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INTEGRATION OF DEVELOPED AND EMERGING EQUITY MARKETS

EMPIRICAL EVIDENCE USING CANONICAL CORRELATION ANALYSIS

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INTRODUCTION

SINCE the introduction of Markowitcz's "Portfolio Selection Theory" in 1952, the investigators of the applicability of this normative theory have emphasized the use of the correlation coefficient to test the degree of integration among the different markets and to construct internationally diversified portfolios. The additional gains from international portfolio diversification are assumed to be generated from the low correlations, the level of which is a function of the degree of integration among the markets. After the collapse of the Socialist Block, many countries started to adopt progressive liberal market policies which have been expected to increase the degree of market integration, leading to a higher level of correlation that would lead to lower gains from international portfolio diversification.

The purpose of this paper is to examine the level of integration between two groups of equity markets. The first group consists of three developed markets: the U.S., Europe, and Japan. While the second group consists of six emerging Asian markets: Indonesia, Korea, Malaysia, Philippines, Taiwan, and Thailand. In addition, the paper will report the results of the application of one particular multivariate technique - Canonical Correlation Analysis CCA to the question of integration between the two groups. The CCA takes into account the fact that ". . . global portfolio is a multidimensional concept and cannot be achieved by one market in isolation but only by examining the characteristics and integration of several markets jointly interacting."

The contribution of this paper is to provide a methodology for statistically testing the applicability of CCA for investment decision especially in the construction of diversified portfolios. Higher integration means that stock prices are in line with international factors, and that the contagion effect is more likely to occur among markets. Consequently, diversification benefits would be reduced with more integration.

Canonical Analysis Method

Daily stock index data for the emerging markets of Indonesia, Korea, Malaysia, Philippines, Taiwan and Thailand as well as the developed Market Index (consisting of France, Germany, Italy, Japan, UK, and USA) were obtained from Morgan Stanley Capital International Index (MSCI) covering the period from 1996 to 2001.

The canonical analysis method will be used to test the integration of the Asian Emerging Markets with world markets. It is a multivariate analysis method that examines the relationship between two sets of variables. The first set, criterion set, consists of the dependent variables, represented by the Asian Emerging Markets, and the second set, the predictor set, consists of the independent variables, represented by the developed markets.

The focus of canonical analysis method is on identifying and testing the significance of the relationship between each pair of linear combinations called "canonical variate." These variables are constructed from the variables

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of both sets such that the correlation between the two sets called "canonical correlation" is maximized. The general formula is obtained by finding weights $a' = [a_1, a_2, a_3, \ldots, a_p]$ and $b' = (b_1, b_2, b_3, \ldots, b_q)$ through maximizing the correlation between X* and Y*, where

$$X^* = a_1 x_1 + a_2 x_2 + a_3 x_3 + \ldots + a_p x_p = a'X$$
$$Y^* = b_1 y_1 + b_2 y_2 + b_3 y_3 + \ldots + b_q y_q = b'Y \quad \ldots\ldots (1)$$

X* is the linear combination of the criterion or dependent variables, Y* is the linear combination of the predictor or independent variables, $(a_1, a_2, a_3, \ldots, a_p)$ and $(b_1, b_2, b_3, \ldots, b_q)$ are the canonical weights, analogous to beta weights in the multiple regression analysis. Those weights are determined in such a way that maximizes the canonical correlation between each pair of linear combinations which are expressed in the following equation:

$$\rho\,(x^* y^*) = \text{Corr}\,(X^*, Y^*) = \left[\frac{a' R_{XY} b}{\sqrt{(a' R_{XX} a)(b' R_{yy} b)}} \right] \quad \ldots\ldots (2)$$

Corr(X*, Y*) is the canonical correlation, a and b are as defined before, vectors of coefficients and weights for set X and set Y, respectively, R_{XY} is the between sets correlation matrix R_{XX} and R_{YY} are the within set correlations for the sets X and Y, respectively.

In summary, all the correlation between the sets of the original variables will be channeled through the resulted significant canonical correlations in the study. (See Morrison, 1967, p.215 and Timm1975, p. 350.) Therefore, the use of the canonical analysis is justified by purpose of this research, which is to test for the integration level between the Asian emerging markets individually and collectively with the developed markets individually and collectively Canonical analysis as explained before will be used to provide:

1. The individual integration of each emerging market with its own regional market, as measured by the canonical loadings.
2. The individual integration of each emerging market with the other world developed markets measured by the canonical cross-loadings.
3. The collective integration of the group of emerging markets with the group of developed markets measured by the canonical redundancy coefficients.

