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COUNTRY AND INDUSTRY EFFECTS IN GLOBAL EQUITY RETURNS

DISCUSSION NOTE

We examine the importance of country and industry effects in global equity returns, and explore the implications for portfolio diversification.

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SUMMARY

- We estimate the importance of country- and industry-affiliation for equity returns in developed and emerging markets over the period from 1975 to 2018. We find that their relative importance has changed considerably over time.

- In developed markets, country effects were more dominant until the turn of the century, after which the roles of country and industry have been more balanced. The importance of country effects has steadily declined over time. In recent decades, the importance of industry-affiliation has increased, peaking during the significant downturns associated with the dot-com bubble in the early 2000s and global financial crisis in the late 2000s.

- We observe a similar decline over time in the importance of country effects in emerging market equities. The role of industry effects has been consistently smaller, however, despite a longer term attenuation of country effects.

- The relative importance of country and industry effects has direct implications for diversification. When country effects have been more important, diversification across countries rather than across industries has captured much of the diversification potential in global returns. Significant changes in the relative importance of country- and industry-affiliation over time suggests that both dimensions are important for diversification, however.

- We compare the country-industry model to a range of risk factor models. We find evidence that risk factor models capture the variation in developed market returns better than the country-industry model.

1. Introduction

Country and industry affiliation are commonly used to account for the relative performance of stocks. These are natural categories with which to group stocks, and it is intuitive to expect co-movement between stocks that are similar in terms of geographical or commercial exposure. It is useful to understand this co-movement when constructing a global equity portfolio and when attempting to harness the benefits of international diversification.

For example, the Swiss stock market has historically had a significant concentration of Financial firms. As such, differences in the performance of Swiss and non-Swiss stocks may simply reflect differences in industrial composition. Alternatively, Swiss stocks may have performed differently due to differences in economic factors between Switzerland and other countries, for example variation in fiscal, monetary and legal systems. If the differences in relative performance of stocks are explained by industrial composition, an investor may be better off ensuring sufficient diversification across industries rather than across countries, and vice-versa.

In this note, we decompose firm-level returns from a range of developed and emerging markets. We follow the methodology originally proposed in Heston and Rouwenhorst (1994) that attributes a firm's return to global, country, industry and firm-specific components. Initially, we focus on developed markets, and show that the relative importance of country and industry components of returns has evolved over time. While country effects are larger than industry effects over the full sample period, we observe a decline in the role of country effects over time. This is in line with a trend of increased global integration over this period. In recent decades, the importance of industry-affiliation has increased, peaking during significant downturns associated with the dot-com bubble in the early 2000s and global financial crisis in the late 2000s. The relative roles of country and industry look different within emerging markets. While there also appears to be a downward trend in the importance of country effects, the magnitude of industry effects is consistently smaller.

Following the comparison of country and industry effects, we explore the implications for diversification and portfolio construction. We first show how larger country effects translates into a greater scope for diversification across countries, and vice-versa for industries. However, the country-industry model does not explain a high proportion of the cross-sectional variance of returns, and we explore whether there are additional factors or models that can improve diversification. We compare the country-industry model to a range of risk factor model alternatives. We assess the models' ability to capture variation in developed market equity returns, and find evidence that risk factor models can perform well compared to the country-industry approach.

The note proceeds as follows. Section 2 outlines the model and estimation methodology used to identify country and industry components of returns. In Section 3, we then apply the methodology and compare country and industry effects over time, in developed and emerging markets, and over different horizons. Section 4 shows how these results translate into diversification benefits and compares the diversification performance of the country-industry model to other risk factor models. Section 5 concludes.

2. Estimating Country and Industry Effects

In an influential contribution to the country vs. industry literature, Heston and Rouwenhorst (1994) propose a model for separating country- and industry-specific drivers of equity returns. The model assumes that the stock return R_{it} can be decomposed into factors associated with its industry affiliation, indexed by j, and its country affiliation, indexed by k,

$$R_{it} = \alpha_t + \sum_{j=1}^{J} \beta_{jt} I_{ij} + \sum_{k=1}^{K} \gamma_{kt} C_{ik} + e_{it} \tag{1}$$

Here, I_{ij} and C_{ik} are dummy variables equal to one if stock i belongs to industry j and country k, respectively.[1] β_{jt} and γ_{kt} are the respective industry- and country-specific effects: shocks that impact all firms within a given industry or within a given country. In addition to country and industry effects, α_t represents an effect relevant to all securities, which can be interpreted as a global effect, and e_{it} represents the effects specific to firm i. As an example, if stock i is a US bank, this implies that $I_{i,FIN} = 1$ and $C_{i,US} = 1$, and there are zero values for all other country and industry dummy variables. This implies that its return is decomposed into a factor that is specific to Financial firms, β_{FIN}, and a factor specific to US firms, γ_{US}, as well as global and firm-specific effects.

In order to empirically identify the country and industry components of the model, additional constraints need to be imposed.[2] Following Heston and Rouwenhorst (1994), we impose the following restrictions for each cross-sectional regression at each point in time:

$$\sum_{j=1}^{J} w_{jt} \beta_{jt} = 0$$

$$\sum_{k=1}^{K} v_{kt} \gamma_{kt} = 0$$

where w_{jt} and v_{kt} are the beginning-of-period market capitalisation weights of industry j and country k respectively.[3]

These restrictions allow for the estimation of equation (1), where this approach is equivalent to measuring country and industry effects relative to a market capitalisation-weighted benchmark. When imposing these restrictions on the model, estimated using weighted least squares, the α_t

[1] For convenience, we do not include time subscripts for industry and country variables, though a small number of securities in our sample change either industry or country during the sample.

