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The rise in comovement across national stock markets: market integration or IT bubble?

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Abstract

A stylized fact in the portfolio diversification literature is that diversifying across countries is more effective than diversifying across industries in terms of risk reduction. But with the rise in comovement across national stock markets since the mid-1990s, this no longer appears to be true. We explore if this change is driven by global integration and therefore likely to be permanent, or if it is a temporary phenomenon associated with the recent stock market bubble. Our results point to the latter hypothesis. In the aftermath of the bubble, diversifying across countries may therefore still be effective in reducing portfolio risk.

JEL classification: G11; G15
Keywords: Diversification; Risk; International financial markets; Industrial structure

1. 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. As Fig. 1 shows, the correlation coefficient of US 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. There are several possible explanations for this. First, there may have

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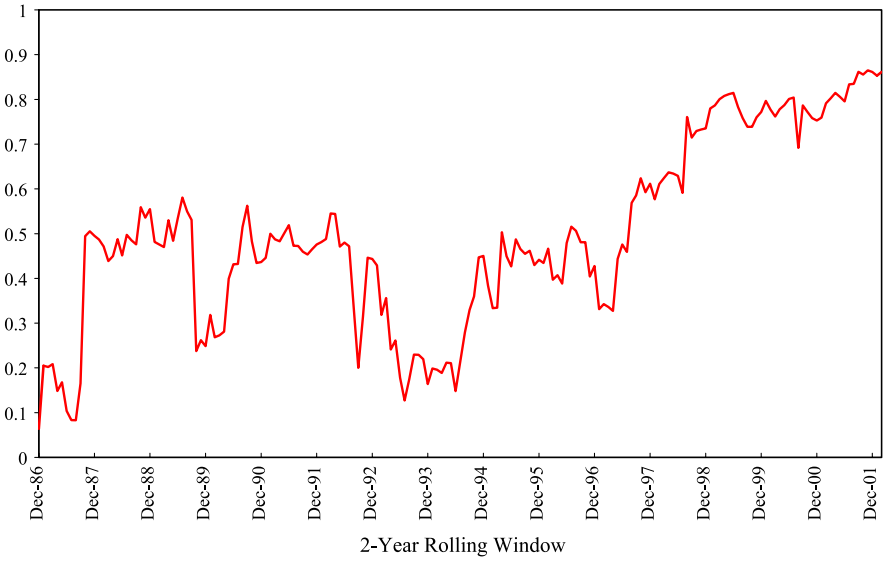

Fig. 1. Two-year rolling window for the correlation coefficient of monthly US dollar-denominated stock returns with returns in other developed markets, based on US dollar-denominated monthly total returns from the Datastream Global Equity indices. The developed markets index excluding the US comprises the United Kingdom, France, Germany, Italy, Japan, Canada, Australia, Austria, Belgium, Denmark, Hong Kong, Ireland, the Netherlands, New Zealand, Norway, Spain, Portugal, Sweden, Switzerland, Finland, Luxembourg and Singapore. The underlying data goes from January 1985 to February 2002.

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 more exposed than before 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 bubble.[2]

For the portfolio diversification literature, 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 thus more likely to be temporary, is of great interest. This is because recent studies have challenged the widely held view that variation in international stock returns is due mainly to country-specific effects. 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. Griffin and Karolyi (1998) find

[2] 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.

that this is even more so for a broader sample that includes emerging markets, where global industry factors explain only around four percent of the variation in national stock markets.[3]

However, against the backdrop of the dramatic rise in comovement across national stock markets in the late-1990s, recent additions to the diversification literature have found that global industry effects are becoming more important. Baca et al. (2000) report that the importance of global industry factors in explaining international return variation increased towards the late-1990s. Cavaglia et al. (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. This result matches that in L'Her et al. (2002) who find that global industry effects surpassed country effects in importance in 1999–2000. These findings dovetail 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.

Against this background, we make several advances over the literature. We construct a new dataset that covers virtually the entire global stock market in capitalization terms and find—for this more comprehensive dataset—that industry effects have gone from less than half as important as country effects in the mid-1990s to almost twice as important in recent years. This shift is primarily driven by a dramatic rise in magnitude of industry effects, with country effects roughly stable since the mid-1990s. But what is the rise in global industry effects capturing? Is it a reflection of greater economic and financial integration across countries, in which case the rise in sector effects is likely to be permanent, or is it simply a temporary phenomenon associated with the recent stock market bubble?[4]

We explore this question in two ways. First, we examine the breadth of the recent rise in sector effects, by exploring the evolution over time of country and industry effects outside of the technology, media and telecommunications (TMT) sectors. Our focus on TMT derives from the fact that these sectors have been identified in financial circles as being central to the recent stock market bubble.[5] We find that, outside of TMT, there is no significant rise in the absolute or relative importance of global industry effects since the mid-1980s, something we find hard to reconcile with the notion that their rise is capturing greater economic and financial integration. For one thing, this is because there is no a priori reason to think that greater integration should be confined to a narrow set of sectors. For another, the greater volatility of TMT stocks is perhaps a temporary phenomenon associated with the recent stock market bubble.

[3] Using a different empirical approach, Heston et al. (1995) find some evidence that stock markets across Europe and the U.S. are integrated.

[4] For an alternative approach to investigating the permanent and transitory components in international stock market comovement, see Hecq et al. (2000).

[5] Following the market peak in March 2000, The Economist writes in November 25, 2000: "Where there has been uncommon value since June has been in shorting TMT shares and buying conservative value shares." In May 5, 2001 The Economist links the TMT sectors and the stock market bubble even more explicitly: "Excessive as the TMT-Nasdaq bubble may have become, it helped finance an infrastructure that has boosted the American economy."

Beyond TMT, we find no systematic increase in the importance of industry effects. Instead, we observe that the ratio of industry to country effects follows a U-shape pattern from the mid-1980s to the late-1990s, a cyclical pattern whereby global industry effects become temporarily more important in relative and absolute terms around periods of stock market distress, such as October 1987 and March 2000. We view this cyclical pattern as further evidence that the recent increase in industry effects is temporary.

