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GLOBALIZATION'S IMPACT ON THE EFFECTIVENESS OF DIVERSIFICATION

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## ABSTRACT

Financial experts praise diversification for its benefits in risk reduction. However, with the introduction of modern technology, the world, its countries, companies, and economies are more interrelated and connected than ever. When nations such as Greece, Italy, or China experience periods of economic or political distress, investors begin to panic worldwide. In fact, from 2000 to 2015 the world has experienced significant changes in several different market areas, and within the economies in certain geographical areas. Therefore, it is of paramount importance to revisit the benefits of diversification through correlations, and what happens to the standard deviations of a portfolio, all else held constant. This paper attempts to answer if globalization, higher correlations, and greater market integration from the years 2000-2015 are occurring, and if these changes have an impact on the effectiveness of diversification for the average American investing internationally.

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## Chapter 1

### Literature Review

Diversification, a seemingly simple word abreast the tongues of investors, portfolio managers, and financial advisors alike, but is it actually beneficial to modern investors? Through the paper I attempt to answer this very question, and more regarding diversification. The questions are as follows. Exactly how integrated are international markets when the interconnectedness is represented by correlations? Why does this, and should this matter to the average American investor? Lastly, in light of recent events such as the housing crisis of 2008, PIIGS (Portugal, Italy, Ireland, Greece, and Spain) in Europe, and economic fears arising regarding China; how effective is global diversification to the average American investor? This last question is especially relevant, since minimal research on diversification and correlation is available regarding the average investor, and no research within light of these recent events exists.

In *Is Globalization Today Really Different than Globalization a Hundred Years Ago*, the Authors attempt to compare and contrast both differences and similarities in recent markets versus those of the past. However, they do claim that integration is deeper and broader than it was prior. An indicator of this is GDP, because “trade has grown more rapidly than production for those sectors engaged in trade,” (Bordo, Eichengreen, and Irwin 5) inferring that as more nations or economic sectors engage in trade worldwide, the effect is an increase in the integration of the international economy.

So why is diversification a tool for an investor? It offers a decrease in risk associated with a certain group of assets that would only be obtainable if the assets are to put in a single portfolio. The more effective the portfolio, the less similarities each asset will have with one another. Expanding on the idea of different assets, exist different asset classes, such as automotive or energy. Each of these industries has the tendency to perform differently. For example, automotive and rail tend towards “violent upswings and downturns,” (Milne 3) for industry earnings, findings from *Benchmarks for a Diversified Portfolio*. With this in mind, the author continues to mention that this method of portfolio management helps to determine outliers, or any unusual behavior of certain assets. This way it is easier to see how one asset acts given a certain period in time compared to another, or a group of assets such as a portfolio.

In a paper on a similar point, *How Many Mutual Funds Make a Diversified Mutual Fund Portfolio*, O’Neal looks at why investors should be willing to hold mutual funds, since they aid in further diversification. This is due to the mutual fund’s ability to pool the money of investors, then using it to purchase varying types of stocks, in greater quantities. This adds diversification to the investment, allowing investors to own a portion of the assets a mutual fund owns. The only down side is depending on the mutual fund and their specialty, their performance in a given time interval is highly volatile (O’Neal 38).

The findings of O’Neal dictate that as the number of mutual funds included in a portfolio increase from one to six, the expected variability of terminal wealth reduces from 70 to 40 percent (O’Neal 38). Therefore, mutual funds are significant sources of diversification. This is especially certain for the average investor, who would not be able to afford investing in the same number of securities, and breadth as a mutual fund. This is especially the case because even the addition of one mutual fund to a portfolio brings significant benefits to that very portfolio in

terms of diversification, and thereby a decrease in the total risk associated to that portfolio, given a certain level of return. Consequently, as the number of mutual funds increase, the volatility of the portfolio tends to decrease at an increasing rate.

