*The Role of Country and Industry Effects in Explaining Global Stock Returns**

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Abstract

We study the relative role of industry and country factors in explaining global returns on individual stocks. In contrast to past studies, e.g. Heston and Rouwenhorst (1994) and Roll (1992), the sensitivities of stocks' returns to these factors are allowed to differ across stocks. We find that the industry factor explains 20% - 30% of the variation in stock returns which can be accounted for by country and industry, and about 7% of the variation explained when a global factor is also included. This relative explanatory power for the industry factor is much higher than the 1%-or-less estimate reported by Heston and Rouwenhorst because, we argue, they focus on index returns. Strikingly, however, we find that the broad nine-segment "industrial classification" in the Dow Jones Global Index (DJGI®) explains as much return variation as the finer 68-industry classification, and that the 38-industry classification in the Morgan Stanley Capital International (MSCI®) World Index explains slightly more. Finally, we find that measuring global stock returns in a common currency decreases the return variation attributable to industry factors by about 15%.

1. Introduction

Global stock market indices typically classify stocks by country and industry. Industry representation is also often an important criterion in choosing which stocks to include in stock market indices, both domestic and international.[1] The attention paid to industry and country classifications is no doubt due in part to the belief that stocks within a country and stocks within an industry tend to behave similarly. It is believed, in other words, that there are significant country factors and industry factors that explain stock price movements. Somewhat surprisingly however, the results of some empirical studies seem to suggest that while country factors are important in explaining co-movement among stock prices, industry factors are less important and seem in many cases inconsequential in determining the behavior of stock prices. In this paper, we investigate the relative importance of these two factors in explaining the stock returns.

In asking how important is industry classification in explaining stock returns a distinction must be made between explaining the returns earned on stock market aggregates and explaining the returns of individual stocks. Several of the papers that have examined the explanatory power of industry and country factors have been largely focused on explaining the behavior of market indices. They ask, for example, to what extent can the return of the German index be explained by the industrial composition of the German market, and how much of the variation in the index is due to a country factor that affects all German stocks. In principle it is quite different to ask this type of question on the individual stock level. For example, one might ask how much of the movement of Daimler Benz's stock return is due to the fact that Daimler Benz is in the automobile industry and how much is due to the fact that Daimler Benz is a German company. The fact that Daimler Benz is in the automobile industry could be quite important to explaining its return even if the industrial composition of the German market explains

[1] For example: "Each MSCI country index is constructed…assuring that all industry groups are proportionately represented, and that each country's contribution to the global or regional index is accurately based on its market capitalization" (Morgan Stanley Capital International (1996, p. 4)); "…the [S&P]500 is constructed from the bottom-up by industry group. S&P identifies important industry groups within the U.S. economy and then allocates a representative sample of stocks within each important industry group to the S&P 500" (Standard and Poor's (1994, p. 7)).

little of Germany's return. In this paper we are primarily concerned with the relevance of industry and country factors in explaining returns on individual stocks. Obviously once the analysis has been done on the individual level, one can answer questions posed at the aggregate level quite easily.

To determine the relative importance of industry and country factors, some assumptions must be made concerning how these factors affect individual stock returns. In this paper we make an assumption that is different from the assumptions made in most of the other papers which have addressed this issue. In most other studies it is assumed that all stocks within an industry are affected by the industry factor in precisely the same way and that this is also true for country factors. In other words most of the prior work has assumed that returns are generated by a process like the following:

$$\tilde{R}_{ijkt} = A_i + \tilde{G}_t + \tilde{I}_{jt} + \tilde{C}_{kt} + \tilde{e}_{ijkt} \qquad \textbf{(Model 1)}$$

In this formulation R_{ijkt} is the rate of return realized in period t on stock i, a stock which we assume is listed in country k and belongs to industry j. The term A_i is the expected rate of return on stock i in time period t; $\tilde{G}_t$ is a global "market" factor in cases where a global factor is included in the model; $\tilde{I}_{jt}$ is the industry-j "factor" in time period t, $\tilde{C}_{kt}$ is the country-k "factor" in time period t; and $\tilde{e}_{ijkt}$ is an idiosyncratic error term.

It is in our opinion quite restrictive to assume that all stocks in a country and all stocks in an industry are affected by their respective country and industry factors in precisely the same way. There are indeed sound theoretical reasons for doubting such an assumption. For example, if two firms are identical in every way except that one has much higher leverage than the other, then the two must have different sensitivities to the country and industry factors. For this and a number of other reasons, we think it much more plausible that returns are generated by the following model:

$$\tilde{R}_{ijkt} = A_i + a_i\tilde{G}_t + b_{ij}\tilde{I}_{jt} + c_{ik}\tilde{C}_{kt} + \tilde{e}_{ijkt} \qquad \textbf{(Model 2)}$$

Model 2 differs from Model 1 only in that we allow the stocks' sensitivities to the industry and country factors to vary. The sensitivity to the industry factor is measured by b_{ij} and the sensitivity to the country factor by c_{ij}. In addition, the stocks' sensitivities to the global market factor $\tilde{G}_t$ can vary across stocks in cases where that global market factor is included in the model. (The method and identifying restrictions we use in estimating Model 2 will be described below.)

Estimating Model 2 for stocks in the Dow Jones Global Index (DJGI), we find that the industry factor explains 20% to 30% of the variation in global stock returns which can be accounted for by country and industry, and about 7% of the variation which can be accounted for by country and industry together with a global market factor. While we strongly believe that Model 2 is a more reasonable specification of how stock returns are affected by industry and country factors, it is still directly tied to the information in industry classification. It is reasonable to examine the sensitivity of the results to the classification scheme itself. One way to address this question is to compare how much of the fitted variation in stocks' returns can be explained using a broad industrial classification with how much can be explained by a more detailed one. To do this here, we compare the return variation explained under the Dow Jones Global Index classification of constituent stocks into nine major-business segments with the variation explained by the finer DJGI classification of the same stocks into sixty-eight industry classes.

The results of the 68-industry versus 9-major-segment classification comparison will perhaps surprise some people. If only country and industry factors are fitted to returns, the portion of the fitted variation attributable to the industry factor using the 68-industry DJGI classification is 22.28%. If the 9-segment DJGI classification is used, the point estimate of the percent explained by the corresponding industry factor actually *increases* to 29.61%. One might conjecture that this occurs because the major-segment classes are aggregated to a level such that the "industry" factor is closer to a true global factor. However, if a global factor is fitted to returns along with the industry and country factors, the industry factor estimated from the 68-industry classification explains 9.40% of the fitted variation due to the country plus industry factors (or 6.68% of the fitted variation

explained by country plus industry plus global factors), while the 9-major-segment factor explains 10.54% (or 5.45% of the country plus industry plus global factor explanatory power). One implication is that our conclusions concerning the relative explanatory power of industry and country factors are not substantially affected by the number of classes used in defining industry. An additional implication is that there is a good deal of noise in industry classifications, so much so that "more is not better," at least if one's objective is to explain return variation.

Another way of judging the importance of industrial classification is to compare the variation explained by the industry factor computed using the 68-industry classification used in the Dow Jones Global Index with the 38-industry classification used in the Morgan Stanley Capital International (MSCI) World Index. The industry factors estimated for the former explain 22.28% of the variation in stock returns which can be explained by both country plus industry factors, versus 37.16% for the MSCI. This result is consistent with the broader-is-better conclusion concerning industrial classification.

Our results, which concern the sensitivities of individual stocks to country and industry factors, cannot be directly compared to most other studies since, as was mentioned above, most other studies report results for market aggregates. Heston and Rouwenhorst (1994), for example, estimated industry and country "factors" as coefficients in period-by-period regressions of individual stock returns on industry and country dummy variables. Insofar as their dummy variable coefficients are implicit estimates of industry effects which best fit individual stock returns, at least one period at a time, their approach resembles our's. However, the dummy variable procedure implicitly imposes the restriction that all stocks have the *same* exposure to industry and country factors (and to a "global" factor if included). They are therefore using Model 1, not Model 2.

Like Heston and Rouwenhorst, Roll (1992) also estimated industry factors rather than assuming that they are just the returns on a pre-specified industry index. Because he did not have data on individual stocks, Roll estimated the factors using returns data for stock market indexes. Implicitly, his analysis was also based on the assumption that all stocks had the same exposure to industry factors. But contrary to Heston and Rouwenhorst (1994), who conclude that "…industry-specific effects are simply much smaller than

country effects. Industrial specialization explains less than 1% of the variance of equally-weighted [European] country index returns," Roll concludes that the industry factors explain about 40% of the variance in the stock market indices. One possible explanation for this sharp difference is that Heston and Rouwenhorst estimate their industry factors each period in a cross-sectional regression with an unrestricted intercept that can be interpreted as a global market factor on which all stocks have the same loading. By so doing, their (global) industry factors are less likely to be contaminated by global market factors.

We believe, however, that the main reason Heston and Rouwenhorst conclude that industry effects are so unimportant is because they measure those as a component of the variance *of countries' index returns.* In fact, when we repeat Heston and Rouwenhorst's procedure, we still find that industry effects in fact explain about 17% of the fitted variation in *individual stock returns.* In other words their result is due to the fact that they report their findings for aggregates. It is clear that within a country index the industry factors will to at least some extent be diversified away while country factor effects will not be. To see the potential magnitudes involved, suppose that country and industry factors are orthogonal, and that there are N comparable industries amongst which the stocks are evenly distributed, and that within each industry stock returns are perfectly correlated. Letting σ_C^2 be the variance of the country factors and σ_I^2 the variance of the industry factors, the fraction of the variance of a country's index return explained by country is

$$(\sigma_C^2 / [\sigma_C^2 + N\left(\frac{1}{N}\right)^2 \sigma_I^2]) . \qquad (1)$$

Assuming that $N = 7$ and using our estimates of σ_C^2 and σ_I^2, this ratio equals 99.3%, i.e. less than 1% of the variance of a typical equally-weighted index would be explained by industry effects. If there were a 20% correlation between industries, the fraction of index variation explained by industry would increase to about 4%. This fraction would be relevant only to an investor who buys a country index fund. The average of the fraction explained across countries is likewise relevant only to someone who invests in a portfolio

of index funds. If on the other hand an investor has the flexibility to invest in alternative combinations of stocks, the contribution of industry effects to individual returns is more important. Indeed, for an investor who has a view about a particular industry, the importance of industry on individual returns is all-important.