But what if the recent rise in TMT industry effects reflects the fact that these sectors are more international than their "old economy" counterparts, something for which there is at least anecdotal evidence?[6] We address this question in two ways. First, we follow Griffin and Karolyi (1998) who distinguish between traded and non-traded goods sectors. Consistent with their paper, we find that country-specific factors explain a larger proportion of the variation of stock returns for non-traded than for traded goods industries. However, we find that the relative importance of global industry effects rises faster towards the end of the sample for non-traded than for traded goods sectors, something we find hard to reconcile with the hypothesis that the recent rise in industry effects is driven by globalization.

Second, we collect firm-level balance sheet data from Worldscope on how integrated the firms in our sample are into the global economy, using the percentage of total sales that are generated by foreign subsidiaries and the fraction of total assets that are held by these subsidiaries as proxy measures for international integration. Compared to the sector-level traded versus non-traded goods classification, this approach reduces the potential for measurement error because traded goods firms may after all not export and non-traded goods companies may sell their services abroad. Ranking our sample by the share of international sales and assets that firms have, we find that global industry effects explain more variation than country effects for stock returns of firms in the top quartile (internationally diversified) than in the bottom quartile (not internationally diversified). However, the ranking also shows that the relative importance of industry effects has risen by more since the mid-1990s for the bottom than for the top quartile of firms. Again, consistent with our results for the sector-level traded versus non-traded goods classification, we find that industry effects towards the end of the sample have become more important for firms that are less global—more evidence against the hypothesis that the recent rise in sector effects is driven by greater global integration.

We address the same question using a slightly different approach. One way in which the recent literature has rationalized the growing importance of global industry effects is that they are capturing the increasingly global nature of certain industries. We investigate this hypothesis explicitly by using the foreign sales and asset data to sort the firms in our sample into deciles and creating decile dummies that proxy for the extent to which firms operate globally. We then augment the standard regression in the literature—a cross-

[6] Business Week, in its September 11, 2000 issue gives as one reason for the rise of global industry effects the growing importance of high-tech firms, which it says are especially global in their reach—40% of Yahoo!'s customers are outside the U.S., while Finland's Nokia has a 37% share of the U.S. cellular market.

sectional regression of international stock returns on country and global industry dummies—with these decile dummies, which we call international diversification effects below. In the event, we find that they explain virtually none of the recent rise in industry effects.

Our attention has so far focused on the changing importance over time of the global industry effects. We also investigate the variation over time in the importance of country-specific effects—for our global sample they have declined significantly since the mid-1980s. We explore, with a special focus on emerging markets, if the dates for the opening of financial markets in Bekaert et al. (2002) explain variation over time in the importance of these country effects. We find that the dates for financial liberalization in Bekaert et al. (2002) match up roughly with declines in the importance of country-specific effects in many emerging markets during the mid-1990s. However, these declines were reversed during the Asian crisis and country effects for emerging markets remain much larger today than for mature markets, as recently established by Serra (2000).

In summary, we find that there is little indication that a rise in global integration at the firm level is driving the recent rise in industry effects. In the aftermath of the bubble, diversifying across countries may therefore still be effective in reducing portfolio risk. The remainder of this paper is organized as follows. Section 2 discusses the data, while Section 3 reviews our empirical approach. Section 4 presents the results, and Section 5 concludes.

2. The data

The data cover monthly total US dollar-denominated stock returns and market capitalizations from January 1985 to February 2002 for 9679 companies.[7] The data include all constituent firms in the Datastream Global Market Indices for 42 developed and emerging countries as of March 2002 (see http://www.datastream.com/product/investor/index.htm for a description of these indices) and are augmented with a list of active and inactive stocks for each country derived from Worldscope. Each company is assigned to 1 of 40 (Level 4) Datastream Global Market industries. Table 1 in Brooks and Del Negro (2002) lists these industries and shows how they can be aggregated into the broader (Level 3) industry sectors.

Compared to the existing literature, several aspects of our data are worth noting. 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 2400 firms in 25 developed and emerging markets. Cavaglia et al. (2000) cover 2645 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

[7] Using US 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, a result which is consistent with Heston and Rouwenhorst (1994).

assessment of just how segmented these markets are.[8] 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.

For illustrative purposes, Table 1 provides a brief overview of the data. In December 2000 our sample contains 8969 active firms.[9] The overall market capitalization of the sample amounts to US$31,852 billion at that point, which is almost 99% of actual market capitalization in our 42 countries, according to the Standard and Poor's Emerging Stock Markets Factbook (2001). The United States makes up almost 50% of the sample in percent of overall market capitalization, which is reasonable according the Stock Markets Factbook. United Kingdom and Japan each make up about 10% of the sample, again consistent with the Factbook. In contrast, the capitalization weight of emerging stock markets is much smaller, measuring only about 5%, compared with 7% in the Stock Markets Factbook. In terms of industrial composition, companies in the financial sector are most heavily represented, making up almost 23% in capitalization terms, while the information technology sector is the second largest, at just above 15%. Two thirds of all companies in this sector are located in the United States, judging by market capitalization. Coverage is relatively stable going back towards the beginning of the sample. In December 1990, for instance, the overall market capitalization of the sample comes to US$9102 billion, about 97% of stock market capitalization in the 42 sample countries as measured by the Stock Markets Factbook.

For each firm in our sample, we also collected annual fiscal year-end Worldscope data for each company from 1985 to 2001 on the percentage of total sales generated by foreign subsidiaries and the fraction of total assets held by these subsidiaries.[10] Table 1 shows

[8] An important aspect of our data is that it includes firms that become inactive over time, due to bankruptcy or merger for example. Although this phenomenon is significant in numbers, with 1996 companies in the sample becoming inactive after January 1995, of which 806 companies became inactive after March 2000, it turns out not to have a significant bearing on our results below.

