

## RECESSION AND INTERNATIONAL MARKET CORRELATIONS

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### ABSTRACT

*This paper investigates the relationships between various world stock indices from June 2007 to May 2009. The primary concern is whether the recession and the higher variance in daily market returns impact correlations between market indices. The results suggest that the correlations between daily returns on market indices are higher during the recession period of September 2008 to May 2009.*

### 1. INTRODUCTION

Since the crash of the U.S. stock market in October 1987, the relationship between the U.S. stock market and international stock markets is consistently discussed by both researchers and investors. As the U.S. market bears shocks, these are likely to impact international markets like the crash in the U.S. in 1987 lead to crashes in other markets. This relationship between the U.S. market and international markets results in reasonable concern regarding the benefits of international diversification. Blackman, Holden, and Thomas (1994) note that changes in the regulations regarding capital movements in the 1970s and 80s result in greater ease of access for investors interested in foreign markets, but if the world markets are highly correlated, then there would be no great need for international diversification.

Prior to 1987, there is very little evidence of interdependence between international stock markets. Blackman, et. al., (1994) find that there is no long-term relationship between international markets between 1979 and 1983. During the time frame from 1979 to 1985, Eun and Shim (1989) show that the U.S. market is not affected by international markets, but shocks in the U.S. quickly impact international markets. As a result, the causality in the relationships between international markets along with the long-term impact are of great interest.

Several studies suggest that any interdependency between international markets is short-lived. Smith, Brocato, and Rogers (1993) find very few instances of interdependency in world stock markets between 1979 and 1991. The only detection of interdependency occurs in 1987 when the U.S. market crashed. For the years 1983-1996, Kanas (1998) finds no long-term relationship between the U.S. market and the European stock markets. Dwyer and Hafer (1988) note that international markets are highly positively correlated right after the crash in 1987, but the correlations do not persist even a few weeks after the crash. In fact many post-crash correlations are negative. Using a later time frame of 1997 to 1999, Bessler and Yang (2003) find that there is still very little interdependency between international markets, and the U.S. stock market is the only market that consistently impacts international markets. According to these studies, international markets are not interdependent in the long-term, and therefore international diversification is beneficial.

Even though studies do not support long-term interdependencies between international markets, the need to continually study this issue persists. As information, access, disclosure, easing in government regulations regarding capital movements and taxes, etc. continue to increase, the globalization of international markets along with their interdependencies are of concern. Fischer and Palasvitra (1990) show that interdependencies between international stock markets are increasing with time using data in 1974 and 1986 to 1988. They also show that the U.S. market leads most of the other markets in the world.

One interesting study uses American Depositary Receipts on Japanese stocks and futures contracts on the Nikkei Index as proxies for the Japanese market. Karolyi and Stulz (1996) use these proxies in order to eliminate the timing issue. Since the markets in Japan and the U.S. are not open at the same time, using Japanese investment tools that trade in the U.S. while the U.S. markets are open may provide new information regarding interdependencies. They find that major shocks result in a higher positive correlation between Japan and U.S. markets. These shocks are most likely global since they also consider macroeconomic shocks such as major fluctuations in the exchange rate between the dollar and the yen, changes in T-bill rates, and

industry effects, and find that these have no impact on the correlation between Japan's market and the U.S. Another result of interest is that as the absolute rate of return increases, the correlation between the markets is higher. Contagions may be the source of this result. Karolyi and Stulz (1996) suggest that investors follow the crowd as investors make great gains or losses in one market and therefore investors in other markets follow suit.

Ramchand and Susmel (1998) find that the correlation between the U.S. stock market and international markets is 2 to 3.5 times higher when the variance in the U.S. market is high. This may suggest that times of chaos may lead to higher interdependencies between international markets and is consistent with Karolyi and Stulz's (1996) contagion hypothesis. The purpose of this paper is to investigate the relationship between market variance and correlation between international markets given the current recession.

## **2. DATA**

Daily closing values for 13 market indices are collected from Yahoo! Finance for the time frame of May 31, 2007 to May 29, 2009. The indices are the Merval (Argentina), Ibovespa (Brazil), S&P/TSX Composite (Canada), IPC (Mexico), S&P 500 (United States), All Ordinaries (Australia), SSE Composite (China), Hang Seng (Hong Kong), Nikkei 225 (Japan), FTSE 100 (United Kingdom), Swiss Market (Switzerland), Deutscher Aktien (Germany) and Cotation Assistée en Continu (France). These indices are listed in Table 1 along with the symbols that are used to identify them in this paper. There is also a short explanation regarding the make-up of each index.

The data are divided into two subsets in order to study the correlations between the indices prior to the recession and then during the recession. For the S&P 500, Table 2 contains the average daily return and the standard deviation of the daily returns for each month from June 2007 to May 2009. From June 2007 to August 2008, the standard deviations are in a range of 0.86% in June 2007 to 1.81% in March of 2008. After August 2008, the standard deviations are much higher and the range is 1.80% in May 2009 to 5.04% in October 2008. Based on the standard deviations, the pre-recession set is June 2007 to August 2008, and the recession data

is September 2008 to May 2009.

