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**THE EFFECT OF NATIONS'
ECONOMIC LINKAGES ON THE
CO-MOVEMENT OF THEIR
STOCK MARKETS**

Research Honors Project

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INTRODUCTION

The flow of international investments has been rapidly increasing in recent years. One of the foremost reasons for international investing is that it provides diversification which can be explained in simple terms as selecting securities that do not move together. The main benefit of diversification is that it reduces risk (Markowitz 1952). The amount of diversification provided by investing in international equity markets is dependent on the extent of co-movement of equity markets across the globe.

Thus the study of the co-movements of stock prices in different countries is crucial for the individual investor who wishes to know the countries whose stock prices move together, in opposite directions or in altogether unrelated ways. This study attempts to locate the factors that determine the extent of correlation between a pair of stock markets.

With the increasing trend towards dismantling of trade and capital barriers between nations, it becomes important for the investor to know how these changes in economic relationships affect the correlations between markets (and thus the potential for diversification). This study will attempt to test how the correlations between the stock markets of pairs of nations are affected by the underlying economic linkages between the nations.

After a discussion of the factors that give rise to correlations between markets as suggested by theory and past research, the model that this study develops and the methodology

that is used is presented. This will be followed by the results of the estimated model and the conclusions that may be drawn from this study.

SOURCES OF CO-MOVEMENT OF STOCK PRICES

There are several reasons why we may expect the stock prices of various countries to be correlated. Stock indices can be seen as indicators of economic developments in a country and hence the factors that increase economic interdependence and produce similar economic conditions across countries can be expected to contribute to increasing correlations of equity markets.

Ripley (1973) suggests reasons why national equity markets can be expected to be correlated. Synchronizations in stock prices can arise due to similar movements in national income because the latter affect expectations of future economic developments and the investors' abilities to purchase equities. Common movements in national income are most likely in countries that trade extensively with each other. The greater a nation's involvement in foreign trade, the more sensitive is the profitability of its firms to economic conditions around the world (Dwyer and Hafer 1988). Thus we may expect a pair of nations with greater trade links to have more correlated stock price indices.

Countries with greater capital flows amongst themselves can also be expected to have more correlated stock prices. Capital flows tend to reduce interest rate differentials between countries by increasing the supply of capital in countries with high

interest rates and reducing the supply in countries with low interest rates. Since stock prices are affected by interest rate movements, we may expect increasing capital flows (which reduce interest differentials) to lead to increasing co-movements in price differentials (Ripley 1973). In general, the greater the extent of economic integration as manifested in similar movements of macro-economic variables, the greater we may expect the degree of synchronization of markets to be.

Multinational operations of companies also produce co-movements of nations' stock indices. When two countries' markets trade shares of the same group or similar groups of multi-national companies, expectations about the future of these companies would be similar and these experiences would be reflected in similar price movements (Ripley 1973).

Correlation between markets is also affected by the business cycle in the two markets. Expected stock returns are linked to the business cycle. Thus countries in the same cycle have similar expected returns and can be expected to have more correlated stock indices than countries who are in different phases of the business cycle.

From the theoretical discussion we can hypothesize that the correlation between two markets is an increasing function of the trade and direct investment between them and a decreasing function of their interest differential. Coherence in their business cycles can also be expected to increase their correlations.

PREVIOUS RESEARCH

While there has been extensive literature on connections between world stock markets, very little of that research has concentrated on how fundamental economic linkages like trade and foreign direct investment affect the co-movement of stock markets. Grubel and Fadner (1971) studied a closely related issue at the industry level. They attempted to test the hypothesis that correlation is an "increasing function of the share of the industries' domestic consumption which is either imported or exported." The empirical testing of this hypothesis was severely constrained by the lack of data, by their own admission

There has been a considerable amount of research done on the transmission of price volatility between markets, focussing on the 1987 crash. Studies by Bennett and Kelleher(1988) have shown that correlations go up considerably in periods of volatility. The October 1987 crash was evidence of stock markets overreacting to each other.

In addition to the above factors, there are other country-specific factors that affect correlations involving certain countries. These factors may be due to particular characteristics of the structure of some nation's stock markets and special institutional factors. A study by Schollhammer and Sand (1989) found the Netherlands to be consistently more correlated with other nations than might be suggested by the factors under

examination. This was attributed to the fact that a very high percentage of companies comprising the Dutch stock index are multinational companies.

EMPIRICAL MODEL

My model examines the effects of each of the factors discussed on the bilateral correlation between stock price indices of two markets. Correlation coefficients across 9 different countries (35 different pairs) are used to study whether they follow patterns of economic linkage. While most correlation studies have examined time-wise patterns to see how and why they have changed across time, this study attempts to examine how and why they vary across different countries, expecting differing extents of economic linkage to be the explanatory factors in country-wise patterns of correlation. The study uses data relating to nine countries - Canada, France, Germany, Italy, Japan, Mexico, Netherlands, United Kingdom and United States for the years 1990, 1991 and 1992.

The explanatory factors of the correlations between pairs of nations are summarized in the following table.

Dependent variable: Correlation coefficient between a pair of nations

Independent variables	Expected effect on correlation
Bilateral Foreign Investment	+
Bilateral Trade	+
Interest differential	-
Out-of-phase business cycle	-
Excessive volatility	+
Country-specific factors	?

