empirical regularities in international equity markets has been the low degree of correlation of returns across national stock markets. This empirical regularity has broken down in recent years. The correlation coefficient of U.S. stock returns with equity returns in other developed countries has risen from a relatively stable level of around 0.4 from the mid-1980s through the mid-1990s to close to 0.9 more recently.[2] There are several possible explanations for this. First, there may have been a decline in home bias in the portfolio holdings of investors. As a result, the marginal investor in German equities may no longer be German, so that country-specific investor sentiment now plays a smaller role in national equity markets. Second, firms may be becoming more diversified across countries in their sales and financing. As a result, companies around the world may be becoming more exposed to the global business cycle, causing national stock markets to move together more. Third, it is possible that the rise in comovement since the mid-1990s is simply a temporary phenomenon associated with the recent stock market boom and bust.[3]

For portfolio managers the question of whether the rise in synchronization across national equity markets is driven by fundamentals, and therefore likely to be permanent, or if it is linked to the recent stock market bubble, and therefore temporary, is critical. This is because portfolio managers have traditionally followed a top-down approach, first choosing the countries in which to invest and then selecting the best securities in each market. This approach is consistent with the view that the variation in international stock returns is due mainly to country effects, a view that was until recently validated by academic research. For example, Heston and Rouwenhorst (1994, 1995) show that country-specific sources of return variation are dominant even in geographically concentrated and economically integrated regions such as Western Europe. In a broader sample that includes emerging markets, Griffin and Karolyi (1998) find that global industry factors explain only around 4 percent of the variation in national stock markets.

However, more recent papers have found that industry effects are becoming more important. For example, Baca and others (2000) report that the importance of global industry factors in explaining international return variation increased toward the late-1990s. Cavaglia and others (2000) show that industry factors surpassed country effects in importance in the late-1990s, concluding that diversification across industries may now provide greater risk reduction than

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[2] To compute these correlation coefficients, we used U.S. dollar-denominated monthly returns from the Datastream Global Equity indices. The developed markets index excluding the United States comprises Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong SAR, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, and the United Kingdom.

[3] There may be additional reasons why comovement across national equity markets has increased, including convergence in industrial composition and greater policy coordination across countries, or simply that country-specific shocks have declined in importance.

diversification across countries. Their result dovetails with a growing conviction in the investment community and in the financial press that globalization and the new economy are raising the importance of global industry effects, at the expense of country-specific factors.[4]

Against this background, we make two contributions to the literature. First, using a new dataset that covers virtually the entire global stock market, we test the robustness of the recent rise in global industry effects (i) by excluding stocks in the telecommunications, media, biotechnology, and information technology (TMBT) sectors from the sample; and (ii) by excluding United States firms from the sample. If there is no evidence, beyond the TMBT sectors and outside of the United States, that industry effects have grown significantly in importance, this may be an indication that the recent dominance of industry over country effects is a temporary phenomenon associated with the stock market bubble of the late-1990s. This is because there is no a priori reason to think that economic and financial integration should be confined to a narrow set of sectors or countries. Second, we investigate the extent to which there are regional differences in the evolution of country and industry effects over time. In particular, we follow the Morgan Stanley Capital International (MSCI) country index classification by grouping our sample into three broad regions: the Americas, Europe, and the Far East. Our motivation stems from the fact that there are substantial differences across these regions in how economic and financial integration has progressed. Notably, in Europe the start of the European Monetary Union (EMU) and the increasing harmonization of government policies stand in contrast to the Americas and the Far East, where there has been little comparable effort to promote integration. We thus explore whether the evolution of country and industry effects within each region is consistent with differences across regions in economic and financial integration. One advantage of this exercise is that it essentially nests earlier work by Rouwenhorst (1999) and Heston and Rouwenhorst (1994, 1995) that focuses exclusively on Europe.

Our results suggest the following. At the global level, we find that industry effects have significantly outgrown country effects in explaining international return variation. Our data suggest that global industry effects have became close to twice as important as country effects since the late-1990s, where the relative importance of country versus industry effects is captured by the ratio of the so-called mean absolute deviations or MADs, following Rouwenhorst (1999) and Cavaglia and others (2000).[5] However, this result is driven by a

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[4] For example, *Business Week* (2000) has interpreted the growing importance of global industry effects in the late 1990s in the context of three phenomena: the rise in cross-border mergers and acquisitions has increased the number of multinationals and accelerated the trend toward global industry sectors (consolidation within industries has accounted for three-quarters of all cross-border mergers in the late 1990s); the growing role of high-technology companies, which are especially global in their reach (40 percent of Yahoo!'s customers are outside the United States, while Finland's Nokia has a 37 percent share of the U.S. cellular market); and finally the fact that the Internet makes it easier for investors to gather information on foreign companies, reducing home bias in portfolio composition.

[5] The MADs are capitalization weighted absolute values of the country and industry effects and provide a summary measure of the overall importance of these effects. For example, when a country is fully integrated into the world portfolio, its pure country effect should be

relatively narrow segment of the data. We find that, beyond the TMBT sectors and outside of the United States, the ratio of country to industry MADs is virtually unchanged from the mid-1980s to the late-1990s and follows an inverted U-shape over the sample period. There is no evidence to suggest that industry effects have been growing systematically over time. Instead our results point to a cyclical pattern, by which industry effects become temporarily more important, in relative and in absolute terms, around periods of stock market distress, such as October 1987 and March 2000.

Our regional analysis yields a very different picture. In Europe, we find that there has been a broad-based increase in the relative and absolute importance of industry effects. Even after dropping firms in the TMBT sectors, the ratio of country to industry MADs falls from around 2 in the late-1980s to 0.6 in recent years, and is significantly below one. We see this as a possible sign that the trend toward greater European economic and financial integration is finally showing up in equity markets. There is no similar evidence in other regions, such as the Americas or the Far East. In the former, there is no significant change in the MADs ratio over the sample period, with or without the TMBT sectors. In the latter, the MADs ratio actually rises over the sample period, suggesting that country effects have become relatively more important since the mid-1980s, again with or without the TMBT industries.

Of course, the MSCI Europe index contains far fewer emerging markets than do the Americas or the Far East indexes. This difference in composition does not, however, explain why Europe is different. Once we drop the TMBT sectors, there is no evidence in mature markets outside of Europe that industry effects have become significantly more important than country effects. Why is our result for Europe different from that of Rouwenhorst (1999)? Restricting ourselves to the 12 Western European markets that are the focus of his study, we find that the ratio of country to industry MADs only falls significantly below one after August 1998, which is when his sample period ends. The rise in European industry effects above country effects is thus a relatively recent phenomenon.

The paper is organized as follows. Section II discusses the data, while Section III reviews our empirical approach. Section IV presents our results. Section V concludes.

II. THE DATA

The data cover monthly total U.S. dollar stock returns and market capitalizations from January 1985 to February 2002 for 9,679 companies.[6] The data include all constituent firms in the Datastream country indices for 42 developed and emerging markets as of March 2002

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zero. The higher the MAD for country effects, the greater the evidence that markets are segmented. Similarly, if global industry characteristics do not help explain international return variation, the industry effects and their MAD should be zero.

[6] Using U.S. dollar-denominated returns has the effect of lumping nominal currency influences into country-specific effects in international stock returns. We investigate the magnitude of this bias by redoing our estimations using returns denominated in foreign countries' local currency and generally find it to be negligible.

and are augmented with a list of active and inactive stocks for each market derived from Worldscope. Each company is assigned to one of 40 (Level 4) Datastream industries. Table 1 lists these industries and shows how they can be aggregated into the broader (Level 3) FTSE industry sectors.