Daily returns for each index are calculated using

$$r = \ln\left(\frac{V_t}{V_{t-1}}\right)$$

where  $r$  is the daily return,  $V_t$  is the value of the index on trading day  $t$ , and  $V_{t-1}$  is the value of the index on the trading day before day  $t$ . Using the daily returns, the correlations between the indices are calculated. The results of these correlations are available in Tables 3, 4 and 5.

### **3. EMPIRICAL RESULTS**

Correlation measures the strength of the relationship between the daily returns for one index and the daily returns of another index. In Table 3 the correlations for every possible pair of indices are calculated for the entire sample, i.e. June 2007 to May 2009. All of the correlations are positive suggesting that the market indices tend to move in the same direction on a given calendar date. Not surprisingly, the correlations are generally higher in regions where it is likely that markets are open at the same time. For the Americas, correlations range from 0.6472 between MERV and the S&P and 0.8178 between the BVSP and IPC. For the Far East, the lowest correlation is between AOI and SSE at 0.2955, and the highest is between AOI and N225 at 0.7317. Overall the highest correlations occur in Europe with a low of 0.8207 for SMI and DAX and a high of 0.9454 for FTSE and CAC. A possible explanation for the higher correlations in Europe may be the European Economic Union and the use of a standard currency.

For the pre-recession time period from June 2007 to August 2008, the correlations (Table 4) are generally lower than those for the entire sample period. A few of the correlations are even weakly negative. However, the positive correlations still persist with the strongest positive correlations still occurring between the indices in Europe.

During the recessionary time period when the variance of the S&P is much higher, the correlations are generally all larger than the entire sample period and the pre-recession period.

Table 5 contains the correlations for September 2008 to May 2009. Regionally, the correlations range from 0.4704 to 0.7316 in the Americas, 0.2539 to 0.6964 in the Far East, and 0.8440 to 0.9381 in Europe. It appears that the correlations are definitely higher than the pre-recession period. This is most likely the result of a world-wide recession, but the role of the U.S. economy, industry, and market is not determined at this point. The correlations between the S&P and the other indices are definitely higher during the recession, ranging from 0.1202 to 0.8147 during the recession and -0.1040 to 0.7185 during the pre-recession period. However these numbers do not indicate causality between indices.

#### **4. CONCLUSION**

Market indices throughout the world seem to be positively correlated to each other. This is not a surprise in a world that is becoming more globally minded. The opportunities to invest directly in foreign markets, the proliferation of information available to investors, and the loosening of regulations result in more interest in every aspect of investment. Economic shocks also seem to play a role in the interdependency between world stock markets. As the world sank into recession, the stock markets followed resulting in a higher correlation between international stock indices.

Further research will provide more information regarding the relationships between world markets. For the most part, stock markets in different regions are not open at the same time, and therefore it would be useful to use time-series analysis to better identify relationships between world markets. Also a Granger Causality Test would be helpful to determine the direction of the relationship. Eun and Shim (1989), Fischer and Palasvitra (1990) and Bessler and Yang (2003) all show that the U.S. market generally leads and impacts international markets, but the international markets have little or no influence on the U.S. market. Finally, a larger sample size may enable a study of the change in correlations for many years. This may be especially beneficial for discovery of the rationale for the high correlations between European markets.

Regarding portfolio diversification, many of these correlations seem very high. An investor in Europe may not want to only diversify in Europe but also in the Far East markets where the correlations are a lot lower. In general international diversification is still beneficial especially outside of the investor's region.

**TABLE 1**

Indices for each country with the symbols used to denote each index.

<b>Country</b>	<b>Index</b>	<b>Symbol</b>	<b>Explanation of Members</b>
Argentina	Merval	MERV	variable based on market cap (about 42)
Brazil	Ibovespa	BVSP	50 based on trading volume
Canada	S&P/TSX Composite	TSX	variable based on market cap
Mexico	IPC	IPC	35 as industry representatives
United States	S&P 500	S&P	500 based on market cap
Australia	All Ordinaries	AOI	500 largest
China	SSE Composite	SSE	all stocks traded on the Shanghai Stock Exchange
Hong Kong	Hang Seng	HSI	45 based on market cap
Japan	Nikkei 225	N225	225 blue-chips
United Kingdom	FTSE 100	FTSE	100 based on market cap
Switzerland	Swiss Market	SMI	20 largest and most liquid
Germany	Deutscher Aktien	DAX	30 based on market cap and volume
France	Cotation Assistee en Continu	CAC	40 out of the 100 highest market cap

