International Portfolio Diversification: Industry, Country, and Currency Effects Revisited

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Abstract

We analyze the role of industrial structure, currency risk and country factors on country returns and their impact on international diversification strategies. We evaluate the performance of industry versus country portfolios in terms of the Jensen measure, which indicates whether industry or country portfolios offer investors sufficient diversification benefits. We develop a new test to compare the Sharpe ratios of different portfolios constructed from the same primitive assets. We use this test to investigate the relative efficiency of international diversification strategies based on industry or country indices. Unconditional tests suggest that there are no significant differences in terms of maximum Sharpe ratios between industry, country and ICAPM motivated portfolios of the world index and currency deposits. However style analysis shows that it is easier to mimic industries with countries than vice versa. Conditional tests confirm these results and show further that, under short sales constraints, dynamic portfolios constructed from the world index and currency deposits significantly outperform both country and industry portfolios. The results suggest that country specific factors rather than industrial structure drive international diversification benefits but that further gains can be achieved by considering ICAPM motivated portfolios that explicitly include currency deposits .

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1 Introduction

Although the benefits of international diversification arising from the relatively low level of correlation among national equity markets are now well documented (e.g. Solnik, 1974, Elton and Gruber, 1992, De Santis and Gerard, 1997), the issue of which factors drive these correlations remains controversial among both academics and professional portfolio managers. Many have argued that the low correlations between country equity indices arise from differences in economic conditions across national boundaries due to variations in regulatory environment, economic policies, and growth rates. Others claim that it is due mostly to their different exposure to exchange rate changes. Lastly it has been argued that differences in industrial composition drive most of the variation in international stock returns.

The issue of whether country specific factors, currency risk or industry composition are the main determinants of the differences across national equity returns has taken added practical relevance with the introduction of the euro as the common currency for most European community countries. The adoption of the single currency has seen most professional investment managers abandoning geographical diversification within the EMU and reorganizing their holdings on the basis of pan-European industry groupings. This behavior reflects the belief that the elimination of intra-EMU exchange rate risk has erased the major source of geographical diversification benefits within the EMU. Although it is now well established that exposure to currency risk is a major determinant of international equity returns (see for example Dumas and Solnik, 1995, De Santis and Gerard, 1998, De Santis, Gerard and Hillion, 1999) it is unclear that the remaining differences between country index returns are solely driven by differences in industrial composition. If that were not the case, international investors abandoning cross-country diversification strategies in favor of cross-industry diversification strategies may very well forfeit a large fraction of the benefits of international diversification.

To address these issues, we focus our analysis from the perspective of the portfolio manager. We take industry portfolios within countries as our primitive assets and consider whether we should combine them either in global industry portfolios or in country portfolios as the intermediate step in constructing internationally diversified portfolios. Using country portfolios to construct globally diversified portfolios allows investors to fine tune country exposures while constraining their choice of industry exposures. If industry factors are the primary determinants of returns differences across countries, this approach will yield suboptimally diversified portfolios and entail an efficiency loss. A similar reasoning applies to international diversification strategies based on global industry portfolios. Such portfolios allow investors to fine tune industry exposures while constraining the choice of country exposures. If country specific factors are the primary determinants of returns differences across countries, this will result in lower diversification benefits. These efficiency losses are what we aim to measure, compare and test. A similar approach is used to investigate whether the country specific component is due mainly to currency risk, or to other country specific factors.

To conduct our investigation, we develop a new test to measure and evaluate the statistical significance of the diversification gains of some portfolio strategies over others. The test is related in spirit to the spanning tests developed by DeRoon, Nijman, and Werker (2001). While spanning tests evaluate the benefits of adding new assets to an initial menu of assets, our test is designed to evaluate the benefits of alternative portfolio strategies constructed from the same set of primitive assets. It has thus wide applicability beyond the empirical issue investigated in this paper. This test is comparable to the test described by Jobson and Korkie (1981), but does not assume normality of asset returns. To shed further light on the link between country, industry and currency returns, in a second stage, we use style analysis. We propose a novel way to implement style analysis in a conditional framework to include managed portfolios among the base assets.

The role of industrial structure in explaining cross-country return differences and covariability was first investigated by Lessard (1974). In recent years, the issue has received renewed attention in papers by Roll (1992), Heston and Rouwenhorst (1994) and Griffin and Karolyi (1998)[1]. Using three years of daily data for 24 countries over the 1988 to 1991 period, Roll finds that approximately 40% of country returns volatility is explained by industry factors, while approximately 20% is attributable to exchange rate changes. Heston and Rouwenhourst however, using monthly data for 12 European countries over the 1978-1992 period and a different empirical approach, show that Roll's methodology significantly overstates the role of industry factors in country returns. They find that differences in industrial structure have a negligible impact and account for less than 1% of the cross sectional variance in country index returns. Griffin and Karolyi, using the same methodology, confirm the results of Heston and Rouwenhourst using weekly returns from 1992 to 1995 on a larger sample of countries and industries. Using a finer industry classification scheme, they uncover significant differences in the role of country and industry factors between traded good and non-traded good industries. For industries in the traded good sector country factors are dominant and industry factors are negligible. For the non-traded good sector, the role of country factors, while still dominant, is reduced and the industry factors become significant. Although the last two papers conclude on the dominance of country factors in international equity returns, neither paper assesses the role of currency risk in those factors. Furthermore none of the cited papers is able to measure and to test the added benefits of country diversification over industry diversification. Our methodology allows us to address these issues.

[1]Further papers investigating the impact of industrial structure on portfolio strategies include Grinold, Rudd and Stefek (1989), Drummen and Zimmerman (1992), Beckers, Grinold, Rudd and Stefek (1994), Cavaglia et al. (1995), Heston and Rouwenhorst (1995).

We conduct our empirical investigation using monthly returns for industry and country indices for the G7 countries from January 1974 to November 1998. Hence we bring to bear a much longer sample period than previous studies and cover the major developed markets. Further we investigate the role of a given country's domestic component of the global industry returns in explaining that country's returns, and the impact of an industry's local component in country indices in explaining that industry's returns. Lastly, we explicitly include currency deposits in the set of assets under investigation.

We first implement our tests in an unconditional framework, in a sense assuming fixed portfolio strategies over the whole sample period. In practice, however, investors revise their estimates of returns and risks as new information becomes available and rebalance their portfolio accordingly. Hence, in a second stage we implement conditional versions of the tests using commonly available economic variables as a proxy of the investor's information set.

Our unconditional results indicate that there are no significant differences between industry and country portfolios in terms of maximum Sharpe ratios. However, a style analysis suggests that it is easier to mimic global industry portfolios with country indices than vice versa. Moreover, our results show that the domestic content of global industry returns is critical to the ability of industry portfolios to track country returns. Excluding a country (industry) component from industry (country) returns, yields a sharp decrease in the mimicking properties of industry indices, but hardly affects the mimicking properties of country indices. Further, adding an industry to the set of country portfolios which exclude that industry component does not lead to significant alphas and diversification benefits, whereas the opposite is true for country components in industry returns. We find that when industry portfolios are constructed with a particular country's factor omitted, adding the country yields significant performance improvement. These results are sharper when short sales constraints are imposed. This suggests that country effects rather than industrial structure are the dominant influence on international equity returns. Our results show further that portfolios constructed from the world index and currency deposits as suggested by the ICAPM yield, in an unconditional framework, no benefits over either country or industry based portfolios.

The results of the conditional analysis shows that the maximum Sharpe ratio of unconstrained portfolios of industries is significantly larger than that of country portfolios, but that neither industry or ICAPM motivated portfolios comprising the world equity index and short term deposits on the three major currencies spans the other one. If short sales restrictions are imposed on equity positions, the difference between country based and industry based portfolios becomes insignificant, both in economic and statistical terms, showing that short sales constraints are especially important for industries. In this case however, the ICAPM portfolios deliver dramatically superior Sharpe ratios relative to the country or industry only portfolios.

This suggests that including currency deposits delivers significant diversification and return enhancement benefits to international portfolios. Finally, our conditional tests confirm the unconditional analysis in that it is easier to mimic industries with countries than vice versa and that country factors are much more important than industry factors in explaining international diversification benefits.

The paper proceeds as follows. Section 2 develops the empirical framework and introduce our new test. Section 3 describes the data. Section 4 investigates the benefits of country vs industry diversification in a static framework. Section 5 reports the results of the conditional analysis. Section 6 concludes. An appendix details the derivation of some econometric results and data manipulations.

2 Empirical framework

2.1 Efficiency tests

The main purpose of this paper is to analyze whether investors should invest in country or in industry portfolios, or whether restricting their choice to either country or industry portfolios is suboptimal relative to combining both sets of assets. The latter question comes down to testing whether in terms of the familiar Jensen measure, industry portfolios outperform country portfolios or vice versa. In our framework, investors can base their portfolio on a set of industries with excess return vector r_t^y, or a set of countries with excess return vector r_t^x. The combined set of assets will be denoted by the return vector $r_t = (\ r_t^{x\prime} \quad r_t^{y\prime}\ )'$. If it is sufficient for an investor to invest in the set x or y only, then the intercepts a_y or a_x in the regressions

$$r_t^y = a_y + B_y r_t^x + \varepsilon_t^y, \quad (1a)$$

$$r_t^x = a_x + B_x r_t^y + \varepsilon_t^x, \quad (1b)$$

should be equal to zero. If $a_y = 0$, then investors can construct their global portfolios from the countries r_t^x only, whereas if $a_x = 0$ investors can build their portfolios on the industries r_t^y only. These results follow from standard spanning tests as described e.g. in Huberman and Kandel (1987), Gibbons, Ross and Shanken (1989) and Jobson and Korkie (1989). Britten-Jones (1999) provides an alternative to test the relevance of assets within a portfolio by looking at the sampling error of the efficient portfolio weights. The extension of spanning tests to the case with short sales constraints is given DeRoon, Nijman and Werker (2001).

