Firm-Level Evidence on International Stock Market Comovement

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Comments Appreciated

Abstract

Against the backdrop of a dramatic rise in comovement across national stock markets, we explore whether this rise reflects the increasingly global nature of firms around the world. Using stock returns and balance sheet data for 1,239 firms in 20 countries, we estimate a factor model that decomposes stock returns into global, country and industry factors. First, we find that, in the cross-section of our data, there is a large and significant link between the sensitivity of stocks to global and country shocks and the degree to which firms operate internationally. For example, a firm that raises its international sales by 10 percent raises the exposure of its stock returns to global shocks by two percent and reduces its exposure to the country shocks by 1.5 percent. Second, there is some evidence that this cross-sectional relationship has grown stronger over time – a reflection of the changing importance of global and country-specific shocks.

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1. Introduction

One of the most pronounced empirical regularities in international equity markets has been the historically low degree of comovement across national stock markets. However, this regularity has broken down in recent years. For example, the correlation coefficient of U.S. stock returns with equity returns in other developed markets 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.[1] There are several possible explanations for this rise in comovement, a decline in home bias in the portfolio holdings of investors and improved policy coordination across countries among them. Another explanation that is popular, against the backdrop of a dramatic rise in cross-border mergers and acquisitions, is the increasingly global nature of businesses around the world. To quote Cavaglia, Cho and Singer (2001): "corporations have sought to consolidate and to rationalize enterprise activities globally. This is seen in the explosion of cross-border mergers and acquisitions, rising from an average of $40 billion per year over the 1989 – 1993 period to an average of $400 billion per year over the 1994 – 2000 period."

In this paper, we focus on the latter explanation. More broadly, we investigate the link between stock market comovement and the degree to which firms operate globally. We collect stock returns and balance sheet data for 1,239 firms in 20 developed and emerging markets from 1985 to 2002 and estimate a factor model that decomposes international stock

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[1] To compute these correlation coefficients, we use U.S. dollar-denominated monthly 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.

returns into global, country-specific and industry-specific factors. This model is similar to the one employed in the international diversification literature (see Heston and Rouwenhorst 1994, Griffin and Karolyi 1998) with one important distinction. Instead of constraining the exposure of firms to world, country-specific, and industry-specific shocks to be either one (if the firm belongs to the given country or industry) or zero (if it does not), we let the exposure – or the "beta" – to be unconstrained whenever it is not zero.[2]

We use this framework to explore the link between comovement and firm-level diversification in two dimensions. First, we examine the importance of this link in the cross-section of our sample by regressing the firm-specific betas on different measures of firm-level diversification. We use three different pieces of information to measure the extent to which a firm is international. The first is the sector of affiliation – whether a firm belongs to a traded or non-traded sector – and additionally accounting variables such as the level of international sales, assets or income. To these two measures, both of which have been used in the literature, we add a third one: the real-side exposure of the firm to global and country specific shocks. We construct this measure by running the same model that we apply to stock returns to total sales' growth rates data.

We find that, from 1985 to 2002, global shocks are on average a more important source of return variation for companies that are more globally diversified, as measured by the international component of their sales, assets or income. We also find that country-specific shocks are less important for these firms. But how important is this link quantitatively? It appears to be quite large. A company that raises the international

[2] Whenever a firm does not belong to a given country, its beta relative to that country shock (say, the exposure of a Honk-Kong firm on an Austrian country specific shock) is still constrained to be zero, as in Heston and Rouwenhorst 1994. This is a crucial identification assumption, as discussed in the section describing the statistical model.

component of its sales by 10 percent raises the exposure of its stock return to the global shock by two percent and reduces its exposure to country-specific shocks by 1.5 percent. The second dimension in which we explore the link between international stock market comovement and firm-level diversification involves us estimating a more general specification of our model, in which we allow the variances of the global, country-specific and industry-specific factors to vary over time. In this dimension, we find that the importance of the global factor has increased sharply in recent years, while that of the country factors has fallen. Most interestingly, this pattern is more pronounced for firms that are highly internationally diversified, evidence that there may be a real counterpart to the rise in comovement across national stock markets. Indeed, we find some evidence that the cross-sectional link between stock market comovement and firm-level integration has increased from the late 1980s to the late 1990s, partly as a reflection of the fact that the importance of country shocks has declined more in countries where firms are more integrated.

But how much of the recent rise in comovement across national stock markets can be attributed to the increasing globalization of businesses? While the global factor has certainly increased in importance since the mid-1980s, its importance in explaining international stock returns actually describes a U-shape over our sample period. This U-shape – which contrasts with the monotonic increase of integration on the real side - leaves open the possibility that some of the rise in the cross-sectional link between comovement and firm-level diversification is due to temporary factors such as the recent stock market bubble.

Our paper builds on a literature on international portfolio diversification, which looks at the relative importance of global, country and industry factors in international stock returns. It continues a trend in this literature, which has shifted its attention from country- and industry-level analysis to firm-level analysis. Heston and Rouwenhorst (1994) regress a cross-section of international stock returns on country and industry dummy variables, to assess the relative importance of country versus global industry effects in international return variation. They control for industrial structure in part out of recognition that some industries are more global than others. This idea is tested explicitly in Griffin and Karolyi (1998) who distinguish between traded and non-traded goods industries and find that global industry effects are more important relative to country effects for traded than for non-traded goods industries. But there are limitations to this industry-level analysis. First, though firms may nominally belong to a given industry, their true exposure to shocks may be different. Think of Spanish banks, nominally a non-traded goods sector, that are heavily exposed to the crisis in Argentina. Second, there may be heterogeneity across sectors in the exposure to global shocks—some traded goods industries may be more global than others. Third, there may be substantial heterogeneity within countries and industries in the exposure of firms to shocks. These problems have prompted several authors, Diermeier and Solnik (2000) and Cavaglia, Cho and Singer (2001) among them, to use firm-level accounting data on the international component of sales as a proxy for the exposure of firms to stock market comovement. Our work differs from these papers in three dimensions: i) our firm-level diversification measures are broader. Besides the international component of sales, we also look at the international component in assets and income. Since these variables may not capture the full extent to which firms are internationally integrated, we also measure firms' exposure to global, country- and industry-specific shocks in their annual sales growth. ii) Our measure of firms' exposure to stock market shocks is different. Diermeier and Solnik (2000) do not account for country- and industry-specific shocks. And though Cavaglia, Cho and Singer (2001) use an empirical model very similar to ours, there is an important difference in the estimation procedure. They use the iterative approach of Marsh and Pfleiderer (1997) described below, while we use maximum likelihood methods. There are reasons to believe that our maximum likelihood estimates of shock exposures are more precise than those obtained using the iterative Marsh and Pfleiderer (1997) algorithm. Perhaps this is the reason that we find a large and significant link between international stock market comovement and firm-level diversification, while Cavaglia, Cho, and Singer (2001) do not.

Our paper is also related to a literature that explores differences in the sensitivity of stock returns to exchange rate movements. Dominguez and Tesar (2001a, 2001b) and Griffin and Stulz (2001) examine whether the stock returns of more global businesses, as measured by their foreign sales component and industry affiliation, are more exposed to exchange rate shocks.

Finally, our paper is related to a literature that explores the importance of financial linkages across countries in terms of macroeconomic variables. Forbes and Chinn (2003) find that the strength of stock market comovement across countries is positively related to the importance of bilateral trade linkages. Their aggregate-level result is consistent with our main result, that stock market comovement and trade integration are related and that this link has strengthened in recent years.

