
National versus Global Influences on Equity Returns

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Simple factor models of worldwide equity returns are used to explore the level and trend in international capital market integration. Global influences and national influences are of roughly equal importance in explaining the common movements in equity returns. Significant evidence indicates a trend toward increasing integration within the European Union, but not worldwide.

A large proportion of international portfolio managers and pension fund trustees allocate their funds in a top-down fashion, first making a decision across countries and/or geographical regions and then selecting securities within the various countries or regions. Similarly, most financial analysts evaluate the health of a company's balance sheet within a national context rather than in comparison with similar companies in other markets. These practices reflect a segregationist view of world capital markets. In a recent trend toward global analysis, however, securities are categorized and/or selected according to their underlying characteristics, not according to the nationality of their market listing. The conventional wisdom, at least as reflected in current practice, seems to be that the level of worldwide capital market integration is not high but is slowly increasing over time.

Capital market integration can be defined in at least three ways. One definition focuses on the barriers to international investing, such as regulatory, fiscal, or administrative impediments. To the extent that all investors have equal access to all world securities, markets are fully integrated by this definition. A second approach focuses on the consistency of asset pricing across markets. Under this definition, markets are integrated if any two assets with the same level of risk and the same expected cash flows always have the same price irrespective of the markets in which they trade. A third approach concentrates on the correlations of security returns across different markets. Under this definition of integration, the comovements in

security returns are linked to a set of common factors. If markets are fully integrated, then the factors explaining the correlations of returns will be international ones, with no role for national factors. This third, correlation-based definition of integration is the focus of this article.

The correlation-based definition of integration permits accurate and reliable empirical testing. An accurate test of asset pricing integration may require 100 years or more of returns data, whereas correlation-based analysis yields meaningful test statistics based on as little as three years of monthly returns.¹

Our analysis follows along the lines of earlier work by Beckers, Grinold, Rudd, and Stefek; Grinold, Rudd, and Stefek; and Heston and Rouwenhorst.² Grinold et al. and Beckers et al. used a fundamental factor model with factors for size, success, volatility, and yield, as well as a CAPM-style local market factor to characterize each stock. The factor exposures, derived from combinations of accounting data and time series returns data, are used in monthly cross-sectional regressions to derive the factor returns.

Heston and Rouwenhorst relied on a much simpler type of factor model. They used simple dummy variables to identify the industry and country affiliation of each stock. When these dummy variables are regressed on the cross-section of security returns, the estimated coefficients on the dummy variables are the implicit returns of country and industry factors. Translated into standard factor modeling terminology, the factor betas in the Heston and Rouwenhorst model are all equal to zero or unity and the regression coefficients correspond to country and industry factor returns.

In this study, we used the same factor modeling approach as Heston and Rouwenhorst. We extended their approach in several ways, however:

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We estimated and compared a set of factor models with the same basic structure but varying degrees of national versus international focus, and we present some new procedures for measuring integration (both in its level and trend through time) and provide new empirical findings.

One of our key models contains a global market factor, country factors, and global industry factors. In this model, the global market factor explains 21 percent of the typical equity return variance, country factors explain an additional 14 percent, and global industry factors an additional 4 percent. The two global influences (the global market factor and global industry factors), therefore, explain 25 percent between them. In some of our other factor model specifications (e.g., with local industries), the national influences slightly outweigh the global influences. Our general conclusion is that global and national influences are of roughly equal importance.

We investigated the trend toward greater worldwide integration by testing for increased explanatory power coming from the world market factor and global industry factors and for decreasing power from the country factors. We found only weak (and not statistically significant) evidence for increasing integration worldwide, but the evidence for the European Union (EU) is strong and statistically significant. Additional evidence of increasing EU integration is found in the increase in the correlations of EU country factors through time.

DATA

Our study is based on monthly excess returns for December 1982 through February 1995, 147 months in total. The data base covers 19 countries from the developed world.³ The sample each month consists of stocks that were part of the Financial Times Goldman Sachs World Index that month. The number of stocks in the sample varies across months; the average number is 2,123. For some parts of our research, we also considered the European Union (EU) separately in order to investigate whether economic integration is more pronounced in the EU than in the rest of the world. Our EU subset consists of 9 countries and has an average of 723 stocks. Stocks are classified as belonging to 1 country from among the 19 countries and 1 industry from among a set of 36 industries. We also tried seven broad economic sectors as an alternative to the 36 industries. The sector and industry classifications are those used in the Financial Times Goldman Sachs Index.