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

[10] Foreign income could be a better indicator of foreign activities, but coverage of this variable is poor. The Worldscope variable that measures the percentage of foreign sales in total sales is called *ForeignSalesPctSales*. This variable captures sales generated by operations in foreign countries and therefore omits export sales, according to the Worldscope data definitions guide. The Worldscope variable for the share of international assets in total assets is *ForeignAssetsPctTotalAssets*. This variable captures total or identifiable assets of foreign operations before adjustments and eliminations. The underlying data for both variables is converted to US dollars using the fiscal year end exchange rate.

simple averages across firms using data for 1998, when the cross-sectional coverage of these variables is greatest. In that year, data on foreign sales is available for 4984 firms, while data on foreign asset holdings is available for 3746 firms. The average for foreign sales as a share of total sales in 1998 is 23.4%. This ratio is significantly lower for the United States (17.9%), a reflection of its large domestic market. It is higher for smaller, more open economies such as Canada (33.0%) and the United Kingdom (25.5%). Dividing the sample into a traded and a non-traded goods producing sectors, following Griffin and Karolyi (1998), yields an international sales ratio for traded goods producing sectors of 31.0% on average. The average ratio for non-traded goods producing firms is 17.1. These ratios illustrate that the sector-level traded versus non-traded goods classification is obviously imperfect, because some traded goods producing firms may not export, while a non-traded goods producing company may sell its services abroad.[11]

Foreign assets as a fraction of total assets average 10.0% for the sample in 1998. This ratio is slightly higher for U.S. firms (10.8%) and is highest for the Netherlands where it reaches 34.4%. Firms in the traded goods sector have a higher ratio of international assets on average (13.9%) compared with firms in the non-traded goods sector (7.2%).

3. 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.

Eq. (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

[11] Following Griffin and Karolyi (1998), we treat the following (level4) industries as tradable goods producing sectors: AUTMB, OILGS, FSTPA, PHARM, CHMCL, INFOH, ELTNC, SFTCS, HHOLD, MNING, STLOM, TOBAC, FOODS, ENGEN, PERSH.

Table 1
Summary statistics for the data by country and industry

	December 2000			1998 (Fiscal year-end)		January 1985–February 2002	
	Number of firms	Market capitalization weight (%)	Standard and poor's emerging stock markets factbook 2001 (Market capitalization weight (%))	Mean foreign sales ratio (%)	Mean international asset ratio (%)	Mean US dollar return (in % per month)	Standard deviation (in % per month)
United States	1309	48.66	47.42	17.91	10.82	1.48	4.66
United Kingdom	986	9.45	8.09	25.48	9.85	1.39	5.27
France	363	5.03	4.54	44.26	16.25	1.56	5.90
Germany	404	3.62	3.99	36.46	8.21	1.25	5.68
Italy	219	2.38	2.41	29.44	1.48	1.27	7.10
Japan	1189	10.10	9.91	15.44	10.73	0.85	6.94
Canada	424	2.44	2.64	32.95	22.51	1.14	4.87
Other Developed Markets	2101	13.48	13.81	38.80	15.89	1.43	4.99
Emerging Markets	1974	4.85	7.18	3.48	1.58	1.50	6.60
Mean	997	11.11	11.11	27.14	10.81	1.32	5.78
Median	986	5.03	7.64	29.44	10.73	1.39	5.68
Basic Industries	1059	3.93		26.30	11.29	1.15	5.12
General Industrials	1140	8.79		38.48	16.32	1.23	5.11
Cyclical Consumer Goods	457	2.74		32.07	13.55	1.20	5.04
Non-Cyclical Consumer Goods	990	14.16		26.90	11.89	1.51	3.96
Cyclical Services	1455	11.69		21.47	9.16	1.39	4.50
Non-Cyclical Services	376	10.99		10.86	4.54	1.29	4.85
Utilities	345	3.48		4.47	1.86	1.12	3.96
Information Technology	815	15.27		27.92	11.22	1.53	7.83
Financials	1925	22.95		7.53	4.95	1.36	4.91
Resources	407	6.00		26.75	16.03	1.21	4.97
Mean	897	10.00		22.28	10.08	1.30	5.02
Median	903	9.89		26.52	11.25	1.26	4.94
Traded	3678	41.67		30.99	13.89	1.33	4.83
Non-Traded	5291	58.33		17.08	7.16	1.36	4.22
Total	8969	100.00	100.00	23.39	10.00	1.35	4.33

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. Eq. (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 Eq. (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 $\sum_{j=1}^{J} w_j \mathrm{var}(\beta_{jt})$ and $\sum_{k=1}^{K} v_k \mathrm{var}(\gamma_{kt})$, for brevity.

We follow Rouwenhorst (1999) in using mean absolute deviations (MADs) as our second metric. This measure weights the absolute values of the country and industry

Note to Table 1:
The dataset covers monthly total US dollar-denominated stock returns and market capitalizations for 9769 stocks in 42 developed and emerging markets from January 1985 to February 2002. A total of 8969 firms are active in December 2000, with the remainder having exited the sample due to bankruptcy or merger or not having yet entered the sample. Other developed markets include Australia, Austria, Belgium, Denmark, Finland, Greece, Hong Kong, Ireland, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden and Switzerland, consistent with the MSCI country index classification, which can be accessed at http://www.msci.com/equity/index.html. Emerging markets are given by Argentina, Brazil, Chile, China, Colombia, Czech Republic, India, Indonesia, Korea, Mexico, Peru, Philippines, Poland, South Africa, Taiwan, Thailand and Turkey. Foreign sales ratios measure the percentage of total sales generated by foreign subsidiaries, while the international asset ratio denotes the percentage of total assets held by these firms. The means are simple averages across firms, by country and aggregated Datastream Global Market (Level 3) industry sectors. The paper uses more disaggregated Level 4 Datastream Global Market industries, of which there are 40, for the empirical analysis. The mean and standard deviations of the monthly returns are for value-weighted country and industry portfolios.

effects by their respective market capitalizations. Country and industry MADs in a given month are:

$$\mathrm{MAD}_{Ct} = \sum_{k=1}^{K} v_{kt} \, | \, \gamma_{kt} \, | \tag{5}$$

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

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 et al. (2000) for instance, has emphasized the ratio of country to industry MADs as a measure of their relative importance. A ratio greater than 1 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.