Having Jensen measures a_y or a_x that are different from zero, indicates that portfolios that are based on countries or industries only are inefficient relative to portfolios in which countries or industries are combined. It may be the case though that portfolios that are based on both countries and industries are indeed more efficient than portfolios based on countries or indices exclusively, but that there is no difference in the efficiency of country and industry only portfolios. Since the interest in this paper is also in the relative efficiency of country versus industry based diversification, we need a test for the relative efficiency of two portfolios.

If country and industry only portfolios are equally efficient, then the maximum Sharpe ratios of the two sets must be equal. The maximum Sharpe ratios of set x and y will be denoted θ_x and θ_y respectively, whereas the maximum Sharpe ratio of the combined sets is θ. It is well known that there is a straightforward relationship between the maximum Sharpe ratios θ_x, θ_y, and θ on the one hand and the Jensen regressions (1) on the other. The increase in the maximum Sharpe ratios is determined by the adjusted Jensen measures, using:

$$\theta^2 - \theta_x^2 = a_y' \Omega_{yy}^{-1} a_y, \tag{1c}$$

$$\theta^2 - \theta_y^2 = a_x' \Omega_{xx}^{-1} a_x, \tag{1d}$$

where Ω_{ii} is the covariance matrix of ε_t^i in (1). The hypothesis of interest is whether θ_x equals θ_y. Taking the difference of (1c) and (1d) gives

$$\lambda = \theta_y^2 - \theta_x^2 = a_y' \Omega_{yy}^{-1} a_y - a_x' \Omega_{xx}^{-1} a_x. \tag{2}$$

Therefore, the hypothesis that the two sets x and y are equally efficient can be formulated as $H_0 : \lambda = 0$.

A test for the hypothesis that λ equals zero may be based on the weighted least squares type regressions

$$\Omega_{yy}^{-\frac{1}{2}} r_t^y = c_y + D_y r_t^x + u_t^y, \tag{3a}$$

$$\Omega_{xx}^{-\frac{1}{2}} r_t^x = c_x + D_x r_t^y + u_t^x. \tag{3b}$$

Since this regression amounts to a simple linear transformation of the dependent variables in the regressions in (1) it follows immediately that

$$c_y = \Omega_{yy}^{-\frac{1}{2}} a_y,$$

$$c_x = \Omega_{xx}^{-\frac{1}{2}} a_x,$$

and therefore that

$$\lambda = c_y' c_y - c_x' c_x. \tag{4}$$

Thus, the hypothesis that the two sets of assets, x and y are equally efficient can be tested by estimating the regression in (3) and testing the hypothesis that $c_y' c_y - c_x' c_x = 0$. Since this is a single nonlinear restriction on the intercepts, a Wald test statistic for this restriction will, under the null-hypothesis and standard regularity conditions, asymptotically be χ_1^2-distributed. An alternative test for the difference between two Sharpe ratios can be found in Jobson and Korkie (1981), but their test requires normality of asset returns which is not the case for the test described here.

In practice the test will require a two-step estimation, where in the first step we estimate the regression in (1). This estimation will yield consistent estimates of the covariance matrices Ω_{xx} and Ω_{yy} which in the second step can be used to estimate the transformed regression in (3). Naturally, this implies that we will have estimation error in the dependent variables in (3). Appendix A describes how consistent estimates of the covariance matrix of the parameters c and D can be obtained, taking into account the estimation error in $\widehat{\Omega}$.

Conditional strategies are easily incorporated in this framework by using managed portfolios. Since the tests described above rely on the use of excess returns, the return space can be increased by considering returns on managed portfolios, $z_{k,t-1}r_{i,t}$ where $z_{k,t-1}$ is the value an instrument takes at time $t-1$. The managed portfolio strategy implies that each period a position with a size $z_{k,t-1}$ in asset i is chosen. If there are L assets and K instruments, excluding a constant, then we get a total of $(K+1)\times L$ assets in this way.

2.2 Style analysis

An alternative way to investigate country versus industry factors is to look at the 'mimicking abilities' of country versus industry portfolios. It may be that industry portfolios can be replicated with country portfolios, while the reverse is not true. Style analysis (Sharpe (1992)) provides a tool to study mimicking portfolios. The objective is to find a positive weight portfolio of the benchmark assets, such that this portfolio return mimics as closely as possible the returns on a target fund. For instance, the styles of the industries in terms of the countries is determined by estimating the regression:

$$r^y_{i,t} = \alpha_i + \sum_{c=1}^{L} b_{i,c} r^x_{c,t} + e^y_{i,t}, \tag{5a}$$

$$\text{s.t. } b_{i,c} \geq 0 \quad \forall i,c, \qquad \sum_{c=1}^{L} b_{i,c} = 1. \tag{5b}$$

where L is the number of assets in the mimicking portfolio. The restrictions that the coefficients $b_{i,c}$ are all positive and that they sum to one imply that they form a positive weight portfolio, which is known as the *style* of the industry. This yields the country portfolio which mimics industry i best, in the sense that this is the portfolio which minimizes the variance of the tracking error. To the extent that a particular industry is concentrated in one country, we may also expect that the coefficient $b_{i,c}$ for this country will be relatively large.

The R^2 of the style regression gives us an estimate of how well an industry (country) can be mimicked by countries (industries). The style coefficients together with the R^2 provide information on the risk characteristics of countries in terms of industries and vice versa. An additional advantage of using style analysis in this way is that we put less weight on the mean returns than the mean-variance analysis above.

As with the efficiency tests described above, we also want to include conditional strategies in style analysis. To implement conditional style analysis we need to modify slightly the approach used earlier. Assume that K instruments z_t can be used to predict asset returns, in particular the returns on the benchmarks. It is assumed that the instruments in z_t are normalized such that

$$0 \leq z_{kt} \leq 1, \qquad \forall k, t.$$

One way to normalize the instrument is to consider the transformation

$$\Phi\left(\frac{z_t - m_z}{s_z}\right),$$

where m_z is the mean of z_t, s_z is the standard deviation of z_t, and $\Phi()$ is the cumulative normal distribution function.

The vector z_t does *not* include a constant in our setup. It is then useful to construct managed portfolios from the instruments, $z_{kt-1}r^x_{ct}$ where each period a position with a size z_{kt-1} in asset i is chosen. In this way we get a total of $(K+1)\times L$ assets. Consider the expanded style regression

$$r^y_{it} = \alpha_i + \sum_{c=1}^{L}\beta_{ic0}r^x_{ct} + \sum_{c=1}^{L}\sum_{k=1}^{K}\beta_{ick}z_{kt-1}r^x_{ct} + \varepsilon^y_{it}. \tag{6}$$

The total position in asset c is now equal to

$$w_{ict} = \beta_{ic0} + \sum_{k=1}^{K}\beta_{ick}z_{kt-1}. \tag{7}$$

The issue is how to incorporate the portfolio and positivity constraints with respect to each asset. A way to make sure that the total asset positions sum to one is to impose the constraints

$$\begin{aligned} \sum_{c=1}^{L}\beta_{ic0} &= 1, \qquad (8)\\ \sum_{c=1}^{L}\beta_{ick} &= 0, \qquad \forall k. \end{aligned}$$

In this way, the net effect of each instrument z_{kt} is zero, no matter what the value of that instrument is, and the total portfolio positions will always sum to one.

Next, we need to make sure that the net position in asset c is always positive. Since we normalized the instruments to take values between zero and one only, the maximum value of z_{kt} is always one, and positivity of the net position in asset i is guaranteed if

$$\begin{aligned} \beta_{ic0} &\geq 0, \\ \beta_{ic0} + \beta_{ick} &\geq 0, \quad k = 1, ..., K \\ \beta_{ic0} + \beta_{ick} + \beta_{icl} &\geq 0, \quad k, l = 1, ..., K, l \neq k \\ &\vdots \\ \beta_{ic0} + \sum_{k=1}^{K} \beta_{ick} &\geq 0. \end{aligned} \tag{9}$$

This implies a total of 2^L positivity constraints per asset. If β_{ic0} plus any combination of the β_{ick}'s is positive, then the total position in asset i will always be positive. The restrictions in conditional style analysis are therefore given by (8) and (9), a total of $(L + 1 + K \times 2^L)$ restrictions.

3 Data

We collect monthly returns and market value data on the DataStream(DS) aggregate equity market indices for the G7 countries and for the ten major industry sectors within each country. Our sample covers the period December 1973 until November 1998 (299 observations). Both the country and the industry indices have dividends reinvested. In addition to the seven country and industry sector returns, we use returns on the forward contracts for the different currencies. The forward returns are constructed from the exchange rates and one-month Eurocurrency rates. From the country indices, we construct a G7 market portfolio. Similarly we construct the G7 global industry portfolios from the country sector indices[2]. In this fashion, the geographical and industry span of the global industry portfolios and the market portfolio proxy are exactly identical. All indices are value weighted and returns are computed both in US$ and in local currency.

