

WORLD, COUNTRY AND INDUSTRY RELATIONSHIPS

IN EQUITY RETURNS

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The growing awareness that different national equity markets display considerable differences in performance at any point in time have led to increased investor interest in international diversification of investment portfolios. However, it appears that at least for the U.S., this interest has not been translated into very much actual foreign portfolio investment.

Three characteristics distinguish international equity markets from the single domestic market considered by most investors. The first is that the variance-covariance structure of returns is characterized by much higher covariances among securities within national markets than between securities in different markets, i.e. national factors have a strong impact on security returns relative to any common world factor. This contrasts with the more familiar variance-covariance structure of the single market, like that of the U.S., where there is a well-defined national market factor and few stable relationships between returns on individual securities beyond this country factor.

The second differentiating characteristic is the existence of barriers imposed by taxation, currency controls, or even investor tradition. These barriers may segment financial markets into a series of national markets in which securities are priced in a domestic as opposed to an international context.

Third, and finally, international markets are characterized by the existence of different currencies and fluctuating rates of exchange between them. The resulting issue of exchange risk in international investment is very much an open question.

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In this paper we present evidence concerning the international variance-covariance structure of equity returns and discuss a few of its implications for portfolio selection. The results are largely descriptive, but this seems appropriate given the current lack of information about the international structure of returns.

The questions addressed are the following: Does this structure form a useful basis for simplified models of security covariances, incorporating single or multiple indexes, which can be used in forecasting or portfolio selection. To what extent does this structure of returns reveal whether international capital markets are integrated or segmented. And, finally what does it suggest about gains from international diversification if markets are assumed to be either integrated or segmented.

Two sets of data are used. The first consists of monthly percentage changes in market value weighted price indexes for 16 countries and for 30 industries covering the period January 1959 to October 1973.¹ The second includes monthly price changes for 205 individual securities from 14 countries and 14 industries for the period January 1969 to October 1973.²

The Variance-Covariance Structure of Returns

Results obtained by Solnik [1973] and others for a large number of countries show that substantial proportions of the variances of returns on individual stocks are related to national market factors. Since these national factors

¹ The indexes incorporating capital changes but excluding cash dividends, are computed by Capital International S.A. and published in their monthly publication, Perspective. These indexes are superior to most national market indexes since they exclude foreign stocks listed on a particular market. The indexes were converted into U.S. dollars at official rates by Capital International through May, 1971 and by the author at quoted rates in subsequent periods.

² The countries are the same as in the first set, excluding the U.S. and Canada. The 205 stocks are the same ones used to compute the respective industry indexes.

Table 1

AVERAGE PROPORTION OF VARIANCE OF INDIVIDUAL
SECURITY RETURNS EXPLAINED BY NATIONAL MARKET FACTOR^a

Country	Solnik Results 1966-1971	205 Stock Sample 1969-1973 ^b
Australia	-	.34
Austria	-	.37
Belgium	.16	.49
Denmark	-	.31
France	.30	.46
Germany	.45	.44
Italy	.46	.43
Japan	-	.27
Netherlands	.23	.40
Norway	-	.46
Spain	-	.40
Sweden	.45	.42
Switzerland	.35	.51
U.K.	.37	.37
U.S.A.	.22	-

^a Proportions reported are for returns translated into U.S. dollar equivalents.

^b Solnik's data are for two-week periods, the data for the 205 stocks are monthly.

contribute to the risk of virtually all securities in each market, the risk associated with them cannot be diversified away within the national market. The remaining systematic risk plays a key role in determining the prices of individual securities.

Solnik's results, as well as those obtained from the 205-stock sample from 14 industries in 14 countries are described in Table 1. Although the two sets of results differ, both because of different sample compositions and time periods, they show that there is substantial interdependence among returns within individual countries. However, a number of studies (Grubel [1968], Grubel and Fadner [1971], Joy et al [1974], Lessard [1973], Levy and Sarnat [1970], Ripley [1973], and Solnik [1973]) show that the correlations between the national market factors are relatively low and, therefore, only a fraction of national systematic risk elements are systematic in a world context.

Simplified Models of the Variance-Covariance Structure

The existence of common elements in returns within each country and of relatively low correlations between these country effects are consistent with a multi-index market model of the following form for security i from country j :

$$\tilde{R}_{ij} = \alpha_i + \beta_i \tilde{F}_w + \gamma_i \tilde{F}_j + \epsilon_i \quad (1)$$

where α_i , β_i , and γ_i are stable parameters specific to security i and \tilde{F}_w and \tilde{F}_j are respectively world and national factors (indexes).