THE EXPLANATORY POWER OF NATIONAL VERSUS INTERNATIONAL FACTORS

We used simple factor models of returns with zero/one exposures to the explanatory variables (country and industry factors). First, we describe the model with country factors and global industry factors (what we call the countries + global industries model). All the other models have essentially the same form, so describing each in detail is not necessary. In all the models, we used returns in excess of the local risk-free rate and expressed in local currency. From the viewpoint of an investment practitioner, our return calculations correspond to fully hedged excess returns. From the viewpoint of a financial researcher, the distorting effects of currency movements are not included in the comovements.

In the countries + global industries model, the local excess return to each equity in a given month is divided into a global market return, a country factor return, a global industry return, and an asset-specific return; that is,

$$r_i = f^G + \sum_{h=1}^M \delta_{ih^I} f_{h^I} + \sum_{j=1}^L \delta_{ij^C} f_{j^C} + \varepsilon_i, \quad (1)$$

where

- r_i = excess return to security i $i = 1, \dots, N$
- f^G = return to the global market factor
- f_{h^I} = return to industry factor h $h = 1, \dots, M$
- f_{j^C} = return to country factor j $j = 1, \dots, L$
- ε_i = asset-specific return to security i
- δ_{ih^I} = 1 if security i is in industry h , 0 otherwise
- δ_{ij^C} = 1 if security i is in country j , 0 otherwise

We estimated the factor returns for each month by applying ordinary least squares to the cross-section of returns using Equation 1 subject to two linear constraints. That is, we found $\hat{f}^G, \hat{f}^I, \hat{f}^C$ to minimize $\sum_{i=1}^N \hat{\varepsilon}_i^2$ in Equation 1 subject to

$$\sum_{i=1}^N \sum_{h=1}^M \delta_{ih^I} \hat{f}_{h^I} = 0 \quad (2)$$

and

$$\sum_{i=1}^N \sum_{j=1}^L \delta_{ij^C} \hat{f}_{j^C} = 0 \quad (3)$$

The two linear constraints, Equations 2 and 3, imply that each month, the average worldwide effect of the country factors is zero and the average worldwide effect of the industry factors is zero. Adding the two equality restrictions implies that the country factor returns are measured net of the global market return. If security returns worldwide are mostly positive in a given month and German securities are also up but by less than worldwide securities generally, then the German factor return will be negative. The same holds for the industry factors: If security returns are generally positive worldwide and steel stocks are also up but by less than in most other industries, then the steel industry factor return will be negative.

The country and industry factors are neutralized returns because they are estimated simultaneously. So, for example, the German country factor return is neutralized with respect to the differing industrial composition of the German market compared with other markets. If the German stock market is up in a given month but all of the positive return can be attributed to the heavier representation of German stocks in particular industries that did well worldwide that month, then the German country factor returns will be zero. As long as no two countries in the sample have exactly the same proportions of firms in all industries, there is no identification problem in simultaneously estimating industry-neutralized country factors and country-neutralized industry factors.

In addition to the countries + global industries model, we estimated a set of alternative factor models with varying degrees of national versus international focus. By comparing the fit of these models, we hoped to learn about the relative importance of national versus international influences. Drop the country dummies from the countries + global industries model to produce the global industries-only model, or drop the industry dummies to produce a countries-only model. Also, changing the industry dummies produces a different industry factor return for each country. We

called this model the local industries-only model to differentiate it from the global industries-only model. All models include the global market factor (that is, a cross-sectional intercept). The model with nothing except the intercept is called the global market model. We also tried the seven sectors in place of the 36 industries. This approach does not produce any additional information about the level or trend in market integration, but it gives a different specification of industry factors. The full list of models and the linear constraints necessary to identify each model are shown in Table A1 in the appendix.

Table 1 shows the findings for the models, reporting two measures of model fit: the average R^2 s and the EP (explanatory power) statistics.⁴ (Both are adjusted for degrees of freedom.) The message from the average R^2 statistics confirms the general conclusions reported in Grinold et al., Beckers et al., and Heston and Rouwenhorst: National influences dominate global influences. The countries-only model has a three times higher average R^2 than the global industries-only model. Adding countries to the global industries-only model increases the average R^2 by 16.67 percent, whereas adding the global industries to the countries-only model increases the average R^2 by 4.29 percent. Alternatively, compare the global industries-only model to the local industries-only model: Using local industries in place of global industries increases the average R^2 from 5.22 percent to 25.71 percent. The simple message from the average R^2 analysis is that national influences (country factors and country-specific industry factors) are much more important than global influences in explaining equity returns. Note that, by construction, the average R^2 is exactly zero for the global market model.