[2] On each date in our sample, we would ideally regress the cross-section of returns on the set of country and industry dummy variables. This is not possible as, when including all industry and country variables, there is perfect collinearity between the regressors and the regression model cannot be estimated.

[3] These are market capitalisation weights which sum to one: $\sum_{j=1}^{J} w_{jt} = 1$ and $\sum_{k=1}^{K} v_{kt} = 1$

term in equation (1) is equal to the return on the value-weighted global portfolio. In other words, the restrictions imply that the value-weighted global portfolio has no country or industry effects, and country and industry effects are expressed relative to the global portfolio. For further intuition, and dropping t subscripts for convenience, Heston and Rouwenhorst (1994) show that the returns on a value-weighted country k index can be expressed as

$$R_k = \hat{\alpha} + \sum_{j=1}^{J} w_j^k \hat{\beta}_j + \hat{\gamma}_k \tag{2}$$

where w_j^k is the market capitalisation weight of industry j in country k. Here, a country return is equal to the global return, $\hat{\alpha}$, adjusted for industry tilts of that country, $\sum_{j=1}^{J} w_j^k \hat{\beta}_j$, plus a pure country component, $\hat{\gamma}_k$. Using this, we can therefore describe the estimated country effect for country k as the return on the country index relative to the global index adjusted to have the same industrial composition. The same logic applies to the returns on a value-weighted industry j index, which can be expressed as

$$R_j = \hat{\alpha} + \sum_{k=1}^{K} v_k^j \hat{\gamma}_k + \hat{\beta}_j \tag{3}$$

where v_k^j is the market capitalisation weight of country k in industry j. The estimated industry effect for industry j refers to the return on the industry index relative to the global index adjusted to have the same country composition. To add further intuition, this implies that the volatility of the estimated country (industry) effects is a measure of the tracking error of a country (industry) position relative to a industry-neutral (country-neutral) global benchmark.

While the Heston and Rouwenhorst (1994) methodology has been widely used in studies examining country and industry effects, it has well-known limitations. A key limitation is that it assumes constant unit exposures of firms to the global, country and industry components. As discussed in Bekaert, Hodrick, and Zhang (2009), this is potentially problematic given the well-documented upward trend in correlations in international returns over time, which would be associated with an increasing exposure to the global component of returns for many equities. Later in the note, we introduce additional models that allow for such time-varying global exposures. Marsh and Pfleiderer (1997), Brooks and Del Negro (2006) and Eiling, Gerard, and De Roon (2012) also propose methodologies that relax the unit exposure assumption within the Heston and Rouwenhorst (1994) approach. In Appendix B, we estimate country and industry effects using the method proposed in Eiling, Gerard, and De Roon (2012), which allows for non-unit industry and country exposures, and time-varying exposures using rolling regressions. These estimates are very close to those in our main analysis.

Data

We estimate country and industry effects using an international data set of firm-level equity returns. For the estimation of the Heston and Rouwenhorst (1994) model, we use total monthly returns in US dollars, obtained from MSCI, over the period from January 1975 to December 2018.[4] We use country and market classifications ('Developed' or 'Emerging') as provided by MSCI.

In total there are 30 country classifications and 10 industry classifications in our sample.[5] We include countries that cover a sample period greater than 10 years, and that have a reasonable number of total constituents at the country-level.[6] This leads to the exclusion of a number of smaller countries within the MSCI universe, though the countries in our sample cover over 95% of the total market capitalization throughout our sample. We do not have data for all countries over the full 1975-2018 sample period, where samples are shorter in particular for smaller and emerging markets. Appendix A lists the countries and industries in our sample alongside the sample period.

In order to compare country and industry effects, we need consistent industry classifications for all securities. The industry classifications that we use are closely aligned with the Global Industry Classification System (GICS) Level 1 Sector classifications used by MSCI. We use the GICS Level 1 Sectors for all firms following their introduction in September 1999, and retroactively apply classifications prior to its introduction for firms that have been assigned a GICS industry. For firms that do not have GICS classifications, we map MSCI industry codes to GICS classifications based on where the majority of constituents for given MSCI industry group were reclassified following the introduction of GICS.[7]

3. Country versus Industry Effects

In this section, we estimate country and industry effects and examine their relative importance over time, across developed and emerging markets, and across different horizons.

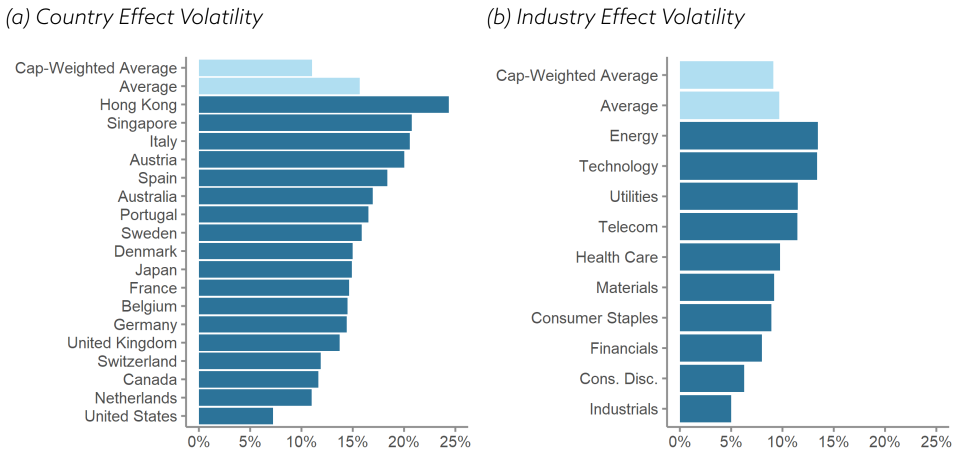
[4] The results presented later in this section are robust to the currency used to measure returns, and in general currency effects do not drive our results. This is in line with Heston and Rouwenhorst (1994) and similar studies that check robustness of their findings to currency effects.

