

STOCK MARKET CORRELATIONS AND CROSS-EQUITY HOLDINGS

by

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ABSTRACT

The objective of this research is to find how world stock markets correlate with each other and what causes that correlation. Multiple dependent variables that may have a high impact on correlations are tested, with a particular focus on cross-equity holdings. All the variables but one tested significant at the accepted 90% confidence level. The model showed a negative relationship between equity holdings and stock market correlation. The results may inspire further research with more in depth analysis of international equity holdings and investor behavior in world stock markets.

DEDICATIONS

I dedicate this last piece of work as an undergraduate student to my loving mother and father who have always supported me throughout my life and continue to do so.

Thank you mom and dad!

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INTRODUCTION

With the current rapid globalization and the creation of trade agreements and economic integration unions such as the European Union, international investments have also increased by a great deal. US international equity investments as of December 2007 totaled \$5.2 trillion. That is 38% of the US GDP for that year and it is equivalent to the total holdings of all global reserves held by national governments (Ammer 2012).

Since equity investments impact stock markets, my research will attempt to discover: if a country holds equity of another country, how will that impact the correlation of their stock markets. Cross-equity holdings by definition, is when corporations or investors own stock in a foreign stock market. Before explaining my hypothesis of why cross-equity investments could affect the correlation of stock markets, the nature of stock markets must be discussed. The stock markets also called equity markets are a public entity where company stocks (also called shares) are traded. The main purpose for a company to list its stock in a stock exchange is to raise capital. The money gained by selling its shares helps the company to expand. The stock market is also very liquid, compared to other forms of investment such as real estate. Investors who hold stocks can easily transform them into cash. An investor makes profit in the market by buying a stock at a certain (low) price and sells it at a higher price. The price may not be necessarily low but it needs to have a potential to grow more. The second way of making profit is by short selling a stock, which has the potential to decline in price and cover the position at the lower price. That simultaneous buying and selling of stocks may form trends. A bullish trend is formed when buyers exceed sellers and bid the price up, and a bearish trend is formed when sellers exceed

buyers, thus reducing price. Given the considerable share of cross-equity holdings mentioned above, changes in these holdings may play a big role in the correlation between markets. The easiest way of making a foreign equity investment is by buying a cross-listed stock. Cross-listed stocks are foreign equities which have been listed in the home market, allowing investors at home to buy them. They impact the home equity market as well as the foreign one. In 2007 cross-listing accounted for 25-35% of all US investments in foreign equities, although only 4% of foreign firms are cross-listed. Among the non cross-listed firms, US investors prefer firms that are large, liquid and transparent. A majority of the investors acquire foreign shares directly from the firm's home market (Ammer 2012). Equity investments between markets may form same trends in both markets, thus making the correlation between the indices higher.

In this research I investigate cross-equity holdings data between the US and 5 other developed countries and try to determine how these investments impact the correlation between the indices. The results show a negative relationship, which is important in understanding where investors invest in a foreign market. I consider the 2001-2010 period because it is generally characterized by high economic volatility such as that observed during the recessions in 2001 and 2008 and the recovery from the 2001 recession. I will be examining how markets and foreign investments behaved during this period.

In the long run stock markets have had a lower correlation but that may be changing since equity markets have dramatically increased their correlations in the last few decades. For example, Tokat (2004) finds that average stock market correlation between EU countries and the European Monetary Union (EMU) has increased by fifty percent going from the 1970s to the 1990s. According to the author, US and international stocks produced higher returns because of

the low correlation between the two, possibly due to differences macroeconomic fluctuations and policies imply that correlations of international markets. Thus, this low correlation predicts that diversification benefits may exist.