The paper is organized as follows. Section 2 discusses our empirical approach, while Section 3 reviews our data. Section 4 presents the results. Finally, section 5 concludes.

2. The Model

In this section, we briefly outline the model we use to extract the firms' betas with respect to world, country, and industry specific shocks. Our starting point is the fixed-effects model used in the international diversification literature, i.e. in Heston and Rouwenhorst (1994), Griffin and Karolyi (1998) and elsewhere. Let us denote by R_{nt} the return on stock n in period t, where n goes from 1 to N and t goes from 1 to T. We index countries with the letter c (c = 1,..,C) and industries with the letter i (i = 1,..,I). The fixed effects model is described by the following equation:

$$R_{nt} = \beta_n^G f_t^g + \sum_{c=1}^{C} \beta_{nc}^C f_t^c + \sum_{i=1}^{I} \beta_{ni}^I f_t^i + \varepsilon_{nt} \qquad (1)$$

where f_t^g is the return on the global market factor, f_t^c and f_t^i are the returns on the country factor c and industry factor i, respectively, and ε_{nt} represents the idiosyncratic shock to the return on stock n, all in period t. The model is also characterized by the restrictions that $\beta_n{}^G$ = 1, $\beta_{nc}{}^C$ = 1 if stock n belongs to country c and 0 otherwise, and $\beta_{ni}{}^I$ = 1 if stock n belongs to industry i and 0 otherwise. These restrictions imply that at each point in time, f_t^g, f_t^c and f_t^i can be estimated by regressing the cross-section of R_{nt} on the dummies $\beta_n{}^G$, $\beta_{nc}{}^C$ and $\beta_{ni}{}^I$, after taking into account the multicollinearity among the regressors.

The model used in this paper – and more extensively described in Brooks and Del Negro (2002c) – builds on that described by equation (1), with a few important differences. These are as follows. First, we relax the restriction that the β's, when they are not zero, have to be one. Therefore we have that $\beta_n{}^G$ = *unconstrained*, $\beta_{nc}{}^C$ = *unconstrained* if stock n belongs to country c and 0 otherwise, and $\beta_{ni}{}^I$ = *unconstrained* if stock n belongs to industry i and 0 otherwise. Second, we treat the returns on the world, country and industry factors (f_t^g, f_t^c, f_t^i) as unobservable random variables. This means that we effectively estimate (1) as a factor model, as opposed to a fixed-effects model (we move from a fixed-effects to a random-effects model). It is important to bear in mind that the zero restrictions imply that our factor model is different from those typically used – for instance - in the APT literature: this factor model is *identified*. As is well known, without our set of zero restrictions, the factors can be rotated arbitrarily and thus cannot be identified separately. In our model, the zero restrictions pin down the rotation matrix and give an economic interpretation to the factors, allowing us to characterize them as world, country-specific or industry-specific factors.

Third, we follow the APT literature in estimating (1) using excess returns over a riskless benchmark. The rationale for this change is that the time *t*-1 expected value of the right hand side of expression (1) can then be interpreted as the risk premium for stock *n* over the riskless asset – which for simplicity we assume to be constant over time. In conclusion, we estimate the following model:

$$R_{nt} = \mu_n + \beta_n^G\left(f_t^g - E_{t-1}\left[f_t^g\right]\right) + \sum_{c=1}^{C}\beta_{nc}^C\left(f_t^c - E_{t-1}\left[f_t^c\right]\right) + \sum_{i=1}^{I}\beta_{ni}^I\left(f_t^i - E_{t-1}\left[f_t^i\right]\right) + \varepsilon_{nt} \quad (2)$$

subject to the zero restrictions on the β's and the assumption that $E_{t-1}(\varepsilon_{nt}) = 0$ for all *t* and *n*.[3]

The model in equation (2) is estimated in Marsh and Pfleiderer (1997) using an iterative approach, a variant of which is recently applied in Cavaglia, Cho and Singer (2001). This approach involves i) estimating the β's by OLS given the factors and ii) estimating the factors by OLS given the β's. Marsh and Pfleiderer (1997) use this approach on the grounds that "with the large cross-section of stocks…we know of no feasible way to estimate the restricted factor model by maximum likelihood methods" (page 9).[4] A value-added of Brooks and Del Negro (2002c) is that they provide such a method. In that paper we show that the Lehman and Modest (1985) EM algorithm delivers an approach for computing maximum likelihood estimates of model (2) that is computationally feasible even for large cross-sections.[5] The EM algorithm follows the same intuition as the iterative procedure in Marsh

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[3] For a cross-section of 1965 stocks in 21 developed and emerging markets, Brooks and Del Negro (2002b) estimate the model in equation (2). They explicitly test the restriction inherent in the fixed-effects model that all stocks with exposure to a given shock must have the same exposure to that shock. They find that this restriction is strongly rejected by the data.

[4] Marsh and Pfleiderer (1997) use an iterative procedure that has intuitive appeal but where the statistical properties of the resulting estimator are not well-known.

[5] Convergence is reached whenever the mean squared gradient is less than 10^{-4}. Lehman and Modest (1985) adopt a slightly tighter criterion, namely that the sum of the squared gradients is less than 10^{-4}. Given that the EM algorithm is notoriously slow to converge close to the

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and Pfleiderer (1997), but unlike their approach it delivers maximum likelihood estimates. In order to estimate (2) via maximum likelihood, we need to make distributional assumptions however. Specifically, we assume that i) both the factors and the idiosyncratic shocks are normally distributed—conditional on time *t*-1 information:

$$f_t^g - E_{t-1}\left[f_t^g\right], f_t^c - E_{t-1}\left[f_t^c\right], f_t^i - E_{t-1}\left[f_t^i\right] \xrightarrow{d} N(0,1) \tag{3.1}$$

$$\varepsilon_{nt} \xrightarrow{d} N\left(0, \sigma_n^2\right) \tag{3.2}$$

for all t, c, i and n, where the assumption of unitary variance is purely a normalization assumption, and ii) the idiosyncratic shocks are cross-sectionally uncorrelated:

$$E_{t-1}\left[\varepsilon_{nt}\varepsilon_{mt}\right] = 0 \tag{4}$$

for all t, n and m.

The model we use has some important limitations. First of all, the maximum likelihood approach we use is applicable to a balanced panel only. This could be an important shortcoming in that it prevents us from including firms that exit before the end of the sample or firms that join after the start of the sample. However, in this specific case, we have evidence that the use of a balanced panel may not distort our results too much. In Brooks and Del Negro (2002a), we estimate the fixed-effects model both for this balanced panel and for a more comprehensive unbalanced panel and find the results qualitatively unchanged. Second, the assumptions of normality and cross-sectional uncorrelatedness of the idiosyncratic shocks—while standard in much of the APT literature—are certainly not innocuous. In Brooks and Del Negro (2002c), we address the latter assumption by increasing the number of

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summit of the likelihood and that our results do not change as long as the mean squared gradient is less than 10^{-2}, we adopt a slightly looser convergence criterion.

factors, so as to capture the largest possible amount of cross-correlation. Again, our key results are qualitatively unchanged.