In their study, Heston and Rouwenhorst (1994) found that "…only a small portion of the country-specific return variation is associated with exchange rate fluctuations." This is a somewhat surprising result until one remembers that they are measuring these effects in terms of market aggregates. As we suggested above, the diversification effect reduces the effect of industry on an index to less than 1% even if industry is quite important in explaining individual returns. Obviously if industry only explains 1% on this aggregate level, introducing exchange rate risk that amplifies the country effect will have little effect in whittling away the industry effect because the industry effect has already been whittled away! This will not necessarily be the case when we measure the effects on the individual stock level. We find that when we measure the returns of the stocks of all countries in a common currency, e.g. US dollars or Deutschmarks, rather than in local currencies, the variation of the average stock explained by the "country" factor (which now includes exchange rate risk) increases by about 15%.

Finally, it is to be emphasized that in none of our's, Roll's, or Heston and Rouwenhorst's work is the industry "factor" equated with the return on an industry index. Rather, the industry factor is estimated implicitly, albeit under different assumptions in our papers, as an unobservable factor which best describes the variation in stock returns subject to the restriction that only those stocks classified as belonging to an industry are exposed to that industry. If industrial classification is noisy enough, this restriction loses more than it adds, and we will do better in modeling returns to jettison the classifications altogether (e.g. Fedrigo, Marsh, Pfleiderer (1996)).

2. A Model for Industry and Country Effects

As mentioned above the model we estimate is

$$\tilde{R}_{ijkt} = A_i + a_i \tilde{G}_t + b_{ij} \tilde{I}_{jt} + c_{ik} \tilde{C}_{kt} + \tilde{e}_{ijkt} \qquad \textbf{(Model 2)}$$

We begin by assuming that there is no global market factor in Model 2, i.e. stock return movements are attributed to just country and industry factors. Given that assumption, we would like to estimate A_i and the coefficients b_{ij} and c_{ij} in the reduced Model 2 simultaneously with the industry and country factors I_{jt} and C_{kt} using the cross-section-time-series of individual stock returns R_{ijkt}. By doing this, we will be able to explain the returns on individual stocks in different countries and industries.

Obviously Model 2, with or without the global factor, is not identified unless we make some assumption about either the scaling of the coefficients b_{ij} and c_{ik} or the variance/covariance matrix of the I_{jt}'s and C_{kt}'s. Our normalization assumption is that the variance of each of the I_{jt}'s and C_{kt}'s is 1. An over-identifying set of restrictions would be that the variance-covariance matrix of the I_{jt}'s and C_{kt}'s is the identity matrix, i.e. that the country and industry factors are also all orthogonal. In simulations we have found that the model is uniformly better estimated without this over-identifying restriction even when it holds in truth. Further, we find that the estimated factors turn out to have little correlation, even when we don't impose the restriction *à priori*. We therefore report here the results for the weaker restrictions. We further assume (as is done in all the other studies in this area) that the industry coefficient b_{ij} equals zero if stock i is not in industry j and c_{ik} equals zero if stock i is not in country k.

Model 2 is in the form of a factor model with restrictions on the factor loading matrix. Unfortunately, with the large cross-sections of stocks in the global indices (typically 2,500 to 2,800), we know of no feasible way to estimate the restricted factor model by maximum likelihood methods. Instead, to estimate Model 2 we begin with initial values for the coefficients b_{ij} and c_{ik} and calculate least squares values of I_{jt} and C_{kt}. We then normalize these estimates of I_{jt} and C_{kt} so that their estimated variances are unity. Then, taking these first-step estimates of I_{jt} and C_{kt} as given, we compute least squares values for b_{ij} and c_{ik}. Then, taking these second-step estimates of b_{ij} and c_{ik} as fixed, we calculate new estimates of I_{jt} and C_{kt}. We continue with the successive iterations that amount to a contraction mapping and converge quite quickly to a fixed point for least

squares estimates[2] of both the country and industry factors and stocks' sensitivity to those factors.

3. Estimates of Country and Industry Effects

Our first set of results are for the 2,839 stocks which were continuously in the Dow Jones Global Index over the year from July 10, 1996 to July 9, 1997. The Dow Jones Global Index includes stocks in 29 countries and classifies them into 68 industries, and into 9 market sectors. We used the 239 local daily returns ending July 9, 1997 in making our first estimates. We estimated the industry and country effects b_{ij} and c_{ik} for each stock simultaneously with the industry and country factors I_{jt} and C_{kt} in Model 2 *sans* the global factor We then computed the percent of the fitted variance of each stock's return that was explained by the country effect as $V_{ijk}^{c} = c_{ik}^2 /(b_{ij}^2 + c_{ik}^2)$. (Recall that we have normalized the variances of both the country and industry factors to be unity.) This measure is an unambiguous measure of the portion explained by country if the country and industry factors are orthogonal. While we have not imposed orthogonality (see the discussion about overidentifying restrictions above), we find that the industry and country factors are in most cases close to being orthogonal.

Table 1 gives the equally-weighted average of the fraction of that fitted variance which is explained by the country effect, i.e. $\sum_i V_{ijk}^{C} / n_k$ for the n_k stocks i in each country k, for all countries k=1,…,29. The percent of variance explained by the country factor is highest for the stocks in Italy at 93.27%, and lowest for Ireland at 30.7%. On average, it is 77.72%. It is interesting that the industry effect, which is 22.28% (the industry effect is 100.0% minus the number in the Table), is roughly comparable to the industry effect estimated by early researchers for U.S. stocks (e.g. King (1966)). Roll (1992) estimates industry effects to be about 40% internationally, but he estimated the industry effects using only index return data.

[2] We confirmed that in simulations the least squares estimates converge to their true values. We found that using portfolio returns as instruments for the factors and calculating initial-step instrumental variable estimates for the coefficients improved the estimators substantially.

The results for Ireland illustrate in part the difficulties that can even arise in the country assignments which *à priori* seem more straightforward than industry classification. There are 11 Irish stocks in the DJGI, the fewest of any country. The Irish exchange was itself split off from London only in 1996, and six of the eleven stocks are London domiciled. Four companies, CRH Plc Ord (London), Jefferson Smurfit Group Plc, Allied Irish Banks and Bank of Ireland, account for roughly half the Ireland's market capitalization. The two banks are described in the *Dow Jones Guide to the Global Stock Market* (1997, p. 219) as "…two international retail banks." Jefferson Smurfit "…has operations in the U.K., the Netherlands, Germany, France, Italy, Spain, the United States, Columbia, Mexico, and Venezuela…[and also] a 27.5% shareholding in Austrian paper manufacturer Nettingsdorfer" (p. 223). "CRH has operations throughout Europe, the United States, and Argentina" (p. 222). In short, Ireland consists of a small number of largely "international" stocks. When returns are attributed only to country or industry, it is not surprising that the global industry factors take on such importance. Indeed, when below a global market factor is fitted to returns in addition to country and industry, the explanatory power of the industry factor drops to 6.83% for Ireland, in line with other countries.[3]

The percent of fitted return variance explained by the country effect is broken down by industry in Table 2, i.e. $\sum_i V_{ijk}^C / n_j$ for all n_j stocks i in industry j across all countries. On average for stocks across industries, about 70% of the fitted variation in daily returns on the stocks in an industry is explained by the country "factor." There are at least three general determinants of the degree of fitted return variation explained by the respective industry factors in Table 2. One is the nature of the industry. The more "local" an industry, the less the industry factor will explain returns across countries. So it is not

[3] It is also interesting to compare Ireland with New Zealand, the country with the next fewest stocks (18). For example, as will be able to be seen in Table 3, the country factor explains 81.21% of the returns on the two New Zealand Media stocks Independent Newspapers Ltd. but only 2.28% of Ireland's Media stock, Independent Newspapers Plc. Consistent with these results, the Dow Jones Guide contains the following descriptions of the stocks: "Independent Newspapers [New Zealand] owns a group of publishing businesses specializing in community newspapers," (the other NZ Media stock, Wilson & Horton, also appears to have a substantially local focus), while "International Newspapers [Ireland] is an international media and communications group." In addition, the NZ stock in Building Materials, Fletcher Challenge Bldg, and the NZ stock in Paper Products, Fletcher Challenge Paper, are part of the conglomerate Fletcher Challenge Ltd., so it is not surprising that the respective industry factors are relatively unimportant for them.

surprising that, say, Lodging explains very little of the variation in returns across stocks in different countries. On the other hand, some industries are defined for a single country or just a small number of countries, and thus country explains relatively less of their returns, e.g. U.S. S&Ls (32%), Health Care Provider (35%), and Water Utilities (54%)[4].

Second, even if an industry is truly global, there may simply be little variation in the global industry factor which, all else equal, would mean that it explains less of stocks' return variation. Third, some industries are simply better defined because they are more homogeneous than others. For example, it is not surprising that the country factor explains 93% of the fitted variation in returns on Conglomerates (and thus industry only explains 7%), while it explains only 35.51% of the fitted variation in returns on Precious Metals stocks or 42.68% of that on Oil Companies - Majors.