O'Neal also claims that this form of investing is better for individuals like average Americans because it allows fixed investment goals during different transitional periods of their life. As a result, investors are able to plan for major life events such as purchasing a house, attending college, or buying a car. In addition, investing in mutual funds provides flexibility, allowing easy entry and exit of the market, and are available within many different market segments. Therefore, the addition of mutual funds to a portfolio are beneficial to both long and short term planning.

Within each diversified portfolio are assets and some percentage of those assets will be stocks. According to Statman the author of *How Many Stocks Make a Diversified Portfolio*, the number of stocks a borrowing investor should have is 30, while the lender should maintain around 40 (Statman 362). Therefore, Statman disagrees with Evans and Archer, researchers who think the number to be 10 to 15 (Statman 362). This creates room for ambiguity, even furthermore demonstrating the need for more research on portfolio diversification, not necessarily thoughts on improving it as both authors offer. Many researchers have run with the findings of Evans and Archer, and yet some investors choose to diversify with less. This is possibly due to simplicity of only owning 10 or less assets, compounded by the simple notion that an increase in the number of investments will cost an investor more money, which is something the average investor might not have available unless they are aware or have access to index funds. This is also evident in the sense that many investors might not be aware of the benefit of diversification. The problem according to Statman is that people fail to see the

umbrella connecting all their assets together; essentially making everything they possess, its own portfolio. This occurs by people using money meant for vacation to pay for a college loan. As a result, all assets have an underlying connection, letting them act as supplements for one another.

Another point made in *How Many Stocks Make a Diversified Portfolio*, is the risk level associated with each group of assets, and how minimal dispersion is common among the general American. This equates to some individuals putting a significant amount of money into a house for renovation or just in the initial purchase, yet choosing to invest more heavily in bonds, since, “it is possible that diversification is accomplished through bonds, real estate, and other assets” (Statman 361). However, this results in the average investor not properly diversifying total wealth, since minimal to null diversification becomes less effective as the correlation of the assets begin to increase, or the returns on held assets become more and more similar. Statman notes, “...limited diversification is observed even where assets other than stocks are included” (Statman 361), demonstrating how common this investor issue occurs, as well as the likelihood of limited diversification given certain assets.

Another paper looking at *Investment Performance of US Based Multinational Companies* compares global investing by looking at the effectiveness of diversification through assets purchased by the investor, versus multinational firms who invest through shareholders. Aggarwal continues to argue that companies offer similar levels of diversification, which the integration and correlation of modern markets includes. This is partially because companies are diversifying their own portfolio of real assets; essentially diversifying themselves, and what exactly their stock price represents risk wise. A company such as Apple might own assets pertaining to Asia or Europe. The range can be anything from fixed assets such as properties to monetary options,

bonds, or stocks to hedge the risk of operating in that country. This is something the average American investor would not be capable of doing with the capital they have, so it is almost as if the multinational firms are partially diversifying on their investors' behalf. Since,

“...corporate expansion into another country and market not perfectly linked to its existing operations or markets provides for a reduced level of overall operating risk and, furthermore, an internationally diversified company may be able to tap the markets for capital and for goods and services of these other countries obtaining access to possibly lower cost and more diversified sources of funds, goods, and services.” (Aggarwal 100)

Since this structure for a company was not as common prior to the 19<sup>th</sup> century, the increasing amount of them, as well as the increases in international trade, are plausible reasons for higher levels of global integration and correlation. It is important to note that “in early 1900, integration was high, but the number of available investments were small,” (Bordo, Eichengreen, and Irwin 25). Adding to this, Bordo, Eichengreen, and Irwin touch on technology's participation in solving prior issues with the transferring of assets and ease of obtaining financial information in relatively short periods, over vast distances. This is not the case today with the introduction of online broker dealers, and the ability to trade constantly across differing time zones and continents. Now, sending information is easier, faster, and cheaper.