The EP statistic offers quite a different interpretation of the same regression results. The EP of the global market model is 21.07 percent. Considering the countries + global industries model, we can decompose its explanatory power by viewing

Table 1. Adjusted R^2 and EP for Each Model, with and without October 1987
(data in parentheses exclude October 1987)

Model	No Industry or Sector Factors	Global Sector Factors	Global Industry Factors	Local Industry Factors
<i>Average adjusted R^2</i>				
No country factors	0.0000 (0.0000)	0.0208 (0.0206)	0.0522 (0.0517)	0.2571 (0.2558)
Country factors	0.1760 (0.1746)	0.1947 (0.1928)	0.2189 (0.2170)	0.3039 (0.3022)
<i>Adjusted EP</i>				
No country factors	0.2107 (0.1800)	0.2282 (0.1977)	0.2537 (0.2238)	0.4308 (0.4058)
Country factors	0.3620 (0.3347)	0.3778 (0.3503)	0.3970 (0.3700)	0.4695 (0.4453)

it as a combination of three models. The global industries add 4.30 percent explanatory power to the 21.07 percent explanatory power of the global market factor alone, whereas the countries add 14.33 percent to the global industries-only model. The global industries alone are the weakest influence, but the two global influences together (global market factor plus global industries) contributed 25.37 percent to the explanatory power of this model, whereas the country factors only contributed 14.33 percent.

It is notable that in comparing the *differences* between the explanatory power of the factor models, the EP and average R^2 statistics shown in Table 1 give similar findings. The observed differences between EP and average R^2 stem largely from the substantial explanatory power that the EP assigns to the global market factor. The EP is discussed in more detail in the appendix.

Table 1 shows that global industries are more powerful explanatory variables than global sectors and local industries are more powerful than either. The countries + local industries model has the highest average R^2 and highest EP.

THE COUNTRIES + GLOBAL INDUSTRIES MODEL

We estimated the countries + global industries model on the full cross-section of 19 countries and also separately on the 9 European Union (EU) countries. The EU-only sample does not include six current members of the European Union: three of them (Greece, Luxembourg, Portugal) because we have no reliable data, and three (Austria, Finland, Sweden) because these countries joined the EU very recently and so are not relevant for our historical analysis. In the EU-only model, the "global" market factor captures the EU-wide market movement. Similarly, the "global" industry factors for the EU-only model are the industry factors measured across the nine EU countries.

The importance of a factor derives from its contribution to explaining asset return variance. Because each factor exposure is either zero or one, the variance of the factor return captures its influence on asset variance. For each group of factors (countries or industries), we analyzed the average of the factor return variances across all of the group.

Table 2 shows the average factor return variance for each of the categories of factors for both the worldwide and EU models. The inclusion of October 1987 increases the variance of the global market factor substantially, especially in the worldwide model. In the EU model, the global market factor explains the largest percentage of volatility and the country factors are a close sec-

Table 2. Average Variance with and without October 1987
(data in parentheses exclude October 1987)

Sample	Variance of Global Market Factor	Average Variance of Country Factors	Average Variance of Industry Factors
Worldwide	0.001764 (0.001369)	0.0015306 (0.0015096)	0.0002769 (0.0002748)
EU-only	0.002209 (0.001849)	0.0012089 (0.0012027)	0.0006074 (0.0006013)

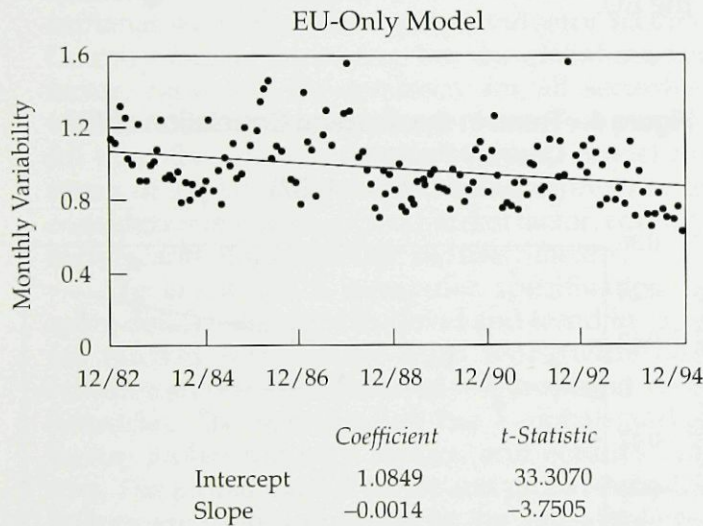
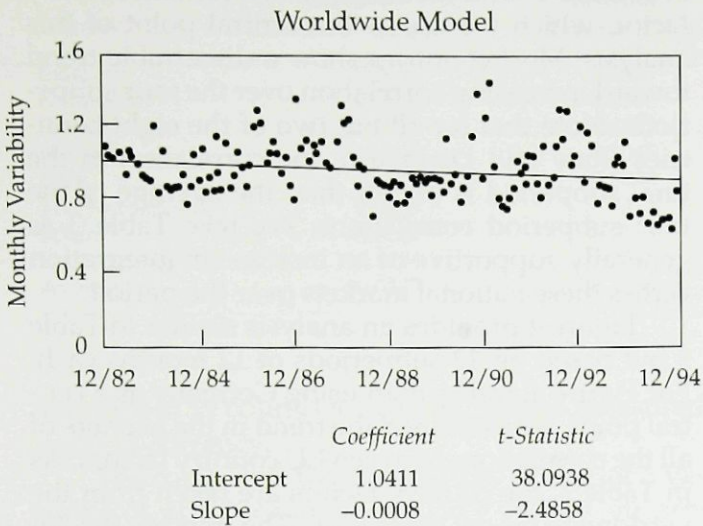
ond. The global industry factors lag well behind the other two. The worldwide model has stronger country factors than the EU model, a weaker global market factor, and smaller global industry influences. These comparative findings argue that the EU is more integrated than the world generally, possibly as a result of the harmonization of economic, monetary, and fiscal policies during the past 20 years.