Stock market movements can also be affected by the scale of a country's economy. Historical evidence suggests that larger economies' stock returns have a great impact on smaller countries' returns. For example, Tokat (2004) argues that the US and Japanese equity markets impact most global markets and the Asian equity markets, respectively. Similarly, the stock markets in United Kingdom, France and Germany greatly impact the returns of the rest of the markets in Europe. During the period of 1973 to 2003, 70% of the developed countries in the world experienced bear markets whenever the US market was bear (Tokat 2004). History shows us that markets have a higher correlation when the US is in a bear trend, rather than a bullish one (Tokat 2004). The dominance of the financial and economic power of the United States to other countries worldwide has diminished much of the diversification in international equity investments. It is harder for US investors to create a well diversified international portfolio because of the influence of the US stock on the rest of the world. An opportunity of investment may arise if the intensity of international bear markets is lower. Bull markets generally provide a better diversification of portfolio, because during these periods, markets tend to be less correlated. According to Tokat (2004), this period of lower correlation was from 1915 to 1971 and international integration was very low during the world wars, the cold war and the Bretton Woods system therefore causing the international stock markets to have lower correlations.

This topic requires a well thought-out model and most importantly, a proper way to estimate the model. Although my hypothesis is that equity holdings will cause a positive

correlation of stock markets, the case may be different. Depending on the result I get and how my other variables affect that correlation, I will be able to find out how significant and important cross-equity holdings are in my model. The result may also aid investors to consider various macroeconomic factors, such as exchange rates and economic growth in a certain country, before they make an investment

LITERATURE REVIEW

Prior research on the topic of the determinants of stock market correlations focuses mainly on identifying certain independent variables and testing their significance. Chintrakarn and Prasatkitjaroen (2010) used a gravity model to explain the co-movements of international stock markets taking distance and overlapping opening hours as the key variables. They examined 47 markets from 2003 to 2009. The other “less important” variables they included were market capitalization and dummy variables for border, language and currency. Their results revealed that the coefficient estimates of distance were reduced almost every year during their time period (2003-2009), after the introduction of overlapping opening hours. The conclusion was drawn that overlapping opening hours were the main determinant of international stock market correlation.

Flavin and Hurley (2002) took a general trade gravity model approach to explain the co-movements of stock markets. However, they included extra variables that are better associated with financial markets. Their results also supported the assertion that distance is not statistically significant but overlapping opening hours is an important determinant of correlation.

Significance was also found in the measure of corporate governance. The positive coefficient indicates that the more markets are “investor friendly”, the more likely they are to move together. More conventional financial variables such as market capitalization and risk influence the correlation as well. Larger markets tend to be more correlated. This result may be due to market liquidity and the fact that more liquid markets exhibit stronger co-movements than less liquid markets. Stock markets with a common dominant industry also exhibited higher co-movements.

Fasnacht and Louberge (2007) examined the sectoral correlation of 7 large markets. They found that the highest correlation coefficient was for the sector pair of US-Canada in basic materials (0.7). A negative coefficient was found between the industries of France Telecom and Japan Utilities (-0.12). The highest correlation was found between Industries and Consumer Services in the US as well as Technology and Industries in Japan. The authors observed that sector correlations within the markets are on average higher than the sector correlations between the markets. The final conclusion was that market correlations are on average higher than correlations at the sectoral level. Knowing how much equity is invested in each sector could help better understand the results of how equity holdings impact stock market correlation. The data were unavailable and it could be the subject of future research.

Coerdacier and Guibaud (2005) were among the few who scrutinized the topic of bilateral equity holdings and stock market correlations. The first regression they ran, they did not control for geography and trade. The results showed a positive relationship between market correlation and equity holdings. Theory indicates that investors looking to diversify their portfolios should invest in less correlated markets, thus making the relationship negative. After running a new regression with geography and trade variables the relationship was still positive. Increasing economic integration may lead to higher cross-equity holdings and higher stock co-movements. It may also be coming from omitted variable bias. Since degree of integration cannot be really captured, controlling for this variable is not viable. After adding instrumental variables and running the regression, a negative relationship appeared between equity holdings and market correlation.