[5] A small number of industries could lead to a downward bias in industry effects if granular industry effects are diversified away when using broad industry definitions. However, we find that the results presented later in this section are robust to using more granular industry classifications, consistent with Marsh and Pfleiderer (1997), Griffin and Karolyi (1998) and Brooks and Del Negro (2006).

[6] We require countries to have in excess of around 20 constituents over the sample period. For our main analysis, we exclude countries that have a low number of constituents for significant periods, as this leads to imprecise estimates of country effects for these countries. In Section 4, we only consider country-industry portfolios that include greater than 5 constituents on average.

[7] To ensure a consistent set of sectors in our sample, we do not follow the separation of the Real Estate sector in 2016, where we extend the Financials classification for the relevant securities following the change. Also, we do not incorporate changes to the Telecommunications, IT and Consumer Discretionary sectors in September 2018, where we keep Media companies in the Consumer Discretionary sector and Internet Service companies in the IT sector.

Figure 1: Volatility of Country and Industry Effects: Developed Markets



Developed Markets

We initially focus our attention on a range of developed markets, for which data are available over the full history.[8] Figure 1 summarises the importance of each effect by measuring the volatility of each country and industry effect series, and also shows the average across countries and across industries.

Over the full sample country effects have tended to be larger than industry effects. In most cases, the volatility of country effects is higher than for industry effects. This is in line with the results from Heston and Rouwenhorst (1994) and other studies such as Griffin and Karolyi (1998) and Rouwenhorst (1999). Also in line with these studies, we find differences across countries with lower volatilities of country effects for the United States, United Kingdom, Netherlands and Switzerland. We also obtain similar results to previous studies when looking across industries. While industry classifications are not defined in an identical way to these past studies, our results align in finding higher volatility associated with Energy and Information Technology industries, and lower volatility of the Industrials and Consumer Discretionary industries.

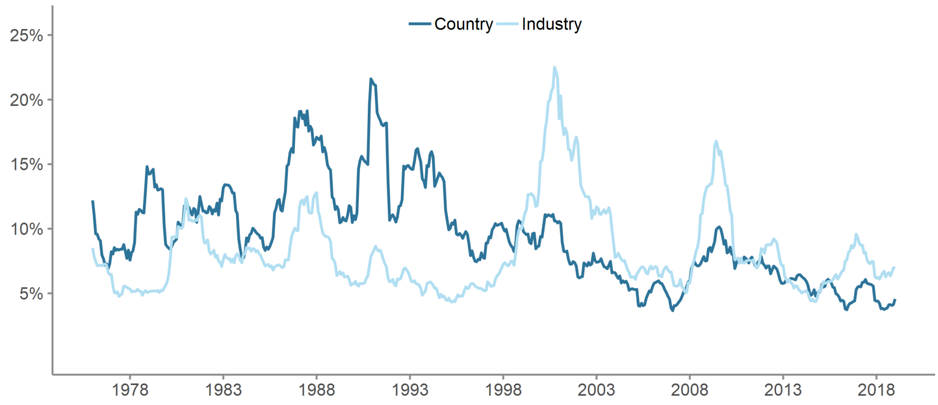
While Figure 1 gives an overview on the relative roles of country and industry over the full sample, it is potentially also interesting to examine how the estimated effects have changed over time. We measure the total volatility for all countries and for all industries over time using the 12-month rolling volatility of the estimated effects, shown in Figure 2. Our results align with the academic and practitioner literature on countries versus industries in equity returns, and the evolution in the debate over time.[9] At different points in time, either country or industry dimensions have been thought to be more dominant.

In the earlier part of the sample, the figure shows that country effects tended

[8] With the exception of Portugal, for which data are available from 1988. While classified as an emerging market earlier in the sample, it has been classified as a developed market for a longer period of time within the sample.

[9] The volatilities of country and industry effects are weighted by market capitalisation. Our findings do not change materially when using equal weights.

Figure 2: Rolling Volatility of Country and Industry Effects: Developed Markets



Note: Cap-weighted 12-month rolling standard deviation (annualised).

to be more important. This aligns with the results of Heston and Rouwenhorst (1994), who use data more closely in line with the earlier part of our sample. In the second half of the sample, however, we observe a more balanced role of country and industry effects. This reflects a couple of key themes in the late 1990s and early 2000s that re-opened the country vs. industry debate. First, there appears to be a steady downward trend in the role of country effects, particularly during the 1990s. As noted in Rouwenhorst (1999), this was a period of significant cross-country convergence within Europe, in particular following the 1992 Maastricht Treaty. These developments would be expected to reduce the importance of country effects as countries became more integrated. Indeed, there is evidence of declining country effects associated with this integration, for example as shown in Eiling, Gerard, and De Roon (2012).