Next, we examined whether there is a trend in the relative explanatory powers of the three groups of factors. Recall that in our simple factor model with zero/one factor exposures, the explanatory power of a factor can be measured by the factor return variance. If the world (or EU) is becoming more integrated over time, the variance of the global factors (that is, the global market factor and industry factors) should be increasing and/or the variance of the country factors should be declining over time.

The relative explanatory power of a factor can increase, even though its return variance does not increase, if the average return variance across stocks decreases through time. Average return variance declined significantly during the past 12 years for both the worldwide and EU-only sample. Figure 1 shows the month-by-month variability of total return relative to its long-run average. It is clear from Figure 1 that, both for the EU and the worldwide sample, average return variability has declined over the sample period. Our measure of relative variability for the factors is adjusted for this decline in total return variability (see the appendix for the technical definitions).

Figure 2 shows the trends in the relative variability of the global market factor, global industry factors, and country factors for the worldwide model. The country factors show some tendency to decrease in importance through time, with a concomitant increase in the relevance of the global industry factors, but neither of these effects is significant at the 10 percent level. The effect of the global market factor changes very little through time. Therefore, the evidence for an increase in the

Figure 1. Trends in the Average Variance of Individual Equities
(excludes October 1987)



importance of global influences in the worldwide model is weak at best.

Figure 3 repeats the same tests for the EU-only sample. Here, the results are clearer and statistically significant: The EU-only global market factor increases in importance through time, the country factors lose importance, and the global industry factors increase in importance. All of these effects point toward increasing market integration within the EU.

Another measure of the trend in European integration is based on the EU country factor returns from the worldwide model. We estimated the correlations of the EU country factor returns over four subperiods of 37, 36, 36, and 36 months. Under the null hypothesis of no increased integration, the true correlation matrix should be the same in the subperiods. Under the alternative that the

Figure 2. Trends in the Variability of the Global Market, Countries, and Global Industries Factors, Worldwide Sample
(excludes October 1987)