METHODOLOGY AND DATA

The main goal of this research is to identify the relationship of bilateral cross-equity holdings between two countries and their stock markets. More accurately, how these investments affect the correlation of the two nations' stock indices. Since impact on correlation is tested, the dependent variable is the correlation coefficient of the stock market indices of two countries. To make sure the best results were produced, the most appropriate countries to work with had to be carefully chosen. The main country was the US, which was used as the home country and paired with other foreign ones. In determining the foreign countries, developing countries were excluded, because data was not available for them. The characteristics needed for a country were to be a developed nation with an open large economy. Data for these countries were more more easily accessible. The countries that filled the criteria and were the final choice, were Canada, France, Germany, Japan and the United Kingdom. The limited resources and lack of data restricted me from using other countries that were also eligible. Data of equity holdings was only available for pairs that included the US. Working with six countries and pairing the US to the other five, produced five pairs to examine.

After selecting the countries, their stock markets had to be examined and the most appropriate index had to be chosen, since all countries had multiple equity indices. For the United States the Dow Jones Industrial Average (DJIA) was used, which is the largest stock index in the country and is used as a measure of how the American stock market is trending in general. The indices for Canada, France, Germany, Japan and United Kingdom were TSX Toronto, CAC 40, DAX, Nikkei 225 and FTSE 100 respectively.

Data for each country's stock market were gathered from Yahoo Finance. Daily data was collected at its closing price from 2001 to 2010 and entered into Excel. Since the stock markets used in this project are not all open at the same time every week day due to national holidays, the closing prices were matched with each day every market was open. Any day, in which at least one market was closed was disregarded. Since quarterly data was the frequency throughout the entire research, daily data of the stock values was used to compute the correlation coefficients for each quarter between 2001 and 2010.

Determining the independent variables required a look at similar research papers done in the past. Chintrakarn and Prasatkitjaroen (2010) tested what affects stock market correlation with the main variables being distance and overlapping opening hours. Both Tavarez (2009) and Guibaud (2005) included some common variables generally used, when explaining stock market correlations, such as bilateral trade, currencies, GDP and common border. After reviewing all papers that can relate to this project, the independent variables were determined. While most of the prior experiments tested which independent variable had the most significant impact on market correlations, in this paper the main interest is on cross-equity holdings. Other control variables have been added to identify the independent effects of cross-equity holdings on stock market correlation.

The independent variables used for this research are cross-equity holdings, GDP, bilateral trade, exchange rates, distance, overlapping opening hours, property rights and investment freedom. The data for equity holdings was obtained from the International Monetary Fund (IMF) website in their Coordinated Portfolio Investment Survey database. The IMF's database provided

equity investments from the foreign countries to the United States. Since the frequency of the data was annual, each quarter of every year was assigned the same value for that year. Real GDP data was collected quarterly from the first quarter of 2000 to the fourth quarter of 2010 from the website of the Federal Reserve Bank of St. Louis (FRED). Using Excel, the percent change difference between the quarters of each year was calculated using the following formula:

$$\frac{(Q_n year_t)}{(Q_n year_{t-1})} - 1$$

where Q_n specifies the quarter within the year.

The values from Q1 2001 to Q4 2010 were calculated for each country. The foreign countries' GDP growth rates were then subtracted from the US growth rate. This control variable was used in the regression to find out if stock markets are closely correlated when the growth difference is larger or smaller. I expect a lower growth difference to cause a higher stock market correlation, because if two economies move in the same direction their stock markets should follow. Quarterly values of international trade were taken from the Census Bureau website. The trade variable measured the volume of trade done each quarter; that is imports plus exports, and not the net difference between imports and exports. The exchange rate variable also had a quarterly frequency and it was obtained from the Federal Reserve Bank of St. Louis (FRED) website. The exchange rates helped in determining if strengthening or weakening of a currency in terms of another had any effect on the correlation of equity markets. Distance (in miles) was measured from New York City to each of the capitals of the foreign countries. MapCrow's travel distance calculator website was used to calculate it (mapcrow.com). The same value for each quarter was used for the different countries since distance does not change. Overlapping opening hours is another variable that does not change. It is a measure of the amount of time the US