There are several possible specifications of both the world market factor and the national factors and the relationships between them. Options include defining the \tilde{F}_j 's as the national stock market indexes or as residuals resulting from regressions of these indexes on some world factor, or as factors orthogonal with respect to the world factor as well as all other national factors. The world factor, in turn, might be defined as the return on the world

TABLE 2

CORRELATIONS OF MONTHLY PRICE RELATIVES FOR 16

NATIONAL STOCK MARKET INDICES January, 1959 - October, 1972

NAME	AUSTRALIA	BELGIUM	SWITZER	DENMARK	SPAIN	FRANCE	GERMANY	NETHERLANDS
ASTRALIA	1.000	0.168	0.197	0.134	0.118	0.125	0.199	0.24
BELGIUM	0.168	1.000	0.524	0.082	0.089	0.521	0.471	0.58
SWITZER	0.197	0.524	1.000	0.085	0.023	0.528	0.617	0.63
DENMARK	0.134	0.082	0.085	1.000	0.246	0.088	0.043	0.09
SPAIN	0.118	0.089	0.023	0.246	1.000	0.242	0.049	0.00
FRANCE	0.125	0.521	0.528	0.088	0.242	1.000	0.418	0.43
GERMANY	0.199	0.471	0.617	0.043	0.049	0.418	1.000	0.51
NETHER	0.243	0.580	0.632	0.092	0.009	0.438	0.515	1.00
ITALY	0.145	0.279	0.369	0.173	0.028	0.278	0.363	0.25
JAPAN	0.151	0.082	0.206	0.161	0.052	0.169	0.173	0.17
NORWAY	0.159	0.404	0.268	0.140	0.147	0.239	0.266	0.23
AUSTRIA	-0.010	0.158	0.317	0.116	-0.027	0.223	0.421	0.19
SWEDEN	0.314	0.376	0.297	0.101	0.176	0.243	0.316	0.26
UK	0.355	0.307	0.268	0.056	0.100	0.235	0.270	0.40
USA	0.225	0.462	0.487	0.037	0.041	0.249	0.377	0.60
CANADA	0.254	0.448	0.475	0.094	0.093	0.315	0.370	0.55

NAME	ITALY	JAPAN	NORWAY	AUSTRIA	SWEDEN	UK	USA	CANADA
ASTRALIA	0.145	0.151	0.159	-0.010	0.314	0.355	0.225	0.254
BELGIUM	0.279	0.082	0.404	0.158	0.376	0.307	0.462	0.448
SWITZER	0.369	0.206	0.268	0.317	0.297	0.268	0.487	0.475
DENMARK	0.173	0.161	0.140	0.116	0.101	0.056	0.037	0.094
SPAIN	0.028	0.052	0.147	-0.027	0.176	0.100	0.041	0.093
FRANCE	0.278	0.169	0.239	0.223	0.243	0.235	0.249	0.315
GERMANY	0.363	0.173	0.266	0.421	0.316	0.270	0.377	0.370
NETHER	0.250	0.179	0.239	0.191	0.264	0.400	0.606	0.558
ITALY	1.000	0.088	0.151	0.262	0.180	0.164	0.213	0.207
JAPAN	0.088	1.000	0.136	0.112	0.068	0.096	0.128	0.198
NORWAY	0.151	0.136	1.000	0.182	0.265	0.177	0.169	0.244
AUSTRIA	0.262	0.112	0.182	1.000	0.055	0.047	0.124	0.187
SWEDEN	0.180	0.068	0.265	0.055	1.000	0.281	0.327	0.376
UK	0.164	0.096	0.177	0.047	0.281	1.000	0.293	0.285
USA	0.213	0.128	0.169	0.124	0.327	0.293	1.000	0.800
CANADA	0.207	0.198	0.244	0.187	0.376	0.285	0.800	1.000

market portfolio or as some other factor deemed to more closely reflect the behavioral relationships among returns.³

The choice of specification depends primarily on the use to which the resulting multi-index model will be put. Designating the world factor as the world market portfolio would be appropriate for a world capital asset pricing mechanism, assuming integrated capital markets, but it is not likely to be the best representation of the process which generates the returns. One would expect some relationship between different economies due to both trade and financial flows, but there is no a priori reason for assuming that these impacts would be reflected by a market portfolio, especially since the dominant position of the U.S. in the market portfolio drastically overstates its role in international trade and perhaps also in terms of financial flows. If there is some common underlying factor affecting various markets, its impact on the market portfolio will be clouded by the U.S. national factor.

This can be seen by examining the relationship between the variance of the world market portfolio and that of an hypothesized world factor and the set of national factors. For purposes of simplicity, we illustrate the case where the national factors are uncorrelated from the world factor and among themselves.