Summary statistics of the returns for the seven countries, ten industry sectors and six currency deposits can be found in Table 1. The summary statistics show that the country indices have somewhat higher mean returns than the industry indices, but appear to have somewhat higher standard deviations as well. The p-values for the Wald test statistics that the mean returns are equal to zero show that this hypothesis is easily rejected for both the countries and the industries. The hypothesis that the mean returns are equal can not be rejected for either the countries or the industries,

[2] Details of the construction of the G7 market portfolio and global industry indices are provided in the appendix.

nor can the equality of industry and country mean returns. Therefore, according to those tests, the cross-sectional variation in the mean returns is not very high. The next three columns show the average correlations of each country, industry and currency with the set of countries, industries and currencies respectively. Thus, the third column shows the average correlation of each individual index with the seven country indices. The correlation of each index with itself is always excluded from the mean. Similarly, the fourth and fifth columns show the average correlation of each individual index with the ten industry portfolios and the six currency deposits. The table shows that the average correlation between the countries is noticeably lower than the average correlation between the industries. This suggests that diversifying across countries may yield higher benefits than diversifying across industries. Also, the countries appear to have a higher correlation with the industries than with other countries, whereas the industries tend to have higher correlations with other industries than with countries. Lastly the level of the correlations between currencies and both countries and industries are very similar. This correlation structure suggests that differences between countries are more pronounced than differences between industries and may not be fully accounted for by currency risk.

4 Unconditional tests of diversification effects

4.1 Countries vs. industries: a portfolio perspective

The summary statistics suggest that industries are more highly correlated with each other than countries, whereas the cross sectional differences in mean returns appear to be small, although for the countries they are somewhat higher than for the industries. In this section we analyze whether the differences in the characteristics between country and industry returns also translate into portfolio differences.

Obviously, a sufficient condition for a country based portfolio to be efficient for the entire set of country and industry indices, is if the country indices span the industry indices. In the case of excess returns this comes down to a zero Jensen measure of each of the industries relative to the seven country indices. Similarly, a zero Jensen measure of each country relative to the ten industries is a sufficient condition for the existence of an industry portfolio that is efficient for the entire set of indices. Panel A of Table 2 shows the Jensen measures of each industry relative to the seven countries and the Jensen measures of each country relative to the ten industries. Panel A of Table 2 also reports p-values associated with the spanning test-statistic, i.e., a test whether all n Jensen measures are jointly equal to zero. Also reported are the maximum attainable Sharpe ratios, with or without short sales constraints, the p-value of the loss of efficiency due to the short sale constraints and the p-values of the Wald tests of the difference between the maximum Sharpe ratios for the two sets of assets.

The spanning tests suggest that the industries do not outperform the countries and that the countries do not outperform the industries either. This follows from the p-values of the spanning test statistic, but also from the individual Jensen measures which are not significantly different from zero in all but one cases: it is only for the Basic industries that we find a significant underperformance relative to the country-based portfolio. Notice that a negative (positive) performance measure of an industry implies that the country-based portfolio is overweighted (underweighted) w.r.t. this industry. However, the negative performance of the Basic industries does not show up in the joint test for outperformance of all ten industries. Thus, this first test suggests that it does not matter whether an investor constructs a portfolio from industries or from countries. When a portfolio is constructed from countries (industries), its unconditional Sharpe ratio cannot be improved upon by changing the industry (country) weights.

The fact that we cannot reject efficiency for the country based or the industry based portfolios, suggests that the maximum attainable Sharpe ratios of the industries and the countries are about the same. The third to last row of Panel A shows that the maximum Sharpe ratio for the industries is 0.260 whereas for the countries it is 0.233. Although this difference is economically meaningful, the p-value for the Wald test whether the difference in Sharpe ratios is zero is 0.615, implying that we cannot reject the hypothesis that the two Sharpe ratios are in fact equal, which is consistent with the spanning tests.

Notice that the portfolios that yield these maximum Sharpe ratios may contain short positions which may not always be implementable in realistic investment settings. Therefore, the last row of Panel A of Table 2 also shows the maximum attainable Sharpe ratios in case short selling is prohibited. In this case, the maximum Sharpe ratios for the countries and the industries become almost indistinguishable, showing that from an investor's perspective the two portfolios diversification possibilities are equally attractive. The decrease in Sharpe ratios that results from the short sales constraints is statistically insignificant, but economically important. This is especially the case for the industry based portfolios where the Sharpe ratio is lowered from 0.260 to 0.202.

4.2 Excluding country and industry factors

Although the results sofar suggest that when constructing passive portfolios investors may be indifferent between country based portfolios and industry based portfolios, the tests do not tell us whether the diversification benefits are driven by country effects or industry effects. To answer this question we would like to know for instance if industry j adds diversification benefits to the countries when the industry component is removed from the countries. Similarly, for a specific country i we would like to test the performance relative to the industries, when the country i component is removed from the industries. Since the DataStream industry indices as well as their market value are available at the country level, for each country and industry, we recompute the G7 industry indices excluding each country's component and country indices excluding each industry's component. Hence when we regress for instance Canada on the global industry indices, none of the global industry indices will include Canadian stocks. All our recomputed indices are market value weighted across their remaining components. We then replicate the spanning tests for industries and countries. Denoting the return of country c excluding industry i as $r_{c,t}^{x\backslash i}$ and the return of industry i excluding country c as $r_{i,t}^{y\backslash c}$, our tests are now based on the following regressions:

$$r_{i,t}^{y} = a_i + \sum_{c=1}^{L} \beta_{ic} r_{c,t}^{x\backslash i} + \varepsilon_{i,t}^{y}, \tag{10a}$$

$$r_{c,t}^{x} = a_c + \sum_{i=1}^{N} \beta_{ci} r_{i,t}^{y\backslash c} + \varepsilon_{c,t}^{x}. \tag{10b}$$

Panel B of Table 2 shows the results of these tests. First, as in Panel A we see that for the industries the Basic industries show a significant underperformance relative to the country based portfolio, whereas all other Jensen measures are not significantly different from zero. The second but last line of Panel B shows the p-value for a Wald test whether all ten alphas are equal to zero. As with the spanning test in Panel B we cannot reject the hypothesis that all industry alphas are zero. Notice that this joint test is not a spanning test in the traditional sense (e.g., Huberman and Kandel, 1987, DeRoon, Nijman, and Werker, 2001), since the benchmark assets are different in each regression (i.e., each regression excludes a different industry).

For the countries we see that now there are two out of seven countries that show a significant outperformance relative to the industries, at least at the ten percent level. More importantly, the joint test whether the seven country alphas are zero results in a p-value of only 0.039. Thus, when constructing portfolios from industries, leaving out a country may lead to underdiversified portfolios. On the other hand, the tests in Panel B suggest that leaving out an industry from country based portfolios does not lead to a significant loss in efficiency. This suggests that country effects are more important than industry effects in realizing international diversification effects.

Since in the Jensen regressions (10) in Panel B the test assets and the benchmark assets are mutually exclusive it makes sense to incorporate short sales constraints in these regressions. Notice that in Panel A the stocks that were included in the test asset were also included in the benchmark assets. Therefore, a negative Jensen measure for an industry (country) implied that the country (industry) based portfolio was underweighted w.r.t. that industry (country). In (10) on the other hand, a negative Jensen measure for an industry (country) implies that a short position should be taken in that industry (country). We follow the procedure outlined in

DeRoon, Nijman, and Werker (2001) to incorporate short sales constraints on both the test assets and the benchmark assets in each of the regressions in (10). The last line of Panel B of Table 2 shows the p-values of the Wald test that all industry alphas and all country alphas are zero, taking into account that short sales are prohibited. These p-values confirm our findings: industries do not lead to a significant increase in performance relative to country based portfolios, even if the industry component is removed from the countries, but the countries do lead to a significant increase in performance relative to the industries when country specific components are removed from industries.

Thus, although Panel A of Table 2 shows that there is not a material difference in portfolio performance when portfolios are constructed from either countries or industries, the results in Panel B suggest that it are actually the country effects rather than the industry effects that drive international diversification benefits.

4.3 Style analysis

As explained in Section 2, an alternative way to study the relative importance of country and industry factors, is to analyze the mimicking properties of country and industry portfolios. This can be done by finding the replicating portfolio of industries (countries) in terms of countries (industries), using style analysis (Sharpe, 1992).

Table 3 shows the styles of industry portfolios in terms of country portfolios. Similarly, in Table 4 the styles of the countries are given in terms of industry portfolios. Here we may expect a coefficient $b_{c,i}$ to be relatively large if industry i is important for country c. For instance, according to the coefficients in Table 4, Finance is an important industry for Japan, whereas Resources are relatively important for Canada.

The last row of each panel of Table 3 and Table 4 presents the R^2 of the style regression. The average R^2 in Table 3 is 0.69, whereas in Table 4 it is only 0.50. This suggests that it is easier to mimic industries with country portfolios than vice versa, even though there are more industries than countries in our sample.

A more interesting picture arises if we look at the mimicking abilities of countries (industries) for a particular industry (country), when that industry (country) is removed from the country (industry) indices as we did in the previous section. Thus, we are using the analysis as in (5) but with (5a) replace by

$$r_{i,t}^{y} = \alpha_i + \sum_{c=1}^{L} b_{ic} r_{c,t}^{x\backslash i} + e_{i,t}^{y},$$

and we make a similar adjustment for the country regression. We replicate the style analysis using these regressions for industries and countries. The results are reported in Table 5 for the industries and in Table 6 for the countries and should be compared to the results in Tables 3 and 4.

Consider first the regression of the industry returns on the country returns, where, for each industry, the country returns exclude that industry contribution. Hence none of the stocks composing the industry returns are also included in country indices. The average R^2 is 62%, while in Table 3, it is 69%, a decrease of 7%. Hence the ability of country portfolios to mimic industry portfolios is not materially affected by excluding from the country portfolios all that industry' stocks.