4. The results

We first discuss the capitalization weighted time-series variances of the country and industry effects. Table 2 gives these variances for the composite country (Panel A) and industry (Panel B) effects over the full sample period, January 1985 to February 2002, and for 4-year sub-periods. We compute these variances for the full sample, which covers all firms, and for an estimation on a sub-sample without the TMT sectors.[12] As discussed in the introduction, the TMT sectors are seen as being central to the recent stock market bubble. Since we want to investigate the extent to which the full sample results are driven by the IT bubble, it is natural to examine the subsample without TMT firms.

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%-squared) to the composite industry effects variance (11.41%-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 4-year sub-periods 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 (1986–1990) and at the end (1998–2002) of the sample. Towards the end of the sample the variability of industry effects rises dramatically and

[12] We include the biotechnology sector among the TMT sectors. This has no bearing on our results, which are unchanged if the TMT sectors comprise only telecommunications, media and information technology.

Table 2
Decomposition of index returns into country and industry effects 1985:1 to 2002:02

	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
Panel A. Capitalization weighted time-series variances of the pure country effects					
Full Sample	23.03	17.77	15.94	30.33	19.92
Full Sample ex TMT	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 TMT	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 TMT	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					
Full Sample	11.41	29.29	4.14	6.18	10.95
Full Sample ex TMT	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 TMT	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 TMT	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

For the full sample period and for 4-year sub-periods, 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 sub-sample 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 sub-sample 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 sub-sample. Market capitalization and returns data are US dollar-denominated. Returns are in percent per month. The full sample covers almost 10,000 stocks in 42 mature and emerging markets. The full sample ex TMT drops all firms in the telecom, media, biotech and information technology sectors. The full sample ex U.S. drops all US 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.

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 several 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 sub-sample without TMT firms. Our conclusion is that it is not very robust: beyond the TMT sectors the variability of industry effects still rises towards the end of the sample, but it is far less impressive and not large enough to surpass the variability of country effects.

Table 2 also examines the recent rise in the importance of global industry effects along other dimensions. It re-estimates the variances of the country and industry effects for a sub-sample without U.S. firms and for different regional breakdowns of the data. The latter decomposition of the data is motivated by the fact that economic and financial integration within some regions, especially Western Europe, has been greater than elsewhere. This raises the question whether 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).[13] 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).[14] Documentation on the MSCI country index classification can be accessed at http://www.msci.com/equity/index.html. Finally, we break out mature and emerging markets, in order to assess the degree of segmentation in emerging markets.[15]

The regional 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 TMT 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.

Our second metric, the mean absolute deviations (MADs), tell a similar story. Fig. 2 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, the MADs are given for 2-year (lagged) moving averages, along with error bands that measure two

[13] 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.

[14] 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.

[15] 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.

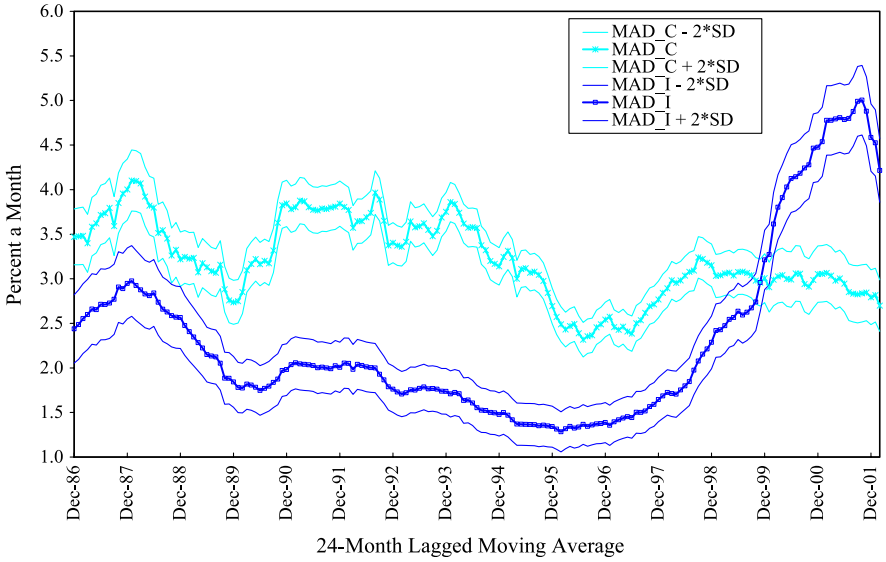

Fig. 2. Cap-weighted mean absolute deviations (MADs) of the pure country (MAD_C) and pure industry (MAD_I) effects with error bands that measure two standard deviations around the MADs for the full sample of all firms. The error bands are constructed using the Delta method and assume no serial correlation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

standard deviations either side.[16] In line with Table 2, country MADs are larger than industry MADs over the full sample period. The average country effect for the full sample period is 3.17% per month (in absolute value), while the average absolute industry effect is 2.4% per month. Fig. 2 also shows that the magnitude of country MADs has declined over time. The two-year average of the country MADs at the beginning of the sample measures 3.47%. This number hovers between three and 4% until the mid-1990s and then gradually falls to 2.70% during the last 2-year sub-period, which is significantly below the initial estimate.[17] The pattern for industry MADs is U-shaped and consistent with the results in Table 2. The two-year average of the industry MADs at the beginning of the sample is 2.44%. This number falls below 1.5% in the mid-1990s, but grows to 4.22% by the end of the sample, significantly above both the initial estimate and the end-of-period country MAD.

[16] Country and industry MADs are non-linear functions of the estimates from model (2). The variance of the country and industry MADs is computed every month from the covariance matrix of these estimates 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 Eq. (2).

[17] If x_1 is the initial 2-year average of the country MADs and x_2 is the end-of-sample 2-year average of the country MADs, we use the test statistic $t=(x_2-x_1)/(\mathrm{sqrt}(\mathrm{var}(x_1)+\mathrm{var}(x_2))$, which is asymptotically distributed as a $N(0,1)$, to test if the initial and terminal MADs are significantly different.