Compared to the existing literature, the data differ in four respects. First, coverage across and within countries is more comprehensive. For example, Heston and Rouwenhorst (1994) examine data on 829 stocks in 12 European countries. Griffin and Karolyi (1998) collect data on 2,400 firms in 25 developed and emerging markets. Cavaglia and others (2000) cover 2,645 firms in 21 developed countries. The greater coverage within markets has the advantage that the database comes closer to approximating the true universe of stocks, while the greater coverage of emerging markets permits a quantitative assessment of just how segmented these markets are. Second, the number of industries (40) is similar to the number of countries (42), so that—on average—country and industry portfolios are of equal size. In this respect, the paper follows Griffin and Karolyi (1998), who argue that broad industry classifications (Level 3) bias against finding important industry effects because they result in industry portfolios that are larger and therefore more diversified than country portfolios. Third, the sample period goes back to 1985, while Griffin and Karolyi (1998) use a shorter sample period that goes from 1992 to 1995. The advantage of starting in 1985 is that the data include the October 1987 stock market crash, an important benchmark against which to judge the market downturn since March 2000, and that the longer sample period allows a more accurate assessment of how country and industry effects have changed over time. Fourth, the data include firms that become inactive over time, due to bankruptcy or mergers for example. This phenomenon is significant, with 1,996 companies in the sample becoming inactive after January 1995, of which 806 companies became inactive after March 2000. In contrast to earlier work, the results in this paper are therefore less likely to exhibit survivorship bias.

For illustrative purposes, the data in December 2000 contain 8,391 active firms.[7] The overall market capitalization of the sample amounts to $31,486 billion at that point, which is almost 99 percent of actual market capitalization in our 42 countries, according to the IFC stock market fact book. The United States makes up almost 50 percent of the sample in percent of overall market capitalization. The United Kingdom and Japan each make up about 10 percent of the sample. In contrast, emerging stock markets constitute only a small fraction of the data. In terms of market capitalization, companies in the financial sector are most heavily represented, making up almost 24 percent, while the information technology sector is the second largest, at just under 16 percent. Two-thirds of all companies in this sector are located in the United States, judging by market capitalization.

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[7] Countries and regions in the sample are Argentina, Australia, Austria, Belgium, Canada, Chile, China, Colombia, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong SAR, India, Indonesia, Ireland, Italy, Japan, Luxembourg, Malaysia, Mexico, the Netherlands, New Zealand, Norway, Peru, the Philippines, Poland, Portugal, Singapore, South Africa, Korea, Spain, Sweden, Switzerland, Taiwan Province of China, Thailand, Turkey, the United Kingdom, and the United States.

Our coverage is relatively stable going back toward the beginning of the sample. In December 1990, for instance, the overall market capitalization of the sample comes to $9,102 billion, about 97 percent of stock market capitalization in the 42 sample countries as measured by the IFC.

III. The Model

Following Heston and Rouwenhorst (1994, 1995), we assume that the return on each stock depends on four components: a common factor (α), global industry factors (β), country factors (γ), and a firm-specific disturbance (e). We write the return on stock i in industry j and country k as:

$$R_{it} = \alpha_t + \beta_{jt} + \gamma_{kt} + e_{it}. \tag{1}$$

The paper estimates a time-series for the realization of the common factor, industry factors and country factors by running the following cross-sectional regression every month:

$$R_i = \alpha + \sum_{j=1}^{J} \beta_j I_{ij} + \sum_{k=1}^{K} \gamma_k C_{ik} + e_i, \tag{2}$$

where I_{ij} is a dummy variable that equals one if the stock belongs to industry j and zero otherwise, and C_{ik} is a similar dummy variable that identifies country affiliation. There are J industries and K countries in total.

Equation (2) cannot be estimated in its present form because it is unidentified due to perfect multicollinearity. Intuitively, this is because every company belongs to both an industry and a country, so that industry and country effects can be measured only relative to a benchmark. To resolve this indeterminacy, we follow the literature in imposing the restriction that the weighted sum of industry and country effects equal zero at every point in time, so that the industry and country effects are estimated as deviations from the intercept α:

$$\sum_{j=1}^{J} \beta_j \sum_{i=i}^{N} I_{ij} x_i = \sum_{j=1}^{J} \beta_j w_j = 0 \tag{3}$$

$$\sum_{k=1}^{K} \gamma_k \sum_{i=1}^{N} I_{ik} x_i = \sum_{k=1}^{K} \gamma_k v_k = 0. \tag{4}$$

N is the total number of firms in a given month. Equation (2) is estimated using weighted least squares, with each stock return weighted by its beginning-of-month share of world stock market capitalization x_i. Then w_j corresponds to the market capitalization of industry j as a share of the total, while v_k is the market capitalization share of country k.

We follow the literature in using two different metrics to quantify the importance of country and industry effects. The first computes the estimated variances of the industry and country effects. From equation (2) the excess returns over the benchmark portfolio can be decomposed into the weighted sum of country and industry effects. The higher the variance

of country (industry) effects, the higher the proportion of the variability in excess returns explained by country (industry) factors. More intuitively, if the variability of industry effects is higher than that of country effects, portfolio managers can achieve more reduction in risk by diversifying across industries than by diversifying across countries. Since there are J variances for the industry effects and K variances for the country effects, we report only cap-weighted averages of these variances, namely $\sum_{j=1}^{J} w_j \operatorname{var}(\beta_{jt})$ and $\sum_{k=1}^{K} v_k \operatorname{var}(\gamma_{kt})$, for brevity.

We follow Rouwenhorst (1999), Cavaglia and others (2000) in using mean absolute deviations (MADs) as our second metric. This measure weights the absolute values of the country and industry effects by their respective market capitalizations. Country and industry MADs in a given month are:

$$MAD_{Ct} = \sum_{k=1}^{K} v_{kt} |\gamma_{kt}| \tag{5}$$

$$MAD_{It} = \sum_{j=1}^{J} w_{jt} |\beta_{tj}|, \tag{6}$$

where w_{jt} and v_{kt} are the capitalization weights at the beginning of period t. The country MAD can be interpreted as the capitalization-weighted average tracking error for returns on industry-neutral country portfolios relative to returns on the benchmark portfolio. The industry MAD has an analogous interpretation. The recent literature, Cavaglia and others (2000) for instance, has emphasized the ratio of country to industry MADs as a measure of their relative importance. A ratio greater than one means that in period t country effects dominate industry effects. The opposite is true if the ratio is smaller than one. Intuitively, the implication of the MADs for portfolio managers is as follows. If the ratio is greater than one the return of a portfolio that is not diversified across countries will on average deviate from the benchmark more than a portfolio that is not diversified across industries.