Now consider the regression of the country returns on the industry returns, where for each country, that country's stock have been excluded from the industry returns. The average R^2 in Table 6 is 24%, less than half of the 50% it was in Table 4. Although the reduction in R^2 is minimal for Italy and France, it is larger for the other countries and extremely dramatic for Japan and the US. Take the US for example. The R^2 of the US regression in panel b of Table 4 is 79%. In Table 6 it drops to -12%. A closer look at the loadings on the industry portfolios, shows that in both regression the US mimicking portfolio comprise the same three industries with similar loadings. This suggests that the domestic component of the industry portfolios is critical in the ability of industry portfolios to mimic country indices, especially for the larger economies.

Combining the results of Table 3 to 6, the following conclusions emerge. Given the high R^2 of the style analysis regressions of the industries in terms of countries, portfolios of country indices perform very well to mimic the returns of industry portfolios, even when the country indices exclude all stocks from that industry. This suggest that global industry portfolios have a "country structure" that can be duplicated well with stocks outside of that industry. On the other hand it is much more difficult to replicate the returns of country portfolios with industry portfolios, even more so when that country's stocks are excluded for the industry portfolios. Overall the results lend support to the conclusion that "country effects" rather than industrial structure is the main determinant of international equity returns. For international investors this suggests that the benefits of international diversification stem mostly from cross-country diversification, rather than form cross-industry diversification.[3]

4.4 An ICAPM perspective

A straightforward alternative to country or industry based portfolios are the portfolios suggested by the International CAPM (ICAPM) (Adler & Dumas, 83) and its empirical implementations (Dumas and Solnik, 1995, De Santis and Gerard, 1998): the world portfolio and a number of foreign currency deposits. If the ICAPM is a valid pricing model, then neither industries nor countries should be able to outperform the world portfolio and foreign currency deposits. Hence the maximum Sharpe ratio that can be obtained with the ICAPM portfolios should be no worse than the

[3]We replicated all the tests with minimum variance hedged returns. The results are virtually unaffected.

maximum Sharpe ratio that can be obtained with either the country or the industry portfolios. Moreover, since there is no reason for the industry and country portfolios to constitute efficient portfolios, it may very well be the case that the ICAPM portfolios outperform the country or the industry portfolios.

Our specification of the ICAPM uses the value weighted portfolio of the G7 countries as the World portfolio plus three currency deposits: the Deutschemark, the British Pound and the Japanese Yen. The Canadian Dollar is excluded because of its high correlation with the US Dollar. Similarly, because of the fact that the Deutschemark, the French Franc, and the Italian Lira are all from the EMU countries, we only use one of those currencies in our ICAPM (see also De Santis, Gerard, and Hillion, 1999). Thus, according to our specification, we should have that for each asset with excess return $r_{i,t}$, the intercept α_i in the regression

$$r_{i,t} = \alpha_i + \beta_i r_t^w + \sum_{j=1}^{3} \delta_{ij} f_{j,t} + \varepsilon_{i,t}. \tag{11}$$

is zero. Here r_t^w is the excess return on the world portfolio and $f_{j,t}$ are the excess returns on the currency deposits.

Table 7 reports tests of the comparative performance of portfolios constructed from country indices, portfolios constructed from industry indices, and ICAPM inspired portfolios of the world equity index portfolio and Yen, DEM and Pound one month Eurodeposits. We also compare these portfolios to the passive world benchmark. Consider first the tests of the performance of the countries versus the ICAPM portfolios. The first panel reports the p-values associated with the Wald tests that the ICAPM portfolios span the countries and that the countries span the ICAPM portfolios respectively. The p-value of 0.190 shows that we can not reject the hypothesis that the ICAPM portfolios span the countries , i.e., we cannot reject the validity of the (unconditional) ICAPM. By the same token, the second p-value of 0.195 shows that we can not reject the hypothesis that the countries span the unconditional ICAPM portfolios. This suggests that investors are indifferent between an investment in the ICAPM portfolios and an investment in the country portfolios.

The second panel reports the maximum attainable Sharpe ratios for the countries and the ICAPM portfolios, with or without short–selling, as well as a p-test for the difference between these Sharpe ratios. In both cases, the equality of the Sharpe ratios can not be rejected. Note that short selling constraints on the equity positions leaves the maximum Sharpe ratio of the ICAPM portfolio unaffected. This is a result of the fact that we do not impose short selling constraints on the currency deposits.

In principle of course, the countries should be able to mimic the world portfolio. To see whether this is indeed the case, we repeat the same tests for the countries versus the world portfolio, excluding the currency deposits. In this case again, neither the hypotheses that the countries span the world portfolio or that the world portfolio spans the country portfolio can be rejected. Further, although country portfolios yield higher Sharpe ratios than the world portfolio with or without short sales constraints, we cannot reject the equality of the maximum Sharpe ratios of the countries and the world. This suggests that the world portfolio is efficient relative to the country portfolios. These results also suggest that in an unconditional framework, including currency deposits is of little benefit to portfolio performance. This is consistent with the evidence reported by Claessens and Jorion (1991) and De Santis and Gerard (1998).

Similar tests for the industry versus the ICAPM and world portfolios are reported in Table 7. The first panel of Table 7 shows that industry portfolios are spanned by the ICAPM assets and industries also span the ICAPM portfolio. This is also true when we leave out the currency deposits and compare the industry portfolios with the world portfolio only, implying that we cannot reject the efficiency of the world portfolio in terms of industry weights. However, the second panel does show that we can reject the difference between the maximum Sharpe ratio of the industry portfolios and the world portfolio: the industry Sharpe ratio of 0.260 is significantly higher than the Sharpe ratio of the world portfolio, 0.152, at least at the ten percent significance level. However, if we include short sales constraints the maximum Sharpe ratio of the industries drops to 0.202, which is no longer significantly different from the Sharpe ratio of the world portfolio. Also, even if short selling is allowed, the difference between the maximum Sharpe ratio of the industries and the ICAPM portfolios (including currency depostis) is not statistically significant, although in economic terms the difference is important.

Overall, as with the country and industry portfolios in Section 4.1, we can not detect significant differences between the performances of portfolios based on either countries, industries, or the ICAPM. There is a difference between the efficiency of the world portfolio (with no currency deposits added) and the industry based portfolio, but this difference disappears once we take short sales constraints into account.

5 Dynamic country and industry portfolios

Recent evidence (see Dumas and Solnik, 1995 and De Santis and Gerard, 1998) suggests that the impact of currency risk on equity returns varies considerably over time and may be difficult to detect in an unconditional framework. Further, investors typically rebalance their portfolio regularly in response to changing market conditions. Dynamic strategies may heighten the difference between the performance that can be extracted from alternative sets of assets and more clearly delineate their differences. In this section we incorporate conditioning information and managed portfolios in both our spanning tests and style analysis.

To describe the investor's information, we use a set of variables similar to those used in previous research. The instruments include: a constant, the dividend price ratio on the world equity index in excess of the one-month EuroUS$ rate, the US term premium and the U.S. default premium, measured by the yield difference between Moody's Baa and Aaa rated bonds. In addition to the global variables, we use also one country specific variable to predict changes in currency risk premiums: the difference between the return on the local short term deposit and the return on the short term deposit in the reference currency, which we refer to as the interest rate differential. All variables are used with a one–month lag, relative to the excess return series. If we denote the K instruments by the K-vector z_{t-1}, then conditioning information can be implement by adding for each (country or industry) index i the K managed portfolio returns $z_{k,t-1}r_{i,t}$, where each period a position of size $z_{k,t-1}$ in asset i is chosen. In this way we get a total of $(K+1) \times L$ assets.

5.1 Conditional spanning tests

Table 8 reports the results of the conditional spanning and maximum Sharpe ratio tests for portfolios constructed from countries, industry indices, and the ICAPM portfolios. The first panel reports the p-values of the spanning tests, while panel B reports the maximum Sharpe ratio tests.

Turning first to the comparison of managed industry and managed country portfolios, the spanning tests suggest that industries outperform the countries, but that countries do not outperform the industries. We cannot reject the efficiency of a portfolio based on industries relative to the country indices, but we can reject the efficiency of a portfolio based on countries relative to the industry indices. Not surprisingly, the maximum Sharpe ratio for the industries is 0.619 whereas for the countries it is only 0.437. First, comparing these values to the maximum Sharpe ratios obtained in the unconditional analysis (0.260 and 0.233 respectively) is indicative of the value of information and dynamic strategies in enhancing portfolio returns. Second, the difference in Sharpe ratios is economically large and statistically significant. Thus, both the spanning tests and the difference in Sharpe ratio test suggest that, in the absence of short selling restrictions, managed industry portfolios are more attractive than managed country portfolios.

However, these managed portfolios may not always be implementable due to possibly large short positions. Imposing a prohibition on short sales dramatically alters the results.[4] The maximum Sharpe ratio for the managed industry portfolios drops from 0.619 to 0.213, which is significant at the 0.001 level. For the managed country portfolios, the drop is from 0.437 to 0.225, large but not significant. With short sale constraints, managed country portfolios and managed industry portfolios yield

[4] As explained in the Section 2.2, when including short sales constraints, we normalize the instruments, such that they are always in the range $[0, 1]$. A long position in a managed portfolio $z_{k,t-1}r_{i,t}$ then always implies a long position in the underlying assets, and we can simply impose short sales constraints on the managed portfolios.

Sharpe ratios that are about equal. These results show that short sales constraints are more binding for industry portfolios than for country portfolios. This leads to believe that the superior performance of the industry portfolios in terms of the spanning test is highly dependent on the ability to short the industry portfolios, and therefore they may not be attainable for many investors or in equilibrium strategies. Although not reported here, we find that the R^2s from regressions of the returns on the instruments are generally higher for the industries than for the countries.[5] This higher predictability may explain the better performance of the industry portfolios if short selling is allowed. However, apparently, the predictability leads investors to take many short positions and when this is precluded the higher predictability no longer leads to better portfolio performance.