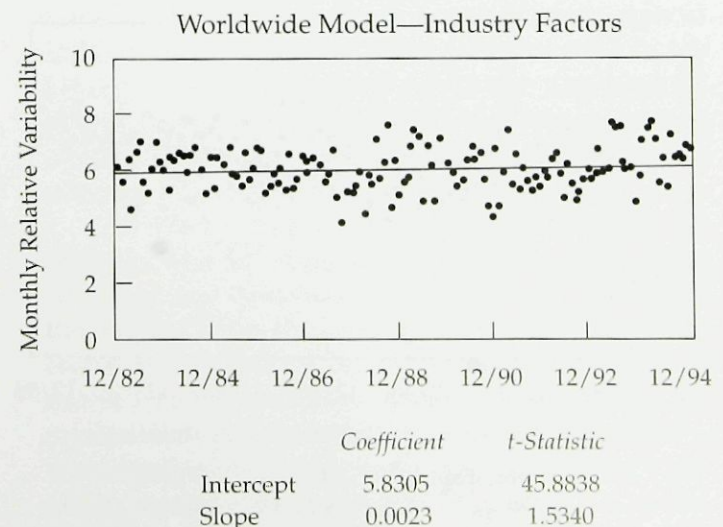
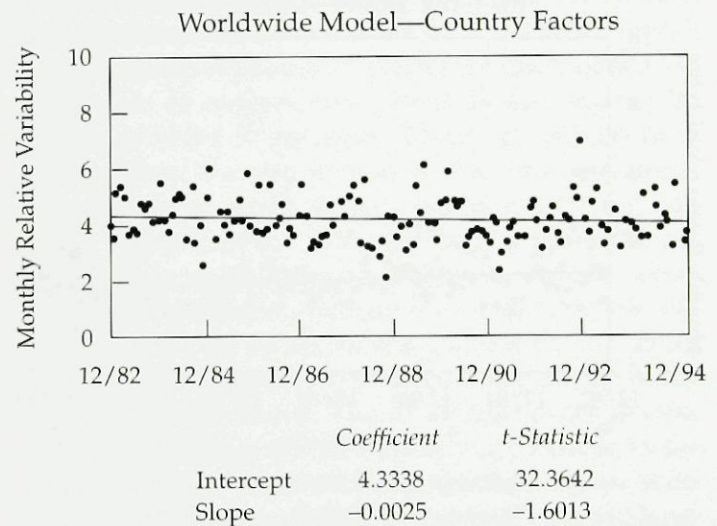
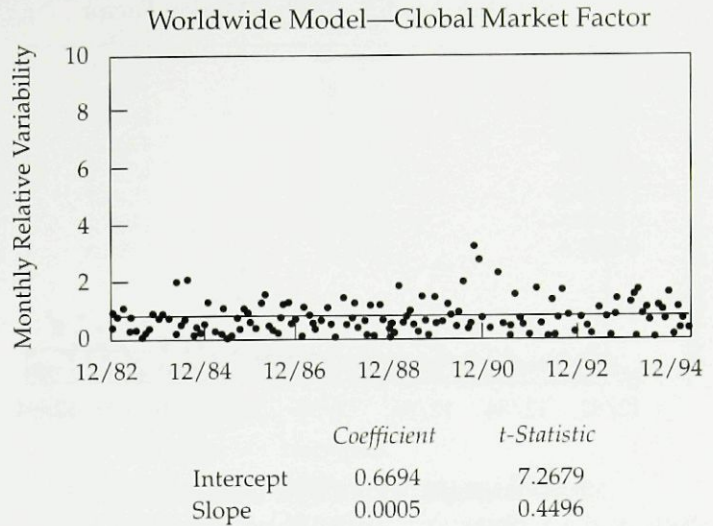
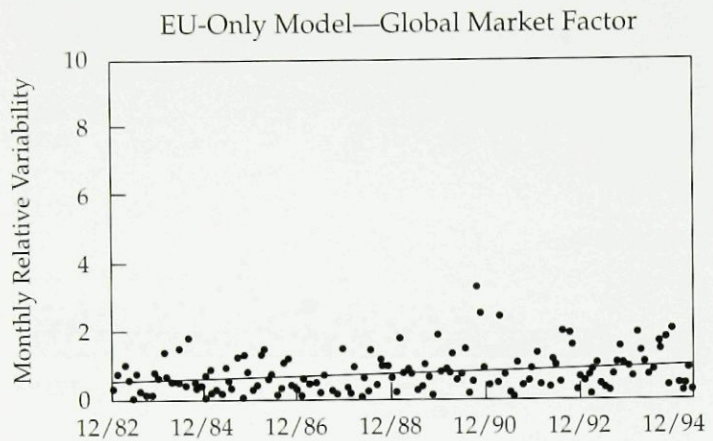
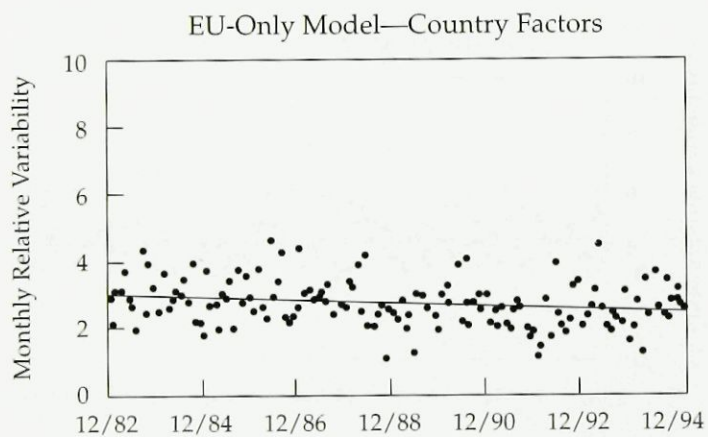