**TABLE 2**

Average daily returns and standard deviations of daily returns for each month

<b>Month</b>	<b>Average Return</b>	<b>Standard Deviation</b>
Jun-07	-0.09%	0.86%
Jul-07	-0.15%	1.10%
Aug-07	0.06%	1.53%
Sep-07	0.19%	0.99%
Oct-07	0.06%	0.87%
Nov-07	-0.21%	1.67%
Dec-07	-0.04%	1.11%
Jan-08	-0.30%	1.53%
Feb-08	-0.18%	1.30%
Mar-08	-0.03%	1.81%
Apr-08	0.21%	1.14%
May-08	0.05%	0.91%
Jun-08	-0.43%	1.24%
Jul-08	-0.05%	1.46%
Aug-08	0.06%	1.31%
Sep-09	-0.46%	3.46%
Oct-08	-0.80%	5.04%
Nov-08	-0.41%	4.48%
Dec-08	0.04%	3.13%
Jan-09	-0.45%	2.48%
Feb-09	-0.61%	2.29%
Mar-09	0.37%	3.06%
Apr-09	0.43%	1.89%
May-09	0.26%	1.80%



**TABLE 3**

Correlations between daily returns on market indices for June 2007 to May 2009

June 2007 - May 2009													
	MERV	BVSP	TSX	IPC	S&P	AOI	SSE	HSI	N225	FTSE	SMI	DAX	CAC
MERV	1												
BVSP	0.7693	1											
TSX	0.7226	0.7566	1										
IPC	0.6858	0.8178	0.6935	1									
S&P	0.6472	0.7650	0.7678	0.7848	1								
AOI	0.2685	0.2267	0.2376	0.2222	0.1119	1							
SSE	0.1555	0.1926	0.0883	0.1256	0.0221	0.2955	1						
HSI	0.3657	0.4202	0.3321	0.3862	0.2642	0.6762	0.4969	1					
N225	0.2812	0.2533	0.3015	0.2415	0.1166	0.7317	0.3147	0.6969	1				
FTSE	0.6211	0.6410	0.5987	0.6239	0.5541	0.3990	0.1517	0.4384	0.4349	1			
SMI	0.5814	0.6041	0.5605	0.5847	0.5404	0.4045	0.1498	0.4175	0.4369	0.8839	1		
DAX	0.6254	0.6639	0.5790	0.6610	0.6295	0.3695	0.1599	0.4395	0.4141	0.8740	0.8207	1	
CAC	0.6261	0.6647	0.5945	0.6397	0.5777	0.3961	0.1612	0.4336	0.4356	0.9454	0.8900	0.9130	1

**TABLE 4**

Correlations between daily returns on market indices for June 2007 to August 2008

June 2007 - August 2008													
	MERV	BVSP	TSX	IPC	S&P	AOI	SSE	HSI	N225	FTSE	SMI	DAX	CAC
MERV	1												
BVSP	0.7223	1											
TSX	0.6678	0.7316	1										
IPC	0.5894	0.7166	0.6330	1									
S&P	0.4704	0.6418	0.6132	0.7185	1								
AOI	0.1888	0.1352	0.1136	0.0833	-0.0065	1							
SSE	0.0737	0.0705	0.0045	-0.0048	-0.1040	0.2539	1						
HSI	0.1925	0.1783	0.1175	0.1059	0.0211	0.7316	0.4511	1					
N225	0.1012	0.1407	0.1061	0.0654	0.0584	0.6924	0.2759	0.6838	1				
FTSE	0.5436	0.5719	0.5133	0.5231	0.4744	0.2745	0.0699	0.2983	0.3039	1			
SMI	0.4640	0.5042	0.4138	0.4889	0.4551	0.2880	0.0620	0.3155	0.3842	0.8556	1		
DAX	0.4901	0.5478	0.4439	0.4553	0.4737	0.2763	0.0693	0.2479	0.3106	0.8779	0.8440	1	
CAC	0.5454	0.5770	0.4898	0.5222	0.5045	0.2639	0.0586	0.2567	0.3164	0.9297	0.8819	0.9381	1

**TABLE 5**

Correlations between daily returns on market indices for September 2008 to May 2009

September 2008 - May 2009													
	MERV	BVSP	TSX	IPC	S&P	AOI	SSE	HSI	N225	FTSE	SMI	DAX	CAC
MERV	1												
BVSP	0.7938	1											
TSX	0.7381	0.7729	1										
IPC	0.7312	0.8614	0.7256	1									
S&P	0.6969	0.8105	0.8068	0.8147	1								
AOI	0.3139	0.2786	0.2983	0.3035	0.1654	1							
SSE	0.2440	0.3303	0.1679	0.2667	0.1202	0.3634	1						
HSI	0.4517	0.5442	0.4256	0.5371	0.3666	0.6403	0.5894	1					
N225	0.3434	0.3041	0.3623	0.3220	0.1347	0.7672	0.4006	0.7114	1				
FTSE	0.6566	0.6708	0.6329	0.6702	0.5840	0.4723	0.2488	0.5130	0.4935	1			
SMI	0.6386	0.6485	0.6207	0.6284	0.5745	0.4737	0.2521	0.4733	0.4633	0.8970	1		
DAX	0.6773	0.7093	0.6215	0.7454	0.6746	0.4234	0.2620	0.5341	0.4556	0.8740	0.8140	1	
CAC	0.6608	0.7002	0.6317	0.6912	0.6017	0.4716	0.2762	0.5241	0.4858	0.9524	0.8948	0.9040	1

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