Comparing managed country portfolios and managed industry portfolios to managed ICAPM portfolios, the Wald tests indicate that the ICAPM managed portfolios are not spanned by either managed country portfolios or managed industry portfolios, while the managed ICAPM portfolios do span the countries but fail to span the industries. Hence neither industries nor countries are efficient with respect to managed ICAPM portfolios.

Consider now the maximum achievable Sharpe ratios and the test of their difference. Managed ICAPM portfolios achieve Sharpe ratios of similar magnitude as the Sharpe ratios of unconstrained managed country or industry portfolios. The test of the difference in Sharpe ratios indicates that the relative efficiency of the managed ICAPM portfolios is not significantly different from the relative efficiency of the managed country or the managed industry portfolios. This suggests that investors should be indifferent between selecting their portfolio from the industry indices, the country indices, or from the ICAPM portfolios.

These results are again drastically affected by short sales restrictions. In this case, the ICAPM portfolios yield a significantly much higher Sharpe ratio than either the managed industry portfolio or the managed country portfolio. The differences are significant at the 0.1% level. For portfolios with a monthly standard deviation of 5%, it translates in an average return difference of about 17% per year. In this case, the ICAPM portfolios outperform the industry or country portfolios because of the returns enhancement and diversification benefits afforded by the currency deposits.

In summary, the spanning tests suggest that, in the absence of short sales restrictions, international portfolios based on either countries, industries, or the ICAPM portfolios are always inefficient relative to each other. The country based portfolios are inefficient in terms of industry weights and ICAPM weights (i.e., world portfolio and currency weights), and the ICAPM portfolios are inefficient in terms of industry weights, while the industry based portfolios in turn are inefficient in terms of the ICAPM portfolios. In terms of the maximum attainable Sharpe ratios, industry portfolios are preferred over country portfolios and there is not a significant difference

[5] These results can be obtained from the authors upon request.

with the maximum Sharpe ratio of the ICAPM portfolios. If short selling is prohibited, the difference between country and industry portfolios disappears entirely. The most striking results are that, when short sales restrictions are in place, the ICAPM managed portfolios outperform both the country and the industry managed portfolios by a very large and statistically significant margin. Part of these benefits may arise from the currency risk exposure of equity returns and hedging benefits of combining equities and currencies.

Finally, as far as the country versus industry based portfolios are concerned, it is again worthwhile to see whether the diversification benefits in international portfolios derive from country or from industry factors. To this end, we use again a regression of countries (industries) on industries (countries), in each regression excluding the country (industry) of interest from the right hand side variables, as in (10). However, we now use managed country and industry returns, conditional on the instruments. Panel C of Table 8 gives the p-values for the tests whether all αs in the regressions are equal to zero. The first p-values are for tests of outperformance when short selling is allowed. In this case, the country alphas are significantly different from zero at the five percent level, and the industry alphas are significantly different from zero at any conventional significance level. This implies that, with conditional strategies, both industry and country factors are relevant in obtaining international diversification benefits. However, these results are again sensitive to short sales constraints as the second p-values show. Incorporating short sales constraints as we did in Section 4.2, industry factors do not add anything to the country based portfolios. For the industry based portfolios, we see that there is a marginally significant outperformance by the managed country portfolios, at the ten percent level. Thus, if short selling is prohibited, omitting an industry factor from country based portfolios does not affect portfolio performance significantly whereas the performance of industry based portfolios does seem to be affected when we leave out country factors. These results confirm the findings of unconditional tests in Section 4 that industry based portfolios are especially sensitive to short sales constraints and that country factors appear to be more important than industry factors in realizing international diversification benefits.

5.2 Conditional style analysis

Finally, we also want to analyze the mimicking properties of industries and countries in a conditional setting. This comes down to doing conditional style analysis, as described in Section 2.2.

Table 9 reports the results of the conditional style analysis of industry portfolios in terms of country portfolios. Similarly, in Table 10 the conditional styles of the countries are given in terms of industry portfolios. The results should be compared to the unconditional results reported in Table 3 and 4 respectively.

The second column of Table 9 and Table 10 presents the R^2 of the style regressions. Also reported are the intercepts of the regressions. For the style regressions of industry indices in terms of country indices, the average R^2 in Table 9 is 0.75, up from 0.69 in Table 3. In Table 10 the average R^2 for the countries in terms of industries is only 0.52, up from 0.50 in Table 4. Note that adding conditioning information slightly improves the overall "mimicking" ability of style portfolios. More importantly however, the evidence confirms the inference drawn from the results reported in Table 3 and 4. It suggests that it is easier to mimic industries with country portfolios than vice versa. The last lines of Table 9 and 10 use as the left hand side variable the optimal managed industry or country portfolio (including short sales constraints), rather than a single industry or country index. These managed portfolios are easier to mimic, as can be seen from the R^2 values, but again the countries have better mimicking properties than the industries.

Finally, The last two columns of Tables 9 and 10 repeat the style analysis in the first two columns, but with exclusion of the country or the industry of interest. Thus, in Table 9, in each regression the industry of interest is excluded from the country indices and in Table 10 we always exclude the country of interest from the industry indices. These results again confirm the unconditional analysis in Section 4: the mimicking properties of the country portfolios are hardly affected when an industry factor is removed (the average R^2 drops from 0.75 to 0.69), whereas removing a country factor from the industries seriously affects their mimicking properties: the average R^2 in Table 10 drops from 0.52 to 0.34. Also, the intercepts in Table 10 increase uniformly over the countries, implying that the average returns of the mimicking portfolios decrease when the country factor is taken out. These results show again that it is easier to mimic industries with countries than vice versa, and that country factors appear to be more relevant in explaining the variation of equity returns than industries.

6 Summary and conclusions

In this paper, we investigate the role of industrial structure, currency risk and country factors on cross country returns and try to disentangle their respective impact on international portfolio diversification strategies. We develop a new test to measure and evaluate the statistical significance of the diversification gains of some portfolio strategies over others. Our methodology looks at the performance of industry versus country portfolios in terms of the Jensen measure, which indicates whether industry or country portfolios offer investors sufficient diversification benefits and allows us to conduct a direct comparison between industry and country portfolios.

Our unconditional results indicate that there are no significant differences between industry and country portfolios in terms of maximum Sharpe ratios. Whereas the maximum Sharpe ratio of the industries is somewhat higher than the one for the countries if short selling is allowed, this is no longer the case if short selling is prohibited. Moreover, style analysis indicates that countries are better able to mimic industries than vice versa, even when the country indices exclude all stocks from that industry. This suggest that industry portfolios have a "country structure" that can be duplicated well with stocks outside of that industry. On the other hand, industry based portfolios do not perform as well to replicate country returns, and their performance worsens significantly when that country's stocks are excluded for the industry portfolios. This suggests that "country structure" rather than industrial structure is the main determinant of international equity returns. For international investors this would imply that the benefits of international diversification stem mostly from cross-country diversification, rather that form cross-industry diversification. Further, our results show that, in an unconditional framework, portfolios constructed from the world index and currency deposits as suggested by the ICAPM yield little benefits over either country or industry based portfolios.

The conditional analysis shows that the maximum Sharpe ration of unconstrained portfolios of industries is significantly larger than that of country portfolios. If short sales restrictions are imposed on equity positions, this difference disappears. The most striking results are that portfolios constructed from the world index and currency deposits as suggested by the ICAPM outperform both country and industry based portfolios and yield significantly higher Sharpe ratios than country or industry portfolios if there are short sales constraints. Finally, our conditional analysis confirm the findings of the unconditional analysis that country factors appear to be more relevant in explaining the variation of equity returns than industries.

A The asymptotic covariance of the test for relative efficiency

For ease of exposition, consider the regression models

$$y_t = \beta' x_t + \varepsilon_t, \tag{12a}$$

$$\Omega^{-\frac{1}{2}} y_t = B' x_t + u_t. \tag{12b}$$

Here $\Omega = Var[\varepsilon_t]$. Notice that we can always rewrite our regressions in this way. The problem that we face is that in (12b) we have to use an estimated covariance matrix $\widehat{\Omega}$ rather than the true covariance matrix Ω.

Denoting $\widehat{y_t} = \widehat{\Omega}^{-\frac{1}{2}} y_t$, the OLS estimate of B is

$$\widehat{B} = \left(\sum_t x_t x_t' \right)^{-1} \left(\sum_t x_t \widehat{y}_t' \right).$$

Defining $\eta_t = \left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}}\right) y_t$, we get

$$\begin{aligned}
\widehat{B} &= \left(\sum_t x_t x_t'\right)^{-1} \left(\sum_t x_t \left(x_t' B + u_t' + \eta_t'\right)\right) \\
&= B + \left(\sum_t x_t x_t'\right)^{-1} \left(\sum_t x_t \left(u_t' + y_t' \left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}}\right)\right)\right).
\end{aligned}$$

Since the last terms converge to zero, $\widehat{B}$ is a consistent estimator of B.

>From the last equation we obtain

$$\sqrt{T}\left(\widehat{B} - B\right) = \tag{13a}$$

$$\sqrt{T}\left(\sum_t x_t x_t'\right)^{-1} \left(\sum_t x_t u_t'\right) + \sqrt{T}\left(\sum_t x_t x_t'\right)^{-1} \left(\sum_t x_t y_t' \left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}}\right)\right)$$

$$\sqrt{T}\left(\widehat{B} - B\right) = \sqrt{T}\left(\sum_t x_t x_t'\right)^{-1} \left(\sum_t x_t u_t'\right) + \widehat{\beta}\sqrt{T}\left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}}\right). \tag{13b}$$

The first term in the limiting distribution is standard, the interest here is in the second term, which arises because we have to use the estimated covariance matrix $\widehat{\Omega}$.