The statistical package SAS was used for the analysis. The standard deviations for the twelve variables were found to vary with the smallest being 1.06013 (UK) and the largest having the value of 4.21827(Indonesia). With this significant range of variability across variables it may be more appropriate to perform the canonical correlation analysis on the correlation matrix R instead of the covariance matrix $\underline{\Sigma}$. This is because it is usually

Table (1): Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Indonesia	1305	-0.15827	4.21827	-206.53808	-43.06071	23.81205
Korea	1305	-0.03668	3.42071	-47.86505	-21.66639	26.88081
Malaysia	1305	-0.08180	2.92129	-106.75522	-36.95133	25.68147
Philippn	1305	-0.10616	2.05938	-138.53491	-10.35550	21.18705
Taiwan	1305	-0.03818	1.90214	-49.82499	-11.12802	7.38538
Thailand	1305	-0.15888	2.84456	-207.33977	-14.88675	16.44259
France	1305	0.03779	1.27486	49.31180	-5.60397	5.28548
Germany	1305	0.02667	1.43474	34.79853	-6.07793	6.00788
Italy	1305	0.03044	1.42543	39.72798	-7.11125	6.62496
Japan	1305	-0.02834	1.55855	-36.98810	-5.78708	12.27237
UK	1305	0.02361	1.06013	30.81690	-4.89150	3.65484
USA	1305	0.04610	1.19949	60.15546	-6.96681	4.88334

desirable to work with the standardized variables whose sample covariance matrix $\underline{\Sigma}_z$ is also the sample correlation matrix R, of the original variables. Thus, standardization avoids the problems of having one variable with large variance unduly influencing the determination of canonical loadings (Johnson and Wichern, 1988). The correlation matrix for the variables has been given in Table 2.

The ratio of the eigenvalues below is the ratio of explanatory importance of the six canonical correlations (labeled "roots") which are extracted for these data. As usual the first canonical correlation is far more important than the others. For these data, however, for the first canonical correlation the "covariate" canonical variate explains only about 15.26% (.391*.391) of the variance in the "dependent" (Emerging) canonical variate as shown in Table 3 below. Table 4 shows that the canonical correlation analysis of the relationship between emerging markets and developed markets yielded only one pair of statistically significant canonical variates at the .05 level.

Table 3

	Canonical Correlation	Adjusted Canonical Correlation	Approximate Standard Error	Squared Canonical Correlation
1	0.390619	0.382227	0.023467	0.152583
2	0.107211	–	0.027374	0.011494
3	0.075371	–	0.027535	0.005681
4	0.041686	–	0.027644	0.001738
5	0.039612	–	0.027649	0.001569
6	0.007387	–	0.027691	0.000055

Eigenvalues of Inv(E)*H = CanRsq/(1-CanRsq)

	Eigenvalue	Difference	Proportion	Cumulative
1	0.1801	0.1684	0.8969	0.8969
2	0.0116	0.0059	0.0579	0.9548
3	0.0057	0.0040	0.0285	0.9832
4	0.0017	0.0002	0.0087	0.9919
5	0.0016	0.0015	0.0078	0.9997
6	0.0001	–	0.0003	1.0000

A procedure for testing the significance of the canonical correlations when the sample size is large, is defined as follows (Johnson, 1998, p. 495): (Also called, Bartelett's criterion to test for independence, Timm, 1975, p. 354.)

$$\Lambda = \prod_{i=1}^{s}(1-r_i^2) = \frac{|S_{XX} - S_{XY}S_{YY}^{-1}S_{YX}|}{|S_{XX}|},\ \ i = 1, 2, \ldots, s = \min(p, q) \ \ldots\ldots (3)$$

with $\Lambda_k = \prod_{i=k}^{s}(1-r_i^2)$ and r_i^2 is the sample estimate of ρ_i^2 are used to test the null hypothesis that the p-variates $X_1^*, X_2^*, X_3^*, \ldots, X_p^*$ are uncorrelated to the q-variates $Y_1^*, Y_2^*, Y_3^*, \ldots, Y_q^*$ is rejected if the calculated χ_c^2 exceeds χ_α^2 (pq) with

$$\chi_c^2 = -\,[N - (p + q + 1)/2\,] \log \Sigma \ \ldots\ldots (4)$$

and χ_α^2 (pq) is the critical value from the chi-square distribution with (pq) degrees of freedom.