A quick aside on the variance decompositions. From equation (2) it follows that the variance of excess returns for stock *n* can be decomposed as the sum of the variances attributed to global, country, and industry shocks and the idiosyncratic component:

$$Var(R_{nt}) = \left(\beta_n^G\right)^2 + \left(\beta_{nc}^C\right)^2 + \left(\beta_{ni}^I\right)^2 + \sigma_n^2 \qquad (5)$$

where *c* and *i* denote the country and the industry that stock *n* belongs to.[6]

3. The Data

We use the dataset constructed by Brooks and Del Negro (2002a), which we briefly review here. Their data cover monthly total U.S. dollar-denominated stock returns and market capitalizations from January 1985 to February 2002 for 9,679 companies.[7] They cover all the constituent firms in the DataStream country indices for 42 developed and emerging markets as of March 2002 and augment this list with active and inactive stocks for each market from Worldscope. Each company belongs to one of 39 Level 4 DataStream Global Equity industries (see www.ftse.com for a description of this classification). Table 1 lists these industries and shows how they can be aggregated into the broader (Level 3) FTSE industry sectors.[8]

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[6] Unlike the existing literature, with the exception of L'Her et al. (2002) who allow for global risk factors, our variance decomposition accounts for a global factor. Relative to the fixed-effects literature, this is likely to reduce the importance of industry-specific shocks in our model because they are orthogonalized on a global shock.

[7] Using US dollar-denominated returns has the effect of lumping nominal currency influences into country-specific shocks in international stock returns. Brooks and Del Negro (2002a) 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.

[8] The Datastream Global Equity industry assignments have been used most recently by Griffin and Stulz (2001). They differ from the Morgan Stanley Capital International (MSCI)

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The data we use differ in three respects from that in Brooks and Del Negro (2002a). First, we balance their dataset because our maximum likelihood algorithm cannot account for missing observations. Second, we download data only for those firms for which a continuous series for U.S. dollar-denominated total sales at fiscal year-end is available from Worldscope. This reflects our desire to investigate comovement in real as well as financial variables. The cross-section of firms for which stock returns, market capitalization and total U.S. dollar sales data are continuously available from January 1985 to February 2002 amounts to 1,239 companies in 20 developed and emerging markets.[9] The country composition of this sample, along with the number of firms in each market, are: Australia (26), Austria (4), Belgium (6), Canada (57), Denmark (9), France (14), Germany (25), Hong Kong (21), Ireland (10), Italy (8), Japan (467), Malaysia (8), the Netherlands (8), Norway (5), Singapore (14), South Africa (13), Sweden (11), Switzerland (7), the UK (150) and the US (376).[10] Our data set includes firms in 34 (out of 39) Level 4 industries. When aggregated into Level 3 industry sectors, the industry composition of the data is: basic industries (210), general industrials (217), cyclical consumer goods (87), non-cyclical consumer goods (162), cyclical services (203), non-

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classification, used by Rouwenhorst (1999) and elsewhere. Brooks and Del Negro (2002a) find that their results for the fixed-effects model using the DataStream classification are qualitatively similar to those obtained by authors who use the MSCI classifications, like Cavaglia, Brightman, and Aked (2000). They also explore if the results change significantly when they switch from the Datastream industry assignments to the Dow Jones World Stock Index industry classification, which is used by Griffin and Karolyi (1998) for example, and find that this is not the case.

[9] The Worldscope variable used for total sales is called *SalesUSD*, which is the net sales or revenues of a company converted to U.S. dollars using the fiscal year end exchange rate, according to the Worldscope data definitions guide.

[10] In addition, when a factor (either country and industry) contains only one or two companies, we eliminate the factor and the corresponding firms from the analysis. This is because we cannot in this case identify the idiosyncratic component separately from the country or industry factor.

cyclical services (29), utilities (69), information technology (58), financials (151) and resources (53). Following Griffin and Karolyi (1998) and Griffin and Stulz (2001), we also distinguish between traded and non-traded goods industries. In this dimension, our dataset has 611 traded and 628 non-traded goods firms.[11] Third, we follow standard practice in the finance literature, see Ferson and Harvey (1994) and Heston et al. (1995) for example, in estimating our factor model over excess U.S. dollar-denominated stock returns, which we compute by subtracting the monthly total return for a 3-month U.S. Treasury Bill from the individual stock returns.[12] Table 1 shows the arithmetic mean for the monthly U.S. dollar-denominated excess return across all stocks for the full sample. Over the full sample, the excess return averages 0.3 percent per month, while the average variance across stocks is 114.34 percent-squared. Table 1 also shows the average annual growth rate for total sales across all the firms in our sample. This number amounts to 8.06 percent. The average variance across firms of the growth rate of annual sales is 477.41 percent-squared.

Although we lose a large number of firms by balancing the data, our coverage compares favorably to that in papers that estimate the simpler fixed-effects model and are thus not subject to the same computational constrains. For example, Heston and Rouwenhorst

[11] Following Griffin and Karolyi (1998), we treat the following (level 4) industries as tradable goods producing sectors: AUTMB, OILGS, FSTPA, PHARM, CHMCL, INFOH, ELTNC, SFTCS, HHOLD, MNING, STLOM, TOBAC, FOODS, ENGEN, PERSH.

[12] We compute monthly total returns for the 3-month Treasury Bill using the Merrill Lynch 3-month Treasury Bill Index. The 3-month US Treasury Bill Index is comprised of a single issue purchased at the beginning of the month and held for a full month. At the end of the month, that issue is sold and rolled into a newly selected issue. The issue selected at each month-end re-balancing is the outstanding Treasury Bill that matures closest to, but not beyond 3 months from the re-balancing date. To qualify for selection, an issue must have settled on or before the re-balancing (month-end) date. While the index will often hold the Treasury Bill issued at the most recent or prior 3-month auction, it is also possible for a seasoned 6-month or 1-Year Bill to be selected.

(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 et al. (2000) cover 2,645 firms in 21 developed countries.

For illustration, the overall market capitalization of our sample amounts to $11,187 billion in December 2000, which at that point is 34.6 percent of the global market in capitalization terms, according to the 2001 Standard & Poor's Emerging Stock Markets Factbook. The United States makes up about 59.6 percent of overall market capitalization in our sample. The next biggest markets are Japan, the United Kingdom, Germany, France and Switzerland, which constitute 17.7 percent, 7.2 percent, 2.8 percent, 1.7 percent and 1.5 percent of the sample respectively. In contrast, emerging markets carry very little weight. The largest emerging market, Singapore, makes up only 0.25 percent of the sample. In terms of market capitalization, companies in non-cyclical consumer goods are most heavily represented, making up 24.8 percent of the sample. The next biggest sectors are general industrials, cyclical services and information technology, at 14.5, 12.0 and 10.4 percent respectively.[13] Firms in traded goods industries make up 51.4 percent of the sample in terms of market capitalization.

Finally, we also collect annual Worldscope data from 1985 to 2001 for each firm on the percentage of total sales generated abroad, the fraction of total assets held overseas and the fraction of total income generated abroad.[14] Unfortunately, the cross-sectional coverage

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[13] We estimate our factor model using Level 4 industry affiliations to identify our industry-specific factors. In this respect, we follow Griffin and Karolyi (1998) who argue that broad industry classifications (such as Level 3) bias against finding important industry effects because they result in industry portfolios that are larger and therefore more diversified than country portfolios.