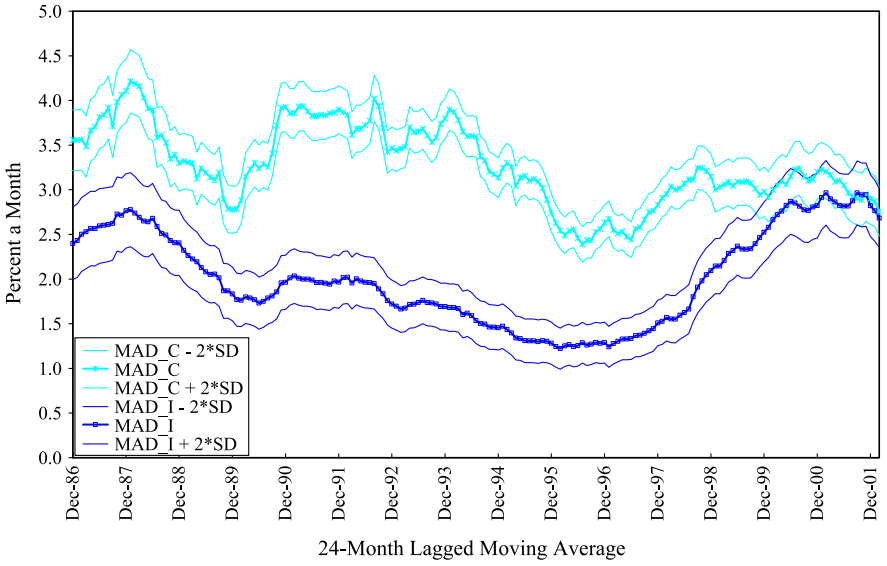

Fig. 3. Cap-weighted mean absolute deviations (MADs) of the pure country (MAD_C) and pure industry (MAD_I) effects with error bands that measure two standard deviations around the MADs for the sub-sample without telecom, media, biotech and information technology (TMT) firms. Error bands are constructed using the Delta method and assume no serial correlation in the residuals of Eq. (2). All series are 24-month lagged moving averages. The full sample covers monthly US dollar market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns in percent per month.

Fig. 3 shows the corresponding series for the sample without TMT firms. The pattern for the country MADs is roughly the same as before—they register a significant decline (at the 1% 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%) from the beginning-of-sample average. There is therefore little evidence that, beyond TMT, sector effects have grown in importance over the full sample period. Fig. 4 takes a more direct look at the relative importance of country and industry effects. It plots the 2-year moving average of the ratio of country to industry MADs, along with two standard deviation error bands, for the full sample regression as well as for the no TMT sector regression. 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 without the TMT sectors. The end-of-sample ratio is not significantly different from one and, more importantly, is not significantly different from the beginning-of-sample MADs ratio (at the 10% level).[18]

In our analysis, the choice of benchmark portfolio is potentially critical because it is against this portfolio that country and industry effects are estimated. In the above results,

[18] We also test whether the rise in sector effects is robust to excluding all U.S. firms from the sample—the rationale for this test being that U.S. was arguably at the center of the recent stock market boom and bust. The results for the sub-sample without U.S. firms are not shown for brevity, as they are virtually the same as for the sample without TMT firms.

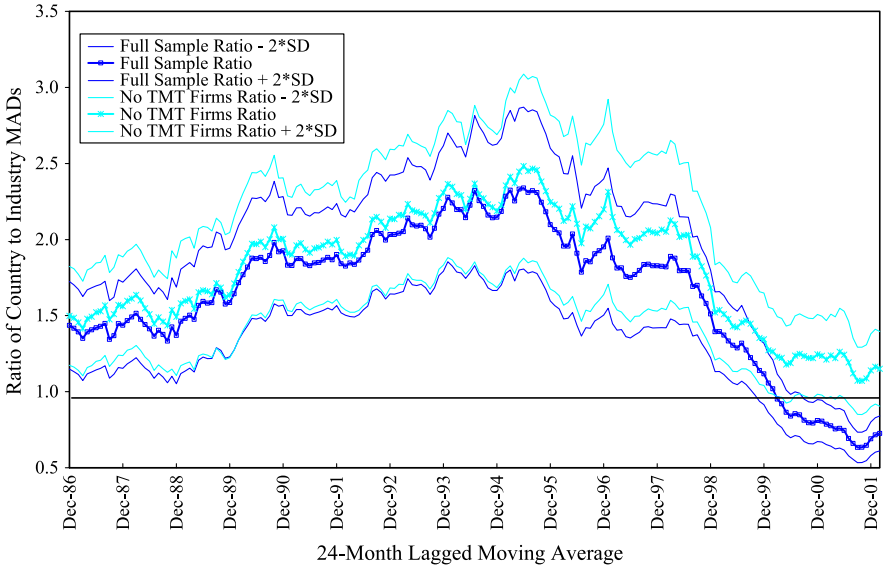

Fig. 4. Ratios of country to industry mean absolute deviations (MADs) for the full sample and the sub-sample without telecom, media, biotech and information technology (TMT) firms. Error bands are constructed using the Delta method and assume no serial correlation in the residuals of Eq. (2). All series are 24-month lagged moving averages. The full sample covers monthly US dollar-denominated market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns are in percent per month. In the sample without TMT firms, the global stock market without TMT stocks is the benchmark portfolio.

the benchmark (country and industry neutral) portfolio is the sample in question. In the case of the regressions for the sample without TMT sectors, the benchmark portfolio is thus the value-weighted global stock market without TMT firms. As a result, the composite MADs in Figs. 2 and 3 are measured relative to different benchmark portfolios, the former against the global value-weighted portfolio and the latter against the global value-weighted portfolio without any TMT stocks. This means that, for example, the composite country MADs for December 1986, the first observation in both Figs. 2 and 3, differ slightly.