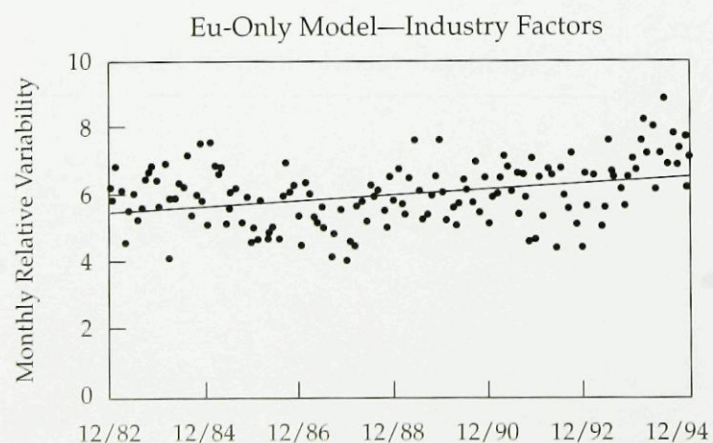
Figure 3. Trends in the Variability of the Global Market, Countries, and Global Industries Factors: EU-Only Sample
(excludes October 1987)



	Coefficient	t-Statistic
Intercept	0.5937	6.4866
Slope	0.0019	1.7483



	Coefficient	t-Statistic
Intercept	2.9499	26.4992
Slope	-0.0040	-3.0812

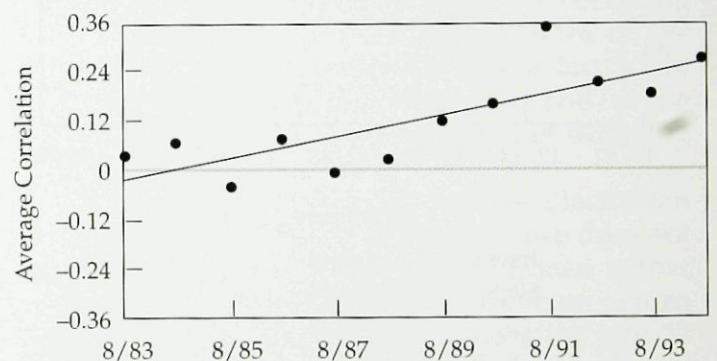


	Coefficient	t-Statistic
Intercept	5.5482	38.3988
Slope	0.0071	4.1756

EU is becoming more closely integrated, the correlation of the country factors for the EU countries will be increasing. Table 3 shows the correlations of each EU country factor with the German country factor, which we use as the central point of this analysis. Most countries show a discernible trend toward increasing correlation over the four subperiods. Note that for all but two of the eight countries (Italy and Denmark), the correlation in the final subperiod is higher than the average of the four subperiod correlations. We take Table 3 as generally supportive of an increase in integration across these national markets over the period.

Figure 4 provides an analysis similar to Table 3 but based on 12 subperiods of 12 months each. For Figure 4, rather than using Germany as a central point, we examined the trend in the average of all the correlations between EU country factors. As in Table 3, the country factors are taken from the worldwide model estimation. The trend in the average correlation is positive and statistically significant, indicating increasing integration within the EU.

Figure 4. Trend in the Average Correlation of EU Country Factors
(excludes October 1987)



	Coefficient	t-Statistic
Intercept	-0.0422	-0.8963
Slope	0.0254	3.9701

SUMMARY

We used a simple approach to examine the influence of national and global factors on equity returns. We estimated factor models in which all securities have zero or one exposures to sector, industry, and/or country factors, with a unit exposure if the security belongs to the sector/industry/country and a zero otherwise. In addition to these zero/one exposures, all equities are assigned unit exposure to a global market factor. The returns to be explained are excess returns to individual

Table 3. Correlations of European Union with Germany in Four Subperiods

Country	December 1982– November 1985	December 1985– December 1988 (excludes October 1987)	January 1989– January 1992	February 1992– February 1995	Average of Four Subperiods
Belgium	0.2650	0.3666	0.4557	0.5269	0.4045
Denmark	0.1695	0.1366	0.3596	0.1269	0.1983
France	-0.2308	0.4862	0.4191	0.5349	0.3060
Ireland	0.0445	-0.1045	-0.0662	0.1037	-0.0060
Italy	0.0528	0.3273	0.4059	0.1533	0.2361
The Netherlands	0.0469	0.4313	0.4374	0.4524	0.3440
Spain	0.0162	-0.1964	0.0473	0.1918	0.0147
United Kingdom	-0.1426	-0.3540	0.1471	0.2013	-0.0363
Average	0.0277	0.1366	0.2757	0.2864	0.1826

equities in 19 countries, with all returns measured in local currency.