It should be noted that testing the importance of the characteristic roots r_i^2 aids this study in determining how many canonical variates can be retained for further analysis. Thus, the above Test statistic χ_c^2 is for testing

Table 2: Pearson Correlation Coefficients, N = 1305

	Y1	Y2	Y3	Y4	Y5	Y6	X1	X2	X3	X4	X5	X6
Y1 = Indonesia	1.000											
Y2 = Korea	0.163	1.000										
Y3 = Malaysia	0.337	0.196	1.000									
Y4 = Philipin	0.376	0.201	0.260	1.000								
Y5 = Taiwan	0.179	0.190	0.179	0.184	1.000							
Y6 = Thailand	0.373	0.296	0.354	0.393	0.215	1.000						
X1 = France	0.089	0.153	0.107	0.119	0.092	0.159	1.000					
X2 = Germany	0.119	0.140	0.107	0.138	0.103	0.169	0.743	1.000				
X3 = Italy	0.087	0.122	0.096	0.111	0.081	0.131	0.727	0.647	1.000			
X4 = Japan	0.210	0.227	0.231	0.206	0.187	0.248	0.221	0.213	0.177	1.000		
X5 = UK	0.105	0.171	0.149	0.136	0.048	0.170	0.643	0.611	0.557	0.211	1.000	
X6 = USA	0.013	0.088	0.013	0.067	0.021	0.045	0.352	0.337	0.281	0.047	0.348	1.000

the first canonical correlation (Σ_1) is zero and that all the remaining canonical correlations (Σ_k , k = 2, 3, 4, s) are zero as well. If the null hypothesis Ho: Σ_1=0 is rejected, then the first pair of canonical variate will be retained for further analysis, and the second canonical correlation (Σ_2) must be tested using $\Lambda_k = \prod_{i=k}^{s}(1-r_i^2)$ instead of Σ when computing χ_c^2 (k=2, 3, 4, 5 6) with [(p-k+1)(q-k+1)] degrees of freedom.

These usual tests of significance (Wilks's Lambda) as shown below in Table (4), indicate that only the first canonical correlation is significantly different from 0, but the remaining five are not

Table 4

Test of H0: The canonical correlations in the current row and all that follow are zero (The Wilks Lambda Test)

	Likelihood Ratio	Approximate F Value	Num DF	Den DF	Pr > F
1	0.83012016	6.83	36 5680.7	<.0001	
2	0.97958930	1.07	25	4808.5	0.3681
3	0.99097979	0.73	16	3956.9	0.7605
4	0.99664151	0.48	9	3154.3	0.8858
5	0.99837642	0.53	4	2594	0.7158
6	0.99994543	0.07	1	1298	0.7902

Other Multivariate Statistics and F Approximations

Statistic	S=6 Value	M=-0.5 F Value	N=645.5 Num DF	Den DF	Pr > F
Wilks' Lambda	0.83012016	6.83	36	5680.7	<.0001
Pillai's Trace	0.17311984	6.43	36	7788	<.0001
Hotelling-Lawley Trace	0.20076520	7.20	36	3766.2	<.0001
Roy's Greatest Root	0.18005723	38.95	6	1298	<.0001

Note: *F Statistic for Roy's Greatest Root is an upper bound.*

In summary, the two significant canonical variates X_1^* and Y_1^* are obtained using:

$$X_1^* = 0.0201\, Z_{X1} + 0.1796\, Z_{X2} + 0.0262\, Z_{X3} + 0.8061\, Z_{X4} + 0.2662\, Z_{X5} - 0.0164\, Z_{X6}$$

$$Y_1^* = 0.1739\, Z_{Y1} + 0.4031\, Z_{Y2} + 0.3037\, Z_{Y3} + 0.2100\, Z_{Y4} + 0.2087\, Z_{Y5} + 0.3008\, Z_{Y6}$$

with Z_{Xi} and Z_{Yi} are the standardized versions of the original variables; (i = 1, 2, 3, 4, 5, 6).