IV. The Results

We begin by discussing the first metric, the capitalization-weighted time-series variances of the country and industry effects. Table 2 plots these variances of the composite country (Panel A) and industry (Panel B) effects for the full sample period, January 1985 to February 2002, and for four-year subperiods. We compute the variances of the country and industry effects for the full sample, which covers all firms, and for different subsamples of the data. Some of these subsamples (the sample without TMBT firms or the sample without U.S. firms) are of interest because they shed light on the robustness of the full sample results. We also look at regional subsamples. We know that economic and financial integration within some regions, especially Western Europe, has been greater than elsewhere. We want to explore if these differences across regions are reflected in the importance of country and industry factors. One regional subsample is Europe (12), which consists of the 12 Western European countries examined in Heston and Rouwenhorst (1994, 1995) and Rouwenhorst

(1999).[8] In addition, we follow the MSCI country index classification by grouping our sample into three broad regions: the Americas (MSCI Americas), Europe (MSCI Europe), and the Far East (MSCI Pacific).[9] Finally, we break out mature and emerging markets, in order to assess the degree of segmentation in emerging markets.[10]

Table 2 shows that country effects on average have been more variable than industry effects over the full sample period. The ratio of the composite country effects variance (23.03 percent squared) to the composite industry effects variance (11.41 percent squared) is about 2:1. This result goes in the same direction as that of Griffin and Karolyi (1998), though they report a higher ratio of 4:1 for a sample with fewer emerging markets. The four-year subperiods in Table 2 show that over time the composite variances of the country and industry effects describe an inverted U-shape and a U-shape, respectively. Country effects are the most variable in the middle of the sample, between 1990 and 1994. Industry effects are the most variable at the beginning (1986–90) and at the end (1998–2002) of the sample. At the end of the sample the variablity of industry effects rises spectacularly and surpasses that of country effects: for the 1998–2002 period the ratio of country to industry variances is almost 1:2. This result has led the some recent papers to conclude that economic and financial integration have changed the way portfolio managers should diversify risk: diversifying across countries is now less important than diversifying across industries. We check for the robustness of this result by looking at a subsample without TMBT firms, one without U.S. firms, and one with neither. Our conclusion is that it is not very robust: beyond TMBT firms or outside the United States, the variability of industry effects still rises toward the end of the sample, but it is far less impressive and not large enough to surpass the variability of country effects. We see this as a sign that the recent dominance of industry over country effects is driven by a relatively narrow segment of the data and may be a temporary phenomenon associated with the recent stock market bubble.

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[8] The 12 Western European countries covered in Heston and Rouwenhorst (1994, 1995) and Rouwenhorst (1999) are Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom.

[9] Our MSCI Americas region has eight markets: Argentina, Brazil, Canada, Chile, Colombia, Mexico, Peru, and the United States. Our MSCI Pacific region has 13 markets: Australia, China, Hong Kong SAR, India, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore, Taiwan Province of China, and Thailand. Our MSCI Europe adds the Czech Republic, Finland, Greece, Ireland, Luxembourg, Poland, Portugal, and Turkey to the Europe (12) region. Our MSCI regions do not overlap exactly with the MSCI region indexes. For example, our sample omits companies in Russia and Hungary, which are therefore not in our MSCI Europe region.

[10] Stock markets that are classified as mature are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the United States, and the United Kingdom.

We now turn to the regional results. The results for the 1985–2002 sample period show that, not surprisingly, country effects in emerging markets are on average much more variable than in mature markets. In mature markets, the relative importance of country and industry effects is of roughly the same order as in the full sample. For emerging markets, country effects clearly dominate. MSCI Pacific, which includes several emerging markets, is in between. Finally, for MSCI Americas the country effects are very small: this is not surprising since the region is essentially a one-country portfolio (the United States) in market capitalization terms. The results for the different time periods show that in Europe the story is very different than in other regions. In Europe the relative importance of industry versus country effects has been rising monotonically over the sample period and this is true with or without the TMBT sectors. For no other region is this the case. In fact, for many regions the relative importance of industry effects is larger at the beginning than at the end of the sample.

We now turn to our second metric, the mean absolute deviations (MADs). Consistent with Table 2, the country MADs are larger than the industry MADs over the full sample period. The average country effect for the full sample period is 3.17 percent a month (in absolute value), while the average absolute industry effect is 2.4 percent a month. In other words, an industry-neutral country tilt relative to the global stock market has given rise to a tracking error that is larger than a country-neutral industry tilt of similar size. However, the margin by which the tracking error associated with country effects outweighs that of industry effects is smaller than that reported by Rouwenhorst (1999), who reports a ratio of 2:1.

Figure 1 plots the country and industry MADs for the entire universe of firms in the sample. To assess the changing importance of country and industry factors over time, mean absolute deviations are given for two-year (lagged) moving averages, along with error bands that measure two standard deviations either side of these MADs.[11] The two-year average of the country MADs at the beginning of the sample measures 3.47 percent. This number hovers between 3 and 4 percent until the mid-1990s and then gradually falls to 2.70 percent during the last two-year subperiod, which is significantly below the initial estimate.[12] The two-year average of the industry MADs at the beginning of the sample is 2.44 percent. This number falls below 1.5 percent in the mid-1990s, but grows to 4.22 percent by the end of the sample, significantly above both the initial estimate and the end-of-period country MAD.

Figure 2 shows the corresponding series for the sample without TMBT firms. The pattern for the country MADs is roughly the same as before—they register a significant decline (at the

[11] The variance of the country and industry MADs is computed every month using the Delta method, which is described in Green (1993). The variances are then averaged over time along with the MAD point estimates to construct the error bands. This procedure assumes that there is no serial correlation in the residuals of equation (2).

[12] If x_1 is the initial two-year average of the country MADs and x_2 is the end-of-sample two-year average of the country MADs, we use the test statistic $t=(x_2-x_1)/(\text{sqrt}(\text{var}(x_1)+\text{var}(x_2))$, which is asymptotically distributed as a $N(0,1)$, to test if the initial and terminal MADs are significantly different.

1 percent level) over the sample period. In contrast, the end-of-sample average of the industry MADs is not significantly different (the p-value is 28 percent) from the beginning-of-sample average. There is therefore little evidence that, beyond the TMBT sectors, industry effects have grown in importance over the full sample period.

Figure 3 takes a more direct look at the relative importance of country and industry effects over the sample period. It plots the two-year moving average of the ratio of country to industry MADs, along with two standard deviation error bands, for the full sample of all firms as well as for the sample without TMBT firms. For the full universe of firms the MADs ratio drops significantly below one by the end of the sample. This is no longer the case when the TMBT sectors are dropped. The end-of-sample ratio is not significantly different from one and, more important, is not significantly different from the beginning-of-sample MADs ratio (at the 10 percent level).

Next, we test whether the rise in sector effects is robust to excluding all U.S. firms from the sample. The United States represents about half of our sample in capitalization terms and was arguably at the center of the recent stock market boom and bust. If there is evidence that industry effects have grown in importance in a sample without the United States, this will support the notion that they are capturing economic and financial integration at a global level and are not driven by one country. The results for the subsample without U.S. firms are not shown for brevity, as they are virtually the same as for the subsample without TMBT firms (the results are available upon request).

Figures 4 and 5 replicate Figures 1 and 3 for the sample of the 12 Western European countries in Heston and Rouwenhorst (1994, 1995) and Rouwenhorst (1999). Figure 4 shows the evolution of country and industry MADs for the European sample. The overall picture is similar to Figure 1: by the end of the sample period, industry MADs rise in importance well (and significantly) above country MADs. Figure 5 plots the associated ratio of country to industry MADs, along with the ratio of country to industry MADs for the European sample without TMBT firms. Figure 5 looks strikingly different from Figure 3. For Europe the exclusion of TMBT companies hardly changes the picture: the ratios are never significantly different from each other. Both end-of-sample ratios are significantly below one—suggesting that there is a broad-based rise in the relative importance of industry effects in Europe—and are below their respective initial values at conventional significance levels.