Adding to the speculation surrounding the effectiveness of diversification in modern times, within *Long Term Global Market Correlations*, the benefits surrounding international diversification have been steadily decreasing. The idea of “International” is represented by four nations (Germany, France, UK, US), all with similar governments, economies, and three from the same continent. Taking into account the growth of financial integration and availability of

information on continents such as Asia and South America, comparing only a small portion of the dominant nations in Europe are not entirely an accurate portrayal of global trends for correlations. To obtain their trend in correlation, two portfolios are compared, one with limited diversification, to another portfolio with unlimited diversification. In *Long Term Global Market Correlations*, Goetzmann, Li, and Rouwenhorst found that as the years tack on, the benefits of diversification tend to decrease, meaning correlations in general have been increasing.

In fact, according to Goetzmann, Li, and Rouwenhorst, from the 1950s to 2000, the amount of risk one can reduce through diversification went from 90% to 65%, demonstrating a decrease in effectiveness for diversification (Goetzmann, Li, and Rouwenhorst 19). Going back even farther to the depression era, in 1929, one was better able to spread around risk, or diversify (Goetzmann, Li, and Rouwenhorst 19). Consequently, these conclusions demonstrate that from the 1920s to 2000, diversification's role in risk reduction decreases in effectiveness.

Furthermore, since in *Time Varying World Market Integration* by Bekaert and Harvey, the economic growth of a nation has a fundamental connection to financial integration, a link between the benefits of international diversification and global integration forms. As a result, when the benefits of diversification decrease, investing opportunities increase with international integration, thereby demonstrating an inverse relationship between international integration and international diversification. If this relationship is to hold weight for the average investor, that investor will have to recognize the other opportunities. If they are unable to, then they are unable to receive them since they are still investing in assets with ever decreasing benefits.

On a similar note, Bekaert and Harvey of *Time Varying World Market Integration* recognize that "economic growth is fundamentally linked to financial integration," (Bekaert and Harvey 437) which supports the notion that the ease of access to financial information that has

contributed to the growth of financial markets, has also influenced international integration.

Goetzmann, Li, and Rouwenhorst of *Long Term Global Market Correlations* also recognize this change, while taking note of the increase in investment opportunities within the latter half of the 20th century. Though these figures are not numerical representations of integration levels, they merely exhibit the increase in choices an individual has during a given period of investing.

However, in *Measurement of Market Integration and Arbitrage*, Chen believes that a lack of literature exists to determine and measure integration consistently, since over the years, many disagree on how intertwined international markets tend to be. Suggesting that two forms exist, a strong and a weak form, the idea is that if the law of one price holds, it is representative of a perfectly integrated market (Chen 289). Since the Law of one price is merely an economic model, the conclusions drawn on international integration are going to be false; but the real question is exactly how far off. For this, there is no certainty.

Another paper by Korajczyk that tries to solve the problem of measuring integration, *Measure of Stock Market Integration for Emerging and Developed Markets* brings to light how the severity of capital controls within a nation affect cash flow, thereby affecting the profitability of the investment. Hence, a hindering on trade will make certain opportunities unprofitable, which influences global integration. Since the asset is now unprofitable, outside investors are unlikely to partake, decreasing global integration in that specific area. Other restrictions for investors that inhibit market integration exist and can vary by severity, market, and nation. These restrictions are what create variability when measuring integration.

Though international integration is greater in the 1990s than in the earlier 1900s, it still contains an element of mild uncertainty. With multiple methods for measurement due to issues pertaining to market structure, governing policies, and to what extent markets are connected,

inconsistencies do exist. However, even though researchers disagree on how to calculate the quantitative portion of the analysis, they do agree that international integration does exist, that it is present, and is greater than in prior years.

Furthermore, correlation is a very important aspect of diversification. The more correlated assets are, or closer to a value of one, the more likely they are to behave similarly in periods of economic turmoil, regular economic states, and booming periods as present in papers by Adjaoute, and Longin and Solnik. For diversification to give its full range of benefits in an investor's favor, portfolios of assets with low or no correlations are satisfactory.