The results in Table 3 elaborate on those in Tables 1 and 2 by providing a two-way breakdown by country and industry of the fraction of return variation due to the country effect. For example, consider the row for Precious Metals in Table 3. There are four major countries in which Precious Metals stocks are important – Australia, Canada, South Africa, and the United States.[5] It is interesting that 79.37% of the returns on the Australian stocks classified as being in the Precious Metal business is explained by country, while only 12.65%, 32.04%, and 14.14% can be so explained for Canadian, South African, and U.S. stocks classified into the Precious Metals industry. That is, the Precious Metals industry factor is substantially less important in explaining the Australian stocks' returns than it is in explaining the Canadian, South African, and U.S. Precious Metals stocks' returns.

There don't appear to be important differences between the characteristics of Precious Metals stocks in Australia and in other countries. For example, there are 7 stocks

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[4] The Water utility stocks are in only three countries --- two in France, five in the U.K., and six in the U.S.

[5] Table 3 also contains Precious Metals stocks in Germany, Japan, and the U.K. where country explains almost all the return. However, when we look at the stocks involved, we would expect this. The sole German company is Degussa which seems to be involved in a range of processing activities for quite a range of minerals; the U.K. company is Johnson Matthey which is typically described as a "British metals and industrial group," and the Japanese company is Sumitomo Kinzoku Kozan which does mine gold in Kagoshima, but is also involved in copper production, electronic and housing materials, and nuclear fuel. In short, these companies' operations don't have much to do with precious metals, and thus we would expect that they would not have a lot in common with precious metals stocks.

classified as being in the Precious Metals industry in Australia, 14 in Canada and South Africa, and 6 in the U.S. The numbers of stocks in Australia and, say, the U.S. are comparable, as are the market capitalizations of those stocks in the two countries.[6]

The lower percentage of Australian Precious Metals (gold) mining stocks' return variation explained by the industry factor could be due to the fact that about 30% of Australian stocks are resource-related, so that the Australian country factor is, in essence, a "resource stock factor." However, the correlation between the estimated Australian country factor and the estimated Precious Metals industry factor (which are not forced to be orthogonal in our estimation) is only about 7.4% (though this is slightly higher than the average correlation between country and industry factors, 5.4%).[7]

The difference in the degree to which Australian and, say, U.S. Precious Metals stocks are explained by the Precious Metals industry factor is due to the difference between the b_{ij} for Australian stocks i which are in industry j =*Precious Metals* and the corresponding coefficients for the U.S. stocks. Fig 1 contains a plot of the industry factor coefficients for the 7 Australian stocks (in light color on the left-hand-side) and 6 U.S. stocks (in dark color on the right-hand-side) classified as being in the Precious Metals industry. It is easy to see that the returns on the U.S. stocks are considerably more sensitive to the Precious Metals industry "factor" than the Australian stocks --- on average, about 2.5 times as sensitive. Conversely, the Australian Precious Metals stocks are relatively more sensitive to the Australian country factor. This case illustrates just how inappropriate it is to force every stock classified into the same industry to have the same sensitivity to the respective industry factor, as in Model 1.

[6] The Australian companies and their July 10, 1997 market capitalizatons ($US million) are: Ashton Mining ($34,883), Great Central Mines ($36,888), Newcrest Mining ($44,291), Normandy Mining ($144,990), Plutonic Resources ($53,802), R.G.C. Ltd. ($63,187), and Sons of Gwalia Ltd. ($32,863). The U.S. companies are: Amax Gold Stock ($44,375), Battle Mountain Gold ($94,242), Hecla Mining ($20,059), Homestake Mining ($145,145), Handy & Harman ($14,032), Newmont Mining (274,102).

[7] When a global factor is included in Model 2, the correlation between the Australian country factor and the Precious Metals factor increases substantially, to 44% (the average correlation between the global, country, and industry factors is 8.6%).

4. Alternative Industry Classifications

Next, we examine the sensitivity of the results concerning the relative magnitude of industry and country factors in explaining stock returns to the industrial classification scheme used. Intuitively, we would expect that the coarser the classification, the less would be explained by industry relative to country, e.g. in the limit of only one industry, there would be no industry effect! The DJGI provides a classification of stocks into 9 sectors as well as into the 68 industries used in obtaining the results presented in Tables 1 – 3, so we can confirm this conjecture by comparing the estimates of country and industry using this broader 9-sector classification with the results above for the finer 68-industry grid.

The percent of fitted variation in the returns of the stocks of each country, on average, which is explained by the country effect when using the 9-major-sector classification, is given in Table 4. The average across all the countries in Table 4 of the stock return movement which is explained by the country effect is 70.39%, i.e. 29.61% is explained by industry. This average country effect is actually lower than the 77.72% fitted variation explained by the country effect when the 68 industry classes are used. That is, a broader industry classification explains *more* of the fitted variation in returns. If we look instead at the equally-weighted average of country effects for the stocks in each industry (rather than the equally weighted average of country effects for the stocks in each country), shown in Table 5, the average across industries/segments is about 65% when the 9-segment classification is used rather than 70% when the 68-industry classification is used.

We can also look at the similarity across countries between the percent of explained variation due to the country effect (and thus by the industry effect) by the 9-sector segment classification and the 68-industry classifications. The correlation across countries in the percent explained under the two classifications is 77%, and the rank correlation is 70%. Moreover, the countries for which stocks' return variation explained by the industry factor goes down the most when moving from the finer to the broader classification are Canada, New Zealand, South Africa, UK and the US. The results in

Table 5 are consistent with the fact that stocks in Canada, New Zealand, and South Africa tend to be in industries (like Gold in Canada and South Africa) that are relatively better measured, and that industrial classifications tend to be less noisy in the UK and the US, perhaps in part because the industry definitions were constructed with those countries in mind.

One potential explanation for why industry explains more, rather than less, of the fitted variation in returns when broader industry classes are used is that the global sector factor is in part a global market factor. However, if we add a global market factor to the country and industry factors in explaining stocks' returns, we find that the industry factor corresponding to the 9-segment classification still explains 10.54% of the fitted variation attributable to country plus industry, versus 9.40% for the 68-industry classification. Since the global factor itself explains a little more of the variation in returns when the 9-segment classification is used to estimate the industry factor, we find that the industry factor actually explain a little less, 5.45%, of the return variation fitted to sector-plus-country-plus-global factors, than the 6.68% for the 68-industry classification. The general conclusion is, then, that increasing the number of industry classes in a given global index does not seem to increase the power of the corresponding industry factors to explain global stock returns. In this sense, industry classifications appear to be quite noisy.[8]

It is also interesting to compare the relative importance of country and industry effects estimated for the DJGI with estimates for the Morgan Stanley Capital International (MSCI®) World Index, which partitions stocks into a different set of 38 industries across 22 countries. The fraction of fitted variation in returns of stocks in the MSCI World Index which is explained by the country factor is given in Table 6. On average, it is 62.84%. This is lower than the 77.72% explained by the DJGI classification. Looked at from the flip-side, the MSCI industrial classification explains 37.16% of the

[8] A moment's reflection and a look at industrial classifications suggest how noisy they can be. Some of the obvious problems are that firms' revenues often come from more than one product, and that even if two firms supply only a single identical product, their production technologies, and thus their return risk, may differ substantially, as it will if investors have any behavioral bias toward regarding stocks as similar or dissimilar. Moreover, industrial classifications typically run far behind the realities of what firms are doing, e.g. "Internet stocks," software stocks, hardware stocks, are all classified together in most popular indexes. As yet another example of structural change, the cover story in the July 11, 1997 Business Week details Hewlett-Packard's plans to use its imaging and printing expertise to compete in the "photography" business, but we probably won't see Eastman Kodak and HP in the same ndustrial classes any time soon!

variation, while the DJGI classification explains 22.28%. One potential explanation is that there are 22 countries in the MSCI World Index versus 29 countries in the DJGI, and that the extra countries tend to have developing stock markets in which stock prices tend to move more closely together,[9] i.e. the country factor is more important. As can be seen from Table 1, this tends to be the case for six of the seven countries that are in the DJGI but not in the MSCI World Index, Indonesia, Mexico, Philippines, South Korea, Taiwan, and Thailand. But the remaining country which is in the DJGI and not in the MSCI World Index, South Africa, tends to counter-balance these six -- industry factors explain a lot more of the returns on South African stocks. A second explanation is that MSCI deliberately construct their World Index with a view to representing the industries that they define. In particular, their target is the inclusion of 60% of the stocks in each industry.

The average fitted variance of stock returns explained by the two-way MSCI industry and country factors estimated in Model 2 is reported in Table 7. As can be seen, in some countries, such as Australia, New Zealand, The Netherlands, Norway, and Spain, the country effect explains less of the returns on stocks in most industries, and thus industry explains more, than it does in, say, Japan, the U.S., Italy, Malaysia, and the UK. Looking across countries for the stocks in a given industry, it can be seen that the pattern across countries for the Gold Mining stocks is similar to that for Precious Metals in the DJGI. In particular, the Gold Mines industry "factor" explains disproportionately less of the fitted movement in returns on gold stocks in Australia (91.91%) than it does for gold stocks in Canada or the U.S. (more than 99%). On average across countries, though, the Gold Mining industry factor explains quite a bit more of stocks' returns compared to the Precious Metals industry factor in the DJGI. This is consistent with the conclusion above that industry explains more of the common variation in stocks' returns when the industry is more homogeneous. Similarly, the returns on stocks classified by MSCI into the Energy Equipment and Services, Metals – Non Ferrous, Forest Products and Paper, and Energy Sources industries tend to be explained more by their respective industry factors.

[9] Of course one reason that the prices of stocks in emerging markets might move more closely together is that industry classifications are noisier in those markets, e.g. there are a smaller number of stocks issued by closely-related companies, conglomerates, and the like. Another reason is that investors tend to trade the stocks as a group, perhaps because of information asymmetry.