We do not find similar evidence in the Americas or the Far East (these results are not shown for brevity). In the former, there is no significant change in the MADs ratio over time, with or without TMBT sectors. In the latter, the MADs ratio rises significantly over the sample period, suggesting that country effects have become relatively more important since the mid-1980s, again with or without the TMBT industries. Europe therefore stands out in our regional analysis as the one region with a broad-based increase in the importance of industry effects, both in absolute and relative terms. This holds true even if we allow for the fact that the MSCI Europe index contains fewer emerging markets than do the Americas or the Far East indexes. Once we drop the TMBT sectors, there is no evidence in mature markets

outside of Europe that industry effects have become significantly more important than country effects.[13]

We now summarize and evaluate our results. Several recent papers have argued that the rising importance of industry effects in international stock returns is a reflection of greater economic and financial integration across countries. At a global level, our results challenge this conclusion. Both the MADs ratios and the ratios of country to industry effect variances have an inverted U-shape that does not sit well with the notion that, in the years covered in our sample, market integration has largely been a nonreversible process. If greater integration were driving the rise in sector effects, we would expect to find monotonically decreasing MADs and variance ratios. In addition, the result that industry effects have eclipsed country effects has been shown to depend heavily on the country (the United States) and the sectors (TMBT) at the center of the recent stock market bubble. Outside the United States and beyond TMBT, there is no compelling evidence at a global level to suggest that global industry effects have eclipsed country factors as a source of international return variation. Of course, it is true that the importance of industry effects has increased since the mid-1990s. But over the *full* sample period, from 1985 to 2002, there is little evidence to suggest that industry effects have grown in importance.

Of course, it is true that the TMBT sectors are a new and growing part of the global stock market. If these sectors are more international than other industries, as some anecdotal evidence suggests, part of the increase in the importance of industry factors may not be short-lived. At the same time, we find it hard to reconcile our findings with greater market integration, since this is usually not seen as a one-sector or a one-country phenomenon.

Is there robust evidence consistent with greater economic integration at a regional level? According to Rouwenhorst (1999), even in Western Europe there is no evidence that differences across countries (as measured by the importance of country effects) have disappeared. He finds that country MADs always dominated industry MADs in Western European stock returns from 1978 to 1998. Our work challenges his result. Most importantly, we show that the Western European ratio of country to industry MADs declines practically through all of the sample period, which is consistent with the notion of nonreversible market integration, and that this decline is robust to the exclusion of firms in the TMBT sectors. We see this result as evidence that stock markets in Western Europe have become more integrated in the course of the 1990s, possibly a reflection of the rise in fiscal and monetary coordination following the Maastricht Treaty as well as the economic impact of the European Union (EU). Consistent with our *a priori* notion that economic and financial integration has advanced more in Europe than elsewhere, we find no evidence in other regions, notably the

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[13] We also investigate whether changes in the composition of the data over time can explain the growing importance of industry relative to country effects and find that, when we balance the data, our results do not change qualitatively. In addition, we investigate the role of survivorship bias in the results, which we find to be minimal, presumably because the regressions are weighted by market capitalization. Finally, we investigate if currency misalignments play an important role in the results, using PPP-implied nominal exchange rates to compute returns and market capitalization shares. We do not find a significant effect from currency misalignments in the results.

Americas or the Far East, that the balance between country and industry effects has shifted conclusively in favor of economic integration. Why does our result for Europe differ from that of Rouwenhorst (1999)? The pickup in industry MADs begins just when his sample ends, in 1998.[14]

V. Conclusion

The degree of comovement across national equity markets has increased dramatically since the mid-1990s. In this context, Baca and others (2000) report that the importance of global industry factors in explaining international return variation increased towards the late-1990s. Cavaglia and others (2000) show that industry factors surpassed country effects in importance in the late-1990s, concluding that diversification across industries may now provide greater risk reduction than diversification across countries. Since portfolio managers have traditionally followed a top-down approach, first choosing countries in which to invest and then selecting the best securities in each market, the question whether the rise in industry relative to country effects is permanent or not is of great importance. Should they change the way the make portfolio decisions, or is the recent rise in sector effects a temporary phenomenon linked to the stock market bubble?

In this paper, we find that, outside the United States and beyond the TMBT industries, there is only weak evidence that industry effects have eclipsed country factors at a global level. We see this as a sign that the recent dominance of industry over country effects might be a temporary phenomenon associated with the stock market bubble of the late-1990s. We also find that, since the mid-1980s, the absolute and relative importance of the industry effects has followed a U-shape, a pattern we see as hard to reconcile with the view that their increasing importance in the late-1990s is a reflection of greater integration across markets. Instead, our results point to an interesting cyclical pattern, whereby industry effects become temporarily more important, in relative and absolute terms, around periods of stock market distress, such as October 1987 and March 2000. Further research is needed to investigate this issue.

For a subset of 12 Western European equity markets that has been widely examined in the literature, most recently by Rouwenhorst (1999), we find that integration has increased significantly, even after excluding firms in the TMBT sectors. In a European sample without TMBT firms, we find that industry effects are now significantly more important than country effects. This finding is in sharp contrast to that of Rouwenhorst (1999) and stems from the fact that the importance of industry effects in European stock returns started rising sharply only after 1998, the end of his sample period. We see this result as supporting the view that the start of EMU and the increasing harmonization of government policies in Western Europe are promoting greater integration across European stock markets.

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[14] Our analysis has allowed the benchmark portfolio, against which we estimate the country and industry effects, to change across subsamples. In the European subsample, for instance, we have implicitly adopted the perspective of a portfolio manager whose performance is benchmarked against the European market, not the global one. This is because we chose the value-weighted European market to be the benchmark portfolio. If instead we assume that the value-weighted global stock portfolio (the full sample) is the constant benchmark portfolio in our analysis across the different subsamples, our results are qualitatively unchanged.

In conclusion, we do find empirical support for greater economic integration in the region where we would a priori expect such evidence to be strongest due to institutional changes. At the global level, as well as in other regions, evidence suggesting that differences across countries have decreased over time is scant. For portfolio managers (outside of Europe), this suggests that the "old" strategy of diversifying across countries rather than industries may still have merit in terms of reducing portfolio risk. For policymakers (outside of Europe), our results suggest that the rise in comovement across national stock markets may well be a temporary phenomenon associated with the recent stock market bubble.

Table 1. Industry Sectors :

Level 3 Sectors	Level 4 Sectors	Level 6 Sectors
BASIC Basic Industries	CHMCL Chemicals	CHEMICALS, COMMODITY
		CHEMICALS, SPECIALITY
	CNSBM Construction & Building Materials	CHEMS.ADVANCED MATS.
		BUILDERS MERCHANTS
		BUILDING MATERIALS
		HOUSE BUILDING
		OTHER CONSTRUCTION
	FSTPA Forestry & Paper	FORESTRY
		PAPER
	STLOM Steel & Other Metals	NON-FERROUS METALS
		STEEL
GENIN General Industrials	AERSP Aerospace & Defense	AEROSPACE
		DEFENCE
	DIVIN Diversified Industrials	DIVERSIFIED INDUSTRY
	ELTNC Electronic & Electrical Equipment	ELECTRICAL EQUIPMENT
		ELECTRONIC EQUIPMENT
	ENGEN Engineering & Machinery	COMMERCIAL VEHICLES
		ENG. CONTRACTORS
		ENG. FABRICATORS
		ENGINEERING, GENERAL
CYCGD Cyclical Consumer Goods	AUTMB Automobiles & Parts	AUTO PARTS
		AUTOMOBILE
		TYRES AND RUBBER
	HHOLD Household Goods & Textiles	CLOTHING + FOOTWEAR
		FURN. + FLOORCOVERING
		HSEHOLD APPS+HSEWARES
		LEISURE EQUIPMENT
		TEXTILES+LEATHER GDS
NCYCG Non-Cyclical Consumer Goods	BEVES Beverages	BREWERS
		DISTILLERS + VINTNERS
		SOFT DRINKS
	FOODS Food Producers & Processors	FARMING AND FISHING
		FOOD PROCESSORS
	HLTHC Health	HEALTH MAINT. ORGS.
		HOSPITAL MANAGEMENT
		MED EQUIP + SUPPLIES
		OTHER HEALTH CARE
	PCKGN Packaging	PACKAGING
	PERSH Personal Care & Household Products	HOUSEHOLD PRODUCTS
		PERSONAL PRODUCTS
	PHARM Pharmaceuticals	PHARMACEUTICALS
	TOBAC Tobacco	TOBACCO
	BIOTE Biotechnology	BIOTECHNOLOGY
CYSER Cyclical Services	DISTR Distributors	DISTRIB. IND. COMPS.
		VEHICLE DISTRIBUTION
		OTHER DISTRIBUTORS
	RTAIL Retailers, General	DISCOUNT STORES
		RETAIL, HARDLINES
		RETAILERS E-COMMERCE
		RETAILERS, MULTI DEPT
		RETAILERS, SOFT GOODS
	LESUR Leisure, Entertainment & Hotels	GAMING
		HOME ENTERTAINMENT
		HOTELS
		LEISURE FACILITIES
		RESTAURANTS AND PUBS

Notes: Levels 3 and 4 are from the FTSE Global Classification System and are equivalent to Economic Groups and FTSE Sectors, respectively. Level 6 is the Datastream industry classification system.