³ Korsvold[1973] and Solnik [1973] discuss alternative multi-index representations of the variance-covariance structure of international returns.

In this case, the variance of the world market portfolio will be:

$$\begin{aligned} \text{Var}(\tilde{R}_w) = & \left(\sum_{i=1}^N x_i \beta_i \right)^2 \text{Var}(\tilde{F}_w) + \sum_{j=1}^J \left(\sum_{i \in j} x_i \gamma_i \right)^2 \text{Var}(\tilde{F}_j) \\ & + \sum_{i=1}^N x_i^2 \text{Var}(\epsilon_i). \end{aligned} \quad (2)$$

where the x_i 's are the weights of individual stocks (their total \$ market value relative to the value of the world market portfolio) and the $\sum_{i \in j}$ represents the sum over all stocks from country j.

Further, if w_j is defined as $\sum_{i \in j} x_i$ and all the F_j 's are scaled so that:

$$\sum_{i=1}^N x_i \beta_i = 1 \text{ and } \sum_{i \in j} \frac{x_i}{w_j} \gamma_i = 1, \quad (2) \text{ becomes}$$

$$\text{Var}(\tilde{R}_w) = \text{Var}(\tilde{F}_w) + \sum_{j=1}^J w_j^2 \text{Var}(\tilde{F}_j) + \sum_{i=1}^N x_i^2 \text{Var}(\epsilon_i) \quad (3)$$

From (3) it is clear that the national factor, F_j , for a large country will have a major impact on the variance of the market portfolio, $\text{Var}(\tilde{R}_w)$. The impact, generally, will be even greater if the assumptions of independence among the factors are dropped.

GNP or trade weighted indexes represent one possible solution. However, the first of these also would ascribe a dominant role to the U.S. One estimate which minimizes the influence of national factors is an equally-weighted index of national portfolio returns. However, this index also may be a poor estimate of the true market factor, since some may be isolated from other capital markets. To the extent to which common world elements in returns are transmitted through financial channels, these countries may merely add noise to the estimate.

A further possibility is a principal component psuedo-index. If estimated from the correlation matrix of the national indexes, it will be similar to the equally-weighted index but will differ somewhat since it standarizes the variances of each national index and weights more heavily those indexes demonstrating the greatest common movement.

Table 3 shows the proportion of variance of each of the national market indexes explained by each of the three world factor estimates. Results are reported only for the entire 1959-1973 period but are quite similar in terms of the average proportion explained for four subperiods in the interval.

The average proportion of the variances of the national indexes explained by the world market portfolio is .219, the average proportion explained by the equally-weighted index is .306, and the average proportion explained by the principal component index is .313. Only the U.S. and Canada are more closely related to the world market portfolio than to the other two market factors. This should be no surprise, since the two markets together comprise roughly 60 percent of the total value of the world market portfolios.

These results are striking in terms of the relatively low average proportion of variance explained by the world factors. They might be contrasted with the .85 proportion typically reported for the diversified domestic portfolios relative to the U.S. market factor. Furthermore, they are considerably lower than the proportions of variance of internationally diversified industry indexes incorporating the same set of stocks explained by any of the world factors.⁴ On the surface, at least, these results confirm the relative importance of the international dimension in risk reduction.

⁴ These results are discussed in Lessard [1974]

Table 3

PROPORTION OF VARIANCE OF NATIONAL INDEXES EXPLAINED BY ALTERNATIVE
 "WORLD FACTORS" - JANUARY, 1959 - OCTOBER, 1973 ^{a]}

Country	Market Value Weighted Index	Equally Weighted Index	Principal Component Pseudo-Index
Australia	.111	.202	.167
Austria	.045	.201	.181
Belgium	.262	.501	.567
Canada	.667	.382	.461
Denmark	.008	.116	.078
France	.096	.402	.407
Germany	.223	.490	.503
Italy	.062	.256	.197
Japan	.079	.155	.103
Netherlands	.454	.527	.615
Norway	.020	.222	.193
Spain	.004	.089	.058
Sweden	.131	.285	.293
Switzerland	.295	.545	.560
U.K.	.169	.226	.213
U.S.A.	.880	.300	.389
Average	.219	.306	.313

a] The proportion of variance explained is equal to the R^2 of $R_{Mj} = \alpha + \beta R_W + \epsilon_{Mj}$
 where R_{Mj} is the monthly percentage change in the national market index for
 country j and R_W is the monthly percentage change in the world market factor.

Industry Elements in the Variance - Covariance Structure

Although the results presented thus far are consistent with a multi-index model involving world and country factors, it is possible that there are other important group elements in the variance-covariance structure. One obvious possibility is a set of industry elements. Table 4 presents averages by country and by industry of the proportions of variance in returns of the 205 individual stocks which are explained by the appropriate country and industry index for each stock.