[14] The Worldscope variable used for the fraction of international sales is based on *SalesUSD*. The percentage of international assets variable is derived from the variable *TotalAssets*,
(continued)

for these variables is imperfect. Only 1,170 firms in our sample have data on international sales at some point over the sample. This number is 1,071 for international assets and 1,059 for international income. Table 2 lists the fraction of traded goods firms by country and industry—as noted above, we follow Griffin and Karolyi (1998) and Griffin and Stulz (2001) in our classification of traded and non-traded goods industries. Table 2 also shows, again by country and industry, the average across firms for the percentage of international sales, international assets and international income. Table 2 shows that the U.S. is relatively more closed compared to the average for the entire sample, both in terms of its traded goods composition and in terms of its international sales, asset and income ratios. It also shows that traded goods industries have a higher international sales, asset and income component on average than non-traded goods industries.

4. The Results

This section reports the estimation results for model (2) with one global factor, 20 country factors (one for each country in the sample) and 34 industry factors (one for each Level 4 industry in the sample). It has three sub-sections. Section 4.1 explores the importance of the cross-sectional link between stock market comovement and firm-level diversification over the full sample period. Section 4.2 then asks whether this cross-sectional link has grown over time. Finally, section 4.3 asks to what extent changes in the importance of the global and country-specific factors over time can be linked to structural explanations.

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which according to the data definitions guide represents the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets.

4.1 The Cross-Sectional Link

This section explores the importance of the link between stock market comovement and firm-level international diversification in the cross-sectional dimension of our data. Our basic strategy is to relate the estimated exposures of firms to global, country- and industry-specific shocks in stock returns, based on the factor model in Section 2, to different measures of the extent to which a firm is internationally integrated.

The first measure we consider is whether a firm belongs to a traded or non-traded goods sector. Following Cavaglia, Cho and Singer (2001) and Diermeier and Solnik (2000), we consider a second measure, namely accounting data on the global exposure of firms through the international component of their sales, income, or assets. An advantage of this approach over the traded/non-traded goods classification is that it exploits firm-level information, and hence takes firm-level heterogeneity into account. The main disadvantage is that accounting variables may be measured with error (see for instance Diermeier and Solnik 2000).

An added value of this paper is that it provides a third – alternative - approach to measuring international integration at the firm level. This approach is to construct a measure of the effective exposure of the real side of the firm with respect to world, country, and industry-specific shocks. In order to construct such measure we apply the factor model described in section 2 to the growth rates of total sales for our panel of firms, and obtain the exposure of a firm's sales growth to these shocks. We call this latter measure of international exposure "sales betas". The advantage of using the "sales betas" is that they may reflect firm-specific features not captured by the industry-level or the firm-level accounting variables. The downside is twofold: i) the underlying model used to estimate the betas may not be correct,[15] ii) even if the model is correct, the estimated betas will have sampling error. At any rate, our exposures based on the sales growth estimation offer a counterpart to the frequently used international sales ratios as a measure of integration at the firm level.

In the remainder of this section we will relate the degree of "globalization" of firms as measured by their stock market betas and the degree of "globalization" of firms as measured by these three approaches. First of all, we look for a qualitative relationship between accounting variables on the one side and the degree of both "financial" and "real" exposure to global, country, and industry-specific shocks on the other. We sort the sample according to our accounting measures and compare the average variance decomposition for the top quartile of our sample (the most international) with that for the bottom quartile (the least international firms). Table 4 shows that, both for stock returns and sales growth, the global factor is more important and the country factor less important for firms in the top quartile based on the international sales, international assets and international income ratios. Comovement in both real and financial variables therefore appears to be greater for firms that operate globally than for firms that do not.

Next we group firms by whether they belong to traded or non-traded goods sectors. Here, the qualitative relationship is not as clear as it is for the accounting variables. On the financial side, world shocks are more important, and country shocks less important, for firms in the traded goods sectors – as expected. On the real side, however, the difference is small

[15] As in the stock market model we assume that all the shocks are iid over time. While this assumption is more unpalatable when applied to sales growth rates data than when applied to stock market returns, it is partially justified by the fact that we are using annual data – i.e., data that are not very serially correlated (as in Stockman 1988). Models with serially correlated shocks are difficult to estimate from a computational point of view given the large size of the cross-section.

and for world shocks has the wrong sign: firms in non-traded sectors appear to have a slightly larger exposure than firms in traded sectors.

Finally, we rank firms by their global and country sales betas. For the ranking based on the global sales betas, the results are the opposite of what one would expect. The global factor in international stock returns is marginally more important for the top quartile than for the average across all firms, but it is even more important for firms in the bottom quartile. Furthermore, the country factor is less important for firms in the bottom quartile than for the more global firms in the top quartile. For the variance decomposition based on the country sales growth factors, the results are more in line with expectations. We find that firms with high country sales betas have a lower than average exposure to the global factor and a greater than average exposure to country shocks, and this is true both on the financial and the real side.[16] The reverse holds for firms in the bottom quartile.

We have established a link between firm-level trade integration and international stock market comovement. But how important is this link quantitatively? Table 5 investigates this issue. In panel 1 we present the results of the regressions of the stock market betas on an array of regressors: the international sales, asset and income ratios, the respective sales betas (also in percent), and a dummy variable which is equal to one if the firm belongs to a traded goods sector and zero otherwise.[17] We focus on global and country betas, in percent. For each stock market beta (global and country), we run a series of bivariate regressions of the betas on each of the regressors (and a constant). We find that for both the global and the

[16] Of course, almost by definition high sales beta firms have a higher exposure to country shocks in terms of sales growth than low sales beta firms.

[17] For each firm we use the full sample average over time of the international sales, assets, and income ratios, whenever these variables are available (they are not available for all firms at all dates). All the regressions include a constant and feature robust standard errors.

country beta the accounting variables, as well as the respective sales betas, are always highly significant. The regression coefficients are however very small. For instance, a 10% increase in the international sales ratio increases the stock market exposure to global shocks by a meager 0.3 percent, and reduces the exposure to country shocks by only 0.12 percent. The impact of sales beta on the respective stock market beta is also small. The r-squareds of these regressions are generally small, which is perhaps not surprising given that the stock market betas themselves are measured with error.

We also run a "horse-race" among the accounting variables in order to determine which one is the most relevant. We find that both the international sales and the international income ratio significantly affect the exposure with respect to global shocks – with the predicted sign. For the regression of the country betas two out of three of the accounting variables also have the expected sign, but none of them is significant. We also run a horse-race among one of the accounting variables (international sales ratio, for which we have the most observations), the respective sales betas, and the traded-non traded dummy. We find that all three variables are significant and have the right sign (with the exception of the dummy for the country beta regression), suggesting that the three measures of integration are somewhat complementary.

The fact that we find very small regression coefficients is not at all surprising. All the regressors, for the different reasons discussed before, are likely to contain sizable measurement error, which in turn biases the coefficients down. In order to get around this problem we do the following: i) we sort the firms according to the dependent variable, ii) we construct N bins containing n/N firms (where n is the total number of firms in the sample), iii) we use as observations the N within-bin averages for the dependent and explanatory variables.[18] If the measurement error in the regressors is not too correlated within each bin, thanks to the law of large numbers, the averaging should considerably improve the results. We use N=20 bins for the bivariate regressions.[19] From panel 2 of Table 5 we can see that the effects of the averaging are staggering – suggesting that the bias in panel 1 is considerable. The regression coefficients generally increase by one order of magnitude. For instance, the estimated impact of a 10% increase in the international sales ratio on the exposure to global stock market shocks is 2% in panel 2, as opposed to .3% in panel 1. While for individual stocks a change in the exposure of 2% may not seem large (the average stock is the sample has a standard deviation of about 10% in the sample) for portfolios this number is considerable: the equally weighted world market portfolio has an in-sample standard deviation of 4.6%. This suggests that our results may have important practical implications for portfolio managers. The respective sales betas have a ¾ to one percent impact on the stock market betas in the bivariate regressions, although the coefficient declines in the multivariate regressions. Finally, it is reassuring to observe that none of the coefficients changes sign from panels 1 to 2, and that the vast majority of coefficients has the expected sign. Most of the coefficients that are significant at the five percent level in panel 1 are also significant at the five percent level in panel 2.