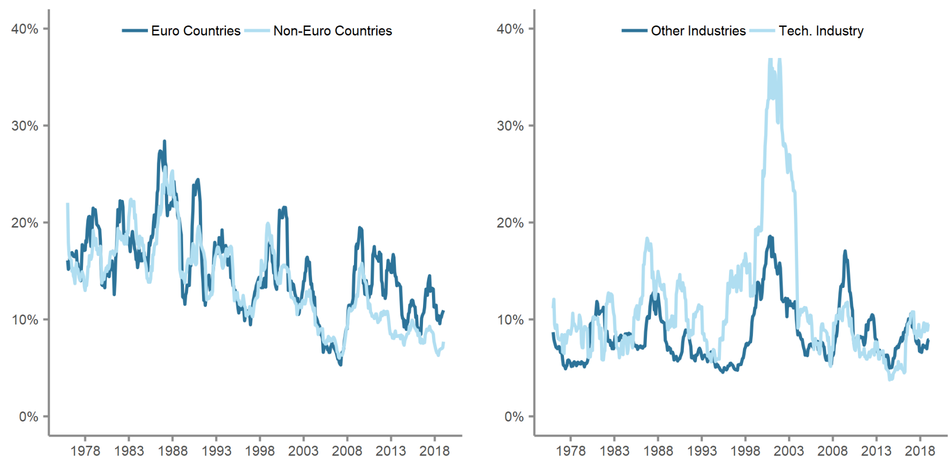
It is well-known, however, that this was also a period of increased global integration which was not exclusive to Europe. Cross-country correlations increased markedly over our sample, as documented in NBIM DN #01 (2017). Figure 3 Panel (a) shows the volatility of country effects where countries are split into euro area members and non-euro members.[10] We see a similar profile for both groups to that observed in Figure 2. This suggests that while declining country importance likely reflects higher levels of integration within Europe, it also reflects the broader globalisation trends occurring over this period.

A second development in the late 90s that changed the balance of country and industry importance was the stock market boom concentrated in the Information Technology sector. The volatility of industry effects increases markedly in this period, and is documented in studies such as Cavaglia, Brightman, and Aked (2000) and Baca, Garbe, and Weiss (2000). The increased importance of industry effects led these studies to call for a re-assessment of the consensus around the dominance of country effects. In

[10] We equally weight country effects for this comparison, since the non-euro country group would be largely driven by the United States, particularly in the more recent sample period.

Figure 3: Rolling Volatility of Country and Industry Effects

(a) Euro area vs. Non-euro Country Effects *(b) Info. Tech. vs. Other Industry Effects*



Note: Average 12-month rolling standard deviation of country effects (annualised).

Note: Average 12-month rolling standard deviation of industry effects (annualised).

addition, several studies sought to determine whether the newly established role of industries should be expected to persist. Brooks and Del Negro (2004) focus on this question and show that the documented increase in industry effects overall was very much driven by their Technology, Media and Telecoms sector. They show that when this sector is excluded, the increased role in industry effects is much less pronounced and no longer larger than country effects in their sample. They argued that the dominance of industry effects may not persist given its lack of broad base. We find a similar result in our sample. Figure 3 Panel (b) shows the volatility of industry effects for the Technology industry compared to other industries. While there is still a greater role for industry effects around this time outside of the Technology sector, the increase is far more pronounced for the Technology sector.

The post-2000 period has been associated with a greater role for industry effects beyond the Information Technology sector, however. The volatility of industry effects returned temporarily to a level in line with country effects in the mid-2000s, but increased again around the Global Financial Crisis in 2008-09. Similar to the technology sector episode, it is intuitive to observe an increased relative role for industry effects during the financial crisis to the extent that the crisis was global in nature and was especially pronounced within the financial industry.

Emerging Markets

We now extend our analysis to country and industry effects in emerging markets. Figure 4 shows volatilities of the estimated country and industry effects for emerging markets over the full sample.[11]

[11]We use real-time MSCI classifications to distinguish between developed and emerging equity markets.

Figure 4: Volatility of Country and Industry Effects: Emerging Markets

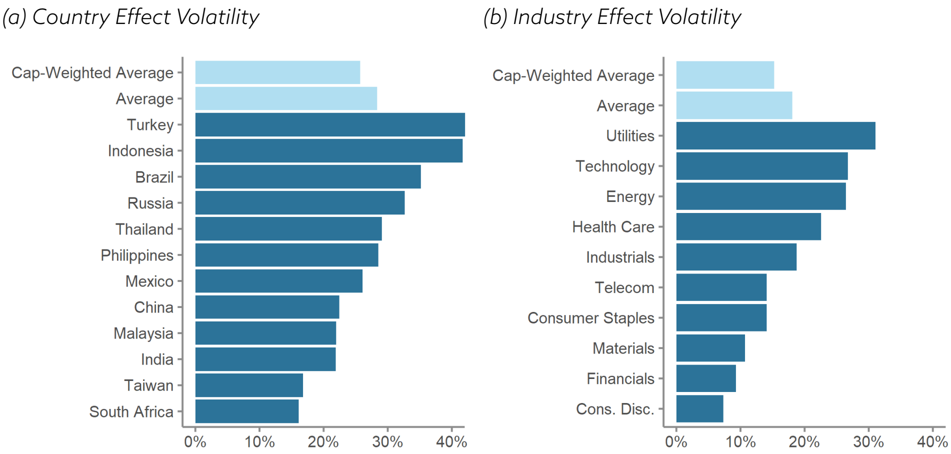
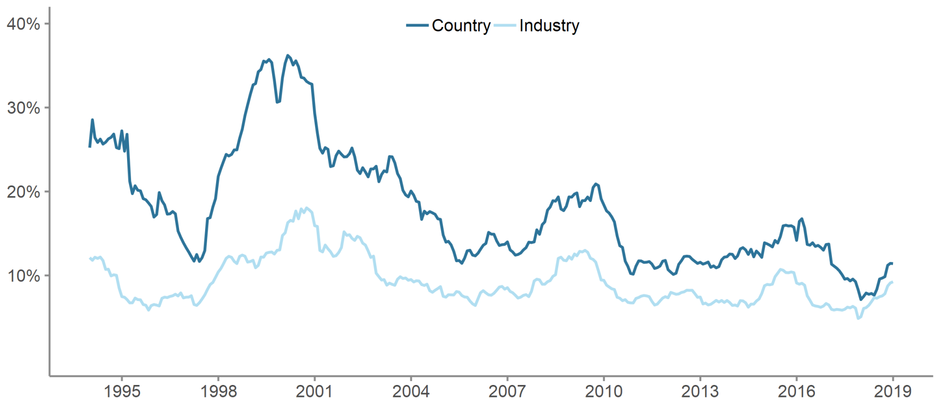


Figure 5: Rolling Volatility of Country and Industry Effects: Emerging Markets



Note: Cap-weighted 12-month rolling standard deviation (annualised).