The results clearly demonstrate the greater importance of the national dimension, reinforcing similar conclusions obtained by Solnik [1974] and Lessard [1974].

Further, it is quite possible that these results overstate the importance of industry effects. The variance attributed to industry factors may primarily reflect a common world element in returns.

In order to test for this, individual stock returns were regressed against a world index and the residuals of the country or industry indexes obtained by regressing these on the world index. Four alternative relationships were estimated involving two different estimates of the world factor--one a market value weighted average of the country indexes (MWI), the other an equally weighted average of the country indexes (EWI)--and the residual of either the country or the industry index on the world index used. To summarize,

$$R_{ijkt} = \alpha_i + \beta_i (MWI)_t + \gamma_i RC_j (MWI)_t + \epsilon_t \quad (4a)$$

$$R_{ijkt} = \alpha_i + \beta_i (MWI)_t + \gamma_i RI_k (MWI)_t + \epsilon_t \quad (4b)$$

$$R_{ijkt} = \alpha_i + \beta_i (EWI)_t + \gamma_i RC_j (EWI)_t + \epsilon_t \quad (4c)$$

$$R_{ijkt} = \alpha_i + \beta_i (EWI)_t + \gamma_i RI_k (EWI)_t + \epsilon_t \quad (4d)$$

Table 4

COUNTRY AND INDUSTRY "RELATEDNESS" OF INDIVIDUAL STOCKS

Stocks Grouped By Country	Average R ² on:		Stocks Grouped by Industry	Average R ² on:	
	Country Index	Industry Index		Country Index	Industry Index
Australia	.339 (14/15)	.281 (13/15)	Chemicals	.410 (18/19)	.157 (12/19)
Austria	.365 (4/4)	.042 (1/4)	Steel	.439 (19/19)	.231 (15/19)
Belgium	.489 (11/11)	.155 (9/11)	Non-Ferrous	.482 (18/18)	.266 (15/18)
Denmark	.306 (2/2)	.081 (1/2)	Build. Prod.	.437 (14/15)	.196 (12/15)
France	.458 (27/27)	.152 (23/27)	Forest Prod.	.276 (15/16)	.173 (10/16)
Germany	.443 (25/26)	.175 (19/26)	Electrical	.509 (14/14)	.273 (13/14)
Italy	.432 (18/18)	.076 (8/18)	Automobiles	.424 (12/13)	.257 (12/13)
Japan	.272 (34/35)	.299 (29/35)	Tires	.386 (8/8)	.252 (7/8)
Netherlands	.395 (7/7)	.221 (6/7)	Food Prod.	.320 (17/17)	.158 (11/17)
Norway	.462 (5/5)	.081 (2/5)	Breweries	.271 (19/19)	.182 (14/19)
Spain	.445 (7/7)	.050 (3/7)	Textiles & App.	.344 (15/15)	.138 (7/15)
Sweden	.415 (7/8)	.124 (6/8)	Pharmaceuticals	.446 (11/11)	.214 (9/11)
Switzerland	.514 (9/9)	.270 (9/9)	Oil	.434 (13/14)	.242 (11/14)
U.K.	.408 (31/31)	.169 (27/31)	Airlines	.395 (7/7)	.217 (6/7)
Average	.408	.169	Average	.395	.217

Numbers in parentheses are number of correlations which are significantly different from 0 at the 5% level divided by the total number in each group. (Two-tailed t-test with 58 observations, critical value of $r=.251$, $r^2=.063$).

where R_{ijkt} is the return on stock i , member of country j and industry k , in period t , MWI is the market value weighted world index, EWI is the equally weighted world index. $RC_j(\)$ is the residual of the country j index on the world index, and $RI_k(\)$ is the residual of the industry k index on the world index.

The results of these regressions, summarized by country in Tables 5 & 6 clearly show the existence of a world element in returns. They also show a relatively strong set of country effects but a much weaker set of industry effects. This is especially marked in the regression involving the equally weighted world index as the proxy for a world factor in stock returns.

Industry factors are large relative to country factors for two countries--Australia and Japan--and in both cases are related to individual companies oriented primarily toward international markets, non-ferrous metals in Australia and steel in Japan.⁵

On the whole, these results are consistent with a multi-index model incorporating a world factor, estimated so as to minimize the impact of country influences, as well as a set of country factors. However, the results do not demonstrate whether such a multi-index model is a useful description of the relationships among returns in different countries.