In conclusion, we observe a large and significant cross-sectional link between the exposure of firms to global and country-specific stock market shocks and the degree to which

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[18] Of course, the sorting is done according to the dependent variable *only*.

[19] There is a trade-off between bias and degrees of freedom in the regressions. The higher is N, the higher the degrees of freedom, but the higher the bias because the averaging occurs among n/N firms. Increasing N to 30 reduces the coefficients somewhat – as expected – but not sizably. The number of bins is 40 for the regressions with more than 2 variables, given that more degrees of freedom are needed whenever there are more regressors. The multivariate regression results are however virtually unchanged for N=30.

these firms are global. Interestingly, the different measures of "globalization" – traded-non traded, accounting variables, sales betas - appear to complement each other, that is, to capture different aspects of the degree of integration of a firm in the international financial markets.

4.2. The Cross-Sectional Link over Time

So far we have investigated the link between "financial" and "real" integration in a cross-sectional sense. We have asked if the global factor in international stock returns is on average more important - and the country factor less important - for firms that are more international. There is mounting evidence, however, that the relative importance of global, country and industry shocks in international stock returns may be changing, as Cavaglia, Brightman and Aked (2000) argue. As the introduction notes, there may be several reasons why this might indeed be the case. The recent wave of mergers and acquisition has made at least some firms more international than they were fifteen years ago. A decline in home bias over time could mean that the impact of country-specific changes in investor sentiment on national stock markets is now be less pronounced than it once was.

In this section we explore if the importance of the global, country and industry factors has changed over time. We ask if these changes, if any, match up with our preconceived notions about a more integrated global economy. For example, have global shocks become more important over time and has the importance of the country-specific factors fallen over our sample period? Finally, we explore the implications of any changes in the importance of the factors for the cross-sectional link between stock market comovement and firm-level trade integration.

To this end, we re-estimate a more general specification of the model in Section 2, one that allows for the importance of the global, country and industry factors to vary across exogenously pre-specified sub-periods of the data. In our baseline specification, the factors in every period are drawn from the same distribution – as described in equation (3).[20] Now we allow for these distributions to evolve over time, perhaps as a reflection of the phenomena just described. Assumption (3.1) is therefore replaced with:

$$f_t^g - E_{t-1}\left[f_t^g\right] \xrightarrow{d} N\left(0, \xi_l^g\right), f_t^c - E_{t-1}\left[f_t^c\right] \xrightarrow{d} N\left(0, \xi_l^c\right), f_t^i - E_{t-1}\left[f_t^i\right] \xrightarrow{d} N\left(0, \xi_l^i\right)$$

for $t_{l-1} + 1 \leq t \leq t_l$ and l=1,..,L (6)

where t_0=1 and t_L=T. Assumption (6) says that our sample period is divided into L periods, each starting at time t_{l-1}+1 and ending at time t_l, In each period we let the variance – and therefore the importance – of our factors change. For normalization purposes we still constrain the variance in the first sub-period to be one for all factors. Hence ξ_l^g can be interpreted as the variance of the global factor relative to its variance in the first period. The variance of excess returns for stock n in period l can therefore be decomposed as follows:

$$Var(R_{nt}) = \left(\beta_n^G\right)^2 \xi_l^g + \left(\beta_{nc}^C\right)^2 \xi_l^c + \left(\beta_{ni}^I\right)^2 \xi_l^i + \sigma_n^2 \tag{5}$$

for $t_{l-1} + 1 \leq t \leq t_l$. As the ξs change over time, the relative importance of global, country, and industry-specific shocks in explaining variations in stock returns can also vary over time.

Before discussing the results from this extended model a discussion of our modelling choices is in order. The model we estimate is a compomise between the baseline model described in section 2 and a model where the βs – the exposures – change over time. The latter model is in principle attractive because we could therefore analyze the relationship between the evolution of the βs over time and the cross-sectional variables considered in the previous section – such as the ratio of international sales, for instance. However since the

[20] Bear in mind that the normalization to one of the variance in inconsequential. What is consequential is the fact that the variance remains constant over time.

cross-section (N=1239), and hence the number of estimated parameters ($4 \times N$), is very high, for practical purposes it is very hard to estimate the βs with any precision. Hence we opt for a more parsimonious representation where the number of additional parameters that needs to be estimated relative to the baseline model is only K (the number of factors) × L (the number of periods).

Second, the choice as to the number and timing of the sub-periods is somewhat arbitrary. Hence we allow for two through eight equally-spaced sub-periods over our sample and systematically test for the increase in explanatory power relative to our baseline model, which holds the factor variances fixed over the sample. Our results below are qualitatively robust across specifications. However, since the model with four sub-periods has the highest BIC (Bayesian Information Criterion), we present the results for that specification only.[21]

Table 6 shows the variance decompositions over time based on international stock returns for the four sub-periods model. As in Table 4, we show the variance decomposition for the average across all firms (the first three columns), for firms in the "highest-international-sales-ratio" quartile (columns 4, 5 and 6) and for firms in the "lowest-international-sales ratio" quartile (columns 7, 8 and 9). Let us first focus on the average decompositions across all firms. The results suggest that the importance of the global factor has grown from 4.26 percent in the first sub-period to 16.49 percent in the last sub-period. However, this rise is confined almost entirely to the last sub-period. Over the four sub-

[21] Brooks and Del Negro (2002a) find that, in the context of the fixed-effects model, the relative importance of country versus global industry effects describes an inverted U-shape over the period 1985 to 2002. This non-linearity means that we need at least three equally-spaced sub-periods over our sample.

periods, the global factor actually describes a U-shape, decreasing between the first and the second sub-period and then rising sharply at the end of our sample. The importance of the industry factors has been approximately constant over time. The country shocks remain in all four periods the most important source of volatility, although their importance has declined relative to that of the global factor in the last period.

Are these patterns the same across all firms? The answer from the comparison of the variance decomposition for high and low international sales firms is no. Note that in the first sub-period, the country-specific shocks are – counter-intuitively – more important for high international sales firms than for low international sales firms. This pattern is reversed in all subsequent periods. In the last period, country-specific shocks are less important for high than for low international sales firms. Noticeably, for high international sales firms global shocks are more important than country shocks in the last period: these firms are more exposed to world shocks than to shocks in their own country.