Table (5-a) shows the standardized canonical coefficients (weights) which are used in calculating the case scores on the canonical variate Y*, (the "dependent" variate) for each of the six canonical correlations which were extracted. Table (5-b) shows the standardized canonical coefficients (weights) which are used in calculating the case scores on the canonical variate X*, (the "predictor" variate) for each of the six canonical correlations. The standardized canonical coefficients show the ratio of importance of each of the original variables in calculating the canonical score for each of the canonical variates. Thus the larger the coefficient, the more important the original variable X or Y in deriving the canonical variate X* or Y* respectively.

Table (5-a)

Standardized Canonical Coefficients for the Emerging Market Variables

	Emerging1	Emerging2	Emerging3	Emerging4	Emerging5	Emerging6
Indonesia	0.1739	-0.3978	-0.4270	0.4713	0.2831	-0.8007
Korea	0.4031	0.4689	0.5429	-0.3358	0.1895	-0.5527
Malaysia	0.3037	0.4059	-0.7271	-0.4706	0.2735	0.3909
Philippn	0.2100	0.0801	0.4550	0.5555	0.5359	0.6661
Taiwan	0.2087	-0.8465	0.1801	-0.5145	0.0498	0.1781
Thailand	0.3008	0.0150	-0.0077	0.2356	-1.1157	0.1300

Table (5-b)

Standardized Canonical Coefficients for the Developed Market Variables

	Dvlpd1	Dvlpd2	Dvlpd3	Dvlpd4	Dvlpd5	Dvlpd6
France	0.0201	0.0721	0.5435	-1.2874	-1.0646	-0.2916
Germany	0.1796	-0.7699	0.0424	1.2639	-0.3493	-0.4137
Italy	0.0262	-0.1918	-0.0406	0.1117	0.5280	1.3927
Japan	0.8061	-0.2781	-0.1778	-0.2975	0.4261	-0.1943
UK	0.2662	1.2096	-0.5077	0.3347	0.0048	-0.0571
USA	-0.0164	0.1570	0.8715	0.0628	0.6044	-0.1814

Table 5(a) shows that the variables Korea (Y2) followed by Malaysia (Y3) and then Thailand (Y6), in that order, contributed significantly to the canonical variate in the set of emerging market (criterion) variables. The variables Japan (X4) followed by UK (5) and then Germany (X2) both by quite a distance, in that order, contributed significantly to the canonical variate in the set of the developed market (predictors) variables. These relationships are further supported by the structure correlations in Table (6-a) and Table (6-b) below, which show how the original emerging market variables (Y) load on each of their six canonical variates and how the original developed market variables (X) load on each of their six canonical variates.

These structure correlations (also known as canonical loadings and cross loadings) are calculated by multiplying the vector and canonical weights by the matrix of the within set of correlations for each variate according to the following equation (Timm, 1975, p.355-356):

Loadings: $\text{Corr}(Z_X, X_1^*) = (R_{XX})a_i$

$\text{Corr}(Z_Y, Y_1^*) = (R_{YY})b_i \qquad i = 1, 2, \ldots, s = \min(p, q)$ .... (5)

Cross-Loadings: $\text{Corr}(Z_X, Y_1^*) = [r_i * (R_{XX})a_i]$

$\text{Corr}(Z_Y, X_1^*) = [r_i * (R_{YY})b_i]$

where Z_X and the Z_Y are the standardized versions of the original variables and r_i is the ith canonical correlation. The canonical loadings provide information regarding the integration of each market with its own regional set of markets and the canonical cross-loadings provide information regarding the integration of each emerging market (criterion variable) with the set of developed market and vice-versa.

Here, the "dependent" canonical variate (Y_1^*) which is associated with the first canonical correlation is most positively related to the emerging market Thailand (Y_6) followed by Korea (Y_2) and then Malaysia (Y_3). Next, Indonesia (Y_1) and Philippines (Y_4) are equally important to the first Emerging canonical variate Y_1^* while Taiwan (Y5) is the least important to Y_1^*. In addition, for the "predictor" canonical variate (X_1^*) is most related (positively) to X_4 (Japan) followed by X_5 (UK) and then X_2 (Germany). For the second canonical correlation, the "dependent" canonical variate (Y_2^*) is most related (negatively) to Y_5 (Taiwan). For the second canonical correlation, the "predictor" canonical variate (X_2^*) is most related (positively) to X_5 (UK). This second canonical correlation along with the third through the sixth canonical correlations are not significant and thus, should be ignored.