Note that there is nothing in the estimation here that bears on the determinants of the country factors. The fraction of fitted variation explained by country factors will simply be 100% if the fitted variation explained by industry is 0.0%. Disclosure requirements, regulatory environment and degree of rigidity in institutional features such as wage contracts, economic policy, etc. probably all differ in hard-to-quantify ways across most of the countries in the Indices, but it would have to be *continual unexpected changes in these features* across countries for them to explain differential stock return movements across countries.

5. Joint Estimates of Global, Country and Industry Effects

In the results so far, only country and global industry factors have been fitted to the returns on stocks in the respective indexes. That is, Model 2 has been fitted with an intercept for each stock that is constant over time. However, especially since stocks are classified into *global* industry categories, it is plausible that some of the stocks' return variation that is fitted to "industry" would in fact be better attributed to a global factor. Conversely, if a truly global factor is blended into the projection of returns on global industry classes, it could partly obscure a "true" industry effect.

In this section, we fit a three-factor version of Model 2 that contains global, country, and industry factors. Specifically, we fit the following equation:

$$\tilde{R}_{ijkt} = b_{ig}\tilde{g}_t + b_{ij}\tilde{I}_{jt} + c_{ik}\tilde{C}_{kt} + \tilde{e}_{ijkt} \qquad (2)$$

In (2), the global factor $\tilde{g}_t$ is identified by assuming that it potentially impacts all stocks, i.e. b_{ig} is not restricted to be zero for any subset of stocks (while the coefficients of the country and industry factors are restricted to zero for stocks not in the respective countries and industries).

The breakdown in fitted variation for model (2) is given for stocks aggregated by country in Table 8 and by industry in Table 9. Table 8 contains three columns of results for each country. The first gives the (equally-weighted) average across stocks in each country of their fitted variation explained by the country factor C_{kt} in (2), as a fraction of

the variation explained by the country and industry factors. The second column gives the fitted variation explained by country as a percent of that explained by the three factors, global, country, and industry, in (2). The third column gives the percent explained by industry relative to the three factors. Comparing the explanatory power of the country factor, which is given in the first column in Table 8, with that given in Table 1 for the two-factor model, it can be seen that including the global factor uniformly decreases the explanatory power of the global industry classifications relative to country (i.e. it increases the relative proportion of fitted variation explained by the country factor). Without the global factor, 22.28% of the fitted country-plus-industry variation was attributed to industry; including the global factor, 9.4% (i.e. 100% - 90.6%) is so explained. Of the fitted global-plus-country-plus-industry variation, industry explains on average 6.68%.

A better understanding of the effect of including the global factor on the relative explanatory power of country and industry factors can be gained by looking at Table 9 which breaks results out by industry classification. The effect of including the global factor on the fitted variation explained by industry can be ascertained by comparing the first results column of Table 9 with Table 2. Including the global factor results in the biggest decrease in the explanatory power of industry (the biggest increase for country) for Media, where the fraction explained by industry decreases by 27.33 percentage points, from 33.93% (equals 100% - 66.07%) to 6.60% (equals 100% - 93.4%). Other industries where the explanatory power of industry decreases substantially when the global factor is introduced are Industrial Technology, Semi-Conductors, Forest Products, Building Materials, Retail, Textiles and Apparel, Electronic Components and Equipment, Precious Metals, Steel, and Chemicals. In general, these industries tend to be quite global, either insofar as the DJGI stocks in them are listed in many different countries[10] (or skewed toward listings in the U.S. and Japan which are heavily represented in the Index), or insofar as the industries are global, e.g. Electronic Components and Equipment, Steel.

[10]For example, there are 17 different countries with stocks in the Media Industry. Even "Forest Products," which one might a priori regard as less global, is represented by seven U.S. stocks, and seven Canadian, 1 South Korean, 1 Indonesian, 4 Malaysian, 2 New Zealand, 1 Swedish, 1 Australian, and 1 Philippines stock.

Conversely, the industries in which the industry factor explains relatively more of the fitted variation in returns, i.e. relative to just the country and industry factors, when the global factor is included are Electric Utilities, Savings and Loans (U.S.), Pipelines, Plantations, Security Brokers, Software, Health Care Providers, and Oil Companies (Secondary). Not surprisingly, these tend to be "local" industries.

6. Comparison with Dummy Variable Estimates for Industry and Country Effects

Heston and Rouwehorst (1994) estimate Model 1 in which industry and country factors are dummy variables (i.e., in which all of the b_{ij}'s and c_{ik}'s of Model 2 are constrained to equal unity) by performing a cross-sectional regression each period. They impose the restrictions:

$$\sum_{j=1}^{J} n_j \tilde{I}_{jt} = 0 \qquad \sum_{k=1}^{K} m_k \tilde{C}_{kt} = 0 \tag{3}$$

where n_j is the number of stocks classified into industry $j, j = 1,..., J$ and m_k is the number of stocks in country $k, k = 1,..., K$. The restrictions (3) imply that the time-varying intercept a_{it} in Model 1 is the same for all stocks, and that it can be interpreted as the equally-weighted average rate of return across all the stocks in the index, a geographically and industrially diversified set of stocks, in time period t. Heston and Rouwenhorst refer to the sum $a_t + \tilde{I}_{jt}$, which is the return on a geographically-diversified portfolio of firms in the j'th industry, as a "pure industry effect." A pure country effect $a_t + \tilde{C}_{kt}$ is the return on a industrially-diversified portfolio of firms in the k'th country (as discussed earlier, Heston and Rouwenhorst assume identical exposures for each stock to the "global" factor a_t, as well as to the industry and country effects).

Roll (1992) earlier used the following regression model in which country index returns are a weighted average of global industry returns:

$$r_{kt} = I_{1t}W_{1k} + I_{2t}W_{2k} + ...I_{7t}W_{7k} + \varepsilon_{kt} \tag{4}$$

where $\tilde{r}_{kt}$ is the index return for country k in time period t, $\tilde{I}_{jt}, j = 1,...,7$ is the return on industry j in time period t (Roll used 7 industry categories in his study), and W_{1k} is the fraction of country k's market capitalization made up by stocks in industry 1, etc. If we multiply through Model 2 for the return $\tilde{R}_{ikt}$ on each stock i by the stock's weight w_{ik} in its country k index, and ignore the country effects, then we get:

$$\tilde{r}_{kt} \equiv \sum_i w_{ik}\tilde{R}_{ikt} = \sum_i w_{ik}\tilde{a}_{it} + \sum_i w_{ik}b_{ij}\tilde{I}_{jt} + \sum_i w_{ik}\tilde{e}_{ikt} \tag{5}$$

A sufficient condition for (5) to be equivalent to Roll's model (4) is that $b_{ij} = 1$ for all stocks i in industry j and zero otherwise, and the time-dependent intercept be absorbed into the definition of the industry factor, e.g., $I_{1t} \equiv \tilde{I}_{j=1,t} + \sum_i w_{ik}\tilde{a}_{it}$.

Using Model 1 (in which all of the b_{ij}'s and c_{ik}'s of Model 2 are constrained to equal unity), we constructed a sequence of 68 industry and 29 country effects $\tilde{I}_{jt}$ and $\tilde{C}_{kt}$ for each of the 239 days in our sample by performing cross-sectional regressions of returns on the industry and country dummy variables. For each industry and country, we calculated the average across time of the industry and country factors estimated in Model 1, $\bar{I}_j$ and $\bar{C}_k$. One measure of the relative importance of industry effects is then the average over time of the effects, $\bar{I}_j, j = 1,...,68$ as a ratio of this average industry effect plus the average of country effects, $\bar{C}_k, k = 1,...,29$. This ratio is 38%, or 37% if we use medians instead of averages. A better measure of the importance of the industry factor is the ratio of the time series variance of the fitted industry factors $\tilde{I}_{jt}$ to the time series variance of the fitted country effects $\tilde{C}_{kt}$. The average value of this ratio across countries and industries is 16.96%. This compares with the 22.8% of fitted variance which we obtained from the fit of our Model 2.

One explanation as to why this country effect estimated using Model 1 is lower than that resulting from our estimate of Model 2 is as follows. If all stocks are erroneously assumed to have the same exposure to the industry factor, then some of the true industry factor will likely manifest itself as a country factor in Model 1. Conversely, if not all stocks have the same sensitivity to the country factor, then some of the true country factor is erroneously impounded in the industry factor estimates in Model 1. If the misspecification is greater for the industry exposures, the net result will be an apparent magnification of the relative importance of the country factor in Model 1. To explore this reasoning, we took the period-by-period estimates of the industry factors estimated under Model 1 (i.e., restricting all of the b_{ij}'s and c_{ik}'s of Model 2 to equal unity) as exogenous. We then performed a "second step" multivariate regression of the time series returns on the individual stocks on these exogenous industry and country factors to estimate industry and country exposure coefficients.[11] In this second-step regression, the cross-sectional standard deviation of the estimated industry coefficient is 0.963, while the corresponding standard deviation for the estimated country coefficients is 0.457. This suggests that there is indeed more disparity among the stocks' exposure to their respective industry factor than their exposure to the country factor, and thus that the relative importance of the country factor is likely to be accentuated when estimated using Model 1.

A direct test of the hypothesis that $b_{ij} = 1 \ \forall \ i$ in each industry $j, j = 1,..., J$ (and similarly that all stocks i in the k'th country have identical coefficients c_{ik}) is to return to our Model 2 and test the hypothesis. This hypothesis is tested using a T^2 test where [Use bootstrap covariance matrix of b_{ij} and also get the distribution for the F statistic]

7. Country Effects for Local Returns versus $US Returns

When the returns of all stocks in a country are deflated by the same exchange rate divisor, we might expect to find that the country effect would on average be higher. It is

[11]We could have improved the performance of this regression by running it as a seemingly unrelated regression, but we didn't do so because of computational limitations.

interesting, then, that Heston and Rouwenhorst conclude that "[i]t is not possible to explain the large country effects in terms of currency movements" (p. 26).

We get about 15%. (Table).