A.1 Limiting distribution of $\widehat{\Omega}$

In a standard regression framework, the limiting distribution of $\widehat{\Omega}$ is

$$\sqrt{T}\left(vech\left(\widehat{\Omega}\right) - vech\left(\Omega\right)\right) \to N\left(0, V\right).$$

We want to derive an expression for the covariance matrix V.

Consider the simple example where Ω is 2×2:

$$\Omega = \begin{pmatrix} \omega_{11} & \omega_{12} \\ \omega_{21} & \omega_{22} \end{pmatrix},$$

in which case we need the limiting distribution of

$$\sqrt{T}\begin{pmatrix} \widehat{\omega}_{11} - \omega_{11} \\ \widehat{\omega}_{12} - \omega_{12} \\ \widehat{\omega}_{22} - \omega_{22} \end{pmatrix} = \frac{1}{\sqrt{T}}\begin{pmatrix} \Sigma_t \varepsilon_{1t}^2 - \omega_{11} \\ \Sigma_t \varepsilon_{1t}\varepsilon_{2t} - \omega_{12} \\ \Sigma_t \varepsilon_{2t}^2 - \omega_{22} \end{pmatrix}$$

The elements of the limiting covariance matrix can be written as

$$\begin{aligned} Var[\varepsilon_{1t}^2] &= E[\varepsilon_{1t}^4] - \omega_{11}^2 \\ Var[\varepsilon_{1t}\varepsilon_{2t}] &= E[\varepsilon_{1t}^2\varepsilon_{2t}^2] - \omega_{12}^2 \\ Cov[\varepsilon_{1t}^2, \varepsilon_{1t}\varepsilon_{2t}] &= E[\varepsilon_{1t}^3\varepsilon_{2t}] - \omega_{11}\omega_{12} \\ Cov[\varepsilon_{1t}^2, \varepsilon_{2t}^2] &= E[\varepsilon_{1t}^2\varepsilon_{2t}^2] - \omega_{11}\omega_{22}, \\ & \text{etc.} \end{aligned}$$

Thus, the covariance matrix looks like,

$$V = \begin{bmatrix} E[\varepsilon_{1t}^4] - \omega_{11}^2 & E[\varepsilon_{1t}^3\varepsilon_{2t}] - \omega_{11}\omega_{12} & E[\varepsilon_{1t}^2\varepsilon_{2t}^2] - \omega_{11}\omega_{22} \\ E[\varepsilon_{1t}^3\varepsilon_{2t}] - \omega_{11}\omega_{12} & E[\varepsilon_{1t}^2\varepsilon_{2t}^2] - \omega_{12}^2 & E[\varepsilon_{1t}\varepsilon_{2t}^3] - \omega_{12}\omega_{22} \\ E[\varepsilon_{1t}^2\varepsilon_{2t}^2] - \omega_{11}\omega_{22} & E[\varepsilon_{1t}\varepsilon_{2t}^3] - \omega_{12}\omega_{22} & E[\varepsilon_{2t}^4] - \omega_{22}^2 \end{bmatrix}.$$

In general, the element of V corresponding to the covariance between $\widehat{\omega}_{ij}$ and $\widehat{\omega}_{lm}$ is $E[\varepsilon_{it}\varepsilon_{jt}\varepsilon_{lt}\varepsilon_{mt}] - \omega_{ij}\omega_{lm}$

A.2 The limiting distribution of $\sqrt{T}\left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}}\right)$

We know that

$$\sqrt{T}\left(vech\left(\widehat{\Omega}\right) - vech\left(\Omega\right)\right) = \sqrt{T} vech\left(\frac{1}{T}\sum_t \varepsilon_t\varepsilon_t' - \Omega\right).$$

For later use we will need the limiting distribution of $vec\left(\widehat{\Omega}\right)$ rather than of $vech\left(\widehat{\Omega}\right)$, but this one is obtained immediately from the above. Notice that $vec\left(\widehat{\Omega}\right)$ will have a singular covariance matrix, but this is not a problem in our application. Using a linear expansion, for the limiting distribution of $\sqrt{T}\left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}}\right)$ we need the differential of $\Omega^{-\frac{1}{2}}$ with respect to Ω.

Following Magnus and Neudecker[6], start with the matrix function $F(X) = X^{\frac{1}{2}}$. Since $X^{\frac{1}{2}}X^{\frac{1}{2}} = X$ we get

$$\begin{aligned} \left(\mathbf{d}X^{\frac{1}{2}}\right)X^{\frac{1}{2}} + X^{\frac{1}{2}}\left(\mathbf{d}X\frac{1}{2}\right) &= \mathbf{d}X, \Rightarrow \\ \left(X^{\frac{1}{2}} \otimes I_K\right) vec\left(\mathbf{d}X^{\frac{1}{2}}\right) + \left(I_K \otimes X^{\frac{1}{2}}\right) vec(\mathbf{d}X^{\frac{1}{2}}) &= vec(\mathbf{d}X) \Leftrightarrow \\ \left[X^{\frac{1}{2}} \otimes I_K + I_K \otimes X^{\frac{1}{2}}\right] \mathbf{d}vec\left(X^{\frac{1}{2}}\right) &= \mathbf{d}vec(X), \end{aligned}$$

[6]We thank Jan Magnus for showing us the necessary steps.

and therefore the differential of $X^{\frac{1}{2}}$ with respect to X is obtained from

$$\mathbf{d}vec\left(X^{\frac{1}{2}}\right) = \left(X^{\frac{1}{2}} \otimes I_K + I_K \otimes X^{\frac{1}{2}}\right)^{-1} \mathbf{d}vec(X). \tag{14}$$

The interest here is not in $X^{\frac{1}{2}}$, but in $F(X) = X^{-\frac{1}{2}}$, for which we have

$$\mathbf{d}X^{-\frac{1}{2}} = -X^{-\frac{1}{2}}\left(\mathbf{d}X^{\frac{1}{2}}\right)X^{-\frac{1}{2}}.$$

Taking *vec*'s gives

$$\mathbf{d}vec\left(X^{-\frac{1}{2}}\right) = \left(-X^{-\frac{1}{2}} \otimes X^{-\frac{1}{2}}\right)\mathbf{d}vec\left(X^{\frac{1}{2}}\right),$$

which can be combined with (14) to obtain

$$\mathbf{d}vec\left(X^{-\frac{1}{2}}\right) = \left(-X^{-\frac{1}{2}} \otimes X^{-\frac{1}{2}}\right)\left(X^{\frac{1}{2}} \otimes I_K + I_K \otimes X^{\frac{1}{2}}\right)^{-1} \mathbf{d}vec(X). \tag{15}$$

If ε_t is a N-vector, then define the $N^2 \times N^2$ matrix A as

$$A = \left(-\Omega^{-\frac{1}{2}} \otimes \Omega^{-\frac{1}{2}}\right)\left(\Omega^{\frac{1}{2}} \otimes I_N + I_N \otimes \Omega^{\frac{1}{2}}\right)^{-1}. \tag{16}$$

The limiting distribution of $vec\left(\widehat{\Omega}^{-\frac{1}{2}}\right)$ is then obtained from

$$\sqrt{T}\left(vec\left(\widehat{\Omega}^{-\frac{1}{2}}\right) - vec\left(\Omega^{-\frac{1}{2}}\right)\right) = \sqrt{T}A\left(vec\left(\frac{1}{T}\sum_t \varepsilon_t\varepsilon_t' - \Omega\right)\right). \tag{17}$$

A.3 The limiting distribution of $\sqrt{T}\left(\widehat{B} - B\right)$

We are now in a position to derive the limiting distribution of$\sqrt{T}\left(\widehat{B} - B\right)$. Takin *vec*'s of (13), we obtain

$$\sqrt{T}\left(vec\left(\widehat{B}\right) - vec\left(B\right)\right) =$$
$$\left(I_N \otimes \left(\sum_t x_t x_t'\right)^{-1}\right)\sqrt{T}vec\left(\sum_t x_t u_t'\right) + \left(I_N \otimes \widehat{\beta}\right)\sqrt{T}\left(vec\left(\widehat{\Omega}^{-\frac{1}{2}}\right) - vec\left(\Omega\right)\right) =$$
$$\left(I_N \otimes \left(\sum_t x_t x_t'\right)^{-1}\right)\sqrt{T}vec\left(\sum_t x_t u_t'\right) + \left(I_N \otimes \widehat{\beta}\right)\sqrt{T}A\left(vec\left(\frac{1}{T}\sum_t \varepsilon_t\varepsilon_t'\right) - vec\left(\Omega\right)\right).$$

The limiting distribution follows from this immediately.

B Data: construction of the industry indices

DataStream constructs and provides local currency denominated price indices, total return indices (including dividends) and market values for 10 economic sectors (see the table below for a description) for each country. Country indices are available in local currency and US$. DS constructs its country and industry indices such that the value weighted value of a country's industry indices is equal to the value of that country's aggregate index. Hence all stocks included in a country portfolio are also included in one of that country 10 industry portfolios. We collected country and industry indices for the G7 countries.

We then construct G7 market indices and G7 industry indices by combining the G7 the countries total and industry portfolios at market value weights. We do this both in US$ and in local currency. In this fashion, we guarantee that country, world and global industry portfolios provide exactly the same geograhical and industry coverage.

To construct the country sector weights in the G7 market portfolio, we proceed as follows. Using the local market value indices we compute the beginning of month weighting of each sector in each country aggregate index. Using US$ market values, we similarly compute the weights of each country in the G7 market portfolio. Multiplying the sector weight within a country by the country weight in the G7 market index yields the weight of each country sector in the G7 market portfolio.