The rationale for presenting out results this way, based on different underlying benchmark portfolios, stems from restriction (3). If instead we used the global value-weighted stock market as the benchmark portfolio, the large and volatile TMT pure industry effects would still be reflected indirectly in other pure sector effects (intuitively, if the TMT sector β's in a given period are large and positive, restriction (3) implies that the capitalization weighted β's for the other sectors have to be large and negative, so that the weighted average of the pure industry effects remains zero). Simply dropping the TMT sector MADs in the construction of the composite MADs therefore does not completely eliminate those sectors from our analysis.

However, even when we use the global stock market as the benchmark portfolio in our analysis without TMT sectors-in this case we construct the composite industry MADs without including the TMT sector MADs using the MAD estimates from the full sample

regressions—our main result is unchanged: there is no evidence outside of TMT that industry effects have become significantly more important than country effects in recent years.[19]

Of course, TMT firms 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, if the rise in industry relative to country effects is the outcome of globalization, we would expect the rise in these effects to show up more strongly in sectors with a global character. To put it differently, if this phenomenon is not just a side-effect of the IT bubble, but a sign that TMT firms are more international, we would expect to see something similar for other companies that are also international in nature.

To address this question, we perform two different analyses: one using sector-level information and the other using firm-level balance sheet data (in both analyses we use a global benchmark portfolio, so that the composite MADs in Figs. 5 and 6 below are based on the MADs from our original regressions for the global sample including all stocks). First, we follow Griffin and Karolyi (1998) and analyze separately sectors that produce tradable and non-tradable goods. Fig. 5 shows the ratios of country to industry MADs for the traded goods sectors, for traded goods sectors excluding IT firms (the traded goods component of TMT, which consists of IT hardware and software companies) and for the non-traded goods sectors. Error bands measuring two standard deviations either side of these composite MADs are omitted for clarity, but are included in the corresponding chart in Brooks and Del Negro (2002). If globalization is driving the recent decline in the country to industry MADs ratio, we expect this decline to be more pronounced for traded (more global) than for non-traded goods producing sectors. Moreover, we expect the ratios of country to industry MADs to be roughly the same whether or not we include IT among the traded goods producing sectors. In fact, neither condition is met. The decline in the country to industry MADs ratio observed toward the end of the sample is more pronounced for non-traded (less global) than for traded goods sectors. In addition, after the mid-1990s the ratio for the non-IT traded goods sectors diverges from that for all traded goods sectors, and by the end of the sample it is marginally above the ratio for non-traded goods sectors-implying that country effects are more important for traded (non-IT) than for non-traded goods firms, though neither ratio is significantly different from one at conventional levels. This suggests that the recent increase in the importance of industry relative to country effects is not a common feature across all traded goods sectors.

As discussed in Section 2, the traded versus non-traded goods classification is imperfect: some firms that are in traded goods sectors may not export at all and firms

[19] These results are omitted for brevity but are available upon request. 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.

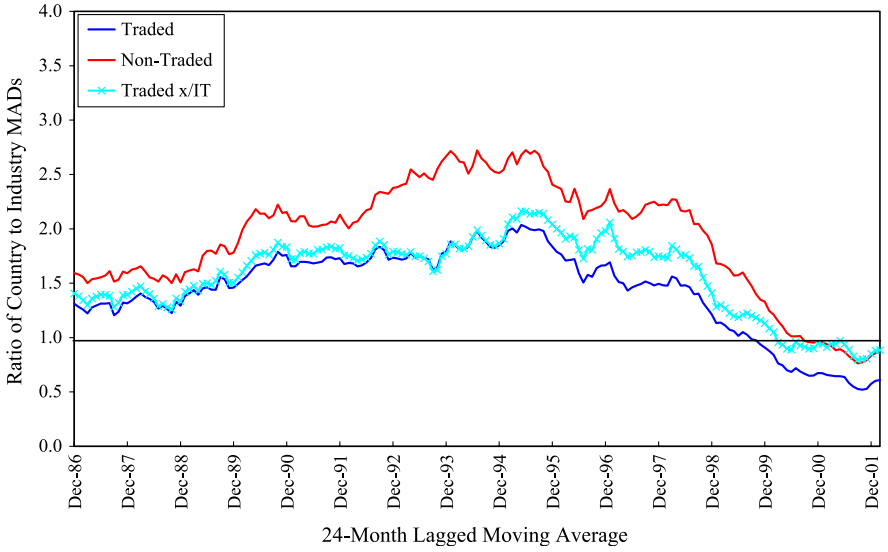

Fig. 5. Ratios of country to industry mean absolute deviations (MADs) for traded goods sectors, traded goods sectors excluding IT and for non-traded goods sectors. All series are 24-month lagged moving averages. The full sample covers monthly US dollar-denominated market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns are in percent per month. MAD ratios are derived using the global stock market as the benchmark portfolio in all cases.

that are in service sectors may well be international. Therefore we make use of firm-level data on the extent to which firms are internationally diversified in their sales and asset holdings. These measures are likely to be noisy, but we view them as an improvement over sector-specific information only. Fig. 6 shows the country to industry MADs ratios for firms that have sizable foreign sales as a percentage of total sales and for firms that do not (we contrast the highest and lowest quartiles using foreign sales shares for 1998, when the cross-sectional coverage of the foreign sales data is greatest. The results are qualitatively unchanged using foreign sales data for other years and are therefore omitted. Similarly, the results based on foreign asset holdings are almost identical and therefore omitted for brevity.) As one would expect, for most of the sample period the ratio of country to industry MADs is higher for firms that are less international, and sometimes significantly so. Country-specific effects in international stock returns are more important for firms that have little or no international sales, while they are less important relative to global industry effects for firms with high international sales.

Is the decline in the country to industry MADs ratios toward the late-1990s consistent with the view that TMT firms are more international? Fig. 6 suggests that this is unlikely because the MADs ratio for the lowest quartile of firms declines by more than the ratio for the top quartile of firms towards the end of the sample. In other words, the decline is more pronounced for firms that are not international than for firms that are. We find this hard to reconcile with the notion that the TMT sectors are more international than the rest of the economy.