Table 1. Industry Sectors (concluded)

Level 3 Sectors	Level 4 Sectors	Level 6 Sectors
CYSER Cyclical Services	MEDIA Media & Photography	BROADCASTING
		CABLE + SATELLITE
		MEDIA AGENCIES
		PHOTOGRAPHY
		PUBLISHING + PRINTING
	SUPSV Support Services	BUSINESS SUPPORT
		EDUCATION + TRAINING
		ENVIRONMENTAL CONTROL
		FUNERALS + CEMETERIES
		LAUNDERIES + CLEANERS
		SECURITY AND ALARMS
	TRNSP Transport	AIRLINES + AIRPORTS
		RAIL, ROAD, FREIGHT
		SHIPPING AND PORTS
NCYSR Non-Cyclical Services	FDRET Food & Drug Retailers	FOOD + DRUG RETAILERS
	TELCM Telecom Services	TELECOM FIXED LINE
		TELECOM WIRELESS
UTILS Utilities	ELECT Electricity	ELECTRICITY
	GASDS Gas Distribution	GAS DISTRIBUTION
	WATER Water	WATER
ITECH Information Technology	INFOH Information Tech. Hardware	COMPUTER HARDWARE
		SEMICONDUCTORS
		TELECOM EQUIPMENT
	SFTCS Software & Computer Services	COMPUTER SERVICES
		INTERNET
		SOFTWARE
TOTLF Financials	BANKS Banks	BANKS
	INSUR Insurance	INSURANCE BROKERS
		INSURANCE NON-LIFE
		OTHER INSURANCE
		RE-INSURANCE
	LIFEA Life Assurance	LIFE ASSURANCE
	INVSC Investment Companies	INVESTMENT COS.(6)
		INV.TST INTERNATIONAL
		INV.TST.EMERGING MKTS
		INV.TST.EUROPEAN
		INV.TST.GEOG.SPECLSTS
		INV.TST.VENTURE + DEV
		INVESTMENT TRUST UK
		AUTH. UNIT TRUSTS
		INVESTMENT COS. (UK)
		OFFSHORE FUNDS
		OTHER S.842 INV.TRUST
		SPLIT CAPITAL INV.TST
		UNQUOTED EQUITIES
	RLEST Real Estate	PROPERTY AGENCIES
		REAL ESTATE DEV.
		REAL ESTATE INV. TST.
	SPFIN Speciality & Other Finance	ASSET MANAGERS
		CONSUMER FINANCE
		INVESTMENT BANKS
		MORTGAGE FINANCE
		OTHER FINANCIAL
RESOR Resources	MNING Mining	GOLD MINING
		MINING FINANCE
		OTHER MINING
	OILGS Oil & Gas	OIL + GAS EXPL/PROD.
		OIL INTEGRATED
		OIL SERVICES
OTHER	OTHER	SUSPENDED EQUITIES

Table 2. Decomposition of Index Returns into Country and Industry Effects
1985:1 to 2002:02

Panel A. Capitalization-Weighted Time-Series Variances of the Pure Country Effects

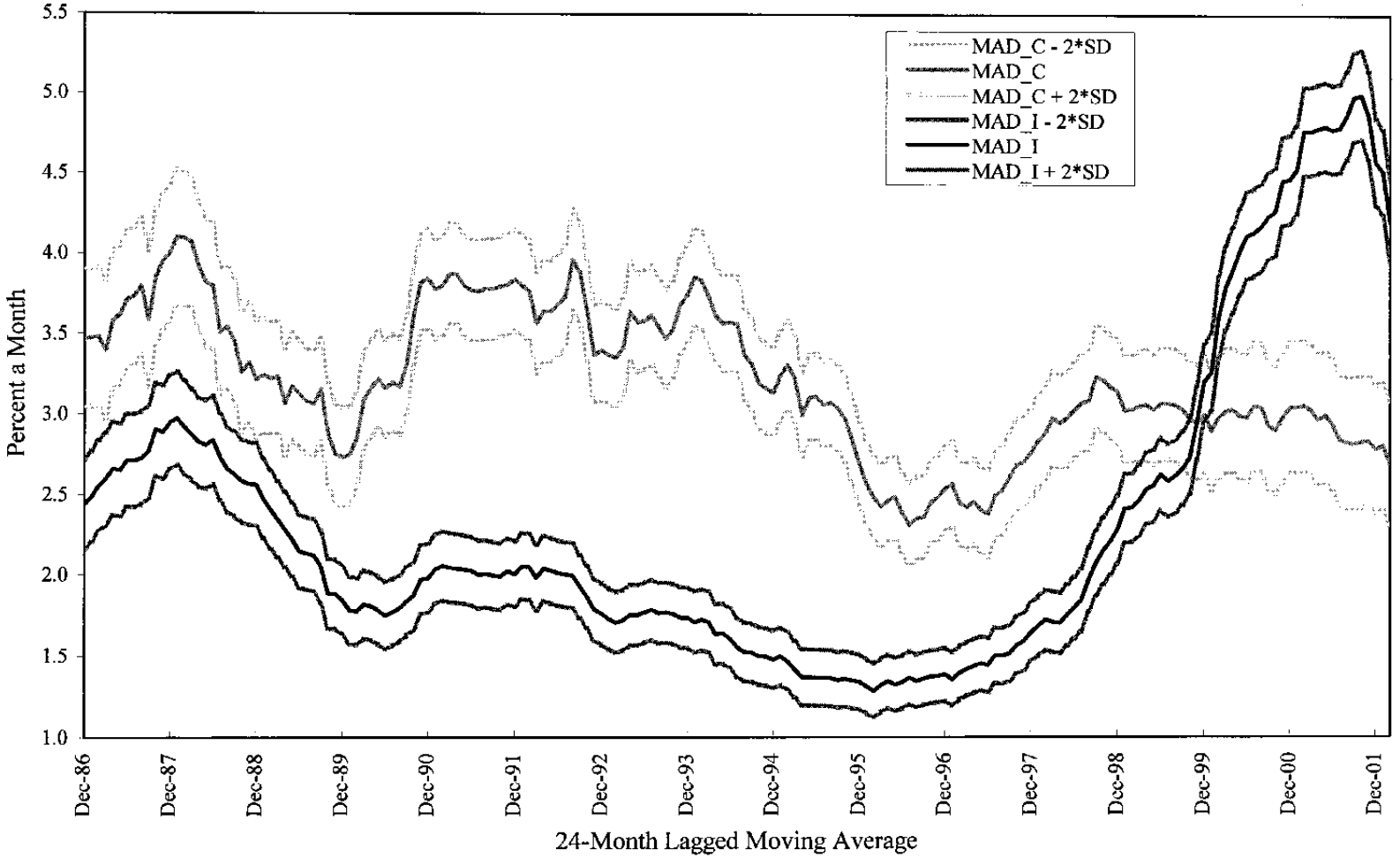
	1985:1 to 2002:2	1998:3 to 2002:2	1994:3 to 1998:2	1990:3 to 1994:2	1986:3 to 1990:2
Full Sample	23.03	17.77	15.94	30.33	19.92
Full Sample ex TMBT	23.30	18.00	16.61	30.27	20.72
Full Sample ex US	29.71	25.75	21.81	35.99	19.27
Full Sample ex US and TMBT	29.53	25.03	22.13	36.13	20.44
Mature Markets	15.56	10.82	9.12	21.08	18.47
Emerging Markets	86.79	63.90	50.19	123.77	43.60
Europe (12)	10.17	6.64	6.52	10.03	14.92
Europe (12) ex TMBT	10.04	6.74	6.04	9.83	14.83
MSCI Europe	12.63	10.76	7.73	12.36	15.36
MSCI Pacific	27.84	26.75	23.62	24.08	11.43
MSCI Americas	7.73	3.10	4.09	21.37	0.61