Sector Description	**Mnemonic**
Resources	Res
Basic Industries	Bas. I.
General industrials	Gen. I.
Cyclical Consumer goods	CCGd
Non-Cyclical Consumer goods	NCGd
Cyclical Services	CS
Non-Cyclical Services	NCS
Utilities	UT
Information Technology	IT
Financials	Fin.

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Table 1: Summary statistics

The table contains summary statistics for monthly returns on country and industry indices and the currency deposit (excess) returns from DataStream. Mean returns and standard deviations are in percentages. 'c(ctry)', 'c(ind)', 'c(cur)' give respectively the average correlation of each index with the seven country indices, the ten industry indices, and the six currency deposits, where the correlation of each index with itself is excluded. 'min' and 'max' are the minimum and maximum returns (in percentages) respectively, and $\rho(1)$ are the first order autocorrelations in the returns. Values in brackets are p-values associated with Wald test statistics for the null-hypotheses mentioned. Returns are calculated in dollars for the period January 1974 until November 1998 (299 observations).

	mean	stdv	c(ctry)	c(ind)	c(cur)	min	max	$\rho(1)$
Country Indices								
Canada	1.02	5.17	0.427	0.536	0.121	-22.3	16.6	0.008
France	1.60	6.73	0.475	0.491	0.309	-22.7	28.2	0.037
Germany	1.28	5.53	0.417	0.456	0.355	-16.4	18.4	-0.034
Italy	1.32	7.81	0.355	0.364	0.163	-22.6	27.4	0.101
Japan	1.18	6.59	0.342	0.633	0.324	-17.6	27.1	0.065
UK	1.83	6.88	0.465	0.541	0.257	-21.2	55.9	0.079
US	1.41	4.24	0.425	0.638	0.018	-20.8	13.4	-0.007
World (G7)	1.29	4.08	0.647	0.818	0.270	-15.0	13.9	0.038
H_0: country means are zero								(0.000)
H_0: country means are equal								(0.775)
Industry indices								
Res	1.30	5.05	0.463	0.493	0.176	-19.4	16.3	0.002
Bas.I.	1.05	5.11	0.590	0.730	0.301	-14.7	17.6	0.029
Gen.I.	1.25	4.63	0.604	0.746	0.223	-19.8	15.5	-0.011
CCGd	1.22	4.94	0.553	0.693	0.182	-18.5	18.2	0.056
NCGd	1.45	4.10	0.547	0.678	0.209	-16.5	13.7	0.041
CS	1.27	4.54	0.594	0.754	0.222	-15.5	17.8	0.112
NCS	1.30	4.24	0.441	0.584	0.155	-10.3	27.7	-0.035
UTs	1.31	4.34	0.390	0.514	0.294	-12.0	26.0	0.062
IT	1.41	5.35	0.489	0.608	0.109	-21.9	16.8	0.013
Fin.	1.41	5.46	0.557	0.689	0.278	-18.6	25.4	0.109
H_0: industry means are zero								(0.000)
H_0: industry means are equal								(0.997)
H_0: country and industry means are equal								(0.9957)
Currencies								
Canadian $	-0.06	1.35	0.209	0.208	0.126	-5.9	3.3	-0.022
French Franc	0.15	3.22	0.225	0.199	0.629	-10.0	8.7	0.012
German Mark	0.02	3.34	0.205	0.187	0.625	-10.3	9.9	0.000
Italian Lira	0.12	3.12	0.221	0.175	0.569	-12.1	8.4	0.093
Japanese YEN	0.14	3.61	0.221	0.295	0.430	-10.9	16.3	0.072
Pound Sterling	0.18	3.30	0.246	0.225	0.519	-11.8	15.1	0.096
H_0: currency means are zero								(0.486)
H_0: currency means are equal								(0.945)

Table 2: Performance tests for countries and industries

The table presents performance tests of the industries relative to the seven countries (first three columns) and of the countries relative to the ten industries (last three columns). $a(\%)$ gives the Jensen measure as a percentage per month and t gives the associated t-value. "Spanning test" gives the $p-$value associated with a Wald test that all the Jensen measures are equal to zero. "Sharpe" gives the maximum attainable Sharpe ratio of the seven industry or country indices, and "Sharpe (nss)" gives the maximum attainable Sharpe ratio if short selling is prohibited. Panel B gives the Jensen measures for industries (countries) relative to country (industry) based portfolios when that industry (country) is excluded from the countries (industries). Wald (all) gives the p-value for a joint test whether all individual Jensen measures are zero. Wald (all,nss) gives the p-value for a joint test whether all alphas are zero taking into account short sales constraints on both the test assets and the benchmark assets.

Panel A: Efficiency tests

Industries			*Diff.*	*Countries*		
	$a(\%)$	t			$a(\%)$	t
Resources	0.04	(0.20)		Canada	-0.20	(0.94)
Basic industries	-0.30	(2.58)		France	0.39	(1.21)
General industries	-0.12	(1.15)		Germany	0.09	(0.33)
Cyclical cons. gds	-0.11	(0.72)		Italy	0.25	(0.60)
Noncycl. cons. gds	0.07	(0.62)		Japan	0.03	(0.15)
Cyclical services	-0.17	(1.75)		UK	0.50	(1.64)
Noncycl. services	0.11	(0.59)		US	-0.02	(0.14)
Utilities	0.22	(1.11)				
Information Tech.	0.00	(0.02)				
Financial	0.05	(0.36)				
Spanning test		(0.476)		*Spanning test*		(0.547)
Sharpe		0.260	(0.615)	*Sharpe*		0.233
Sharpe (nss)		0.202	(0.985)	*Sharpe (nss)*		0.201
Eff.loss from nss		(0.151)		*Eff.loss from nss*		(0.199)

Panel B: Country/industry components removed from the benchmarks

Industries				*Countries*		
	$a(\%)$	t			$a(\%)$	t
Resources	0.13	(0.55)		Canada	-0.22	(0.97)
Basic industries	-0.35	(2.64)		France	0.43	(1.28)
General industries	-0.12	(1.01)		Germany	0.10	(0.34)
Cyclical cons. gds	-0.10	(0.60)		Italy	0.28	(0.65)
Noncycl. cons. gds	0.14	(1.06)		Japan	0.04	(0.11)
Cyclical services	-0.17	(1.58)		UK	0.63	(1.87)
Noncycl. services	0.15	(0.78)		US	0.38	(1.75)
Utilities	0.25	(1.25)				
Information Tech.	0.06	(0.30)				
Financial	0.06	(0.33)				
Joint tests for outperformance:						
Wald (all)		(0.266)				(0.039)
Wald (all, nss)		(0.526)				(0.041)

Table 3: Style analysis of industries in terms of country portfolios

The table presents the style estimates of each industry in terms of country portfolios. α is the intercept in the style regression. All estimated style coefficients are constrained to be positive and to sum to one over the seven countries.

	Res	Bas.I.	Gen.I.	CCGd	NCGd	CS	NCS	UT	IT	Fin.
α(%)	-0.04	-0.25	-0.08	-0.09	0.08	-0.12	-0.04	0.00	0.05	0.11
Canada	0.32	0.14	0.06	0.05	0.00	0.00	0.00	0.00	0.03	0.04
France	0.06	0.06	0.00	0.03	0.00	0.00	0.01	0.03	0.00	0.00
Germany	0.01	0.01	0.12	0.12	0.05	0.02	0.07	0.13	0.01	0.01
Italy	0.00	0.02	0.00	0.01	0.01	0.01	0.05	0.02	0.02	0.07
Japan	0.07	0.46	0.33	0.39	0.20	0.32	0.30	0.40	0.20	0.54
UK	0.16	0.09	0.08	0.04	0.05	0.12	0.04	0.00	0.03	0.08
US	0.39	0.23	0.41	0.36	0.69	0.52	0.55	0.42	0.70	0.27
R^2	0.54	0.85	0.86	0.74	0.81	0.87	0.44	0.36	0.64	0.83
avg(R^2)	0.69									

Table 4: Style analysis of countries in terms of industry portfolios

The table presents the style estimates of each country in terms of industry portfolios. α is the intercept in the style regression. All estimated style coefficients are constrained to be positive and to sum to one over the seven industries.

	Can	Fra	Ger	Ita	Jap	UK	US
α(%)	-0.31	0.39	-0.01	0.01	-0.10	0.57	0.00
Resources	0.45	0.24	0.06	0.00	0.00	0.35	0.21
Basic industries	0.13	0.34	0.00	0.17	0.30	0.08	0.00
General industries	0.00	0.00	0.52	0.00	0.00	0.00	0.00
Cyclical cons. gds	0.00	0.22	0.07	0.13	0.11	0.00	0.00
Noncycl. cons. gds	0.22	0.09	0.12	0.00	0.00	0.00	0.57
Cyclical services	0.00	0.00	0.00	0.00	0.00	0.55	0.00
Noncycl. services	0.00	0.00	0.02	0.17	0.00	0.00	0.00
Utilities	0.00	0.11	0.21	0.00	0.00	0.00	0.00
Information Tech.	0.20	0.00	0.00	0.05	0.00	0.00	0.22
Financial	0.00	0.00	0.00	0.47	0.59	0.01	0.00
R^2	0.55	0.38	0.32	0.22	0.73	0.48	0.79
avg(R^2)	0.50						

Table 5: Style analysis of industries in terms of country portfolios excluding that industry

The table presents the style estimates of each industry in terms of country portfolios. When regressing an industry on the countries, the country indice returns are calculated exclusive of that industry returns. α is the intercept in the style regression. All estimated style coefficients are constrained to be positive and to sum to one over the seven countries.