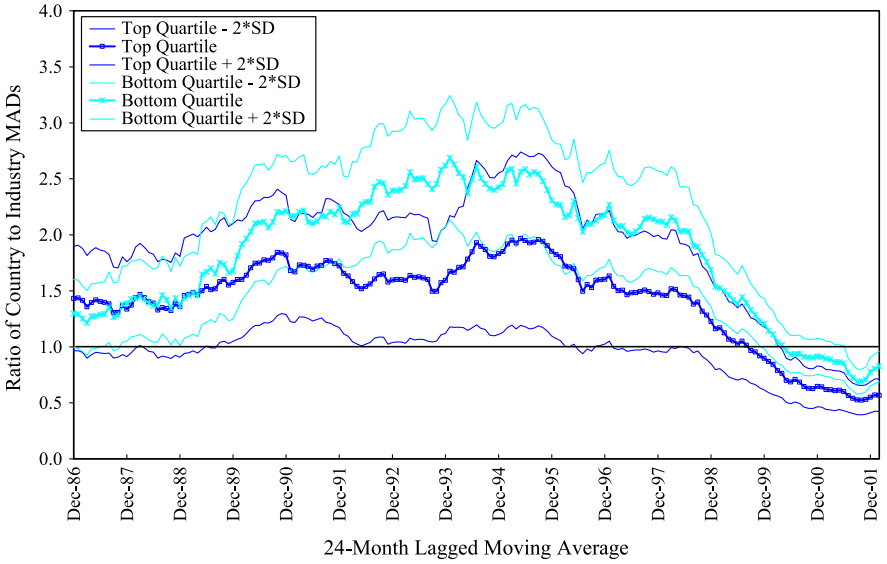

Fig. 6. Ratios of country to industry mean absolute deviations (MADs) for firms with high and low international sales (top versus bottom quartiles, respectively, based on international sales share data for 1998 from Worldscope). Error bands are constructed using the Delta method, assuming no serial correlation of the residuals in Eq. (2). All series are 24-month lagged moving averages. The full sample covers monthly US dollar-denominated market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns are in percent per month. The global stock market is the benchmark portfolio in both cases.

We also use an alternative approach to explore if greater international diversification in sales and asset holdings underlies the recent rise in global industry effects. We divide firms in the sample into deciles according to what fraction of their 1998 total sales is generated abroad. Dummy variables then denote what decile a firm belongs to and are used to augment the dummy variable model.[20] These decile dummies are called diversification effects below because they are intended to proxy for the degree to which firms operate across countries. Fig. 7 shows that these diversification effects explain on average only little cross-sectional variation in international stock returns. Most importantly, relative to a specification with only country and industry effects, they have virtually no impact on the estimated magnitude of country and industry effects—the country to industry MADs ratio is unchanged with or without the diversification effects in the regression. This is also true if we construct the diversification effects using the percentage of international assets that companies hold rather than sales. Again, we have

[20] As for the country and industry effects, the weighted sum of the coefficients on the international diversification dummies is restricted to zero for each cross-section. We explore the robustness of our diversification effects with dummies that contrast the top quartile of very internationally diversified firms with the lower quartiles, dummies that contrast companies with domestic sales only with those that have international sales and decile dummies using international sales and asset ratios from years other than 1998. In all cases, the diversification effects have virtually no impact on the country to industry MADs ratios.

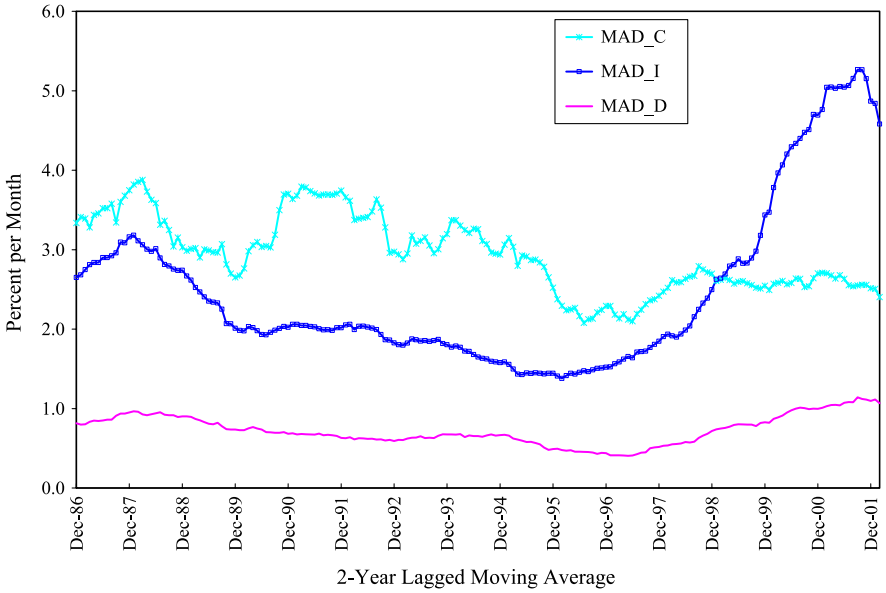

Fig. 7. Cap-weighted mean absolute deviations (MADs) of pure country (MAD_C), pure industry (MAD_I) and pure diversification effects (MAD_D using international sales deciles for 1998), which are constructed by sorting stocks in the sample into deciles according to how important sales by foreign subsidiaries are in total sales. All series are 24-month lagged moving averages. The full sample covers monthly US dollar-denominated market caps and returns of almost 10,000 stocks in 42 markets for January 1985 to February 2002. Returns are in percent per month. The full sample is the benchmark portfolio.

omitted the error bands measuring two standard deviations either side of the composite MADs in Fig. 7 for clarity, but they are included in the corresponding chart in Brooks and Del Negro (2002).