The Stability of World Market Relationships

One possible criterion of usefulness is the extent to which the simplified structure can be used to forecast relationships among securities in future periods. Ideally this would be tested using individual stock data. Unfortunately, these data cover too few time periods for adequate analysis of this type. Index data are used, however, to gain some insights into the relationships between country groups. The test involves a comparison of the

⁵ Lessard [1974] discusses the relative concentration of firms, by market value, on the international industry groups in specific countries. In the case of non-ferrous metals, 58% of the market value corresponds to Australian firms, for steel, 57% corresponds to Japan.

Table 5

WORLD, COUNTRY, AND INDUSTRY CONTRIBUTIONS TO VARIANCE OF INDIVIDUAL SECURITIES

Average Proportion of Variance Explained by -

Stocks Grouped by Country	Market Value Weighted World Index (MWI)	Residual of Country Index on MWI	Residual of Industry Index on MWI	Equally Weighted World Index (EWI)	Residual of Country Index on EWI	Residual of Industry Index on EWI
Australia	.107 (11/15)	.250 (12/15)	.193 (11/15)	.168 (14/15)	.197 (10/15)	.148 (1/15)
Austria	.013 (0/4)	.097 (4/4)	.070 (1/4)	.131 (3/4)	.264 (4/4)	.011 (0/4)
Belgium	.055 (4/11)	.444 (11/11)	.105 (9/11)	.320 (11/11)	.180 (10/11)	.015 (6/11)
Denmark	.051 (1/2)	.280 (2/2)	.037 (0/2)	.148 (2/2)	.191 (2/2)	.002 (0/2)
France	.028 (2/27)	.437 (27/27)	.127 (18/27)	.256 (27/27)	.211 (27/27)	.025 (3/27)
Germany	.086 (17/26)	.366 (25/26)	.107 (13/26)	.275 (25/26)	.169 (21/26)	.030 (6/26)
Italy	.012 (0/18)	.427 (18/18)	.076 (10/18)	.062 (8/18)	.356 (18/18)	.035 (4/18)
Japan	.088 (23/35)	.190 (33/35)	.227 (23/35)	.129 (28/35)	.156 (30/35)	.200 (24/35)
Netherlands	.188 (6/7)	.221 (6/7)	.097 (4/7)	.344 (7/7)	.079 (3/7)	.034 (3/7)
Norway	.008 (0/5)	.457 (4/5)	.077 (2/5)	.188 (4/5)	.294 (4/5)	.013 (0/5)
Spain	.011 (0/7)	.393 (6/7)	.046 (1/7)	.110 (6/7)	.311 (6/7)	.012 (1/7)
Sweden	.069 (5/8)	.356 (7/8)	.070 (3/8)	.165 (6/8)	.260 (7/8)	.016 (0/8)
Switzerland	.161 (9/9)	.363 (9/9)	.139 (8/9)	.387 (9/9)	.141 (7/9)	.017 (0/9)
U.K.	.084 (20/31)	.297 (31/31)	.286 (26/31)	.100 (20/31)	.287 (30/31)	.285 (28/31)

Numbers in parentheses are number of correlations which are significantly different from 0 at the 5% level divided by the total number in each group. (Two-tailed t-test with 58 observations, critical value of $t = .251$, $r = .063$).

Table 6

WORLD, COUNTRY, AND INDUSTRY CONTRIBUTIONS TO VARIANCE OF INDIVIDUAL SECURITIES

Average Proportion of Variance Explained by -

Stocks Grouped by Industry	Market Value Weighted World Index (MWI)	Residual of Country Index on MWI	Residual of Industry Index on MWI	Equally Weighted World Index (EWI)	Residual of Country Index on EWI	Residual of Industry Index on EWI
Chemicals	.065 (8/19)	.350 (18/19)	.095 (9/19)	.184 (12/19)	.239 (15/19)	.040 (4/19)
Steel	.068 (8/19)	.381 (19/19)	.179 (11/19)	.218 (17/19)	.228 (18/19)	.122 (6/19)
Non-Ferrous	.062 (8/18)	.430 (18/18)	.210 (16/18)	.233 (16/18)	.267 (16/18)	.115 (8/18)
Buil. Prod.	.057 (6/15)	.390 (14/15)	.156 (11/15)	.190 (13/15)	.257 (14/15)	.079 (4/15)
Forest Prod.	.065 (7/16)	.218 (15/16)	.136 (8/16)	.138 (13/16)	.155 (12/16)	.123 (6/16) ¹
Electrical	.110 (12/14)	.403 (14/14)	.178 (11/14)	.234 (14/14)	.282 (14/14)	.128 (6/14) ¹
Automobiles	.064 (7/13)	.367 (12/13)	.207 (11/13)	.248 (12/13)	.241 (11/13)	.100 (7/13)
Tires	.041 (3/8)	.358 (8/8)	.223 (7/8)	.158 (6/8)	.240 (8/8)	.106 (5/8)
Food Prod.	.052 (5/17)	.280 (16/17)	.131 (10/17)	.132 (11/17)	.200 (15/17)	.091 (5/17)
Breweries	.080 (11/19)	.214 (17/19)	.112 (10/19)	.181 (17/19)	.131 (13/19)	.107 (6/19)
Textiles & App.	.073 (8/15)	.280 (15/15)	.103 (5/15)	.165 (10/15)	.197 (12/15)	.072 (5/15)
Pharmaceuti- cals	.105 (8/11)	.349 (11/11)	.125 (6/11)	.180 (9/11)	.272 (11/11)	.105 (5/11)
Oil	.073 (5/14)	.370 (13/14)	.182 (7/14)	.218 (13/14)	.237 (13/14)	.114 (4/14)
Airlines	.097 (4/7)	.271 (6/7)	.217 (5/7)	.283 (6/7)	.129 (5/7)	.117 (3/7)