We compared the explanatory power of a variety of specifications. Industry factors outperformed sector factors (the sectors divide securities into broader categories than industries). Nation-specific industry factors have substantially more explanatory power than global industry factors. Country factors are strong, but the global market factor, capturing the tendency for all securities worldwide to move together, is even more powerful than the country factors. The best model (in terms of explanatory power, ignoring theoretical considerations) has a global market factor, country factors, and nation-specific industry factors.

We examined a particular specification in more detail to analyze the level and trend in capital market integration, both worldwide and within a subsample restricted to European Union countries. The specification has a global market factor, global industry factors, and country factors. The global market factor and global industry factors are more important in the subsample restricted to European Union countries than in the worldwide sample, and the country factors are less important. These comparative findings indicate that the European Union is more integrated than the world overall. We also examined the trend in the explanatory power of the three types of factors in this model. We found that in the European Union, the country factors are decreasing in importance while the global industry factors and global market factor are increasing in importance. This result indicates that the European Union is becoming more integrated through time. We found the same trends for the worldwide sample, but the trend coefficients are not statistically significant in this second case.⁵

APPENDIX

Table A1 shows the range of factor models we estimated and describes the equality constraints

we imposed to ensure statistical identification of the models.

Two Measures of Explanatory Power

The factor model was estimated each month by cross-sectional regression, resulting in a time series of monthly regression statistics. We needed to combine these regression statistics into overall measures of explanatory power for the model. One measure of explanatory power is the time-series average of the R^2 statistics. The R^2 at each point in time gives the proportion of the cross-sectional variability of stock returns explained by the factors. Note that an intercept in a cross-sectional regression model has no ability to explain cross-sectional variance, because it merely removes the cross-sectional mean. In the context of our factor model, the intercept coefficient is the return of the global market factor. The R^2 at each point in time effectively assigns zero explanatory power to the global market factor. Taking the time-series average of the cross-sectional R^2 statistics, the explanatory power of the global market factor is lost. Because of this loss, the average R^2 can give a distorted picture of the influence of global versus local influences. For example, if the global market factor becomes more important while the explanatory power of the other factors (industries, countries) and the total asset variability remain the same, the average R^2 statistic *falls*.

An alternative to the average R^2 is the EP statistic. The EP statistic finds the average cross-sectional *and* time-series variability explained by the factors. Thus, the influence of the global market factor is *included* in the EP statistic. If the global market factor becomes more important and the explanatory power of the other factors (industries, countries) remains the same and total asset variability remains the same, the EP statistic *increases*. The EP statistic is therefore not subject to the distortion associated with the average R^2 .

Table A1. List of Models

Model	No Industry or Sector Factors	Global Sector Factors	Global Industry Factors	Local Industry Factors
No country factors	Global Market Model No Constraints	Global Sectors-only Model Constraint B	Global Industries-only Model Constraint C	Local Industries-only Model Constraint D
Country factors	Countries-only Model Constraint A	Countries + Global Sectors Model Constraints A and B	Countries + Global Industries Model Constraints A and C	Countries + Local Industries Model Constraints A and D

Constraints: A=average country factor return equals zero, B=average global sector factor return equals zero, C=average global industry factor return equals zero, D=average local industry factor return equals zero in each country.

Measures of Relative Variability

For the global market factor, we can easily test for an increase in variance by dividing each month's realized squared global market factor return by its time-series variance measured over the whole sample period. If the true variance is increasing through time, then this ratio will tend to increase through time.

The same statistic can be applied to a vector of factors. Consider, for example, the vector of country factors, and suppose we want to test whether their generalized variance is declining through time. Delete one of the country factors. The reason for deleting one country factor is that the country factors are restricted to sum to zero each month. Deleting one of them eliminates this linear dependence between them. Because of the linear dependence, which one of the country factors is deleted has no effect on this test statistic. Let \hat{f}_t^C denote the realized returns on the remaining $L - 1$ country factors at time t and $\hat{\Sigma}_t^C$ their covariance matrix estimated over the entire sample period. The vector analog of the realized squared return divided by variance is the quadratic product of the realized factor returns around the inverse of the covariance matrix $\hat{f}_t^C \hat{\Sigma}_t^{C-1} \hat{f}_t^C$. If the variance of the country factors is decreasing through time, then this ratio will tend to decrease through time. The same statistic can be applied to the industry factor returns.

We denoted these measures of time t variability for the global market factor, country factors,

and industry factors by X_t^G , X_t^C and X_t^I :

$$X_t^G = \frac{1}{\sigma_G^2} (f_t^G)^2$$

$$X_t^C = \hat{f}_t^C \hat{\Sigma}_t^{C-1} \hat{f}_t^C$$

$$X_t^I = \hat{f}_t^I \hat{\Sigma}_t^{I-1} \hat{f}_t^I$$

If the world capital market is becoming more integrated, X_t^G and X_t^I should increase through time and X_t^C should decline.