These results suggest a very asymmetric evolution of comovement in international stock markets. Country shocks have become far less important for firms that have high international sales than for firms that have low international sales. Table 7 takes a different look at this same phenomenon. It explores the evolution over time of the cross-sectional link between stock market comovement and firm-level trade integration. Note that in each period the exposure of firm *n* to world, country-specific, and industry-specific shocks is given by the expressions $\beta_n^g \xi_l^g$, $\beta_n^c \xi_l^c$, and $\beta_n^i \xi_l^i$. We regress these exposures on within-period measures of firm-level integration, such as the international sales ratio and the sales betas.[22] Table 5 is analogous to Table 3 where Panel 1 contains the cross-sectional regression results

[22] It is clear that some of these measures of integration can change from period to period, such as the accounting variables, while others cannot, like the sales betas.

based on the raw stock market betas (in percent), while Panel 2 uses *N*=20 bins to reduce the impact of measurement error on the estimated relationship. For each sub-period, Table 5 presents the estimated slope coefficient on the within-period average international sales ratio, along with the t-ratio and the adjusted r-squared. [23] Panel 2 suggests that the cross-sectional link between the global stock market betas and the international sales ratio has increased by a factor of 2.4. Meanwhile the coefficient on the international sales ratio in the cross-sectional regressions that have the country stock market betas as the dependent variable has switched from 0.18 in the first period (consistent with the greater importance of the country factor for highly international firms than for the average firm in the variance decompositions in Table 4) to -0.19 in the most recent sub-period. The coefficients of the regression of the stock market betas on the respective sales betas always have the expected positive sign: an increase (decrease) in the real-side exposure of the firm to global (country) shocks maps into an increase (decrease) in the financial-side exposure. One can also notice from panel 2 that the coefficients have generally increased from the first to the last period. In other words, there is evidence that the cross-sectional link between comovement across national stock markets and firm-level trade integration has increased since the late-1980s, although this increase is not always monotonic.

It is important to qualify the results shown in table 7, bearing in mind that the model we consider does not allow for time-varying exposures at the firm level, but only for a change in the variance of the different factors. It is apparent for instance that the change in the coefficients for the regressions featuring the global stock market betas on the left hand side is merely a reflection of the fact that the importance of the global shocks, ξ_l^g changes

[23] Throughout the paper we use robust standard errors.

over time. The change in the coefficient for the regressions featuring the country betas on the left hand side is not as mechanical. In this case compositional effects play an important role. The results suggest that country shocks have declined in importance more for countries where firms are more internationally integrated. In summary, the cross-sectional results over time are driven by the evolution of the relative importance of the country and the global factors. This evolution is what we try to analyze in the next section.

4.3 Comovement versus Integration

So far, this paper has documented that a cross-sectional link exists between stock market comovement and firm-level trade integration. In addition, it has shown that this cross-sectional link has grown stronger over time, to the point where it is now large and significant. However, because our model allows only the factor variances to change over time, not the actual betas, any change across periods in the magnitude of this cross-sectional link is driven entirely by the factor variances. This section presents a preliminary investigation into the extent to which the changing factor variances are capturing permanent changes related to greater integration versus temporary factors related to the recent stock market bubble.

We first focus on the evolution of the country factor variances, where the cross-country dimension of the data allows us to use regression analysis to link the evolution of the factors over time to our firm-level international sales measure and to macroeconomic country-level measures of financial and trade openness. In this endeavor, we first explore how successful these measures are in explaining the evolution of the country factor variances over time. For example, is it the case that the importance of country-specific stock market shocks has declined faster for countries that are more globally integrated according to macroeconomic and firm-level criteria? Second, we will try to evaluate the relative importance of macroeconomic openness versus firm-level trade integration as determinants for international stock market comovement. In other words, for the transmission of shocks through international stock markets, does it matter more that the capital account is liberalized or that firms are highly globalized?

Table 8 presents bivariate cross-sectional regressions for each period (except the first period when the country factor variances are normalized to one) of the country factor scale parameters on the full sample averages for the following variables: the international sales ratio, the capital account openness measure of Lane and Milesi-Ferretti (2001) who compute the ratio of foreign assets and liabilities to GDP annually for each country in our sample, the annual ratio of trade to GDP for each country in our sample from the World Bank's World Development Indicators, the IMF's annual measure of capital account restrictions that takes the value of one if restrictions exist and is zero otherwise, the Chinn and Ito (2002) measure of capital account restrictions, which is superior to the IMF measure because it reflects the qualitative importance of different capital account restrictions, the country-level averages for the global sales betas and finally the country-level averages for the country sales betas.

Table 8 shows that firm-level integration is on average negatively associated with the country factor variance. This suggests that the greater is a country's integration for the average firm, as measured by international sales or by the global or country sales betas - the higher the decline in the importance of its country-specific stock market factor. More important, the link between the importance of country-specific shocks and firm-level trade integration has become consistently stronger over time. This suggests the rise in the importance of the cross-sectional link between international stock market comovement and firm-level trade integration is not entirely spurious, at least as far as the changing importance of the country factors is concerned.

Finally, it does not appear that the macroeconomic measures of openness rival our firm-level trade integration measure in explaining the evolution of the country factors over time. The capital account openness measure of Lane and Milesi-Ferretti (2001) comes closest, but here is seems that the relationship has been weakening over time.

Because of the few observations for the global factor variance, we are unable to make a similar statement. The fact that its rise is confined largely to the most recent sub-period looks ominous however. Table 9 shows the evolution of the scale parameter for the global factor variance (denoted global) over the four sub-periods, along with the average across firms for the international sales ratio, and the corresponding values for the current account openness measure (caopen), the trade openness measure (tropen), the IMF's capital account restriction measure (imfres) and the Chinn and Ito (2002) capital account restriction measure (chires). Table 9 illustrates that the pronounced U-shape in the global factor variance is hard to reconcile with the largely monotonic evolution of fundamentals. It is therefore possible that the evolution of the global factor is capturing a temporary rise in comovement, especially since this rise appears confined to the most recent sub-period.

5. Conclusion

In this paper, we investigate the link between stock market comovement and the degree to which firms operate globally. We collect stock returns and balance sheet data for 1,239 firms in 20 developed and emerging markets from 1985 to 2002 and estimate a factor model that decomposes international stock returns into global, country-specific and industry-specific factors. We use this framework to explore the link between comovement and firm-level diversification in two dimensions. First, we examine this link in the cross-sectional dimension of our sample. Here we find that, from 1985 to 2002, global shocks are on average a more important source of stock return variation for companies that are more globally diversified, as measured by the international component of their sales, assets or income. We also find that country-specific shocks are less important for these firms. But how important is this link quantitatively? It appears to be quite large. A company that raises the international component of its sales by 10 percent raises the exposure of its stock return to the global shock by two percent and reduces its exposure to country –specific shocks by 1.5 percent. The second dimension in which we explore the link between comovement and firm-level diversification involves us estimating a more general version of our model, in which we allow the variances of the global, country-specific and industry-specific factors to vary over time. In this dimension, we find that the importance of the global factor has increased sharply in recent years, while that of the country factors has fallen. Most interestingly, this pattern is more pronounced for firms that are highly internationally diversified, evidence that there may be a real counterpart to the rise in comovement across national stock markets. Indeed, we find that the cross-sectional link between stock market comovement and firm-level integration has increased from the late 1980s to the late 1990s – a reflection of the changing importance of global and country-specific shocks.

But how much of the recent rise in stock market comovement is due to firms becoming more global? On the one hand, the fact that the cross-sectional link between stock market comovement and firm-level integration has grown over time certainly points in the right direction. On the other hand, while the global factor has certainly increased in importance since the 1980s, it actually describes a U-shape over the sample period. This non-monotonicity – which contrasts with the monotonic increase in firm-level integration - leaves open the possibility that some of the rise in the cross-sectional link between comovement and firm-level diversification may be due to temporary factors.

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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. (Continued) Industry Sectors.