While much of the change in the relative importance of country versus industry effects is driven by variation over time in the importance of sector effects, Table 2 and Fig. 2 show that there is also a decline over time in the importance of country effects. While most mature markets included in the analysis had lifted barriers to international capital movements by the beginning of our sample, see Edison et al. (2002) for example, several emerging markets liberalized capital movements after 1985. Was capital account and financial market liberalization in emerging markets followed by a decline in country MADs? Dating capital market liberalizations is a complex task, as official and actual liberalizations do not always coincide. Bekaert et al. (2002) provide a variety of exogenous (based on events like official liberalizations, ADRs introductions or launchings of country funds) and endogenous (data driven) dates for financial market integration in emerging markets. While these dates vary from country to country, Bekaert et al. (2002) find April 1993 to be a watershed around which a number of endogenous liberalization dates (as well as ADR launchings) are clustered.[21] Fig. 8 plots the country MADs for mature and

[21] See Bekaert et al. (2002), page 40.

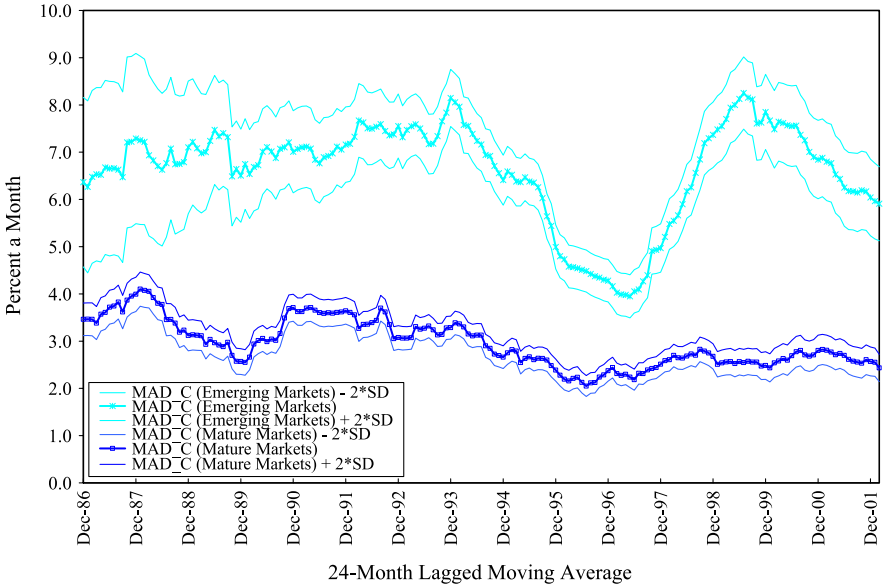

Fig. 8. Cap-weighted mean absolute deviations (MADs) of the pure country (MAD_C) in mature and emerging stock markets with error bands that measure two standard deviations around the MADs for the full sample. Error bands are constructed using the Delta method and assume no serial correlation in the residuals of Eq. (2). All series are 24-month lagged moving averages. The full sample covers monthly US dollar-denominated market caps and returns of almost 10,000 stocks in 42 countries from January 1985 to February 2002. Returns are in percent per month. The global stock market is the benchmark portfolio.

emerging markets.[22] Country MADs for emerging markets begin to drop substantially between 1993 and 1997 (in spite of the 1994 Tequila crisis), which is loosely consistent with the evidence in Bekaert et al. (2002). After the onset of Asian crisis, however, emerging market country MADs start rising again, perhaps because of a reversal in the liberalization process (see Malaysia) or perhaps because of higher volatility in emerging market returns. Mature market country MADs are lower than those in emerging markets, as previously established by Serra (2000) and exhibit a different pattern: a steady decline from the late-1980s to the mid-1990s, followed by a slight increase in the second half of the 1990s. In conclusion, there is some evidence that financial liberalization in emerging markets is associated with a decline in country MADs. To the extent that integration will increase in the future, we may expect country MADs to decline further. However, so far the decline in country MADs has not been large enough to be the driving force behind the change in the relative importance of country and industry factors.

We now summarize and evaluate our results. We have investigated whether the rising importance of industry effects in international stock returns is a (permanent) reflection

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

of greater economic and financial integration across countries, or a (temporary) side-effect of the recent stock market bubble. The evidence appears to favor the bubble hypothesis. Both country to industry 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 non-reversible process. In addition, the result that industry effects have eclipsed country effects has been shown to depend heavily on the sectors (TMT) at the center of the recent stock market bubble. Finally, we find that the rise in industry MADs is not driven by the fact that firms have become on average more global, as measured by the importance of their international sales and overseas asset holdings.

5. Conclusion

The degree of comovement across national equity markets has increased dramatically since the mid-1990s. In this context, Baca et al. (2000) report that the importance of global industry factors in explaining international return variation increased towards the late-1990s. Cavaglia et al. (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. This result matches that in L'Her et al. (2002) who find that global industry effects surpassed country effects in importance in 1999–2000. 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 if 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?

We find that, beyond the TMT sectors at the heart of the recent stock market bubble, there is no evidence that industry effects have significantly outgrown country factors in importance. We also study if the recent rise in the importance of TMT industry effects is due to the fact that these firms are more international than their ''old economy'' counterparts. Our results do not, however, support this hypothesis. We find that the importance of global industry effects rises faster for non-traded than for traded goods sectors towards the end of the sample, something we find hard to reconcile with the notion that the recent rise in sector effects is driven by greater international integration at the firm level. In addition, there is little difference towards the end of the sample in the relative importance of industry effects across traded goods sectors (excluding IT) and non-traded goods sectors. Using firm-level information on the degree of international exposure of individual companies (international sales or assets), we find that the rise in industry relative to country effects since the mid-1990s has been more pronounced for less international firms. Again, this evidence goes against the hypothesis that the recent rise in industry effects is driven by global integration at the firm level. Finally, we use the international sales and asset data to construct international diversification effects and find that they explain almost none of the recent rise in industry effects. Taken together, we see this evidence as suggestive that the recent rise in sector effects is a temporary phenomenon

associated with the TMT bubble. For portfolio managers this suggests that in the aftermath of the IT bubble the "old" strategy of diversifying across countries rather than industries may still have merit in terms of reducing portfolio risk.

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