In *Extreme Correlation of International Equity Markets* by Longin and Solnik, correlations have the tendency to increase when investors rely on them most. This means that in times of economic distress, or bear markets, correlations actually tend to increase within a given set of indices. In conjunction, this finding also demonstrates that during periods of bull market behavior, correlations decrease. Therefore, when one is diversifying their portfolio, it is important to pay attention to the behavior of international markets and their economies.

Other papers such as, *Increased Correlation in Bear Markets*, and *Long Term Global Market Correlations*, and *Forecasting International Equity Correlations*, also find correlations has the tendency to be higher in periods of falling market returns. Longin and Solnik go on to mention that it is not high volatility causing these correlation influxes, but rather the trends of the largest five major international indices (Longin and Solnik 650). Therefore, correlation has the tendency to change depending on the behavior of the market. As a result, diversification decreases in effectiveness as market correlations increase from economic distress.

The difference within *Increased Correlations in Bear Markets*, a claim that the volatility of assets varies by time, and that because of this, it is a factor in how correlations are responding

to markets trends (Campbell 92). As a result, scholars agree that international markets do have higher correlations; they only tend to disagree on how and why.

On a similar note, within *The Interdependence of International Equity Markets* by Grubel and Fadner, it attempts to explain the increases seen in bear correlations, as well as higher global correlations. They note some of the variance to be a result of exchange rate fluctuations. Furthermore, higher global correlations result when the industries within one nation are similar to the industries represented in another nation. This is a logical result, since the companies within the same industry would be investing in similar forms of real and financial assets, while the structuring of debt and equity will differ.

Grubel and Fadner continue on to mention globalization's impact on internationally diversified companies. One major impact is a company's sensitivity to foreign profits due to fluctuation in currencies, and market conditions (Grubel and Fadner 92). In addition, the longer a company holds foreign assets, the less likely business cycles, catastrophes, and exchange rate variations are to influence the portfolios returns (Grubel and Fadner 91). This is present when comparing outcomes to real factors such as economic growth and price stability (Grubel and Fadner 91). Consequently, the longer one owns foreign assets, the more likely they are to have higher correlations since other factors such as catastrophes and business cycles begin to diminish in how severely they affect international correlations. This prolonged impact of holding different assets will affect domestic assets more than out of country assets, resulting in the appeal of international assets for multinational firms.

Within Haim Levey's paper *International Diversification of Investment Portfolios*, the claim Canada and the United States have such close correlations, that the gain in diversification as well as return from combining the two assets are ineffective and insufficient if trying to

diversify, is very bold. It insinuates that even neighboring nations of similar economic and technological standing are still too close when it comes to effectively diversifying internationally. This brings about the question that exactly how far, and how much is enough to provide the benefits investors reaped from international diversification 50 plus years ago?

*Forecasting International Equity Correlations* by Erb, attempts to explain the behavior of correlations. Erb notes the following: lower correlations can still result from two highly integrated economies, correlations are lower in common growth stages than in common recession stages, and that correlations are higher in bear markets versus bull markets (Erb 44). Erb also claims little is available relating to the behavior of correlations and the ability to predict such. *Forecasting International Equity Correlations* thereby sides with the author in *Long Term Global Market Correlations* on this matter. However, in *International Diversification of Investment portfolios* restrictions and regulations on trade, or the flow of capital between nations affect the financial industry. Those affected areas range from markets, companies, and traders, especially those engaging in international investing. Though the prediction of correlations is a necessary component for accurate diversification, the accuracy in determining correlations is a problem in need of more research, spoken of within several academic papers. Consequently, Levy mentions one should diversify or build a portfolio around expected correlations, instead of past averages.