market is open at the same time as the foreign ones. Property rights are regulations posed by the government for obtaining a property. It also measures the degree to which each an individual's property is protected by the government. It could also be interpreted as the easiness of doing business in a country. The variable was annually reported and collected from "The Heritage Foundation" website. I expect property rights to have a positive correlation. Investment freedom measures the constraints posed by the government on flow of investment capital. If it is highly regulated it would be harder for investment capital to move within or in and out of the country. The variable was collected from the same source as property rights and it was annual as well. Tavares (2009) was the only person to include property rights in his research of how economic integration affects stock market correlation. The variable is more interesting than the other ones in a way that it is not as easily quantifiable, but it has to be evaluated and given a numerical value. Financial freedom was not observed in other papers, but it was added to this project because the easiness of making investment capital transactions may have a relationship with stock market correlations.

In constructing the dataset, I followed several steps. The data were quarterly for ten years (forty periods). Since each of the five pairs of countries had its own different values of the variables, each pair also had its own forty periods. Since there are multiple variables changing over time, that forms a cross-section time series or also known as panel data. All the data were entered into a single Excel spreadsheet in a panel data format. The time variable specifies the periods of time for each country. Prior research has been done on how time alone has affected the correlation between major world stock indices. Quinn and Voth (2008) examined stock returns of 16 developed countries. They ran correlation tests of 120 pairs from 1980 to 2008.

Significant increase in stock return correlation was discovered over that period of time. From 1890 to 1947 the correlation coefficient between markets ranged from 0 to 0.4 with a constant low of 0.1 during World War I and a rapid decline from 0.29 to 0.09 during World War II. Right after the second world war correlation increased gradually with time until it reached over 0.8 past 2005 (chart is shown in the appendix). Since time played an important role in stock market correlation, it was added as a control variable as well.

ID is the group variable, which is required for constructing a panel dataset and it ranges from one to five for all five country pairs. Since there are five groups and each has forty periods, it gives us 200 observations. The panel was also balanced because all country pairs were observed during all time periods. The completed data set was imported in Stata for the actual statistical analysis. A specific regression method had to be used in order to obtain the best possible results. The Arellano-Bond GMM estimator was chosen, because it is generally used for dynamic panel data estimation and thus was well suited for this project. One of the features of Arellano-Bond is that it minimizes the risk of reverse causality (Mileva 2007). After importing the data set into Stata, the natural logarithms of the equity holdings, distance and trade variables were taken. Trade and equity holdings were then lagged by one quarter.

$$\begin{aligned}
 Stock_corr_{ijt} = & \beta_0 + \beta_1(ln_equity_{ijt-1}) + \beta_2(GDPgrowthdiff_{ijt-1}) + \beta_3(e_rate_{ijt}) \\
 & + \beta_4(ln_trade_{ijt-1}) + \beta_5(inv_freed_{jt}) + \beta_6(p_rights_{jt}) + \beta_7(ovrl_hours_{ij}) \\
 & + \beta_8(ln_dist_{ij}) + \beta_9(time) + e_{ijt}
 \end{aligned}$$

Stock_corr is the dependent variable of stock market correlations between the home country *i* and the foreign country *j*, while *t* specifies the period of time. The independent variables *ln_equity*, *GDPgrowthdiff*, *e_rate*, *ln_trade*, *inv_freed*, *p_rights*, *ovrl_hours*, *ln_dist* and *time* are

bilateral equity holdings, GDP growth difference, exchange rate, bilateral trade, investment freedom, property rights, overlapping opening hours, distance and time respectively. The \ln in front of equity, trade and distance signifies that the natural log of these variables was taken. The error term is represented by e . The *betas* are the coefficients to be estimated by the model.