Table (6-a): Canonical Loadings

Correlations Between the Emerging Market Variables and Their Canonical Variates

	Emerging1	Emerging2	Emerging3	Emerging4	Emerging5	Emerging6
Indonesia	0.5703	-0.3004	-0.3837	0.4624	0.2001	-0.4282
Korea	0.6618	0.3430	0.4552	-0.2674	0.0769	-0.3996
Malaysia	0.6397	0.2382	-0.6169	-0.2415	0.1597	0.2640
Philippn	0.5922	-0.0187	0.2450	0.5401	0.3229	0.4393
Taiwan	0.4741	-0.7378	0.1590	-0.4256	0.0444	0.1499
Thailand	0.7196	-0.0015	-0.0465	0.2532	-0.6362	0.1059

Table (6-b): Canonical Loadings

Correlations Between the Developed Markets and Their Canonical Variates

	Dvlpd1	Dvlpd2	Dvlpd3	Dvlpd4	Dvlpd5	Dvlpd6
France	0.5161	0.1321	0.4864	-0.0953	-0.6308	0.2695
Germany	0.5406	-0.1071	0.3658	0.5416	-0.5015	0.1324
Italy	0.4434	0.0320	0.3126	0.1449	-0.2232	0.7962
Japan	0.9089	-0.1976	0.1226	-0.2189	0.2391	-0.1210
UK	0.5681	0.6744	0.1109	0.3009	-0.2987	0.1745
USA	0.1888	0.2769	0.8805	0.1705	0.2823	-0.0605

Also, Table 6(a-b) shows that on the average, the proportion of variance in the emerging market variables accounted for by their own first canonical variate is only

$$R^2_{(Y,Ly)} = \frac{1}{6}\ [(0.5703)^2 + (0.6618)^2 + (0.6397)^2 + (0.5922)^2 + (0.4741)^2 + (0.7196)^2]$$

$$= \frac{1}{6}\ [2.265733] = 0.377622$$

which means that, about 37.76% of the common (shared) variance in the set of emerging market variables can be accounted for by the canonical variate Y_1^*.

Similarly, the proportion of variance in the developed market variables accounted for by their own first canonical variate is only

$$R^2_{(X,Lx)} = \frac{1}{6}\ [(0.5161)^2 + (0.5406)^2 + (0.4434)^2 + (0.9089)^2 + (0.5681)^2 + (0.1888)^2]$$

$$= \frac{1}{6}\ [1.939693] = 0.323282$$

which means that, about 32.33% of the common (shared) variance in the set of developed market variables can be accounted for by the canonical variate X_2^*.

Table (7-a-b) shows that all criterion variables are equally influenced by the first canonical variate of the developed markets (X_1^*); whereas the first canonical variate of the criterion variables (Y_1^*) influences Japan (X_5) the most and influences the USA market (X_6) the least.

In addition, it is clear that on the average, the proportion of variance in the emerging market variables accounted for by the first canonical variate of the developed market is only

$$R^2_{(Y,CLx)} = \frac{1}{6}\ [(0.2228)^2 + (0.2585)^2 + (0.2499)^2 + (0.2313)^2 + (0.1852)^2 + (0.2811)^2]$$

$$= \frac{1}{6}\ [0.345728] = 0.057621$$

which means that, about 5.76% of the common (shared) variance in the set of emerging market variables can be accounted for by a linear combination of the variables FRANCE, GERMANY, ITALY, JAPAN, UK, and USA.

The proportion of variance in the developed market variables accounted for by the first canonical variate of the emerging market is only

$$R^2_{(X,CLy)} = \frac{1}{6}\ [(0.2016)^2 + (0.2112)^2 + (0.1732)^2 + (0.3550)^2 + (0.2219)^2 + (0.0737)^2$$

$$= \frac{1}{6}\ [0.295943] = 0.049324.$$

which means that, about 4.93% of the common (shared) variance in the set of developed market variables can be accounted for by a Linear Combination of the Variables Indonesia, Korea, Malaysia, Philipines, Taiwan, and Thailand.