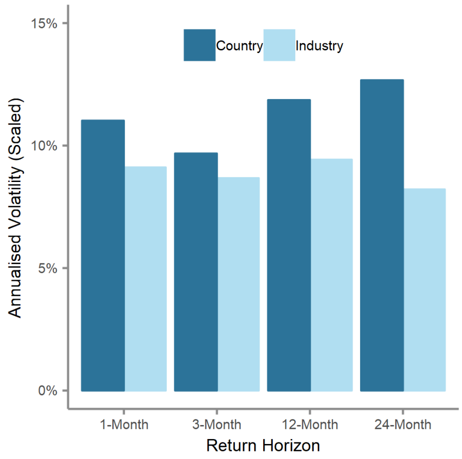
Compared to the results for developed markets, the estimated country effects are considerably higher on average, where the emerging market average is approximately twice as large as the value for developed markets. The greater role for country effects within emerging markets is in line with results from Serra (2000), Phylaktis and Xia (2006) and Estrada, Kritzman, and Page (2006). Figure 5 shows the volatility of country and industry effects over time. Similar to the findings for developed markets, the role of country effects appears to trend downward over our sample period. In contrast, however, the role for industry effects is smaller and consistently so over the full sample, despite the decline in country effects. These findings are also consistent with the results in MSCI (2012) and MSCI (2019), which show that countries consistently account for a larger proportion of variability in returns over time within emerging markets.

Longer Horizons

The analysis so far has been based on country and industry effects estimated using monthly data. This is a relatively short horizon over which to examine

Figure 6: Country versus Industry over Different Horizons

(a) Developed Markets *(b) Emerging Markets*



Note: At each horizon, country and industry effect volatilities are scaled by the proportional changes in the volatility of the total market.

these effects, and an additional question is whether the roles of countries and industries change over longer investment horizons. To explore this question, we re-apply the Heston-Rouwenhorst methodology to estimate country and industry effects for return horizons up to 24 months. It is harder to assess effects over longer horizons given a relatively short sample from which to estimate longer term country and industry effects. We therefore confine our comparison of country and industry effects to the full sample volatility estimates and do not examine the effects over time.

Figure 6 shows the cap-weighted average volatility of country and industry effects for a range of return horizons for developed markets in Panel (a), and for emerging markets in Panel (b). To control for changes in the total volatility of equity returns, we scale country and industry effect volatilities by the proportional changes in the volatility of the total market at each horizon. For both developed and emerging markets, the larger role for country effects observed in monthly returns persists at longer horizons too. The importance of country relative to industry effects increases a little at longer horizons in developed markets. We see the reverse in emerging markets, where industry effects grow in relative importance at longer horizons, albeit only to a small extent.

4. Countries, Industries and Diversification

In this section, we relate the findings on country and industry effects to portfolio diversification and compare the country-industry model used for the analysis so far to alternative risk factor models.

Diversification Curves

We use a simple exercise to illustrate the scope for diversification gains across country and industry dimensions, used frequently in the country versus industry literature. Following Heston and Rouwenhorst (1994), Griffin and Karolyi (1998) and others, we construct diversification curves that represent the extent to which the variance of a portfolio can be reduced on average as the number of constituents is increased, when diversifying either across countries or industries only. This exercise utilises the fact that the variance of an equally-weighted portfolio of stocks converges to the average covariance within the portfolio when the number of portfolio constituents is large. When the portfolio is comprised of a single stock, this represents the least diversified portfolio with the highest variance. Diversification curves show the average portfolio variance as the number of stocks in a portfolio is increased, expressed as a fraction of the individual stock variance.

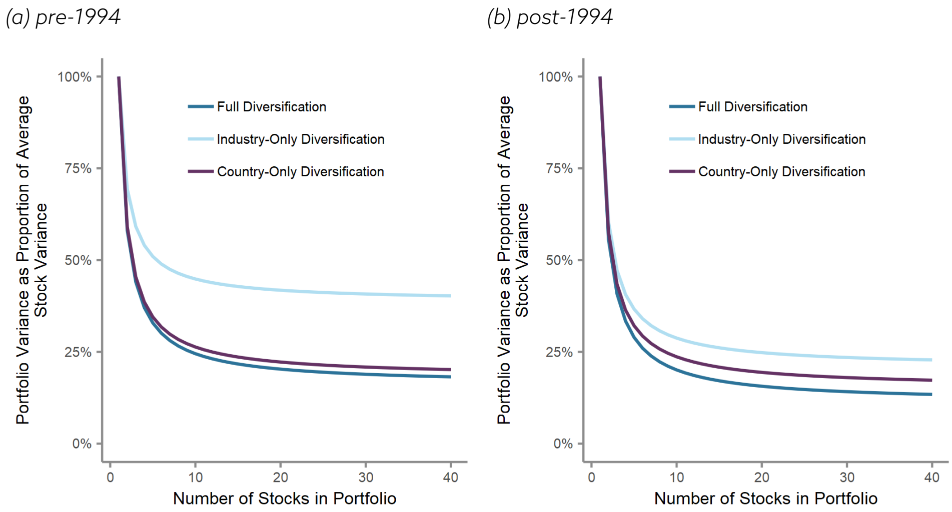
Figure 7 shows diversification curves for developed markets, where we split the sample period into two halves. To interpret these results, it is useful to think of this exercise as a given number of stocks being randomly drawn from alternative groups. In the 'Full Diversification' case, stocks are randomly selected from the full universe of securities, without regard to their country or industry affiliation, and the curves show the average reduction in portfolio variance. In two alternative cases, the diversification curves show the average portfolio variance reductions when randomly drawing either from a single country across any industry (industry-only diversification), or randomly drawing from a single industry across any country (country-only diversification). It is worth noting that in Section 3, the comparison of country and industry is based on value-weighted returns, while this diversification exercise is implicitly using equal weighting. As a result, the magnitudes of diversification benefits align more with the simple averages of country and industry effects presented in the previous section.