8. Summary

In this paper, we have presented estimates of the relative importance of country and industry factors in explaining the returns of individual stocks in global stock indexes, primarily the DJGI. Most previous papers assume that the sensitivities of the individual stock returns to these country and industry factors are equal across stocks, while we allow them to differ.

We identify the country and industry factors by assuming that stocks have zero sensitivity to countries or industries other than those into which they are classified. We estimate the country and industry factors simultaneously with the sensitivities of stocks to those factors. We find that in a model in which (local) returns are fitted with just country and industry factors, the industry factor explains about 20% - 30% of the variation in global stock returns which can be accounted for by those two factors. If a global factor is included as an explanatory variable, industry explains about 7% of the three-factor fitted variation in returns.

Our results are that the industry factor plays a more significant role than is suggested by Heston and Rouwenhorst (1994)'s conclusion that "…industry-specific effects are simply much smaller than country effects. Industrial specialization explains less than 1% of the variance of equally-weighted [European] country index returns." We believe that the difference in the tenor of our's and Heston and Rouwenhorst's conclusion is attributable to the fact that we look at the fitted variation in individual stock returns, while they look at how much of countries' index returns can be explained by industry. For example, we find that if we use exactly the same estimation technique they do, we can explain about 17% of the fitted variation in the individual returns on DJGI stocks.

Notwithstanding the general result that about 20% - 30% of the country-plus-industry fitted variation can be explained by industry factors, or 7% if a global factor is also included, there are substantial differences across countries and industries in terms of how much of their respective stocks' returns can be explained by the country or industry

factors. For example, in Canada and the U.S., more than a third of the fitted returns on stocks can be explained by industry "factors," and thus less than two-thirds by country. At the other end of the spectrum are Italy and Switzerland, where less than 10% of the fitted return is explained by industry factors. There are also significant differences across industries. For example, about 65% of the fitted return on Precious Metals stocks in all countries are due to the Precious Metals industry factor, while only about 15% of the returns on Pharmaceutical stocks can be ascribed to industry (and thus 85% to country).

We also looked at the performance of alternative industrial classification schemes. We ran two comparisons. First, we compared how much of the variation in stock returns could be explained using the DJGI 68-industry classification with how much could be explained using the DJGI 9-major-sector classification. On average over the countries in the DJGI, the 9-major-segment classification permits 29.61% of the fitted variation in returns on their constituent stocks to be explained, which is *higher* than the 22.28% which can be explained using the 68-industry classification. If a separate global factor is included in the return model along with country and industry, the 9-major-segment classification explains about 10.54%, which is still higher than the 9.40% using the 68 classes. Second, we compared the industrial classification of the DJGI with the Morgan Stanley Capital International (MSCI) World Index, which used 38 industry classes. The industry factors estimated using the smaller number of classes in the MSCI World Index classification explain about 37.16% of the fitted variation in stocks' returns compared with 22.28% for the DJGI.

Finally, we confirmed that measuring the returns on stocks in an Index in terms of a common currency, e.g. USD or German marks increases the estimated country effect by about 15%. This result seems reasonable since the returns on all stocks in a country will be deflated by the same exchange rate, but it does contradict Heston and Rouwenhorst's (1994) conclusion that the estimated country effect seems invariant to whether currency movements are taken into account.

REFERENCES

Chamberlain, G., and M. Rothschild, 1983, "Arbitrage and Mean Variance Analysis on Large Asset Markets, *Econometrica*, 51, 1281-1304.

Fedrigo, Indro, Terry Marsh, and Paul Pfleiderer, 1996, "Estimating Factor Models of Security Returns: How Much Difference Does it Make?" Working Paper, U.C. Berkeley and Stanford University.

Heston, Steven L., and K. Geert Rouwenhorst, 1994, "Does Industrial Structure Explain the Benefits of International Diversification?" *Journal of Financial Economics* 36, 3-27.

King, Benjamin, 1966, "Market and Industry Factors in Stock Price Behavior," *Journal of Business*, 39, January, ??

Morgan Stanley Capital International, 1996, *Methodology & Index Policy*, New York, July.

Roll, Richard, 1992, "Industrial Structure and the Comparative Behavior of International Stock Market Indices," *The Journal of Finance*, 47(1), March, 3-41.

Ross, Stephen A., 1976, "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory*, 13, 341-360.

Standard & Poor's, 1994, *S&P 500 Directory*, Standard & Poor's, 25 Broadway, New York, N.Y. 10004.

Table 1
Percent of Fitted Variation in Local Returns on Dow Jones Global Index Stocks Explained by Country Factor: Stocks Grouped by Country

Australia	85.85%
Austria	72.55%
Belgium	87.10%
Canada	59.75%
Denmark	87.50%
Finland	87.46%
France	82.57%
Germany	86.23%
Hong Kong	78.90%
Indonesia	76.60%
Ireland	30.70%
Italy	93.27%
Japan	82.99%
Malaysia	78.40%
Mexico	78.87%
Netherlands	89.34%
New Zealand	83.64%
Norway	87.24%
Phillippines	79.50%
Singapore	78.62%
South Africa	52.51%
South Korea	74.17%
Spain	83.14%
Sweden	81.71%
Switzerland	93.00%
Taiwan	86.90%
Thailand	67.86%
United Kingdom	62.45%
United States	64.97%

Table 2

Percent of Fitted Variation in Local Returns on Dow Jones Global Index Stocks Explained by Country Factor: Stocks Grouped by Industry

Advertising	76.80%	Industrial Technology	55.82%
Air Freight & Couriers	57.27%	Lodging	93.98%
Airlines	71.41%	Heavy Machinery	72.70%
Aerospace & Defense	64.20%	Marine Transportation	82.05%
Auto Parts & Equipment (All)	80.22%	Medical Supplies	70.56%
Auto Manufacturers	73.53%	Media (All)	66.07%
Building Materials	73.41%	Mining - Diversified	71.97%
Banks (All)	80.26%	Medical & Biolgcl Tchnlgy (All)	63.95%
Beverages (All)	70.24%	Non-Ferrous Metals (All)	79.54%
Conglomerates	93.02%	Office Equipment	72.86%
Chemicals (All)	78.29%	Oilfield Equipment & Services (All)	43.15%
Communications Technology (All)	76.21%	Oil Companies - Majors	42.68%
Coal	60.95%	Oil Companies - Secondary	71.96%
Heavy Construction	81.64%	Overseas Trading	79.80%
Cosmetics & Personal Care	68.89%	Paper Products	77.30%
Computers (All)	63.42%	Precious Metals	35.51%
Containers & Packaging	69.31%	Pipelines	48.04%
Pharmaceuticals	85.34%	Plantations	63.68%
Diversified Technology	78.39%	Railroads	85.58%
Electric Utilities (All)	65.26%	Real Estate	73.06%
Electric Components & Equipment	77.74%	Retailers - Broadline	70.25%
Entertainment & Leisure (All)	73.09%	Retailers - Specialty (All)	63.21%
Factory Equipment	76.69%	Savings & Loan Assctns (U.S. only)	32.44%
Food Retailers & Wholesalers	67.22%	Securities Brokers	82.89%
Diversified Financial	77.64%	Semiconductors	53.49%
Food (All)	75.39%	Software	59.75%
Forest Products	70.74%	Steel	76.70%
Gas Utilities	82.24%	Indstrl & Cmmrcl Services (All)	83.99%
Health Care Providers	35.37%	Textiles & Apparel (All)	76.22%
Home Furnishings & Appliances (All)	79.01%	Telephone Utilities (All)	74.44%
Home Construction	76.04%	Tobacco	65.22%
Consmr & Hshld Prdcts & Srvics (All)	89.84%	Trucking	66.90%
Industrial - Diversified	79.85%	Transportation Equipment (All)	80.53%
Insurance (All)	79.47%	Water Utilities	54.79%

Table 3
Dow Jones Global Index
Percent of Fitted Variation in Local Returns Explained by Country Factor
(DJGI Industrial Classification x Country)