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. Sample Means and Variances of Monthly Excess Stock Returns and the Growth Rate of Annual Sales: Averages Across All 1,239 Firms in the Sample.

	Monthly Excess Stock Returns 85:1 to 02:2	Annual Sales Growth 1985 to 2000
Arithmetic Mean (in %)	0.30	8.06
Variance (in % - squared)	114.34	477.41

Table 3. The Percentage of Traded Goods Firms and the International Sales, Asset and Income Ratios by Country and Industry (Full Sample Averages).

	Industry-Le	Accounting Variables		
	%Traded	Int'l Sales	Int'l Assets	Int'l Income
All Firms	49.31	22.35	15.05	18.10
USA	42.82	17.38	13.96	15.88
UK	26.00	35.01	19.36	34.13
France	64.29	47.36	33.82	49.31
Germany	64.00	41.48	30.91	34.62
Italy	25.00	36.49	7.52	0.00
Japan	63.81	14.46	11.00	12.39
Canada	49.12	27.61	22.59	20.40
Australia	38.46	28.27	28.19	26.26
Austria	25.00	56.24	77.61	.
Belgium	66.67	67.10	39.74	13.31
Denmark	66.67	67.94	36.99	31.92
Hong Kong	4.76	14.66	1.38	14.63
Ireland	30.00	46.62	25.58	40.46
Netherlands	75.00	64.55	52.64	63.45
Norway	60.00	63.82	31.23	20.06
Sweden	54.55	61.26	39.87	29.34
Switzerland	57.14	72.69	38.86	33.02
Malaysia	62.50	16.98	13.10	8.86
Singapore	14.29	29.76	19.83	23.60
South Afric	53.85	12.47	4.15	3.95
chmcl	Traded	27.09	18.07	23.32
cnsbm	Non-Traded	19.77	12.69	17.73
fstpa	Traded	21.15	12.32	15.59
stlom	Traded	21.08	17.31	14.87
aersp	Non-Traded	27.53	11.13	20.37
divin	Non-Traded	29.92	23.05	25.89
eltnc	Traded	32.00	21.80	25.49
engen	Traded	34.28	19.60	24.78
autmb	Traded	31.32	24.53	25.99
hhold	Traded	20.44	13.58	13.89
beves	Non-Traded	28.19	17.53	24.39
foods	Traded	20.38	13.70	17.34
hlthc	Non-Traded	31.44	19.11	26.43
persh	Traded	44.67	34.68	40.27
pharm	Traded	21.46	13.67	13.92
tobac	Traded	30.59	13.98	26.64
rtail	Non-Traded	8.90	7.10	8.61
lesur	Non-Traded	12.03	6.98	12.05
media	Non-Traded	27.76	19.98	26.67
supsv	Non-Traded	29.08	20.52	27.71
trnsp	Non-Traded	18.89	10.21	10.39
fdret	Non-Traded	8.71	5.13	2.66
telcm	Non-Traded	13.24	7.25	14.54
elect	Non-Traded	3.53	1.11	0.76
gasds	Non-Traded	2.67	1.61	1.89
infoh	Traded	37.09	22.78	30.43
sftcs	Traded	33.65	19.85	27.75
banks	Non-Traded	10.76	12.07	12.23
insur	Non-Traded	10.46	13.99	8.28
invsc	Non-Traded	0.00	0.00	0.00
rlest	Non-Traded	5.93	3.78	7.56
spfin	Non-Traded	11.07	11.81	6.72
mning	Traded	34.68	25.99	26.75
oilgs	Traded	20.76	19.06	19.72
Traded	.	28.49	19.30	22.75
Non-Traded	.	16.00	10.81	13.57

Table 4. The Link Between Comovement in International Stock Returns and Sales growth and International Integration: Variance Decompositions by Different Measures of Global Integration.

Panel A. International Stock Returns

International Sales Ratio	Global	Country	Industry	Idiosyncr
All firms	6.92	32.24	7.01	53.83
Top Quartile	11.32	25.59	6.70	56.39
Bottom Quartile	3.91	34.34	7.15	54.60

International Asset Ratio	Global	Country	Industry	Idiosyncr
All firms	6.92	32.24	7.01	53.83
Top Quartile	10.04	26.26	8.36	55.34
Bottom Quartile	4.07	35.85	6.55	53.54

International Income Ratio	Global	Country	Industry	Idiosyncr
All firms	6.92	32.24	7.01	53.83
Top Quartile	10.99	25.58	7.35	56.08
Bottom Quartile	4.08	34.85	6.85	54.22

Traded and Non-Traded Goods Firms	Global	Country	Industry	Idiosyncr
All firms	6.92	32.24	7.01	53.83
Traded	8.49	30.36	7.74	53.40
Non-Traded	5.11	34.41	6.16	54.33

Global Sales Growth Factor	Global	Country	Industry	Idiosyncr
All firms	6.92	32.24	7.01	53.83
Top Quartile	7.25	33.58	4.92	54.25
Bottom Quartile	7.68	25.57	9.62	57.13

Country Sales Growth Factor	Global	Country	Industry	Idiosyncr
All firms	6.92	32.24	7.01	53.83
Top Quartile	6.83	33.57	6.02	53.58
Bottom Quartile	7.82	25.03	7.82	59.33

Panel B. International Sales Growth

International Sales Ratio	Global	Country	Industry	Idiosyncr
All firms	10.42	16.58	13.52	59.48
Top Quartile	13.20	14.60	16.07	56.13
Bottom Quartile	11.17	17.15	14.44	57.25

International Asset Ratio	Global	Country	Industry	Idiosyncr
All firms	10.42	16.58	13.52	59.48
Top Quartile	13.22	14.72	15.20	56.85
Bottom Quartile	9.97	17.52	12.80	59.72

International Income Ratio	Global	Country	Industry	Idiosyncr
All firms	10.42	16.58	13.52	59.48
Top Quartile	15.14	15.97	11.05	57.85
Bottom Quartile	10.21	17.84	13.35	58.60

Traded and Non-Traded Goods Firms	Global	Country	Industry	Idiosyncr
All firms	10.42	16.58	13.52	59.48
Traded	8.78	16.51	16.51	58.21
Non-Traded	11.87	16.64	10.89	60.61

Global Sales Growth Factor	Global	Country	Industry	Idiosyncr
All firms	10.42	16.58	13.52	59.48
Top Quartile	20.21	14.48	10.41	54.90
Bottom Quartile	6.74	16.24	17.34	59.68

Country Sales Growth Factor	Global	Country	Industry	Idiosyncr
All firms	10.42	16.58	13.52	59.48
Top Quartile	9.93	30.60	9.22	50.25
Bottom Quartile	11.66	5.61	20.93	61.80

Table 5. The Link Between Comovement in International Stock Returns and Sales growth and International Integration: Regressions of the Betas on Different Measures of Integration.