	Res	Bas.I.	Gen.I.	CCGd	NCGd	CS	NCS	UT	IT	Fin
$\alpha(\%)$	-0.02	-0.30	-0.08	-0.09	0.10	-0.13	-0.04	0.00	0.09	0.11
Canada	0.35	0.11	0.08	0.07	0.00	0.00	0.01	0.00	0.10	0.04
France	0.00	0.07	0.01	0.03	0.00	0.02	0.00	0.04	0.00	0.00
Germany	0.10	0.00	0.13	0.13	0.08	0.03	0.10	0.15	0.05	0.01
Italy	0.00	0.03	0.00	0.01	0.02	0.01	0.06	0.03	0.02	0.08
Japan	0.11	0.44	0.32	0.36	0.21	0.31	0.28	0.39	0.19	0.48
UK	0.14	0.10	0.08	0.05	0.04	0.12	0.04	0.00	0.04	0.09
US	0.30	0.24	0.39	0.35	0.66	0.50	0.52	0.38	0.59	0.30
R^2	0.40	0.82	0.83	0.70	0.73	0.84	0.37	0.28	0.47	0.73
avg(R^2)	0.62									

Table 6: Style analysis of countries in terms of industry portfolios excluding that country

The table presents the style estimates of each country in terms of industry portfolios. When regressing a country on the industries, the industry indices are calculated exclusive of that country. α is the intercept in the style regression. All estimated style coefficients are constrained to be positive and to sum to one over the ten industries.

	Can	Fra	Ger	Ita	Jap	UK	US
$\alpha(\%)$	-0.35	0.39	-0.06	0.04	-0.23	0.63	-0.10
Resources	0.41	0.22	0.15	0.00	0.09	0.32	0.37
Basic industries	0.10	0.31	0.00	0.31	0.08	0.23	0.00
General industries	0.01	0.00	0.03	0.09	0.04	0.00	0.00
Cyclical cons. gds	0.00	0.15	0.20	0.00	0.05	0.19	0.00
Noncycl. cons. gds	0.27	0.04	0.28	0.10	0.01	0.03	0.46
Cyclical services	0.00	0.13	0.05	0.00	0.00	0.11	0.00
Noncycl. services	0.02	0.00	0.01	0.10	0.24	0.00	0.00
Utilities	0.00	0.15	0.22	0.09	0.07	0.01	0.00
Information Tech.	0.20	0.00	0.06	0.09	0.00	0.10	0.17
Financial	0.00	0.00	0.00	0.24	0.42	0.00	0.00
R^2	0.49	0.36	0.25	0.19	0.14	0.37	-0.12
avg(R^2)	0.24						

Table 7: Performance tests of countries, industries and ICAPM portfolios

The table presents tests that compare the performance of country portfolios, industry portfolios and ICAPM portfolios (world + three currency deposits). The first panel reports the p-values associated with a Wald test for the hypothesis that the sets of assets listed in the column headers span the sets of assets listed in the first column. The second panel reports the maximum Sharpe ratios achievable from each set of assets, without and with no short sales (*nss*) restrictions, and the p-values (in parenthesis) associated with a Wald test for the hypothesis of zero loss of effciency due to the short sales retristrictions, and for the hypothesis of equality of the reported Sharpe ratios. The world portfolio is the value weighted portfolio of the G7 countries for DataStream.

A. Spanning tests p-values				
		Benchmark assets:		
Spanning	Cntries	Indust.	ICAPM	World
Countries	n.a.	(0.547)	(0.190)	(0.195)
Indust.	(0.476)	n.a.	(0.221)	(0.241)
ICAPM	(0.742)	(0.851)	n.a.	
World	(0.292)	(0.618)		n.a.
B. Relative performance tests				
	Cntries	Indust.	ICAPM	World
Sharpe	0.233	0.260	0.160	0.152
Sharpe (nss)	0.201	0.202	0.160	0.152
Eff. loss nss	(0.199)	(0.151)		
Test of difference of unrestricted Sharpe ratios				
Countries *vs*	n.a.	(0.615)	(0.136)	(0.101)
Indust. *vs*	(0.615)	n.a.	(0.103)	(0.078)
Test of difference of no-short-sales Sharpe ratios				
Countries *vs*	n.a.	(0.985)	(0.238)	(0.162)
Indust. *vs*	(0.985)	n.a.	(0.192)	(0.175)

Table 8: Conditional performance tests of countries, industries and ICAPM portfolios

The table presents tests that compare the performance of country portfolios, industry portfolios and ICAPM portfolios (world + three currency deposits). The first panel reports the p-values associated with a Wald test for the hypothesis that the sets of assets listed in the column headers span the sets of assets listed in the first column. The second panel reports the maximum Sharpe ratios achievable from each set of assets, without and with no short sales (nss) restrictions, and the p-values (in parenthesis) associated with a Wald test for the hypothesis of zero loss of effciency due to the short sales retristrictions, and for the hypothesis of equality of the reported Sharpe ratios. Panel C reports the p-values for a Wald test that the intercepts are jointly equal to zero in a regression of the countries (industries) on the industries (countries) excluding the country (industry). The instruments used for the countries and industries are a constant, the short term US interest rate, the US term spread, the US default spread, and the spread between the dividend yield on the World portfolio and the US interest rate spread. The instruments for the currency deposits are a constant, the short term US interest rate, and the spreads between the UK and US interest rate, the Japanes and US interest rate, and the German and US interest rate respectively.

A. Spanning tests p-values			
		Benchmark assets:	
Spanning	Countries	Indust.	ICAPM
Countries	n.a.	(0.832)	(0.137)
Indust.	(0.015)	n.a.	(0.000)
ICAPM	(0.000)	(0.000)	n.a.

B. Relative performance tests			
	Countries	Indust.	ICAPM
Sharpe	0.437	0.619	0.507
Sharpe (nss)	0.225	0.231	0.507
Eff. loss nss	(0.120)	(0.000)	
Test of difference of unrestricted Sharpe ratios			
Countries *vs*	n.a.	(0.004)	(0.301)
Indust. *vs*	(0.004)	n.a.	(0.132)
Test of difference of no-short-sales Sharpe ratios			
Countries *vs*	n.a.	(0.845)	(0.001)
Indust. *vs*	(0.845)	n.a.	(0.001)

C. Excluding country and industry factors		
	Benchmark assets:	
	Countries, $r^{x\backslash i}$	Industr., $r^{y\backslash c}$
All country α's zero		(0.043)
All country α's zero, nss		(0.093)
All industry α's zero	(0.000)	
All industry α's zero, nss	(0.431)	

Table 9: Conditional style analysis of industries in terms of country portfolios

The table presents intercepts and the R^2's for style regressions of industries managed country and interest rate portfolios. The style regression estimated is

$$r_{it}^y = \alpha_i + \sum_{c=1}^{L} \beta_{ic0} r_{ct}^x + \sum_{c=1}^{L} \sum_{k=1}^{K} \beta_{ick} z_{kt-1} r_{ct}^x + \varepsilon_{it}^y.$$

with the appropriate restrictions on the β's. The instruments used are the U.S. interest rate (Intrst), the U.S. term spread (Term), the U.S. default spread (Def.), and the excess dividend yield on the world portfolio (Div.). The last row, 'Mngd. Ind.' gives the intercept and the R^2 for a style regression of the optimal managed portfolio of the industries on the managed country returns. The last two columns exclude the industry of interest from the countries.

Industry styles in terms of countries			*Excluding industries from countries*	
	$\alpha(\%)$	R^2	$\alpha(\%)$	R^2
Res	0.08	0.60	0.11	0.47
Bas.I.	-0.24	0.88	-0.26	0.84
Gen.I.	-0.11	0.88	-0.11	0.86
CCGd	-0.10	0.77	-0.08	0.73
NCGd	-0.10	0.84	0.15	0.77
CS	-0.10	0.89	-0.10	0.86
NCS	0.16	0.57	0.19	0.52
UT	0.32	0.51	0.33	0.46
IT	-0.09	0.67	-0.01	0.61
Fin.	0.06	0.87	0.11	0.76
$mean(R^2)$		0.75		0.69
Mngd. Ind.	0.23	0.91		

Table 10: Conditional style analysis of countries in terms of industry portfolios

The table presents the intercepts and the R^2's for style regressions of countries on managed industry and interest rate portfolios. The style regression estimated is

$$r_{ct}^{y} = \alpha_c + \sum_{i=1}^{N} \beta_{ci0} r_{it}^{y} + \sum_{i=1}^{N} \sum_{k=1}^{K} \beta_{cik} z_{kt-1} r_{it}^{y} + \varepsilon_{ct}^{x}.$$

with the appropriate restrictions on the β's. The instruments used are the U.S. interest rate (Intrst), the U.S. term spread (Term), the U.S. default spread (Def.), and the excess dividend yield on the world portfolio (Div.). The last row, 'Mngd. Country' gives the intercept and the R^2 for a style regression of the optimal managed portfolio of the countries on the managed industry returns. The last two columns exclude the country of interest from the industries.

Country style in terms of industries			*Excluding countries from industries*	
	$\alpha(\%)$	R^2	$\alpha(\%)$	R^2
Can	-0.36	0.57	-0.24	0.54
Fra	0.31	0.42	0.35	0.41
Ger	-0.04	0.36	0.13	0.32
Ita	-0.04	0.26	0.16	0.22
Jap	-0.08	0.74	0.03	0.20
U.K.	0.49	0.51	0.60	0.43
U.S.	-0.01	0.81	0.44	0.32
$mean(R^2)$		0.52		0.35
Mngd. Country	0.26	0.86		