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany	Hong Kong	Indonesia	Ireland	Italy	Japan	Malaysia	Mexico	Netherlands	New Zealand	Norway	Phillippines	Singapore	South Africa	South Korea	Spain	Sweden	Switzerland	Taiwan	Thailand	U.K.	U.S.A.
Advertising							88.57%																					99.44%	65.34%
Air Freight & Couriers																												6.26%	65.77%
Airlines		86.39%		92.52%	97.56%	95.77%		96.89%	99.66%				95.22%	48.44%		99.97%				94.45%		90.28%			95.97%			79.29%	33.14%
Aerospace & Defense				60.01%			68.34%		85.14%				82.07%							41.01%		76.00%						66.03%	55.52%
Auto Parts & Equipment (All)	91.22%			52.74%			99.79%	94.37%		19.46%		99.64%	78.48%									76.57%		98.40%		95.94%		70.17%	81.11%
Auto Manufacturers							66.48%	85.06%				88.45%	60.66%	80.31%								44.40%		73.56%		87.98%			86.30%
Building Materials	89.24%	60.95%	82.43%	85.78%	95.06%	99.91%	71.68%	79.81%		62.70%	0.40%	93.00%	80.66%	70.95%	71.75%		76.40%		83.16%		43.47%	82.08%	73.71%		95.68%	85.32%	58.99%	54.67%	72.88%
Banks (All)	68.16%	48.94%	94.44%	68.67%	93.22%	98.85%	87.21%	77.76%	77.22%	95.69%	4.67%	96.01%	83.56%	82.80%		93.43%		98.88%	78.51%	99.12%	42.95%	74.23%	81.91%	67.79%	83.05%	92.80%	65.42%	84.51%	82.64%
Beverages (All)	81.15%	94.65%		70.79%	49.28%		76.05%						84.33%	89.53%	89.90%	56.04%	57.65%		48.29%	63.96%	39.73%	61.28%					27.47%	64.04%	78.70%
Conglomerates	99.45%		98.85%	85.42%	98.17%	97.69%	78.97%	99.95%	99.93%	99.96%		98.41%		90.99%	99.74%		98.67%	92.10%	98.16%	98.62%	68.63%				98.31%			77.24%	98.08%
Chemicals (All)	91.37%		82.77%	66.28%		41.95%	82.97%	77.70%				92.06%	83.81%	90.59%		99.95%	94.71%	91.81%			52.53%	86.07%		97.20%	100.00%	83.63%	60.76%	64.93%	68.81%
Communications Technology (All)				66.38%	99.99%		97.57%			99.63%		99.60%	94.39%		96.96%	98.97%		99.64%			93.10%	95.77%		99.80%			98.61%	99.93%	40.10%
Coal	98.99%												94.76%								69.47%						44.78%		32.20%
Heavy Construction	86.52%	48.84%					89.51%	93.22%	99.95%	3.11%		96.79%	76.14%	82.33%	98.02%				98.59%			88.77%	85.17%	91.39%		90.39%	93.68%	81.86%	74.29%
Cosmetics & Personal Care							85.89%						57.86%									7.86%							90.91%
Computers (All)				99.51%					99.96%			99.27%	54.74%							100.00%	88.53%					99.38%	98.51%		29.43%
Containers & Packaging	99.66%						95.23%	85.86%					62.41%	6.20%												91.94%		42.39%	71.64%
Pharmaceuticals	99.94%			42.07%	99.89%		97.46%	96.73%		86.79%			85.38%					86.30%				42.87%		92.77%	99.73%			94.79%	90.05%
Diversified Technology		92.49%				99.68%	94.49%	99.37%					91.46%			99.94%					99.98%						19.24%	8.20%	72.24%
Electric Utilities (All)		94.62%	85.20%	55.49%					51.57%				97.68%	73.75%			99.97%	99.43%	68.30%			53.37%	60.54%	31.03%	53.40%		61.68%	71.33%	60.27%
Electric Components & Equipment					92.08%		81.33%		33.07%				82.76%	95.52%					98.63%	0.22%	99.98%	95.91%		60.91%	99.25%	70.28%		48.30%	81.74%
Entertainment & Leisure (All)	95.77%			18.99%			78.88%			80.78%			85.74%	96.00%					87.56%		69.11%				99.42%	91.10%	91.93%	55.97%	62.43%
Factory Equipment						99.97%		99.62%				98.19%	86.00%												99.50%			53.97%	30.62%
Food Retailers & Wholesalers			97.11%	71.85%			71.36%				99.97%		63.91%		86.94%	90.29%	54.84%				36.04%							51.08%	63.43%
Diversified Financial	94.98%		65.91%	80.63%	70.32%		90.94%		48.70%		1.72%	99.04%	82.06%	89.15%	57.86%	99.28%				96.16%	67.29%	65.49%	75.84%	89.10%	94.36%	97.06%	69.87%	66.03%	88.40%
Food (All)	89.16%				89.28%	78.84%	81.20%		99.83%	73.36%	93.98%	87.29%	88.63%	50.11%	48.30%	77.67%	76.86%		66.69%	43.00%	33.84%	61.38%	96.80%		97.25%	96.37%	89.72%	56.62%	73.64%
Forest Products	65.00%			62.36%						99.78%				73.60%			81.82%		38.33%			86.07%		93.07%					70.23%
Gas Utilities	100.00%			92.28%			99.51%		98.83%			98.32%	90.61%									3.20%	99.38%					29.52%	90.42%
Health Care Providers				72.59%																									31.65%
Home Furnishings & Appliances (All)					89.67%		97.74%		38.07%		17.30%		79.03%	4.49%		99.99%	71.85%					98.64%		92.63%		97.67%	90.97%		75.36%
Home Construction									99.68%				90.96%	87.09%					55.70%	74.81%		76.07%				93.89%	68.37%	54.35%	76.14%
Consumer & Household Products & Services (All)				59.49%					86.77%	96.49%			96.98%		93.78%					95.05%		96.81%					98.93%	81.80%	87.05%
Industrial - Diversified	99.14%	98.72%		98.59%	99.32%	93.37%	79.58%	84.09%				37.92%	92.57%	88.23%	82.65%	86.15%				30.33%		97.85%		90.29%	88.22%	92.09%		51.72%	79.75%
Insurance (All)	93.84%	89.30%	99.06%	93.73%	51.12%	66.52%	96.89%	89.26%			6.57%	91.42%	74.38%	81.10%		90.93%		99.96%		89.97%	44.84%	69.95%	98.02%	79.79%	86.59%	95.04%	90.42%	96.79%	73.57%
Industrial Technology									43.57%				63.87%															28.44%	53.44%
Lodging							99.96%		97.94%	99.43%			95.92%	99.95%						98.45%	99.49%	98.00%				99.11%	0.11%		96.67%
Heavy Machinery						92.98%							87.83%											93.79%					36.15%
Marine Transportation	88.88%		96.09%		84.11%				79.78%				92.62%	58.14%		99.19%		64.10%		88.51%		88.61%				85.42%		61.24%	78.11%
Medical Supplies						87.64%	85.94%						55.30%															95.42%	71.10%
Media (All)	79.65%			55.89%			91.78%		48.10%		2.28%		48.45%	70.08%	76.01%	67.34%	81.21%	78.44%		98.20%	51.77%						49.85%	65.06%	71.36%
Mining - Diversified	99.17%			67.40%						85.28%					97.41%						95.85%	10.95%						83.70%	27.12%
Medical & Biological Technology (All)				8.84%	96.57%	87.99%							99.68%															81.43%	57.23%
Non-Ferrous Metals (All)	78.26%			80.27%		77.53%	99.80%	95.54%					70.63%	92.03%				58.95%				77.54%		80.53%	98.95%				82.68%
Office Equipment													83.12%			99.69%										10.66%			96.02%
Oilfield Equipment & Services (All)							99.63%					98.00%						96.98%									99.66%		15.70%
Oil Companies - Majors			98.29%	6.65%			98.38%									81.39%							93.56%					77.70%	13.63%
Oil Companies - Secondary	84.85%	99.92%	99.91%	55.22%				93.95%				95.36%	96.27%	78.72%			99.90%	96.08%	96.50%	98.80%	91.53%	87.77%	87.16%				87.32%	77.33%	43.03%
Overseas Trading									91.30%				88.86%	99.54%						58.43%		69.86%				99.79%	66.56%	51.74%	
Paper Products		34.00%		73.27%		91.70%		90.75%		70.08%	15.13%	99.96%	83.59%			96.24%	96.12%	42.51%			83.67%	87.81%		75.00%		93.43%		38.72%	86.17%
Precious Metals	79.37%			12.65%				97.04%					99.24%								32.04%							98.58%	14.14%
Pipelines				95.18%																									24.47%
Plantations														63.68%															
Railroads													94.09%				99.91%											1.12%	74.09%
Real Estate	86.36%			57.70%			57.69%		85.69%	84.65%			68.44%	85.76%		57.22%			77.24%	85.47%			99.44%		98.53%	61.07%	66.29%	57.66%
Retailers - Broadline	70.87%			88.47%		79.86%	97.65%	65.10%	92.75%			91.22%	81.08%		71.16%					47.26%	47.23%	76.29%	44.90%		72.38%	48.87%	67.08%	59.85%
Retailers - Specialty (All)	98.88%			69.85%			96.72%		68.44%	89.91%			48.35%	75.84%						72.14%	45.72%	97.50%			30.08%	46.63%	57.85%	64.78%
Savings & Loan Associations (U.S. only)																													32.44%
Securities Brokers									93.06%				99.31%	98.90%		99.68%						52.90%					98.69%	97.16%	97.67%
Semiconductors									46.65%				32.53%	74.63%								96.33%				98.57%	61.33%		5.70%
Software				41.57%			96.33%	95.95%					95.47%			97.82%					92.22%								40.84%
Steel		99.99%	56.71%	59.24%			88.51%	64.77%					91.21%	84.01%	72.66%		96.48%			79.78%	42.19%	81.27%		86.53%		80.65%	39.41%	32.63%	67.11%
Industrial & Commercial Services (All)	94.61%	99.81%		24.26%	89.59%		66.80%	100.00%	94.40%				93.08%	99.77%					99.88%		63.51%		97.56%	72.66%	99.80%			84.01%	80.85%
Textiles & Apparel (All)		98.74%					77.29%	92.63%	51.34%	13.42%			90.88%									77.29%		53.23%	99.80%	82.49%	57.84%	35.25%	83.08%
Telephone Utilities (All)				58.93%	98.59%			57.70%	53.50%	87.69%		95.59%	79.33%	15.99%	98.06%	84.67%	98.49%		99.95%	96.42%		45.68%	99.29%			52.00%	72.61%	70.81%
Tobacco	31.07%			82.31%			36.32%			98.69%			98.04%	90.30%						58.17%			99.99%		99.99%		70.44%	14.63%
Trucking				13.50%									95.75%			100.00%					4.47%					79.80%			61.20%
Transportation Equipment (All)		79.76%											93.21%							83.04%		60.11%		99.62%					64.76%
Water Utilities							98.36%																					14.63%	73.74%

Table 4
Percent of Fitted Variation in Local Returns on DJGI Stocks Explained by Country Factor with the Nine DJGI Market Segments Used for Industrial Classification: Stocks Grouped by Country

Australia	80.17%
Austria	71.38%
Belgium	71.87%
Canada	39.34%
Denmark	34.53%
Finland	81.70%
France	75.44%
Germany	80.88%
Hong Kong	75.76%
Indonesia	73.71%
Ireland	29.06%
Italy	92.52%
Japan	80.71%
Malaysia	76.55%
Mexico	75.83%
Netherlands	85.73%
New Zealand	74.20%
Norway	81.22%
Philippines	78.13%
Singapore	70.77%
South Africa	29.86%
South Korea	74.00%
Spain	78.15%
Sweden	78.19%
Switzerland	86.29%
Taiwan	84.64%
Thailand	81.16%
United Kingdom	50.65%
United States	48.91%