Table (7-a): Canonical Cross-Loadings (Structure)

Correlations Between the Emerging Market Variables and the Canonical Variates of the Developed

	Dvlpd1	Dvlpd2	Dvlpd3	Dvlpd4	Dvlpd5	Dvlpd6
Indonesia	0.2228	-0.0322	-0.0289	0.0193	0.0079	-0.0032
Korea	0.2585	0.0368	0.0343	-0.0111	0.0030	-0.0030
Malaysia	0.2499	0.0255	-0.0465	-0.0101	0.0063	0.0020
Philippn	0.2313	-0.0020	0.0185	0.0225	0.0128	0.0032
Taiwan	0.1852	-0.0791	0.0120	-0.0177	0.0018	0.0011
Thailand	0.2811	-0.0002	-0.0035	0.0106	-0.0252	0.0008

Table (7-b): Canonical Cross-Loadings (Structure)

Correlations Between the Developed Markets Variables and the Canonical Variates of the Emerging

	Emerging1	Emerging2	Emerging3	Emerging4	Emerging5	Emerging6
France	0.2016	0.0142	0.0367	-0.0040	-0.0250	0.0020
Germany	0.2112	-0.0115	0.0276	0.0226	-0.0199	0.0010
Italy	0.1732	0.0034	0.0236	0.0060	-0.0088	0.0059
Japan	0.3550	-0.0212	-0.0092	-0.0091	0.0095	-0.0009
UK	0.2219	0.0723	0.0084	0.0125	-0.0118	0.0013
USA	0.0737	0.0297	0.0664	0.0071	0.0112	-0.0004

Table (7-c): Loadings and Squared Loadings For Y

Yi	Vaiables Ly1=Loadings	Y1*-Variate Ly1*Ly1	
Indonesia	0.5703	0.325242	
Korea	0.6618	0.437979	Shared Variance in the Criterion Set of Variables
Malaysia	0.6397	0.409216	Explained by the 1st Criterion Canonical Variate 0.377622
Philippn	0.5922	0.350701	
Taiwan	0.4741	0.224771	
Thailand	0.7196	0.517824	This Implies: Redundancy Index = Sqr (Canonical Corr.) *
	Total	2.265733	Shared Vaiance
	Average	0.377622	= 0.152583 * 0.377622 = 0.05762

By letting the percentage of variance in the criterion canonical variate that can be explained by the predictor canonical variate = sqr (Canonical Correlation)

= Canonical R^2 **= (.390619)*(.390619) = 0.152583.**

Thus, the amount of shared variance that can be explained by each canonical function is given by 0.05762. Since a high canonical correlation along with a high degree of shared variance explained by the criterion variate implies a high redundancy index and hence a valuable canonical function.

Table (8-a): Canonical Redundancy Analysis

Standardized Variance of the Emerging Market Variables Explained

Canonical Variate Number	Their Own Canonical Variates			The Opposite Canonical Variates	
	Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1	0.3776	0.3776	0.1526	0.0576	0.0576
2	0.1349	0.5125	0.0115	0.0016	0.0592
3	0.1371	0.6496	0.0057	0.0008	0.0599
4	0.1468	0.7964	0.0017	0.0003	0.0602
5	0.0971	0.8934	0.0016	0.0002	0.0604
6	0.1066	1.0000	0.0001	0.0000	0.0604

Table (8-b):Canonical Redundancy Analysis

Standardized Variance of the Developed Market Variables Explained

Canonical Variate Number	Their Own Canonical Variates			The Opposite Canonical Variates	
	Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1	0.3233	0.3233	0.1526	0.0493	0.0493
2	0.1001	0.4234	0.0115	0.0012	0.0505
3	0.2118	0.6352	0.0057	0.0012	0.0517
4	0.0818	0.7170	0.0017	0.0001	0.0518
5	0.1542	0.8712	0.0016	0.0002	0.0521
6	0.1288	1.0000	0.0001	0.0000	0.0521

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Appendix: Canonical Redundancy Analysis

Squared Multiple Correlations Between the Emerging and the First M Canonical Variates of the Developed

M	1	2	3	4	5	6
Indonesia	0.0496	0.0507	0.0515	0.0519	0.0519	0.0519
Korea	0.0668	0.0682	0.0694	0.0695	0.0695	0.0695
Malaysia	0.0624	0.0631	0.0653	0.0654	0.0654	0.0654
Philipin	0.0535	0.0535	0.0539	0.0544	0.0545	0.0545
Taiwan	0.0343	0.0406	0.0407	0.0410	0.0410	0.0410
Thailand	0.0790	0.0790	0.0790	0.0791	0.0798	0.0798