RESULTS

The results obtained from the final regression model specified above were the following:

Table 1: Panel data regression results

Dependent variable: <i>stock_corr</i>	2001-2010	2001-2010
time	0.0064 (0.0025)***	
ln_equity	-0.0491 (0.0168)***	-0.0186 (0.0151)
ln_distance	0.4471 (0.1364)***	0.2479 (0.1199)**
ln_trade	-0.4262 (0.1744)**	-0.1747 (0.1542)
prop_r	0.0118 (0.0046)**	0.0034 (0.0038)
inv_freed	0.0016 (0.0013)	0.0018 (0.0027)
ex_rate	0.007 (0.0037)*	0.0016 (0.0034)
ovrl	0.3625 (0.1357)***	0.1684 (0.1271)
gdp	-2.5996 (1.0959)**	-2.6007 (0.8614)***
Obs.	195	195

Notes: 1. The first column reports the results from the estimation of the regression equation specified in the section above. The second column reports the estimation without the time trend. The first value reported is the coefficient. Underneath it in parentheses is the standard error.
 2. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2: Time series OLS regression results

Dependent variable: <i>stock_corr</i>	2001-2010 Canada	2001-2010 France	2001-2010 Germany	2001-2010 Japan	2001-2010 UK
time	0.003 (0.0152)	-0.0012 (0.0088)	-0.0013 (0.0045)	0.0268 (0.0149)*	0.0173 (0.0083)**
ln_equity	0.6777 (0.4113)	-0.1425 (0.075)*	-0.0835 (0.0915)	0.2755 (0.381)	-0.2261 (0.1284)*
ln_trade	-0.9528 (0.431)**	-0.2762 (0.2725)	-0.3084 (0.2878)	-0.4599 (0.4589)	-0.4985 (0.3199)
prop_r	0 (omitted)	0.0048 (0.0154)	0 (omitted)	0.0423 (0.0177)**	-0.0041 (0.0129)
inv_freed	0.0048 (0.0108)	-0.0092 (0.0028)***	0.0002 (0.0103)	-0.001 (0.0123)	0.0011 (0.0075)
ex_rate	0.8773 (1.0622)	-0.5892 (0.386)**	-0.2039 (0.4595)	0.0271 (0.0116)**	0.2537 (0.4663)
gdp	-5.0625 (4.5562)	-5.6001 (2.2092)	-3.3797 (2.6367)	9.2332 (4.1265)**	-7.7164 (4.0031)*
Obs.	39	39	39	39	39
R ²	0.42	0.41	0.14	0.26	0.32

Notes: This table shows the results from running five separate OLS regressions for each country.

Numerous regressions were run to solidify the main model. The first table on the left side shows the results of running the regression without the time trend. Although most of the independent variables don't show any significance, equity holdings still holds a negative sign. Adding time had a great impact on the model. From 2001 to 2010 stock market correlations

increased from 0.64 to over 0.8 making it one of the strongest trends for the past decade (Voth 2008). The other independent variables' trend was flat as they were not moving in any particular direction. Taking out the time trend caused them to lose their significance on the correlations.

Five OLS regressions were run for each pair of countries to observe the impact of equity holdings within a pair. The results are shown in table 2. Since the regressions were time-series, distance and overlapping opening hours were excluded, because they are constant throughout the entire period. The omitted status for property rights for Canada and Germany was because the variable was constant for the sample period. Two of the five pairs showed a positive sign for equity holdings. This is fine because not every pair has to be negatively correlated.

The main model shows statistical significance at the 90% confidence level with a p-value of less than 0.10 for all the dependent variables but investment freedom. It was the only variable heavily rejected by the model and it did not affect stock market correlation. Property rights, measuring the easiness of doing business, had a positive relationship with the dependent variable. Countries with more favorable laws of property protection have an increased stock market correlation. The time variable also showed significance. Market correlations were already high in the beginning of the last decade but time, being significant at the 1% level, indicates that it is still an important factor. Exchange rates, was the weakest independent variable after investment freedom but still significant at the 10% level. It is worth mentioning how and why that variable might have affected the correlation of markets. The data for exchange rates were recorded as how much one US dollar is worth in terms of a foreign currency, which is written as USD/xxx. The positive sign shows that as the dollar strengthens against the other currencies, correlation increases. Tokat (2004) explained how markets are more closely correlated when

they are in a bear trend. For the past ten years bear markets were often observed with an increase of the US dollar's strength. During the recessions of 2001 and especially 2008, the US dollar strongly appreciated and all global markets were trending down with increased correlation. This explanation gives a reasonable answer based on the results of the regression. Exchange rates might have a much deeper role in the behavior of global equity markets, but this is not the main focus of this research.