Numbers in parentheses are number of correlations which are significantly different from 0 at the 5% level divided by the total number of each group. (Two-tailed t-test with 58 observations, critical value of $r=.251$, $r^2=.063$).

extent to which relationships of the national indexes to each of the three factors can be used to forecast the correlation matrix. This is done for three time periods, using each 45 month period to forecast the correlation matrix in the following period. The benchmarks are the historical correlation matrix and the average historical correlation coefficient. Presumably, if one of the estimated factors captures the process linking returns, it will outperform the historical estimates, which includes a great deal of noise.⁶

Each element in the correlation matrix is estimated from the following formula:

$$\text{cor}_{ij} = \frac{\beta_i \beta_j \sigma^2(F_w)}{\sigma_i \sigma_j} \quad (5)$$

where β_i and β_j are measured of security responsiveness to the world factor being used. When reduced, (5) becomes $\text{cor}_{iw} \times \text{cor}_{jw}$, the product of the correlations of the two securities with the world factor.

The results, summarized in Table 7, are disappointing. None of the three world indexes provide a better forecast than the average historical correlation coefficient and none performs significantly better than the full historical correlation matrix. There may be stable relationships among the markets but they are obscured by a great deal of noise.

Given the importance of country factors in explaining the returns of individual securities and the difficulty of relating the country factors to each other, it appears unlikely that a single-factor model would adequately describe relationships among individual stocks. It appears much more likely that a multi-index system, with one index for each country and some stated set of correlations among the indexes, will be more appropriate.

⁶ Elton and Gruber [1973] develop the rationale for these types of comparisons.

Table 7

CORRELATIONS FORECASTING ABILITY OF ALTERNATIVE WORLD FACTORS

Period Forecast/ Period Used	Average Historical Correlation	Historical Correlation Matrix	Index Model Using:		Principal Component
			Market Value Weighted Index	Equally- Weighted Index	
Average Absolute Error					
October 1962-June 1966/ January 1959-Sept. 1962	.193	.181	.162	.182	.186
July 1966-March 1970/ October 1962-June 1966	.163	.208	.184	.203	.210
April 1970-October 1973/ July 1966-March 1970	.171	.189	.250	.156	.189
Average of three periods	.176	.193	.199	.180	.195

The Structure of Returns and the Segmentation/Integration Issue

As Adler and Dumas [1973] point out, segmentation or integration cannot be determined from the covariance matrix of returns. A covariance matrix with strong national elements may emerge from an internationally integrated market, although it is easy to see why national fluctuations might be even more important with segmented capital markets. Further, a stable world element is consistent with either type of market relationship. Again, it may be the result of common economic forces which affect different national as well as of linkages in capital markets and capital assets pricing mechanisms.

More revealing tests might be provided by regressions of multinational firm shares against the various national indexes to determine the relative impact of the international distribution of operations and the market in which the shares are traded.

A further possibility also should be considered. This is a world market equilibrium with frictions or costs attached to foreign investments. Such an equilibrium is more likely to be consistent with observed investor behavior of relative concentration in the home portfolio.

The Structure of Returns and Gains From International Diversification

The low correlations between the country factors represent the key to gains from international diversification. It should be noted, however, that these correlations overstate the potential for risk reduction⁷ since only a few countries represent the bulk of the market value and, therefore, risk elements unique to these large countries will contribute to the risk of the world portfolio as shown in (3). This effect is illustrated by a comparison

⁷ A further limitation of the correlation figures between national markets is purely statistical. Several of the markets in question display substantial serial correlations, which may or may not be the result of "non-trading" effects in the data. Regardless of the cause, this serial correlation will result in an understatement of the true correlations between the markets.

of four risk figures based on the actual standard deviations of the 16 country indexes--an equally weighted average of the country index standard deviations, a market value weighted average of them, the standard deviation of a world portfolio incorporating the national indexes in market value proportions, and a portfolio in which each country has equal weights. In Table 8 we see that the market-value weighted average of the standard deviations of individual country indexes is lower than the unweighted average, but the standard deviation of the world portfolio is considerably higher than that of an equally weighted portfolio of the different national indexes.