Panel 1- cross sectional regressions

regressor:	*intn sales ratio*	*intn assets ratio*	*intn income ratio*	*global sales β*	*country sales β*	*traded non traded*	*adj. R2*
regressand:							
global β	0.027 (11.916)						0.113
global β		0.033 (9.329)					0.082
global β			0.029 (10.594)				0.104
global β				0.040 (4.080)			0.018
global β	0.029 (4.399)	-0.011 (-1.568)	0.011 (2.174)				0.129
global β	0.021 (9.383)			0.036 (4.008)		0.739 (7.192)	0.155
country β	-0.012 (-5.301)						0.019
country β		-0.016 (-4.679)					0.018
country β			-0.010 (-3.937)				0.012
country β					0.097 (9.341)		0.098
country β	-0.008 (-1.201)	-0.013 (-1.699)	0.005 (0.779)				0.023
country β	-0.016 (-7.039)				0.098 (8.787)	0.342 (2.808)	0.130

Panel 2- cross sectional regressions using sorted bins

regressor:	*intn sales ratio*	*intn assets ratio*	*intn income ratio*	*global sales β*	*country sales β*	*traded non traded*	*adj. R2*
regressand:							
global β	0.191 (8.886)						0.859
global β		0.297 (9.343)					0.864
global β			0.217 (14.426)				0.897
global β				0.768 (6.620)			0.507
global β	0.217 (1.851)	-0.110 (-0.663)	0.038 (0.474)				0.783
global β	0.126 (4.982)			0.056 (0.523)		3.368 (2.876)	0.826
country β	-0.151 (-2.549)						0.263
country β		-0.274 (-2.821)					0.301
country β			-0.138 (-1.438)				0.167
country β					0.722 (11.548)		0.803
country β	-0.068 (-0.749)	-0.334 (-1.933)	0.170 (2.018)				0.320
country β	-0.091 (-3.618)				0.529 (7.939)	2.952 (1.921)	0.777

Note: All the regressions include the constant. The number of bins is 20 for the bivariate regressions, and 40 for the regressions with more than 2 variables.

Table 6. The Changing Importance of the Global, Country and Industry Factors Over Time: Variance Decompositions (in %) for All Firms, Highly International Firms (top quartile) and Domestic Firms (bottom quartile).

Variance Decomposition (in %) in 4 Sub-Period Model									
	All Firms			Top Quartile: Int'l Sales			Bottom Quartile: Int'l Sales		
	Global	Country	Industry	Global	Country	Industry	Global	Country	Industry
85:1 to 89:3	4.26	29.61	9.57	6.56	34.33	5.19	3.17	26.67	10.47
89:4 to 93:7	2.02	41.97	4.27	3.39	30.56	4.05	1.17	45.16	4.41
93:8 to 97:10	2.72	30.90	5.41	4.62	21.42	6.17	1.54	35.40	5.47
97:11 to 02:02	16.49	29.46	8.73	24.17	21.34	8.22	10.98	31.98	9.15

Table 7. The Cross-Sectional Link Between Stock Market Comovement and Firm-Level International Diversification over Time (All Variables in %).

Panel 1. Cross-Sectional Regressions of Stock Market Betas								
	85:1 to 89:3		89:4 to 93:7		93:8 to 97:10		97:11 to 02:02	
	global	country	global	country	global	country	global	country
Int'l Sales Ratio	0.017	0.008	0.012	-0.017	0.012	-0.015	0.041	-0.015
(T-Ratio)	(9.071)	(3.376)	(9.878)	(-5.352)	(10.820)	(-6.437)	(10.879)	(-6.453)
Adjusted R^2	0.080	0.013	0.090	0.021	0.107	0.032	0.104	0.030
Respective Sales β	0.024	0.046	0.016	0.130	0.015	0.107	0.053	0.088
(T-Ratio)	(3.166)	(5.643)	(3.166)	(8.884)	(3.166)	(9.244)	(3.166)	(7.842)
Adjusted R^2	0.011	0.033	0.011	0.090	0.011	0.108	0.011	0.069

Panel 2. Cross-Sectional Regressions of Stock Market Betas --Sorted Bins								
	85:1 to 89:3		89:4 to 93:7		93:8 to 97:10		97:11 to 02:02	
	global	country	global	country	global	country	global	country
Int'l Sales Ratio	0.123	0.181	0.088	-0.154	0.079	-0.123	0.280	-0.191
(T-Ratio)	(6.617)	(4.051)	(6.983)	(-1.676)	(7.286)	(-2.480)	(9.378)	(-5.604)
Adjusted R^2	0.708	0.335	0.731	0.218	0.786	0.298	0.825	0.517
Respective Sales β	0.634	0.794	0.430	1.050	0.403	0.628	1.440	0.911
(T-Ratio)	(5.232)	(6.959)	(5.232)	(8.941)	(5.232)	(8.972)	(5.232)	(8.159)
Adjusted R^2	0.420	0.630	0.420	0.781	0.420	0.698	0.420	0.789

Table 8. The Evolution of the Country Factor Variances over Time: Firm-Level Trade Integration versus Macroeconomic Openness Variables.

International sales ratio (avg across periods)			
	coeff.:	t-stat:	Adj R2:
subperiod: 1989.04 to 1993.07	-0.0001	(-0.0133)	0.05
subperiod: 1993.08 to 1997.10	-0.0114	(-2.2069)	0.22
subperiod: 1997.11 to 2002.02	-0.0168	(-2.8713)	0.31

Capital account openness measure (avg across periods)			
	coeff.:	t-stat:	Adj R2:
subperiod: 1989.04 to 1993.07	-0.2722	(-1.2752)	0.11
subperiod: 1993.08 to 1997.10	-0.2878	(-2.1355)	0.15
subperiod: 1997.11 to 2002.02	-0.0115	(-0.0555)	0.06

Trade openness measure (avg across periods)			
	coeff.:	t-stat:	Adj R2:
subperiod: 1989.04 to 1993.07	-0.0026	(-1.9079)	0.16
subperiod: 1993.08 to 1997.10	0.0004	(0.3143)	0.06
subperiod: 1997.11 to 2002.02	0.0033	(3.0164)	0.24

IMF capital account restriction measure (avg across periods)			
	coeff.:	t-stat:	Adj R2:
subperiod: 1989.04 to 1993.07	0.0517	(0.1265)	0.05
subperiod: 1993.08 to 1997.10	0.1653	(0.6698)	0.06
subperiod: 1997.11 to 2002.02	-0.1206	(-0.2135)	0.06

Chinn capital account restriction measure (avg across periods)			
	coeff.:	t-stat:	Adj R2:
subperiod: 1989.04 to 1993.07	0.0591	(0.6013)	0.06
subperiod: 1993.08 to 1997.10	-0.0337	(-0.5323)	0.06
subperiod: 1997.11 to 2002.02	-0.0147	(-0.0928)	0.05

Average global sales beta			
	coeff.:	t-stat:	Adj R2:
subperiod: 1989.04 to 1993.07	-1.3945	(-0.1870)	0.06
subperiod: 1993.08 to 1997.10	0.7543	(0.1772)	0.05
subperiod: 1997.11 to 2002.02	-9.9000	(-2.2485)	0.19

Average country sales beta			
	coeff.:	t-stat:	Adj R2:
subperiod: 1989.04 to 1993.07	-1.1163	(-0.6186)	0.06
subperiod: 1993.08 to 1997.10	1.0476	(0.5223)	0.06
subperiod: 1997.11 to 2002.02	3.8162	(1.4352)	0.12

Table 9. The Evolution of the Global Factor Shift Parameter and of Fundamentals over Time.

The Global Factor Variance Scale Parameter and Fundamentals						
	Global	Int'l Sales	caopen	tropen	imfres	chires
85:1 to 89:3	1.00	21.21	0.50	88.40	0.39	1.51
89:4 to 93:7	0.68	21.32	0.66	93.02	0.24	1.76
93:8 to 97:10	0.64	23.45	0.97	95.31	0.11	2.29
97:11 to 02:02	2.27	26.97	1.40	102.57	0.13	2.27