The main variable, equity holdings, had a p-value of 0.003, making it very significant in the model. The coefficient showed that 1% increase in equity holdings decreases stock market correlation by 0.049, which is a significant amount. The negative sign on the coefficient opens the topic of why as equity investments in a foreign market increase, the correlation between both markets decreases, rather than increases. Portfolio theory tells us that investors should maximize their expected return while minimizing their risk. The general way of accomplishing this task is through diversification. Diversification happens when multiple stocks are added to a portfolio to reduce the unsystematic risk. Of course with a reduced risk, the reward is also reduced but it is more certain. In the case of international investments, risk may be diversified through investing in a foreign market. The only way that can be accomplished is if the two equity markets are not perfectly correlated. Although two international stock markets may have a high correlation, a viable strategy of reducing the unsystematic risk is by choosing foreign equities in a sector that is weakly correlated with the home market. A problem for investors to diversify internationally is the home bias. Higher transaction costs of foreign equities, lack of information, and legal restrictions make foreign markets less appealing. Regardless of these drawbacks, international investments can create a more diversified and profitable portfolio than only investing at home.

The initial hypothesis of this paper was that equity holdings should have a positive relationship with equity returns due to the increased integration of investing between markets. The negative sign in this model rejected it and showed a negative relationship between equity holdings and stock market correlations. Coeurdacier and Guibaud (2005) discovered that higher correlation has a negative impact on foreign stock investments. Their findings support portfolio choice theory, but the results here are slightly different. The idea of the research was to show how equity holdings impact stock returns, not the opposite. Since the Arellano-Bond estimator prevents reverse causality, portfolio choice theory does not explain the results. When equity flows from home to abroad, the home market loses capitalization, while the foreign one gains it. Fluctuations of the stock returns for both markets can cause them to be less correlated. That can be possible depending on where in the foreign market the investments went to. Since investors look to diversify their portfolio, they would look for foreign companies that do not have business in the home country or sectors that have low correlation with the home market. Moving capital to foreign equities that have very little impact at home would cause correlation between both markets to decrease.

An interesting result is observed with bilateral trade. The negative coefficient implies that as two countries trade more intensively, the correlation between their equity markets decreases. This is rather controversial, since previous research shows the opposite. The key element here may be the small time frame of the recent ten years. For the recessions of 2001 and 2008 a decrease in trade was observed in the dataset. Earlier in the paper it was mentioned that bear markets cause a higher global stock market correlation. The combination of market downtrends during financial crisis and reduced trade intensity may be the reason of the negative coefficient.

The model also showed that as distance increases, correlation increases too. Markets were most correlated during the past ten years and with higher world financial integration we should see distance being less of a factor. A simple correlation between all markets in this research was calculated:

Table 3: Stock market correlations matrix

	<i>USA</i>	<i>Canada</i>	<i>France</i>	<i>Germany</i>	<i>Japan</i>	<i>UK</i>
USA	1					
Canada	0.805594	1				
France	0.846925	0.588517	1			
Germany	0.835767	0.859204	0.802829	1		
Japan	0.84095	0.652584	0.908296	0.696258	1	
UK	0.89611	0.780918	0.929092	0.926275	0.838862	1

We are interested in the first column because in the model the US was paired with the other countries. Interestingly the chart shows that the US has been least correlated with Canada and more correlated with European countries. This chart still does not explain the negative relationship, which remains a puzzle.