Panel B. Capitalization-Weighted Time-Series Variances of the Pure Industry Effects

	1985:1 to 2002:2	1998:3 to 2002:2	1994:3 to 1998:2	1990:3 to 1994:2	1986:3 to 1990:2
Full Sample	11.41	29.29	4.14	6.18	10.95
Full Sample ex TMBT	8.05	13.21	3.46	5.81	9.92
Full Sample ex US	11.60	21.30	3.81	7.03	16.08
Full Sample ex US and TMBT	9.16	11.06	3.42	6.35	14.49
Mature Markets	12.15	32.02	4.69	5.76	11.38
Emerging Markets	20.26	25.73	10.33	19.45	23.01
Europe (12)	11.13	30.15	5.60	6.46	6.15
Europe (12) ex TMBT	8.57	16.70	5.48	6.31	5.68
MSCI Europe	10.56	28.11	5.32	6.02	6.05
MSCI Pacific	20.86	28.67	7.65	10.49	36.68
MSCI Americas	20.33	52.55	9.52	13.06	13.17

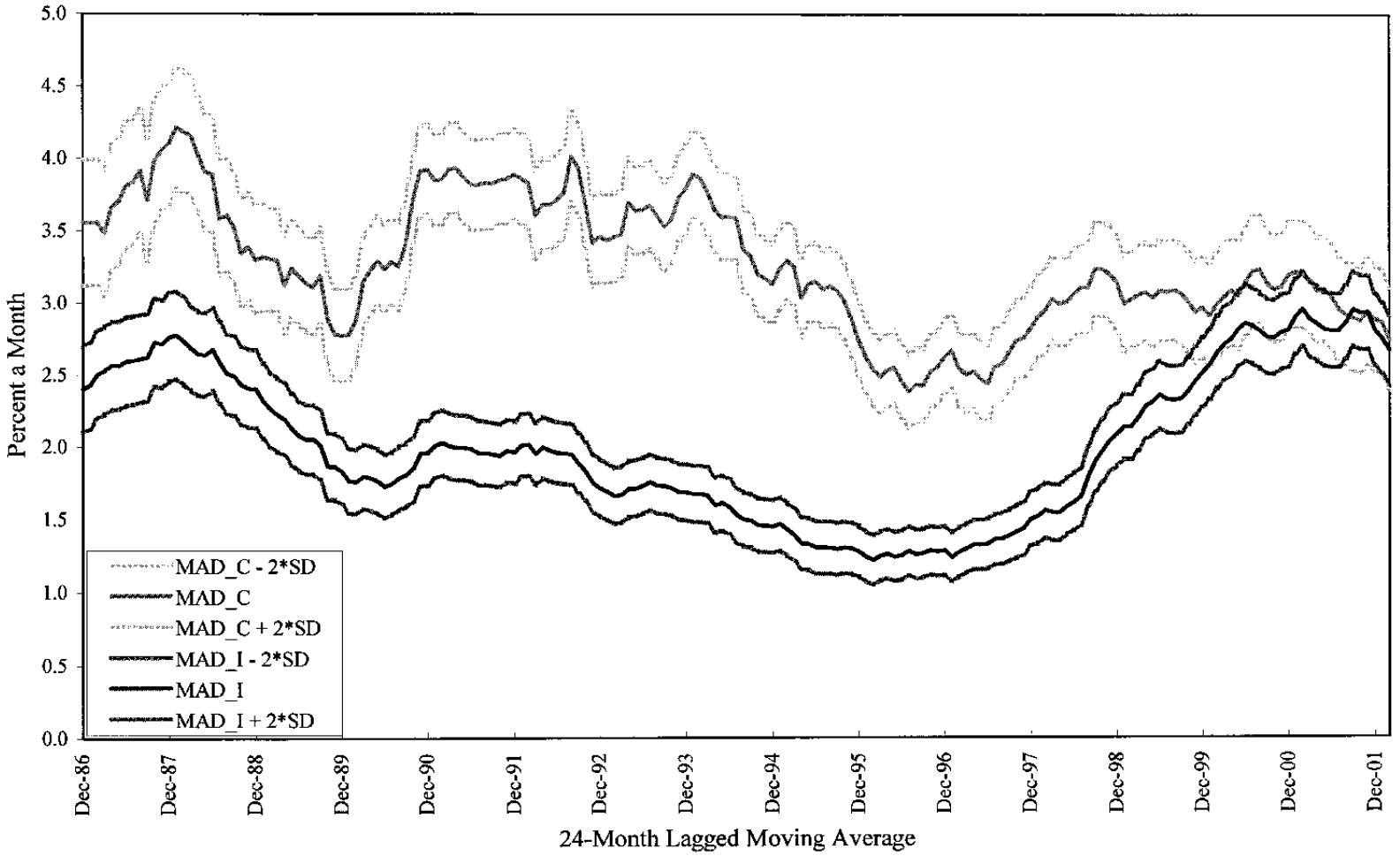
Notes: For the full sample period and for four-year subperiods, Panel A reports the capitalization-weighted cross-country averages of the time-series variance of the estimated pure country effects, $\sum_{j=1}^{J} w_j \, \mathrm{var}(\beta_{jt})$, where w_j is the market capitalization weight of country j in the relevant subsample and β_{jt} is the estimated pure country effect of country j in month t. Panel B reports the capitalization-weighted cross-industry averages of the time-series variance of the estimated pure industry effects, $\sum_{k=1}^{K} v_k \, \mathrm{var}(\gamma_{kt})$, where v_k is the market capitalization weight of industry k in the relevant subsample and γ_{kt} is the estimated pure industry effect of industry k in month t. The β_{jt} and γ_{kt} are estimated separately for each subsample. Market capitalization and returns data are U.S. dollar-denominated. Returns are in percent a month. The full sample covers almost 10,000 stocks in 42 mature and emerging markets. The full sample ex TMBT drops all firms in the telecommunications, media, biotechnology and information technology (TMBT) sectors. The full sample ex U.S. drops all U.S. firms. Europe (12) consists of stocks in the 12 Western European countries examined by Rouwenhorst (1999). MSCI Europe, MSCI Pacific, and MSCI Americas follow the MSCI classification in dividing the full sample into three broad regions. The sample period goes from January 1985 to February 2002.