Figure 7 Panel (a) shows diversification curves over the first half over the sample, where in the previous section we showed that country effects tended to be larger than industry effects over this period.[12] When expanding the size of the portfolio without restricting countries or industries, the portfolio variance can be reduced to below 25% of the average individual stock variance.

When restricting the diversification strategy to across countries only, we are able to generate almost the same reductions as in the full diversification case. This cannot be said for industry-only diversification, where the curve converges to around 40% of the average stock variance. This suggests that over the earlier sample period, country diversification is sufficient to capture the majority of the diversification reduction in global equity returns. Figure 7 Panel (b) shows a different profile in the latter half of the sample, where we saw a more balanced role for industry and country effects in the previous

[12] The curves are limited to 40 stocks for illustration purposes. The universe of available stocks is much larger than this, but the diversification benefits of the alternative strategies are largely captured with around 20-30 stocks.

Figure 7: Diversification Curves: Developed Markets



Note: Portfolio variance for N securities measured as $(1/N)\bar{var}(r_i)+(1-1/N)\bar{cov}(r_i, r_j)$ where $\bar{var}$ and $\bar{cov}$ are the average variance and average covariance, respectively.

section. Here, the country and industry diversification approaches are much more closely aligned, and both approaches capture a large part of the scope for reducing portfolio variance.[13]

Figure 8 shows diversification curves for emerging markets, where we do not split the sample given the shorter period of data available for these markets. In line with the findings in the previous section, Figure 8 shows that country diversification is a more effective strategy compared to industry diversification.[14] Our findings for developed and emerging markets are similar when constructing diversification curves using returns measured over longer horizons.

Country-Industry vs. Alternative Models

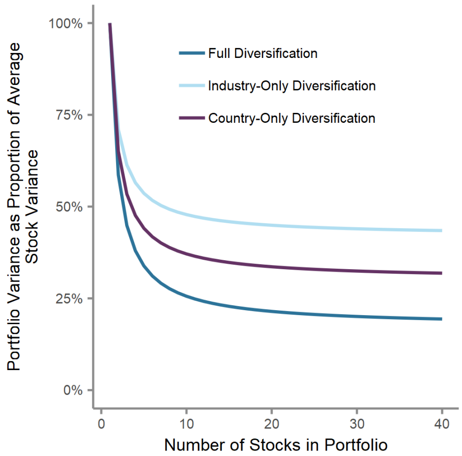
The analysis considered so far has focused exclusively on using country and industry for diversification. It is natural to also consider whether additional dimensions may be useful for diversification purposes. Figure 9 shows the extent to which the estimated country and industry effects can explain cross-sectional variation in returns, across both developed and emerging markets. The chart shows, at each point in time, how much of the variance of the cross-section of firm returns can be explained by the set of country, industry and firm-specific components outlined earlier in equation (1).[15]

[13] Pre-1994, the average annualised individual stock volatility is 38% (47% post-1994), which under full diversification converges to the annualised volatility of the total equal-weighted portfolio of 15% (16% post-1994). With country-only diversification, annualised volatility converges to 16% (18% post-1994), and with industry-only diversification converges to 24% (21% post-1994). Note that the chart shows proportions of variance, not volatility.

[14] Within emerging markets, the average annualised individual stock volatility is 59%, which under full diversification converges to 25%. With country-only diversification, annualised volatility converges to 32%, and with industry-only diversification converges to 38%.

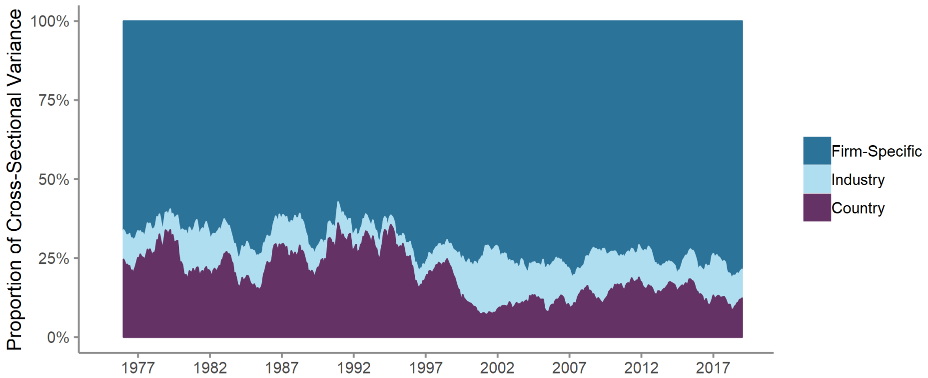
[15] Total cross-sectional variance is defined as the sum of the variance of the three components, such that the sum of proportions of each component equals one. While this omits covariance terms, these terms are small and the overall picture is unchanged with their inclusion.

Figure 8: Diversification Curves: Emerging Markets



Note: Portfolio variance for N securities measured as $(1/N)\bar{var}(r_i)+(1-1/N)\bar{cov}(r_i,r_j)$ where $\bar{var}$ and $\bar{cov}$ are the average variance and average covariance, respectively.

Figure 9: Country vs. Industry: Proportion of Cross-Sectional Variance



Note: 12-month rolling average of market capitalisation-weighted proportion.