Overlapping opening hours had a positive coefficient, as expected. It was one of the main determinants of international stock market correlations in the work of Chintrakarn (2010) and it served its purpose well as a control dependent variable in this paper. The last variable, GDP growth difference, had a meaningful result as well. Countries with higher GDP growth differences were less correlated than the ones with lower growth differences. Overall the model showed a meaningful relationship between the dependent and independent variables.

CONCLUSION

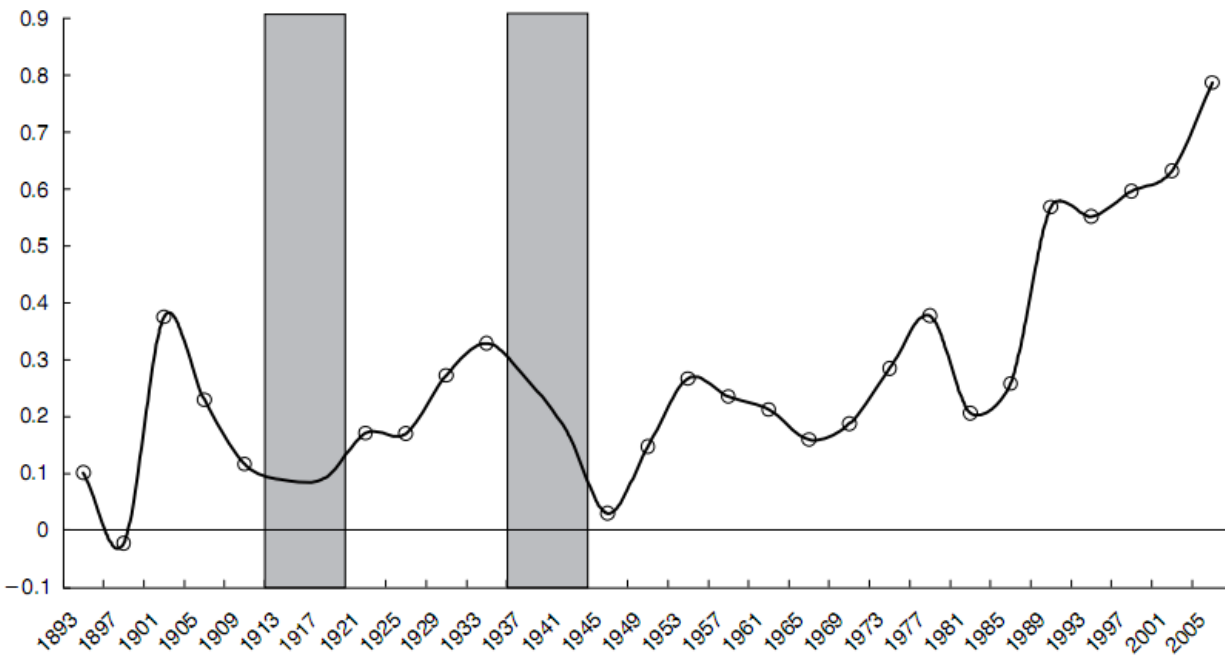
The goal of this project was to explain how cross-equity holdings affect global stock market correlations. Part of the process was to determine which of the variables had an impact on correlation with the possibility that some of them may not be significant or produce “abnormal” results. The main research objective was satisfied, although some of the results were different than my original hypothesis. Cross-equity holdings had a negative relationship with stock market correlations and financial freedom was not significant in the model. One of the main ways this research distinguished from prior research is in the method of analyzing the data. The Arellano-Bond GMM estimator was used here compared to the gravity models that were very common for most of the other data analyses. Getting the same results on many of the control variables proved that the method used was a viable option. However, not many previous studies put a strong emphasis on the relationship between cross-equity holdings and stock market correlations. A research conducted by Guibaud (2005) revealed a negative relationship between the two. It supported portfolio theory, which tells us that investors should invest in less correlated markets to diversify risk. The negative relationship was observed as well in this research. A difference here is that equity holdings were used to explain correlation, while Guibaud did the opposite. Although the end result is the same, the question is “which affects which”.