Further, given the possibility of segmented national markets, no claims can be made about gains from investing internationally based solely on the variance-covariance structure. The analysis also must incorporate estimates of expected differences in returns in various markets. Of course, in an efficient international market with no frictions one would expect all investors to hold the world market portfolio. This would imply an equilibrium set of expected returns consistent with holding the world market portfolio given its nationalistic variance-covariance structure. Any departures from this market portfolio would depend on disequilibrium return expectations for individual stocks or entire national portfolios or on frictions introduced by factors differentiating the returns on securities within individual countries between resident and non-resident investors. These might include differential transactions costs or taxes or restricted foreign exchange markets resulting in disequilibrium exchange rates.⁸

⁸ It has been suggested by some authors, including Adler and Dumas [1973], that the mere existence of fluctuations in exchange rates would produce this result since non-resident investors would face an "exchange risk" and resident investors would not.

Table 8

ILLUSTRATION OF IMPACT OF INTERNATIONAL DIVERSIFICATION
ON PORTFOLIO RISK

	Annual Std. Dev. (%)	Annual Variance (%)
Average of all 16	15.0	2.25
Market Value Weighted Average of all 16	13.6	1.84
World Market Portfolio	10.6	1.12
Equally Weighted Portfolio of National Indexes	8.3	.68

However, casual observations of investor holdings suggest that investors in each country tend to concentrate their portfolios in domestic securities relative to the proportions in the world market portfolio. Certainly, U.S. investor portfolios do not include 40 percent foreign securities as implied by world portfolio proportions.

The interesting question, then, is whether this investor behavior can be explained in terms of rational behavior within the context of efficient, internationally integrated capital markets. Any departure from the world portfolio will involve taking on some risk that is potentially diversifiable. In order for less than complete diversification to be optimal, the assets in the portfolio must offer a sufficient additional return to a specific investor to offset this "unnecessary" risk.

Although we can not measure investor expectations, it is possible to estimate the level of returns on foreign market portfolios relative to the domestic level which should induce investors from each country to start incorporating foreign securities in their portfolio. In a sense, this implies starting from a position of segmented markets with each domestic market in equilibrium. Under these circumstances, the relative returns required on foreign assets are determined by the β 's of the foreign portfolios on the domestic portfolio, i.e. the relative systematic risk of the foreign portfolios from a particular domestic perspective.⁹ Table 9 presents the excess return which would be required by a U.S. investor relative to the expected excess return on the U.S. market portfolio, where the β estimates are based on the actual historical correlations between the U.S. and each of the other markets and on two alternative index models, one with MWI and the other with EWI

⁹ The result will apply strictly only for an infinitesimal investment in the foreign security. Further foreign investment by a domestic investor will, of course, change the domestic equilibrium.

Table 9.

RELATIVE "EXCESS" RETURN REQUIRED TO INDUCE FOREIGN INVESTMENT

$$\text{Relative Excess Return} = [E(\tilde{R}_F) - 1] / [E(\tilde{R}_D) - 1]$$

Basis for Correlation Estimates ^a

Country	Actual Historical Correlation	Market Value Weighted Factor	Equally Weighted Factor
Australia	.283	.444	.318
Austria	.112	.202	.256
Belgium	.324	.438	.354
Canada	.781	.755	.333
Denmark	.012	.080	.172
France	.238	.400	.477
Germany	.521	.689	.596
Italy	.233	.403	.481
Japan	.250	.390	.320
Netherlands	.691	.751	.474
Norway	.052	.169	.332
Spain	.018	.060	.167
Sweden	.314	.370	.318
Switzerland	.650	.762	.604
U.K.	.339	.490	.331

^a Table based on correlations estimated for entire 178 month period.

as proxies for the world factor.¹⁰

These results tend to confirm the usual statements about gains from international diversification based solely on the variance-covariance structure. They show that foreign securities would become attractive to U.S. investors at relatively low levels of returns above the pure rate of interest. Barriers in the form of taxes and/or transactions costs would have to be substantial to justify holding only domestic assets.

¹⁰The U.S. systematic risk of the foreign asset, β_f , is equal to

$\text{cor}_{df} \frac{\sigma_f}{\sigma_d}$, where cor_{df} is the correlation between the domestic and foreign portfolios.