Table 5

Percent of Fitted Variation in Local Returns on DJGI Stocks Explained by Country Factor with Market Segments Used to Estimate Industry Factors: Stocks Grouped by DJGI Market Segments

Basic Material	67.83%
Consumer Cyclical	64.57%
Energy	57.29%
Financial	67.07%
Industrial	68.15%
Independents	79.48%
Consumer, Non-cylical	63.68%
Technology	58.94%
Utilities	59.79%

Table 6
Percent of Fitted Variation in Local Returns on MSCI Stocks Explained by Country Factor: Stocks Grouped by Country*

Australia	33.55%
Austria	55.98%
Belgium	49.49%
Canada	33.36%
Denmark	36.63%
Finland	80.40%
France	47.80%
Germany	35.93%
Hong Kong	71.76%
Ireland	62.26%
Italy	96.17%
Japan	97.72%
Malaysia	94.40%
Netherlands	32.26%
New Zealand	73.34%
Norway	38.28%
Singapore	94.87%
Spain	58.57%
Sweden	55.85%
Switzerland	53.02%
United Kingdom	93.32%
United States	87.60%

*Source for Country and Industry Classifications: Morgan Stanley Capital International (MSCI) World Index

Table 7
MSCI World Index
Percentage of Fitted Variation in Local Returns Explained by Country Factor
(MSCI Industrial Classification x Country)

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany	Hong Kong	Ireland	Italy	Japan	Malaysia	Netherlands	NZ	Norway	Singapore	Spain	Sweden	Switzerland	UK	USA
Aerospace and Military Technology				80.76%			75.24%	48.51%	79.73%			97.26%		1.33%		1.49%	94.12%		90.73%	51.80%	93.18%	93.53%
Appliances and Households	37.13%			38.07%	33.58%		24.97%	31.47%			97.09%	98.95%	99.16%	17.61%	89.81%				96.51%			84.96%
Automobiles							48.54%	41.33%	96.86%		99.72%	98.27%	95.07%					31.06%	92.89%			99.68%
Banking	52.55%	38.03%	84.24%	55.02%	48.45%	67.42%	44.81%	52.73%	97.83%	80.75%	98.43%	98.89%	98.66%	2.67%		32.16%	99.64%	82.01%	53.31%	73.96%	98.56%	99.14%
Beverages and Tobacco	54.16%	50.86%		11.86%	13.97%		6.11%	7.15%	63.60%			98.33%	96.61%	0.92%	82.67%		99.86%	65.51%			99.10%	60.57%
Broadcasting and Publishing	37.87%			44.04%			66.45%	88.95%	81.55%	39.22%	98.70%	92.79%	94.09%	24.17%	99.31%	53.72%	98.64%	21.95%	97.48%		94.45%	89.64%
Building Materials and Components	55.78%	57.22%	54.95%	98.47%		99.24%	48.34%	18.31%		48.10%	99.51%	97.44%	95.38%					73.31%	14.77%	72.60%	94.39%	99.76%
Business and Public Services	21.46%	99.59%		42.31%	4.77%		51.25%	96.20%	99.76%		99.91%	97.93%		47.90%	98.67%	97.01%	99.68%	45.22%	73.90%	18.86%	97.89%	94.33%
Chemicals	23.00%	51.21%	7.89%	32.85%	2.07%	99.56%	44.59%	17.51%			98.53%	97.30%	99.96%	85.84%	92.67%	31.41%		49.84%	69.49%	25.48%	93.68%	94.14%
Construction and Housing	17.12%	59.20%					36.85%	58.62%	99.85%	4.29%	99.93%	97.44%	99.77%	40.96%			99.40%	65.87%	99.95%	90.92%	99.82%	99.17%
Data Processing and Reproduction								18.24%			98.82%	98.43%		49.91%			90.90%				95.83%	97.15%
Electrical and Electronics			98.63%	41.55%	94.93%	98.26%	75.19%	2.80%	98.51%	99.96%	99.88%	98.77%	97.99%						46.80%	62.39%	97.28%	99.09%
Electronic Components and Instrument		99.15%		12.55%			0.66%		97.95%			97.65%	87.89%				69.35%				92.96%	36.34%
Energy Equipment and Services				58.50%			7.50%				95.72%	92.72%		4.36%		19.47%						22.69%
Energy Sources	23.24%	73.59%	32.23%	15.95%			50.99%					98.44%	93.41%	15.31%		9.96%		58.41%			92.97%	76.51%
Financial Services	94.40%		24.60%	87.90%			41.97%		95.55%	70.59%	96.40%	96.03%	97.95%	52.08%				99.45%		48.89%	98.62%	93.10%
Food and Household Products	50.98%				15.46%	92.56%	58.76%	1.73%		88.66%	90.80%	98.64%	99.95%	53.66%			92.78%	39.62%		76.96%	89.14%	94.98%
Forest Products and Paper	9.03%	59.49%		12.50%		22.97%	98.41%	5.59%		15.61%	97.58%	95.85%	99.05%	1.43%	8.62%	11.48%		38.66%	2.39%		92.50%	62.18%
Gold Mines	8.09%			0.10%																		0.92%
Health and Personal Care	37.52%			76.52%	49.51%	41.16%	65.14%	41.46%		99.63%	99.28%	98.32%		51.67%					92.25%	58.92%	99.27%	97.63%
Industrial Components	86.59%	43.95%	41.22%	65.04%	6.43%		56.88%	20.81%			98.57%	97.92%	98.95%	44.74%					46.39%	61.10%	96.24%	98.74%
Insurance	42.83%	76.16%	85.21%	96.54%	97.29%	97.94%	49.31%	37.54%	98.03%	23.10%	99.78%	98.89%	99.96%	41.83%		99.58%		55.94%	98.34%	50.91%	99.20%	97.51%
Leisure and Tourism	78.83%		75.17%	99.90%			58.93%		83.96%		90.10%	92.60%	99.16%			72.17%	91.88%			41.86%	97.68%	88.54%
Machinery and Engineering	90.74%	93.82%		78.82%	29.47%	72.47%	13.34%	49.44%			96.31%	97.83%	99.39%	56.92%		61.96%	99.05%	82.42%	17.78%	48.46%	98.28%	95.69%
Merchandising	41.68%		74.55%	54.94%		99.66%	59.78%	3.22%	77.33%		98.24%	94.81%		26.56%			76.20%	20.24%	100.00%	42.04%	94.13%	94.46%
Metals - Non Ferrous	6.54%		0.01%	3.65%		25.35%	25.60%				56.82%	99.06%	95.35%			0.66%	99.44%	75.94%		23.71%	91.98%	26.42%
Metals - Steels	24.66%	1.43%	71.69%	43.98%		93.07%	26.20%	25.58%			91.60%	98.79%	98.87%	99.54%	93.40%		96.23%	57.82%	78.01%		86.07%	88.49%
Misc. Materials and Commodities	62.17%	59.35%	41.99%	81.29%			32.17%	41.79%				99.05%	84.43%					45.42%			97.42%	98.39%
Multi - Industry	27.29%	28.15%	11.37%	4.75%	15.27%	76.60%	23.98%	17.80%	84.65%	52.89%	98.36%	98.34%	97.40%	0.93%	71.71%	19.32%	98.37%	39.36%	26.53%	32.98%	79.05%	90.88%
Real Estate	1.08%		83.13%	3.92%			33.34%		21.52%		52.02%	98.57%	84.43%	10.42%	9.71%		94.29%	24.03%	36.76%		84.09%	91.12%
Recreation				99.59%	2.66%		59.48%	7.77%	83.85%	99.96%	77.77%	98.17%		25.18%						98.05%	84.12%	96.96%
Telecommunication				38.53%	24.07%				99.48%		96.08%	99.61%	99.82%	87.39%	85.97%		96.76%	94.37%			97.20%	92.97%
Textiles and Apparel		9.39%		49.23%			90.59%	55.40%	51.94%		95.58%	97.35%		23.52%	2.98%						58.99%	98.42%
Transportation - Airlines	12.46%	87.62%		56.89%	91.79%	86.54%		14.21%	98.33%		88.03%	99.98%	99.94%	2.75%	83.98%	92.80%	99.76%			90.50%	99.94%	94.83%
Transportation - Road and Rail	7.52%								91.77%			96.49%					99.15%				78.83%	85.27%
Transportation - Shipping			99.66%		36.36%				96.22%			99.37%	90.43%	0.50%		18.90%	98.22%		74.18%		92.04%	99.11%
Utilities - Electrical and Gas	73.60%	3.66%	35.80%	25.58%				26.96%	86.19%		99.79%	97.95%	96.56%		98.65%	90.38%		73.82%	72.34%	29.86%	98.17%	97.12%
Wholesale and International Trade					1.78%	99.50%			92.46%			98.76%	97.96%	7.00%			99.37%				99.59%	

*Source for Country and Industry Classifications: Morgan Stanley Capital International (MSCI) World Index

Table 8
Percent of the Fitted Variation in Local Returns on DJGI Stocks Explained by Country and Industry when a Global Factor is Included