The model was not perfect by any means. The lack of publically available data restricted the use of more control variables and a larger time frame. Unavailable quarterly data for bilateral equity holdings was perhaps the greatest drawback for this project. Only annual data was available for ten years, which was another drawback and the reason why the time frame was so small. This research opens the door for further research in the field. Using portfolio theory as a

guide to the relationship of international investments and market correlations may not be enough. International investor behavior should also be considered in interpreting the relationship between stock market correlations and cross-equity holdings.

APPENDIX

Table 4: Global stock markets correlation chart



Note: The shaded areas indicate stock returns affected by the two world wars.

REFERENCES

- Ammer, J., Holland, S., Smith, D., & Warnock, F. (2012). *U.s. international equity investment*. Informally published manuscript, Retrieved from <http://www.federalreserve.gov/pubs/ifdp/2012/1044/default.htm>
- Chintrakarn, P., & Prasatkitjaroen, P. (2010). *Reassessing the determinants of international stock market correlation*. Informally published manuscript, Mahidol University, Bangkok, Thailand. Retrieved from www.eurojournals.com/irjfe_60_01.pdf
- Coourdacier, N., & Guibaud, S. (2005). *International equity holdings and stock market correlations*. Informally published manuscript, Retrieved from <http://ideas.repec.org/p/hal/psewpa/halshs-00590777.html>
- Coordinated portfolio investment survey*. (2012, Mar 23). Retrieved from <http://cpis.imf.org/>
- Fasnacht, P., & Louberge, H. (2007). *International stock market correlations - a sectoral approach*. Informally published manuscript, University of Geneva, Geneva, Switzerland. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1071608
- Flavin, T., & Hurley, M. (2001). *Explaining stock market correlation - a gravity model approach*. Informally published manuscript, Department of Economics, National University of Ireland, Maynooth, Maynooth, Ireland. Retrieved from <http://eprints.nuim.ie/87/>
- Economic Research Federal Reserve Bank of St. Louis, *Countries (Real Gross Domestic Product)*. (n.d.). Retrieved from <http://research.stlouisfed.org/fred2/categories/32264>
- Economic Research Federal Reserve Bank of St. Louis, *Exchange Rates*. (n.d.). Retrieved from <http://research.stlouisfed.org/fred2/categories/15>
- Index of economic freedom*. (n.d.). Retrieved from <http://www.heritage.org/index/explore?view=by-region-country-year>
- Mapcrow*. (n.d.). Retrieved from <http://www.mapcrow.info/>
- Market clocks*. (n.d.). Retrieved from <http://www.marketclocks.com/index.php?timezone=-5&timezoneoffset=-4>
- Mileva, E. (2007). *Using arellano - bond dynamic panel gmm estimators in stata*. Informally published manuscript, Department of Economics, Fordham University, New York City, New York. Retrieved from <http://www.doc-txt.com/Bond-Tutorial.pdf>

- Quinn, D., & Voth, H. (2008). *A century of global equity market correlations*. Informally published manuscript, Retrieved from <http://ideas.repec.org/p/upf/upfgen/1119.html>
- Tavares, J., & Morgado, P. (2009). *Economic integration and the co-movement of stock returns*. Informally published manuscript, Department of Economics, New University of Lisbon, Lisbon, Portugal. Retrieved from <http://works.bepress.com/josetavares/3/>
- Tokat, Y. (2004). *International equity investing: Long-term expectations and short-term departures*. Informally published manuscript, Retrieved from <https://institutional.vanguard.com/iwe/pdf/ICRCIISF.pdf>
- United States Census Bureau, *U.s. trade in goods by country*. (n.d.). Retrieved from <http://www.census.gov/foreign-trade/balance/>
- Yahoo finance*. (n.d.). Retrieved from <http://finance.yahoo.com/>