Let σ_r^2 denote the cross-sectional average of the time-series variances of all the assets. Let X_t^r denote the cross-sectional average squared return in month t divided by σ_r^2 . If the average variability of total return is constant, then this ratio should be constant. Figure 1 shows the regression of the square root of this ratio against an intercept and time index. We used the square root because the distribution of this test statistic has fat tails; the square root is better behaved for regression analysis, although either formulation is statistically valid as an alternative hypothesis. Figure 1 indicates that total return variance is declining.

To adjust for the declining level of total return variance, we used the standardized measures X_t^G/X_t^r , X_t^C/X_t^r , and X_t^I/X_t^r rather than X_t^G, X_t^C , and X_t^I to test for the trend in international integration. Figures 2 and 3 show the regressions of the square root of each of these standardized measures against an intercept and time index.

NOTES

1. First, consider asset pricing integration, which involves measuring and comparing risk premiums of assets across national markets. Suppose that an asset has an observed mean excess return of 6 percent per annum and a known standard deviation of 30 percent per annum. In order to reject the null hypothesis that the expected excess return is zero, we need the square root of the number of observations times the ratio of mean excess return to standard deviation to exceed approximately 2.0. This calculation requires exactly 100 years of data. The test statistic is unaffected by whether we measure returns on an annual, monthly, or daily basis. The measurement problem in our case is actually harder than this, because we need to compare risk premiums and show that they are higher or lower in one country than in another, which is more difficult than showing that one risk premium is nonzero.

Next, consider correlation-based analysis. Suppose that a sample correlation between two assets is 0.4. Using an asymptotic approximation, under the null hypothesis that the true correlation is zero, this sample correlation is normally distributed with mean zero and standard deviation equal to the reciprocal of the square root of the number of observations. Given more than 25 monthly observations, we can reject the null hypothesis that the true correlation is zero at the 95 percent confidence level. This simple comparison is illustrative of the much greater power of tests based on correlation compared with tests based on measured risk premiums.

2. See Stan Beckers, Richard Grinold, Andrew Rudd, and Dan Stefek, "The Relative Importance of Common Factors Across the European Equity Markets," *Journal of Banking & Finance*, vol. 1, no. 16 (February 1992):75-95; Richard Grinold, Andrew Rudd, and Dan Stefek, "Global Factors: Fact or Fiction?" *The Journal of Portfolio Management*, vol. 16, no. 1 (Fall 1989):79-88; S.L. Heston and K.G. Rouwenhorst, "Does Industrial Structure Explain the Benefits of International Di-

versification?" *Journal of Financial Economics*, vol. 36, no. 1 (August 1994):3-27; and S.L. Heston and K.G. Rouwenhorst, "Industry and Country Effects in International Stock Returns," *The Journal of Portfolio Management*, vol. 21, no. 3 (Spring 1995):53-58.

3. The countries are Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, the Netherlands, Norway, New Zealand, Spain, Sweden, Switzerland, the United Kingdom, and the United States. See *The Global Equity Model Handbook*, BARRA Inc. (1992), for a list of the industries and sectors.

4. See Gregory Connor and Robert A. Korajczyk, "A Test for the Number of Factors in an Approximate Factor Model," *The Journal of Finance*, vol. 48, no. 4 (September 1993):1263-91; and Gregory Connor, "The Three Types of Factor Models: A Comparison of their Explanatory Power," *Financial Analysts Journal*, vol. 51, no. 3 (May/June 1995):42-46, for a discussion of the EP statistic.

The average R^2 is given by the formula,

$$\text{Average } R^2 = 1 - \frac{\sum_{t=1}^T \frac{1}{T} \frac{\frac{1}{N} \sum_{i=1}^N \hat{\epsilon}_{it}^2}{\frac{1}{N} \sum_{i=1}^N \left(r_{it} - \frac{1}{N} \sum_{i=1}^N r_{it} \right)^2}}$$

whereas the EP statistic is

$$\text{EP} = 1 - \frac{\frac{1}{N} \frac{1}{T} \sum_{i=1}^N \sum_{t=1}^T \hat{\epsilon}_{it}^2}{\frac{1}{N} \sum_{i=1}^N \frac{1}{T} \sum_{t=1}^T \left(r_{it} - \frac{1}{T} \sum_{t=1}^T r_{it} \right)^2}$$

5. We would like to thank Lucie Chaumeton and Richard Grinold for helpful comments.

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