In this decomposition, the country and industry components explain on average around 30% of the variation in the cross-section of returns. There is a considerable portion that is not explained, which is captured by the firm-specific component. In addition, the proportion explained by country and industry has fallen slightly over time. This chart suggests that it may be possible to explain a higher proportion of the cross-sectional return variance by considering additional factors, and this might increasingly be the case given that the explained proportion has declined a little over time.

Following Bekaert, Hodrick, and Zhang (2009) we compare the performance of the country-industry model outlined earlier with risk factor models based on the well-known Fama-French 3-factor model.[16] We consider a range of risk

[16]See Fama and French (1993) and Fama and French (1998).

factor models that are nested within the following specification:

$$R_{pt} = \alpha_{pt} + \beta_{pt}^{GMKT} GMKT_t + \beta_{pt}^{GSMB} GSMB_t + \beta_{pt}^{GHML} GHML_t + \beta_{pt}^{RMKT} RMKT_t + \beta_{pt}^{RSMB} RSMB_t + \beta_{pt}^{RHML} RHML_t + \epsilon_{jt}$$

where R_{pt} is the return on country-industry portfolio p. MKT, SMB and HML refer to market, size and value factors, respectively. The G and R prefixes refer to 'Global' and 'Regional', respectively. This refers to the level at which the Fama-French factors are constructed, where the market, value and size factors are constructed globally and for developed markets within North America, Europe, Japan and Asia Pacific ex. Japan.[17]

In the full specification, we include factors at both the global and regional levels, which we refer to as the 'Global-Region Fama-French' model. We also consider models that restrict to global factors only, where the 'Global Fama-French' model includes $GMKT$, $GSMB$ and $GHML$, and 'Global Market' includes $GMKT$ only, and a 'Global-Region Market' model that includes $GMKT$ and $RMKT$. Following Bekaert, Hodrick, and Zhang (2009), we form country-industry portfolios and use weekly returns, which are available from January 1995 onwards, and estimate the risk factor models every 6 months. Since the risk factors cover developed markets only, we focus our comparison of the country-industry and risk factor models on developed market returns.

Figure 10 shows the cross-sectional return variance explained by the risk factor models alongside the country-industry model.[18] Based on this measure, the 'Global-Region Fama-French' model captures variation in returns better than the country-industry model, while the 'Global-Region Market' model performs comparably. This suggests that there is return variation that can be explained using factors beyond country and industry.[19,20]

The performance of the risk factor models suggests that these models may be useful for diversification purposes. On the other hand, the risk factor models involve the estimation of a large number of coefficients over a relatively short period, which could lead to overfitting the data. The models' performance may be weaker when used out-of-sample. To explore this, we form out-of-sample minimum variance portfolios based on each of the risk factor and country-industry models, where we use the models to estimate covariance matrices for the set of country-industry portfolios.[21]

[17] We obtain the factors from the Ken French Data Library, where full details on their construction can be found.

[18] The proportion of explained variance is slightly higher for the country-industry model compared to the average of Figure 9. Since we use portfolio rather than firm-level returns, there is a smaller proportion of firm-specific variance due to portfolio diversification.

[19] This is consistent with findings in L'Her, Sy, and Tnani (2002), who also show the importance of risk factor loadings relative to country and industry effects. Our findings are also in line with Griffin (2002) and Fama and French (2012) who show that local and regional factors tend to perform better relative to global factors.

[20] The performance of risk factor models relative to country-industry may result from either the use of risk factors as opposed to country/industry factors, or from allowing exposures to vary over time and in the cross-section of country-industry portfolios. We find that when removing either time series or cross-sectional variation, the models perform worse than the country-industry model in terms of matching co-movement, suggesting that these features are important and contribute significantly to the outperformance of risk factor models.

[21] The covariance matrices are implied from models estimated using the 6 months prior to portfolio

Figure 10: Country-Industry vs. Risk Factor Models: Average Proportion of Cross-Sectional Variance (in-sample)

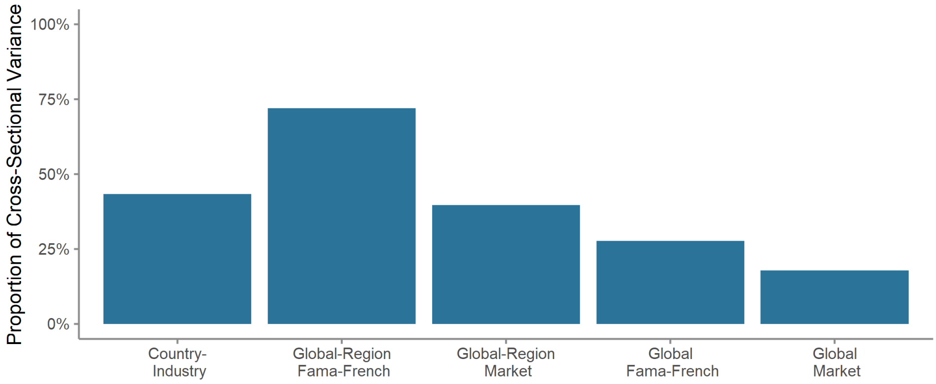


Figure 11: Country-Industry vs. Risk Factor Models: Model-Based Diversification (out-of-sample)