DATA

Dependent variable

The study uses the monthly averages of each country's share price index as reported by various issues of International Financial Statistics published by the International Monetary Fund. These monthly averages are used to obtain the annual correlation coefficients for every pair of countries for each year in the study.

Independent variables

Bilateral trade statistics relating to each pair of countries were obtained from the International Trade Statistics Yearbook. Since imports and exports are valued differently, the total value of trade between a pair of nations was calculated as the sum of imports into each country from the other country of the pair. The data is expressed in millions of U.S. dollars.

Cross border investment for each pair of countries was located in the International Direct Investment Statistics

Yearbook (1994) published by the Organization for Economic Co-operation and Development (OECD). The total cross-border direct investment for a pair of countries for each year was calculated as the sum of the year-end stock of each country's direct investment in the other. The data relating to some countries was published in the local currency and the conversion factor reported by the World Tables published by the World Bank was used to obtain all the figures in millions of US dollars.

The yearly interest rate differential for each pair of countries was measured as the absolute difference in T-bill rates of the two countries as reported by International Financial Statistics. T-bill rates were not reported for Japan and Netherlands and the money market rate (the reported rate closest in nature to the T-bill rate) was used for those countries.

Summary statistics relating to the above 3 independent variables are described below.

SUMMARY STATISTICS

	Direct investment (mill \$)	Bilateral trade (mill \$)	Interest differential (%)
Arithmetic mean	27434.9	34138.16	3.74
Maximum	178458	167305.1	13.87
Minimum	.03466	822.236	.28
Std. deviation	39821.51	39324.11	3.30

A dummy variable was used to examine the effect of non-coincidence of phases of the business cycle. The variable had the

value 0 if the countries of the pair were in the same phase of the business cycle and value 1 if they were in different phases. Real GDP as reported by the World Tables was used to determine the phases of the business cycle. Every country was classified as being in a boom or in a recession for the year depending on whether real GDP increased or decreased from the previous year.

The period of the study includes a period of high volatility, the period of the Gulf War, when all major market indices suffered a crash in their values, ranging from 10% in New York to 21% in Tokyo (Economist, 1990). The effect of the Gulf War was measured with a dummy variable, with value 1 for all observations relating to 1990 and value 0 for all other observations. Individual country factors were also captured using dummy variables for each country. Each variable had value 1 for every observation relating to the country it represented and had value 0 otherwise.

The OLS regression revealed strong heteroscedasticity and hence the model was estimated using Weighted Least Squares.

RESULTS

The table below presents the results of the regression and is followed by a discussion of the results.

DEPENDENT VARIABLE: Correlation coefficient of the monthly stock indices of each pair of nations

Independent variables	Estimated coefficient (t-stat)	Expected sign
Bilateral Foreign Investment	.000001473* (2.1754)	+
Bilateral Trade	.000000204 (0.6843)	+
Interest differential	-.015906565** (7.5164)	-
Out-of-phase business cycle	.098568675** (4.6057)	-
Gulf War	.201555851** (8.6252)	+
France	.155755022** (5.1868)	?
Italy	.171257038** (7.0125)	?
Netherlands	.190356474** (6.7095)	+
United Kingdom	.225762223** (7.7639)	?
United States	-.158227924* (2.4283)	?

** significant at the .01 level * significant at the .05 level

As the table shows, all but one of the factors examined were significant in determining correlations between a pair of nations. The extent of bilateral cross-border investment had a positive relationship with the correlation coefficient between a pair of nations' stock markets.

Interestingly, one of the most important economic linkages between nations, the trade linkage, was found to be insignificant

for the level of correlation between their stock markets. The overall bilateral volume of trade does not seem to be significant in explaining the extent of correlation. The sector of the economy involved in foreign trade may not be represented well in the stock index if the imports and exports are largely non-industrial. It might be necessary to examine the composition of trade to locate the effect of trade links on the correlation of stock markets. The relative importance of trade in each nation's economy may also be more indicative of the effect of trade linkages on bilateral correlation coefficients.

As per the estimated model, a pair of nations with out-of-phase business cycles has greater correlation between its markets than a pair of nations whose business cycles are in phase. This is contrary to what was hypothesized. This could be due to an ineffective indicator of the phases of the business cycle. A study by Erb, Harvey and Viskanta (1994) found that correlations were highest when countries were both in a recession and were lower during common phases of recovery. Thus the actual phase of the cycle that the countries are in is important and this may explain why the business cycle variable used in this study does not have the expected effect on the correlation coefficient between two nations' stock indices.

Correlations between countries were much higher during the Gulf War, as was hypothesized. The correlation coefficient between a pair of countries went up by .20 during the Gulf War, all other factors remaining constant. This indicates that in periods of global panic and anxiety, nations' stock markets move

significantly closer together than under normal conditions. Though this study includes only developing nations, it may be safe to extend these results to all stock markets based on prior research on the market crash of 1987.

Five of the 9 countries examined had significant country-specific factors that caused their correlations to be higher or lower than suggested by the other explanatory variables. Correlations involving France, Italy, Netherlands and the United Kingdom were significantly higher due to country-specific factors while the United States had particular factors causing it to be less correlated than would be estimated by the other explanatory variables.

In general, the study shows that bilateral economic linkages do affect the pattern of stock index correlation between the respective countries. Investment and capital flows are important while the total extent of trade does not seem to be significant in explaining stock market co-movements. This has implications for the long-term global investor. The investor needs to monitor economic relationships between nations since stock market correlations reflect those economic relationships in the long run.

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