Squared Multiple Correlations Between the Developed and the First M Canonical Variates of the Emerging

M	1	2	3	4	5	6
France	0.0406	0.0408	0.0422	0.0422	0.0428	0.0428
Germany	0.0446	0.0447	0.0455	0.0460	0.0464	0.0464
Italy	0.0300	0.0300	0.0306	0.0306	0.0307	0.0307
Japan	0.1261	0.1265	0.1266	0.1267	0.1268	0.1268
UK	0.0492	0.0545	0.0545	0.0547	0.0548	0.0548
USA	0.0054	0.0063	0.0107	0.0108	0.0109	0.0109

Correlations Among the Original Emerging Markets' Variables

	Indonesia	Korea	Malaysia	Philipin	Taiwan	Thailand
Indonesia	1.0000	0.1626	0.3373	0.3756	0.1789	0.3731
Korea	0.1626	1.0000	0.1956	0.2019	0.1904	0.2956
Malaysia	0.3373	0.1956	1.0000	0.2603	0.1790	0.3539
Philipin	0.3756	0.2019	0.2603	1.0000	0.1838	0.3926
Taiwan	0.1789	0.1904	0.1790	0.1838	1.0000	0.2147
Thailand	0.3731	0.2956	0.3539	0.3926	0.2147	1.0000

Correlations Among the Original Developed Emerging Markets' Variables

	France	Germany	Italy	Japan	UK	USA
France	1.0000	0.7432	0.7266	0.2208	0.6430	0.3517
Germany	0.7432	1.0000	0.6465	0.2132	0.6114	0.3373
Italy	0.7266	0.6465	1.0000	0.1769	0.5573	0.2814
Japan	0.2208	0.2132	0.1769	1.0000	0.2111	0.0465
UK	0.6430	0.6114	0.5573	0.2111	1.0000	0.3481
USA	0.3517	0.3373	0.2814	0.0465	0.3481	1.0000

Correlations Between the Original Emerging and the Developed Markets' Variables

	France	Germany	Italy	Japan	UK	USA
Indonesia	0.0890	0.1194	0.0872	0.2105	0.1045	0.0134
Korea	0.1533	0.1404	0.1219	0.2270	0.1707	0.0883
Malaysia	0.1072	0.1070	0.0957	0.2313	0.1494	0.0132
Philipin	0.1188	0.1382	0.1113	0.2061	0.1356	0.0666
Taiwan	0.0918	0.1026	0.0812	0.1867	0.0475	0.0210
Thailand	0.1584	0.1692	0.1313	0.2475	0.1700	0.0446

Univariate Multiple Regression Statistics for Predicting the Emerging from the Developed

Squared Multiple Correlations and F Tests
Numerator DF = 6 Denominator DF = 1298

	R-Square	Adjusted R-Square	Approx 95% Lower CL	CL for RSq Upper CL	F Value	Pr > F
Indonesia	0.051946	0.047563	0.028	0.074	11.85	<.0001
Korea	0.069509	0.065208	0.042	0.094	16.16	<.0001
Malaysia	0.065396	0.061076	0.038	0.090	15.14	<.0001
Philipin	0.054531	0.050161	0.030	0.077	12.48	<.0001
Taiwan	0.041021	0.036588	0.019	0.060	9.25	<.0001
Thailand	0.079764	0.075510	0.050	0.106	18.75	<.0001

Average R-Square
Unweighted 0.060361 Weighted by Variance 0.061520

Univariate Multiple Regression Statistics for Predicting the Developed from the Emerging

Squared Multiple Correlations and F Tests
Numerator DF = 6 Denominator DF = 1298

	R-Square	Adjusted R-Square	Approx 95% Lower CL	CL for RSq Upper CL	F Value	Pr > F
France	0.042830	0.038406	0.021	0.063	9.68	<.0001
Germany	0.046396	0.041987	0.023	0.067	10.53	<.0001
Italy	0.030709	0.026228	0.012	0.048	6.85	<.0001
Japan	0.126767	0.122731	0.091	0.159	31.41	<.0001
UK	0.054839	0.050470	0.030	0.077	12.55	<.0001
USA	0.010899	0.006327	0.000	0.020	2.38	0.0270

Average R-Square

Unweighted 0.052073
Weighted by Variance 0.057227