Figure 1. Cap-Weighted MADs of the Pure Country and Industry Effects for the Full Sample



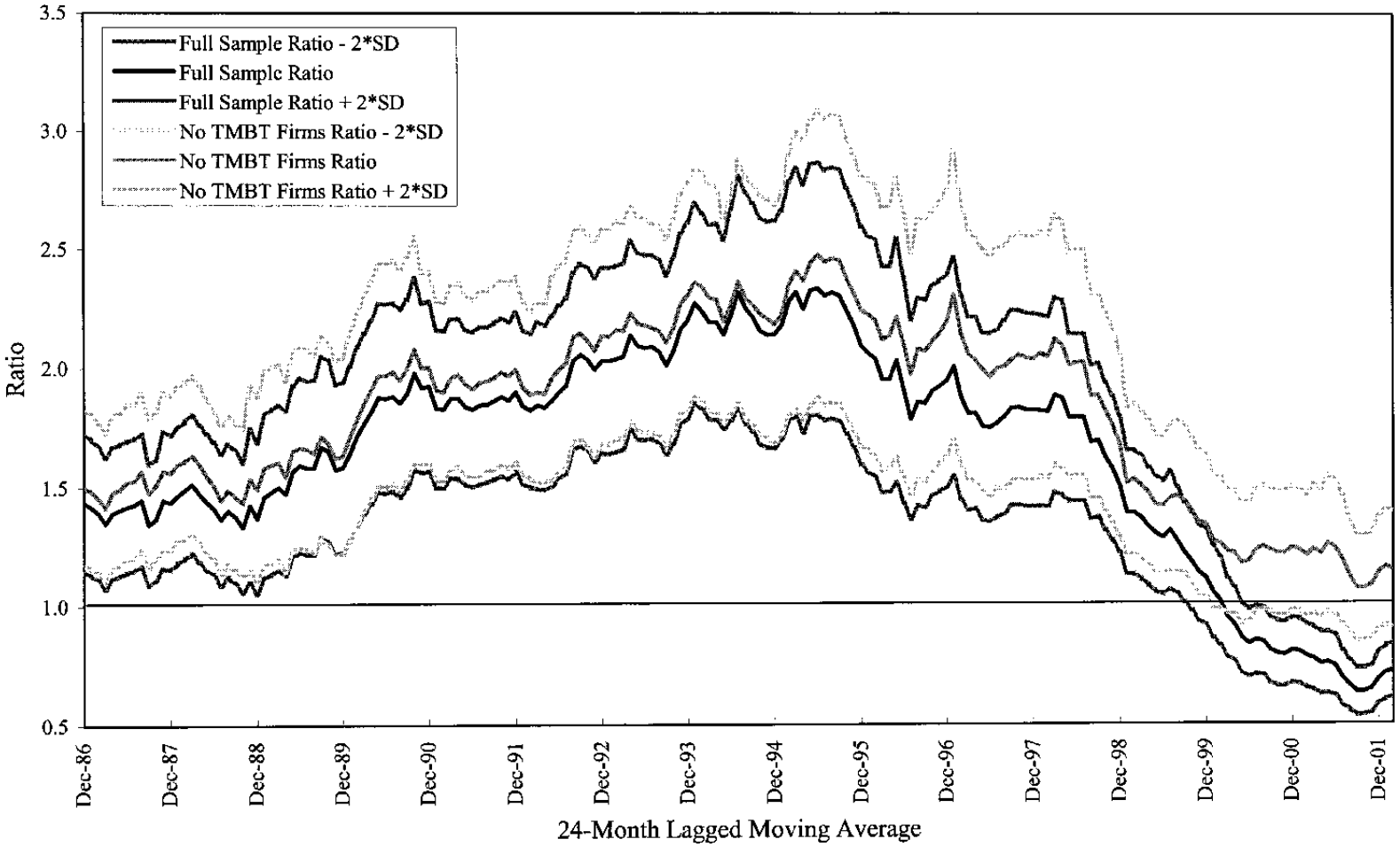
Note:
Cap-weighted mean absolute deviations (MADs) of the pure country (MAD_C) and pure industry (MAD_I) effects with error bands that measure two standard deviations around the MADs for the full sample of all firms. The error bands are constructed using the Delta method and assume no serial correlation in the residuals of equation (2). All series are 24-month lagged moving averages. The full sample covers monthly U.S. dollar-denominated market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns are in percent a month.

Figure 2. Cap-Weighted MADs of Pure Country and Industry Effects for Subsample without TMBT Firms



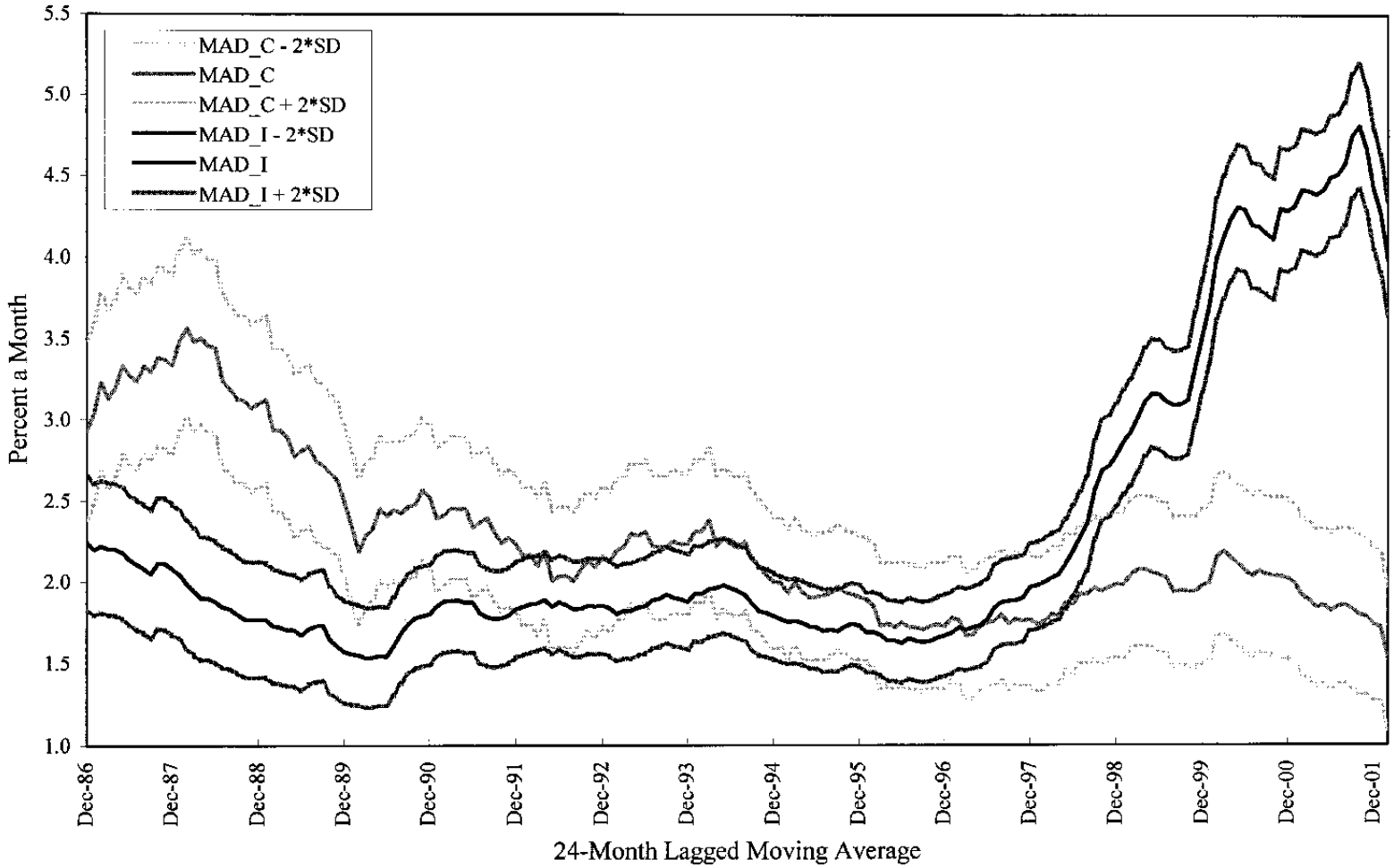
Note:
Cap-weighted mean absolute deviations (MADs) of the pure country (MAD_C) and pure industry (MAD_I) effects with error bands that measure two standard deviations around the MADs for the subsample without telecom, media, biotech and information technology (TMBT) firms. Error bands are constructed using the Delta method and assume no serial correlation in the residuals of equation (2). All series are 24-month lagged moving averages. The full sample covers monthly U.S. dollar market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns in percent a month.