	Cntry/(Cntry+Ind)	Cntry/(Cntry+Ind+Global)	Ind/(Cntry+Ind+Global)
Australia	98.45%	69.09%	1.07%
Austria	84.37%	46.78%	11.79%
Belgium	96.09%	52.86%	2.27%
Canada	68.00%	38.34%	20.81%
Denmark	91.58%	49.13%	6.16%
Finland	92.88%	61.56%	5.07%
France	93.49%	55.32%	3.05%
Germany	96.92%	60.94%	2.35%
Hong Kong	96.66%	61.69%	1.91%
Indonesia	93.68%	62.54%	3.91%
Ireland	91.60%	49.06%	6.83%
Italy	95.99%	71.31%	3.34%
Japan	95.37%	73.18%	3.31%
Malaysia	88.57%	58.63%	8.70%
Mexico	92.33%	62.16%	6.43%
Netherlands	98.48%	70.94%	1.02%
New Zealand	95.77%	60.26%	2.64%
Norway	90.06%	51.93%	4.52%
Phillippines	89.17%	56.11%	7.08%
Singapore	91.57%	59.47%	6.12%
South Africa	88.70%	51.16%	6.58%
South Korea	68.72%	54.61%	26.77%
Spain	97.05%	64.70%	1.72%
Sweden	94.90%	62.68%	2.50%
Switzerland	95.78%	58.82%	3.54%
Taiwan	94.90%	74.81%	4.22%
Thailand	83.18%	74.19%	15.06%
United Kingdom	91.86%	51.31%	4.72%
United States	71.31%	46.86%	20.24%
Average	90.60%	58.98%	6.68%

Model: $R_{ijkt} = b_{ig} G_t + b_{ij} I_{jt} + b_{ik} C_{kt} + e_{ijkt}$

Table 9
Percent of the Fitted Variation in Local Returns on DJGI Stocks Explained by Country and Industry Factors when a Global Factor is Included: Stocks Grouped by Industry

	Cntry/(Cntry+Ind)	Cntry/(Cntry+Ind+Global)	Ind/(Cntry+Ind+Global)
Advertising	75.51%	49.88%	20.73%
Air Freight & Couriers	71.84%	43.28%	24.12%
Airlines	65.45%	43.74%	27.01%
Aerospace & Defense	58.92%	45.09%	25.95%
Auto Parts & Equipment (All)	93.98%	64.80%	4.66%
Auto Manufacturers	84.39%	61.41%	12.31%
Building Materials	94.59%	64.83%	3.47%
Banks (All)	95.10%	65.65%	4.13%
Beverages (All)	88.17%	61.04%	7.11%
Conglomerates	94.16%	59.30%	3.82%
Chemicals (All)	94.84%	67.51%	4.02%
Communications Technology (All)	73.94%	40.25%	22.05%
Coal	76.42%	53.77%	19.49%
Heavy Construction	87.68%	58.17%	8.81%
Cosmetics & Personal Care	85.33%	65.84%	13.11%
Computers (All)	68.82%	46.57%	25.40%
Containers & Packaging	76.77%	52.47%	14.74%
Pharmaceuticals	89.68%	58.66%	8.14%
Diversified Technology	95.27%	58.63%	4.11%
Electric Utilities (All)	38.45%	26.11%	36.35%
Electric Components & Equipment	96.04%	64.18%	2.44%
Entertainment & Leisure (All)	88.49%	59.99%	5.89%
Factory Equipment	83.54%	57.17%	12.53%
Food Retailers & Wholesalers	74.68%	49.06%	16.39%
Diversified Financial	94.81%	61.86%	3.96%
Food (All)	90.38%	63.85%	6.34%
Forest Products	93.12%	62.64%	5.56%
Gas Utilities	87.58%	60.76%	9.39%
Health Care Providers	24.27%	16.64%	58.85%
Home Furnishings & Appliances (All)	94.61%	60.43%	3.68%
Home Construction	92.03%	60.19%	6.95%
Consumer & Household Products & Services (All)	89.38%	67.42%	7.17%
Industrial - Diversified	95.66%	63.38%	3.13%
Insurance (All)	92.27%	66.79%	6.21%
Industrial Technology	82.53%	46.36%	10.47%
Lodging	94.84%	64.74%	4.79%
Heavy Machinery	71.46%	52.46%	21.62%
Marine Transportation	93.18%	69.17%	4.84%
Medical Supplies	90.02%	65.23%	8.09%
Media (All)	93.40%	60.85%	2.48%
Mining - Diversified	80.12%	47.25%	12.47%
Medical & Biological Technology (All)	68.90%	52.08%	23.37%
Non-Ferrous Metals (All)	93.87%	58.37%	4.96%
Office Equipment	81.95%	49.48%	15.05%
Oilfield Equipment & Services (All)	37.13%	19.76%	50.92%
Oil Companies - Majors	47.51%	23.18%	37.11%
Oil Companies - Secondary	61.79%	42.30%	24.55%
Overseas Trading	88.56%	67.51%	9.13%
Paper Products	93.62%	72.92%	5.68%
Precious Metals	52.34%	39.37%	37.52%
Pipelines	33.90%	22.47%	46.06%
Plantations	49.58%	33.70%	37.40%
Railroads	88.20%	64.02%	8.85%
Real Estate	93.47%	55.94%	4.54%
Retailers - Broadline	90.85%	70.56%	6.43%
Retailers - Specialty (All)	83.26%	56.64%	10.10%
Savings & Loan Associations (U.S. only)	14.47%	9.51%	67.00%
Securities Brokers	69.90%	47.71%	28.82%
Semiconductors	76.57%	53.24%	20.89%
Software	46.89%	30.18%	37.24%
Steel	93.35%	73.38%	4.37%
Industrial & Commercial Services (All)	94.01%	62.82%	4.03%
Textiles & Apparel (All)	95.39%	59.00%	2.91%
Telephone Utilities (All)	93.63%	63.42%	5.67%
Tobacco	70.74%	35.70%	21.73%
Trucking	81.36%	43.74%	12.22%
Transportation Equipment (All)	92.47%	63.23%	6.66%
Water Utilities	62.99%	31.59%	23.02%

Model: $R_{ijkt} = b_{ig} G_t + b_{ij} I_{jt} + b_{ik} C_{kt} + e_{ijkt}$

Figure 1
Australian and U.S. Stocks' Coefficients on the Precious Metals Industry Factor for Stocks Classified in DJGI as in the Precious Metals Industry

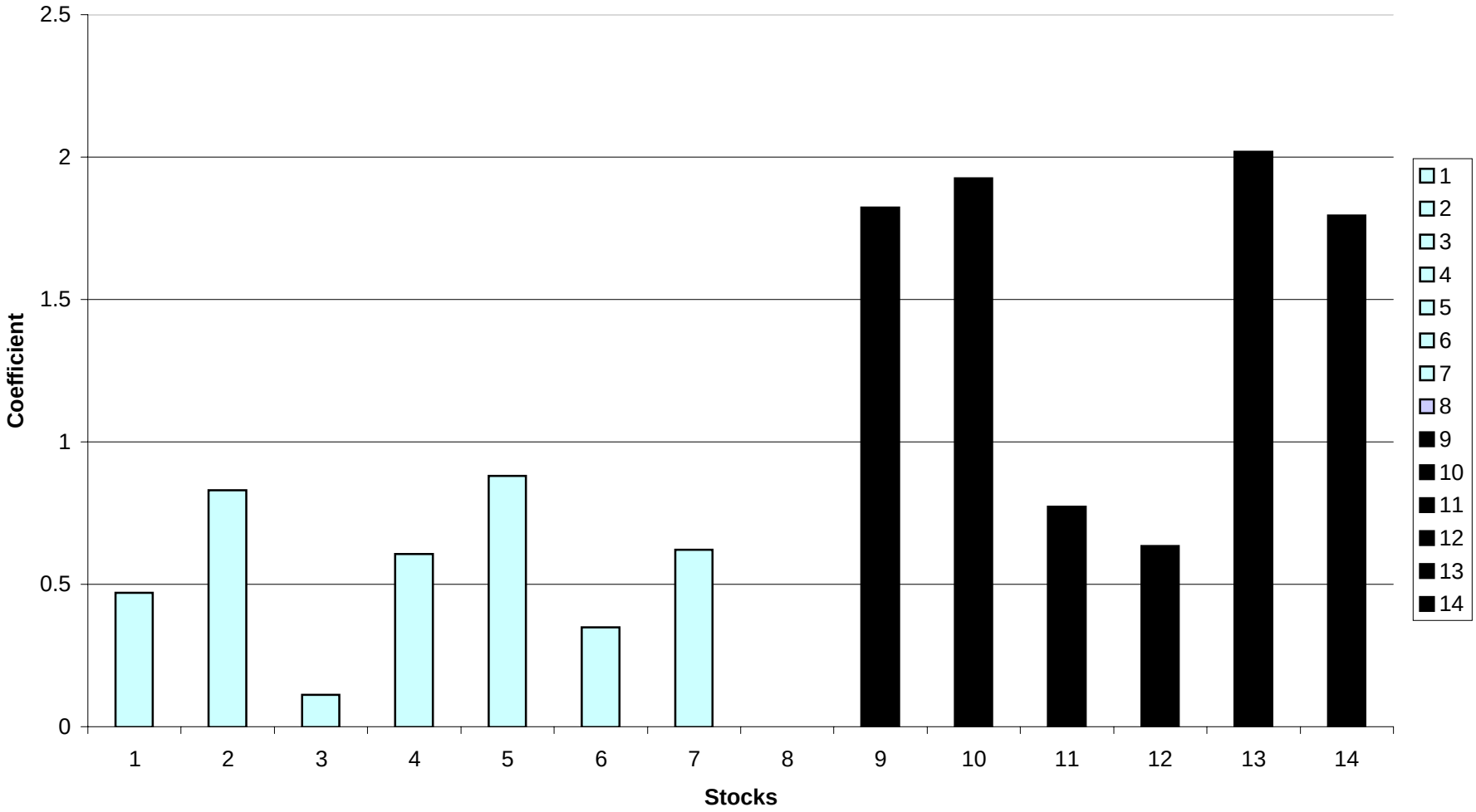

Figure 2
Australian and U.S. Stocks' Coefficients on the Country"Factor" for Stocks Classified in DJGI as in the Precious Metals Industry