If a single-index structure is deemed adequate as a description of the relationships between national markets, then β_f is

$\text{cor}_d^2 \frac{\gamma_f}{\gamma_d}$ where cor_d^2 is the squared correlation of the domestic portfolio

with the world index and the γ 's are the regression coefficients of the respective portfolios on the world index.

A second illustration is based on the assumption that capital markets are integrated internationally and that expected returns reflect the contribution of individual securities to the risk of the world portfolio. We then can determine how much return an investor would give up by holding only his domestic portfolio rather than a globally diversified portfolio with the same total risk. Since this equivalent risk portfolio is a combination of the world portfolio and risk-free borrowing or lending, its expected return is given by the world capital market line,

$$E(\tilde{R}_{wd}) = i + \sigma_d \left(\frac{E(\tilde{R}_w) - i}{\sigma_w} \right),$$

where $E(\tilde{R}_{wd})$ is the expected return on the globally diversified portfolio with the same standard deviation as the domestic portfolio, σ_d ,

i is the pure rate of interest, and $E(\tilde{R}_w)$ and σ_w are the expected return and standard deviation of the world portfolio. The expected return of the domestic portfolio, on the other hand, is given by the security market line,

$$E(\tilde{R}_d) = i + \beta_d [E(\tilde{R}_w) - i],$$

where β_d is the systematic risk of the domestic portfolio, $\frac{\text{cov}_{dw} \sigma_d \sigma_w}{\sigma_w^2}$.

The two return figures are calculated using the β 's and σ_d 's estimated over the entire 1959-1973 period and assuming that $E(\tilde{R}_w) = 10\%$, $i = 6\%$, and $\sigma_w = 10.6\%$, the historical figure. The results, reported in Table 10, show that for all countries except the U.S. and Canada, the domestic investors would suffer a substantial reduction in return if they held only their domestic portfolios. The reason why the U.S. investor would suffer only a minor reduction in return is that the domestic portfolio is very highly correlated with the world portfolio, primarily because it represents such a large proportion of the total value. Note, however, what this implies in

Table 10

RELATIVE RETURN OF DOMESTIC AND EQUIVALENT RISK GLOBALLY DIVERSIFIED PORTFOLIOS

Country	B_d	$E(\tilde{R}_d)$	σ_d	$E(\tilde{R}_{wd})$	Reduction in Return for Equivalent Total Risk
					$E(\tilde{R}_{wd}) - E(\tilde{R}_d)$
Australia	.5052	8.02	16.1	12.08	4.06
Austria	.2605	7.04	13.0	10.92	3.88
Belgium	.5488	8.20	11.4	10.28	2.08
Canada	.9467	9.79	12.3	10.64	.85
Denmark	.1002	6.40	11.5	10.36	3.96
France	.5014	8.01	17.1	12.48	4.47
Germany	.8632	9.45	19.4	13.32	3.87
Italy	.5054	8.02	21.6	14.16	6.14
Japan	.4885	7.95	18.4	12.96	5.01
Nether- lands	.9417	9.77	14.8	11.60	1.83
Norway	.2122	6.85	16.0	12.04	5.19
Spain	.0750	6.30	12.7	10.80	4.50
Sweden	.4635	7.85	13.6	11.12	3.27
Switzer- land	.9553	9.82	18.6	13.04	3.22
U.K.	.6146	8.46	15.8	11.46	3.30
USA	1.1030	10.41	12.5	10.72	.31

terms of expected returns for the various domestic portfolios. The U.S. has the highest expected return, reflecting its extremely high systematic risk.

This illustration, compared to the first, shows the importance of the extent to which domestic markets are linked. With the expected returns generated in perfectly integrated markets, the U.S. investor would lose little by holding only the U.S. portfolio. Of course, if many U.S. investors favored the domestic portfolio, then it would not provide as high an expected return and there would be greater incentive for international investment.

Actual return outcomes are much more consistent with the assumption of the first illustration rather than the second. Results obtained by Bergstrom for 1959 to 1973 show that almost all domestic portfolios have provided higher returns than the U.S.¹¹ The interesting ground, at least in terms of explaining actual portfolio holdings of different national investor groups appears to be somewhere between the two sets of assumptions.

Summary and Conclusions

Evidence has been presented which shows that the international structure of equity returns can be characterized by a world element and a set of country elements with only a minor contribution from industry effects. This nationalistic structure, in turn, is shown to be the key to risk reduction through international diversification.

¹¹ Bergstrom's results are reported in "It Can Pay to Send Money Abroad," Personal Investing, Fortune (August, 1974) p. 124.

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