Figure 3. Ratio of Country to Industry MADs for Full Sample and Subsample without TMBT Firms



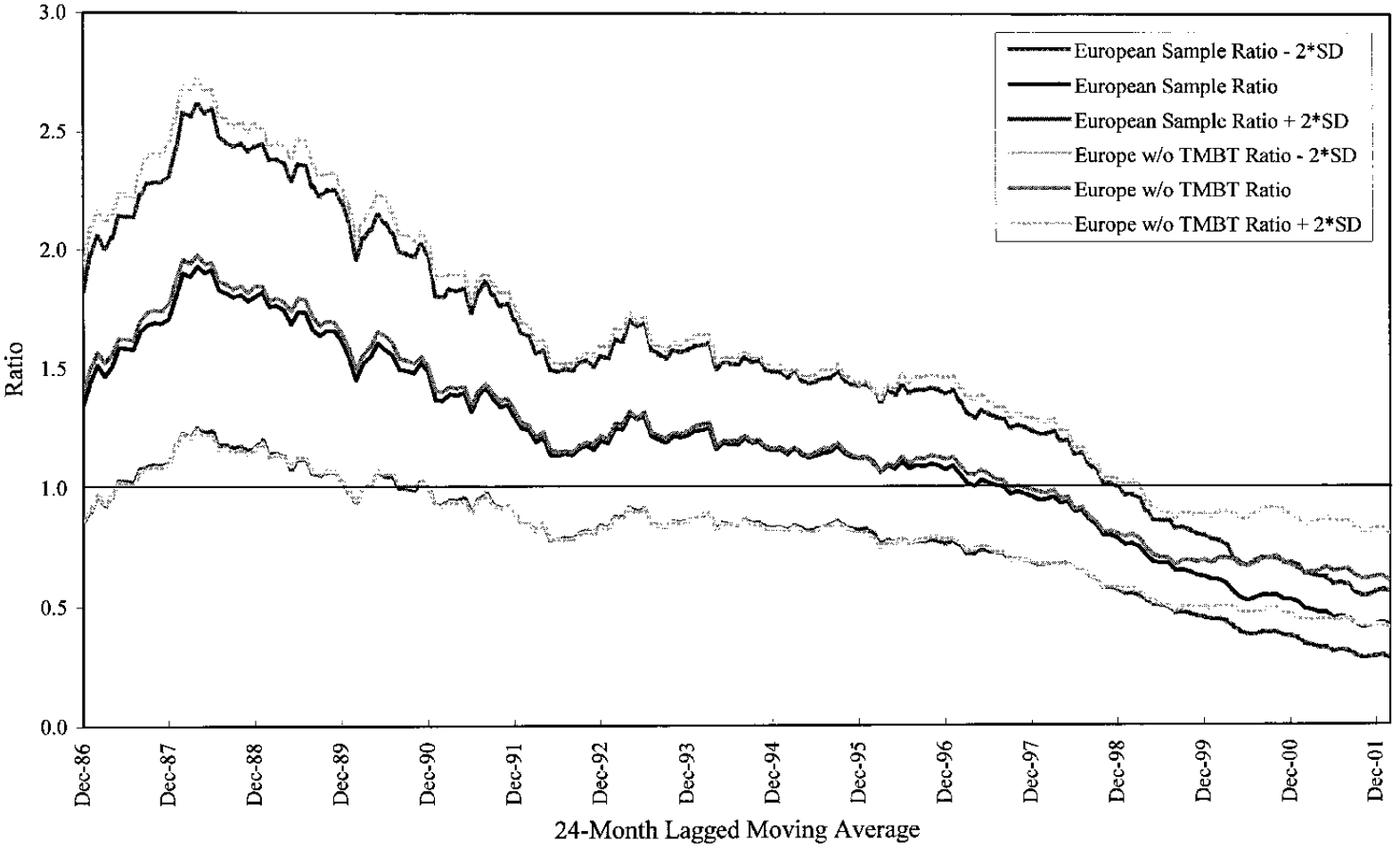
Note:
Ratios of country to industry mean absolute deviations (MADs) for the full sample and the subsample without telecom, media, biotech and information technology (TMBT) firms. Error bands are constructed using the Delta method and assume no serial correlation in the residuals of equation (2). All series are 24-month lagged moving averages. The full sample covers monthly U.S. dollar-denominated market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns are in percent a month.

Figure 4. Cap-Weighted MADs of Pure Country and Industry Effects for Sample of 12 European Countries



Note:
Cap-weighted mean absolute deviations (MADs) of the pure country (MAD_C) and pure industry (MAD_I) effects with error bands that measure two standard deviations around the MADs for the sub-sample of 12 European countries in Rouwenhorst (1999). Error bands are constructed using the Delta method, assuming no serial correlation in the residuals of equation (2). All series are 24-month lagged moving averages. The full sample covers monthly U.S. dollar-denominated market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns are in percent a month.

Figure 5. Ratio of Country to Industry MADs for the European Subsample with and without TMBT Firms



Note:
Ratios of country to industry mean absolute deviations (MADs) for the subsample of 12 Western European countries in Rouwenhorst (1999) and for that subsample without telecom, media, biotech and information technology (TMBT) firms. The error bands are constructed using the Delta method and assume no serial correlation of the residuals in equation (2). All series are 24-month lagged moving averages. The full sample covers monthly U.S. dollar-denominated market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns are in percent a month.

REFERENCES

Baca, S., Garbe, B., and R. Weiss, 2000, "The Rise of Sector Effects in Major Equity Markets," *Financial Analysts Journal*, Vol. 56 (September/October), pp. 35–40.

Braham, L., 2000, "Conquering a Slice of the World: Funds are Dividing the Globe by Industry, Not Country," *Business Week* (September 11), pp. 164–166.

Cavaglia, S., Brightman, C., and M. Aked, 2000, "The Increasing Importance of Industry Factors," *Financial Analysts Journal*, Vol. 56 (September/October), pp. 41–54.

Farrell, C., 2000, "The New Global Investor: New Rules and New Tools for a Global Strategy," *Business Week* (September 11), pp. 160–162.

Green, W., 1993, *Econometric Analysis* (New York: Macmillan Publishing Company).

Griffin, J., and A. Karolyi, 1998, "Another Look at the Role of Industrial Structure of Markets for International Diversification Strategies," *Journal of Financial Economics*, Vol. 50 (December), pp. 351–373.

Heston, S., and G. Rouwenhorst, 1994, "Does Industrial Structure Explain the Benefits of International Diversification?" *Journal of Financial Economics*, Vol. 36, (August), pp. 3–27.

———and G. Rouwenhorst, 1995, "Industry and Country Effects in International Stock Returns," *Journal of Portfolio Management* (Spring), pp. 53–58.

Rouwenhorst, G., 1999, "European Equity Markets and EMU: Are the Differences Between Countries Slowly Disappearing?" *Financial Analysts Journal*, Vol. 55 (May-June), pp. 57–64.