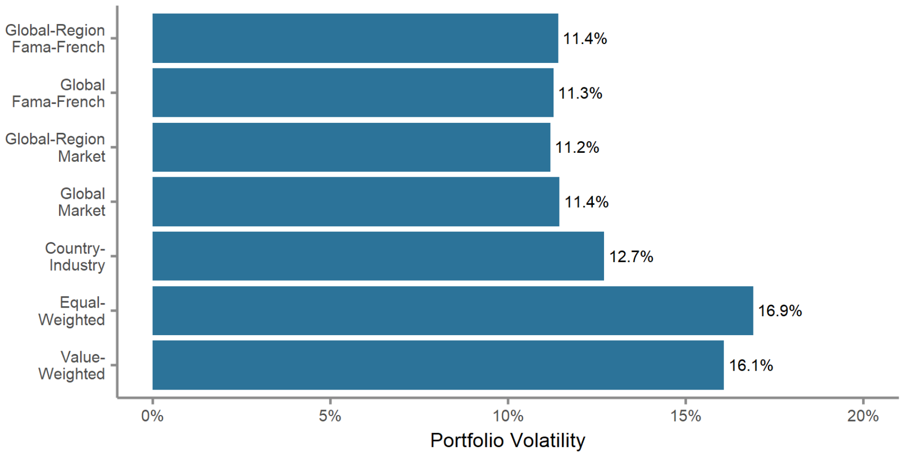


Figure 11 shows the volatility of the out-of-sample factor model-based portfolios against simple value- and equal-weighted alternatives. We find that the portfolios based on the risk factor models generate marginally lower volatility compared to the country-industry model.[22] The performance of the risk models is relatively close despite the differences in in-sample fitting errors in Figure 10, however. In particular, the Global-Region Fama-French model performs comparably to the other risk factor models, implying that there is an out-of-sample deterioration of the model. In general, the results in this section suggest that country and industry affiliation remain useful for diversification purposes, but should be considered alongside other factors.

5. Summary

We estimate that the relative roles of country and industry effects vary over time and by market type. In line with the evolution of the country vs. industry debate for developed markets, we find a decline in the historical dominance

formation, to ensure that portfolio weights do not reflect future information. We constrain portfolio weights to be a maximum of 5%. When constructing the model-based covariance matrices we set variances in line with sample variance estimates.

[22]We find similar results when measuring volatility over longer horizons.

of country effects coinciding with a much greater role for industry effects during the market downturns associated with the tech bubble and the global financial crisis. For emerging markets, there is also a decline in country effects, but they have been consistently larger compared to industry effects over our sample.

We show that country and industry dimensions remain useful for explaining variability in global equity returns. Together, however, country and industry do not explain a high proportion of the cross-sectional variance of returns, and this proportion has fallen over time. We compare the ability of alternative risk factor models to explain equity returns, and find that some risk factor models can better capture variation in developed market returns. Overall, our results suggest that country and industry affiliation are important, but should be considered alongside other factors.

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Appendix A: Country and Industry Lists

Table 1: Country List

Country	Start Date
Australia	1975-01-31
Austria	1975-01-31
Belgium	1975-01-31
Brazil	1988-01-31
Canada	1975-01-31
China	1994-05-31
Denmark	1975-01-31
France	1975-01-31
Germany	1975-01-31
Hong Kong	1975-01-31
India	1993-01-31
Indonesia	1988-01-31
Italy	1975-01-31
Japan	1975-01-31
Malaysia	1988-01-31
Mexico	1988-01-31
Netherlands	1975-01-31
Philippines	1988-01-31
Portugal	1988-01-31
Russia	1995-01-31
Singapore	1975-01-31
South Africa	1975-01-31
Spain	1975-01-31
Sweden	1975-01-31
Switzerland	1975-01-31
Taiwan	1988-01-31
Thailand	1988-01-31
Turkey	1988-01-31
United Kingdom	1975-01-31
United States	1975-01-31

Table 2: Industry List

Industry	Start Date
Consumer Discretionary	1975-01-31
Consumer Staples	1975-01-31
Energy	1975-01-31
Financials	1975-01-31
Health Care	1975-01-31
Industrials	1975-01-31
Information Technology	1975-01-31
Materials	1975-01-31
Telecommunication Services	1975-01-31
Utilities	1975-01-31

Appendix B: Alternative Country/Industry Estimates

We estimate country and industry effects using the method proposed in Eiling, Gerard, and De Roon (2012), which allows for non-unit industry and country exposures, and time-varying exposures using rolling regressions.

Figures 12 and 13 plot the Eiling, Gerard, and De Roon (2012) measure based on 24-month rolling regressions alongside measures based on the Heston and Rouwenhorst (1994) approach. To ensure comparability, we calculate the cap-weighted average of 24-month rolling standard deviation of country and industry effects based on the Heston and Rouwenhorst (1994) methodology.

Figure 12: Alternative Estimates of Country and Industry Effects: Developed Markets

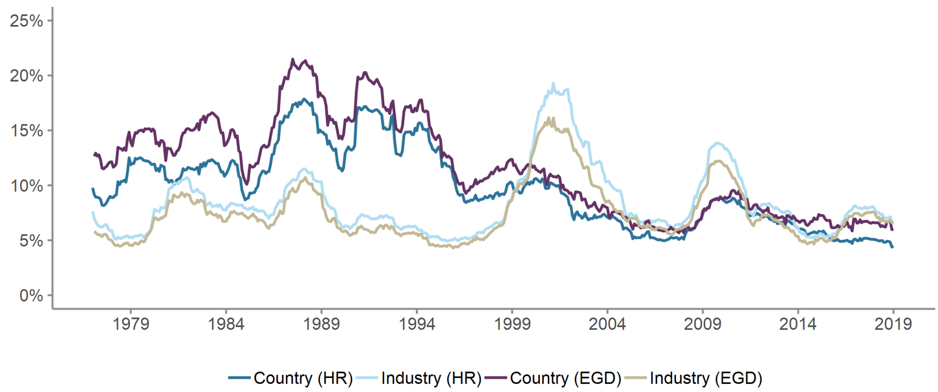

Figure 13: Alternative Estimates of Country and Industry Effects: Emerging Markets