So yes, correlations seem to be higher on average over time, but to know how much higher than previously, we must know the level of integration for the markets given differing period. In *Long Term Global Market Correlations* by Goetzmann, Li, and Rouwenhorst, the difficulty to obtain data from the early 1800s and from emerging markets prior to the use of technology and the computer is the primary inhibitor. In fact, some of the data they were able to

obtain for investments, are assets the average investor would have not been able to purchase. This makes determining the correlations of assets available for the average American through time a difficult process riddled with inconsistency until the early 1900s. Therefore, though we are certain correlations are higher up until the early 2000s, exactly how interconnected the world equity markets have remained through the past 150 years tends to vary considerably depending on the data available, as well as who is doing the investing (Goetzmann, Li, and Rouwenhorst 1).

However, within *Equity Returns and Integration: Is Europe Changing*, a different story about correlations arise. Within the years 1996 to 1999, correlations around the world were unusually low, differing vastly from the previous years (Adjaoute 568). Consequently, during this period, diversification serves its purpose better than prior years. Including this circumstance is pertinent because Adjaoute's research indicates that as the time interval of analysis increases; returns become more similar, resulting in increasing correlations (Adjaoute 568). Therefore, correlations are more likely to experience significant changes, depending on the use of daily, monthly, or annual returns. Daily changes in correlation are going to be more accurate for a given sequence than monthly or yearly values. Most importantly, given the assets in a portfolio, correlations will change by including assets from differing sectors or markets. Consequently, as the assets in a portfolio change, the results for the international correlations will also change, making the analysis on international correlations only an estimate. This finding within 1996-1999 is why research is necessary in the areas of global integration from 2000 to 2015, in addition to international correlations. Correlations might have an upward tendency over the past 100 years, but how it behaves in shorter intervals between the years of 2000 and 2015, and how that affects American international investors through diversification does differ.

## Chapter 2

### Research Methodology

In order to compare the benefits of diversification for the modern American from 2000 to 2015, first a data set of asset returns from around the world are a necessity. For these returns, indices from different areas of the world are paramount. From Asia, CSI or and index in China, S&P for India, and NIKKEI from Japan are chosen. Since many multinationals have outsourced or done business with companies in these nations, whether it be for Technology, cheaper labor, or adequate suppliers, it is even more important to include Japan, China, and India in this analysis on globalization.

Furthermore, within Europe, FTSE, an index for England with data from 1984 on Yahoo.com, and the DAX, an index from Germany that has data on Yahoo.com since 1990 are integral. These indices not only have longer periods of data available online than several of the others, they give a great baseline with the S&P since the United States, England, and Germany have issues with correlations increasing over time. This means it will be easier to compare to previous analysis with research on international correlations and diversification. The similarity and slow increase in average correlations does make sense due to relatively similar governments, government policies, trade agreements, restrictions, markets and economies.

The other indices present are MXX of Mexico, BVSP of Brazil, ASX of Australia, and S&P for the United States. It is important to at least get an Index from each area of the world, especially with nations the United States tend to interact with more. This is why Mexico is included. Brazil is a necessary part to give insight into a more developed nation from South America. ASX for Australia is also important because it is similar in development to parts of Europe, but it is relatively similar to the United States, contains multinational firms and contains

informed investors of a similar economic standing. The index from the United States, or the S&P will be used as the point of reference, or index for the others indices to be compared against. Giving the correlations a baseline in this manner will demonstrate if the correlations with other indices are affecting the assets of an American Investor. Keeping in mind the connections these nations share is paramount in order to discern an idea of how connected companies are to their suppliers, and as a result, to that specific nation they are located in, and on a larger scale to see how connected they are to other nations across the globe.

The returns gathered for the chosen indices are from Yahoo Finance, and based are monthly historical rates. The graphics that demonstrate the look of each step are located in the List of Tables, or The Appendix. To get the monthly rate of return, subtract the opening price from the closing price, and divide by the opening price. To get the average return for each asset, find the mean of the returns from that data set, and then multiply by 12, converting it from monthly to the average annual return.

For each index, the individual and portfolio annual standard deviation and average annual returns are necessary to analyze the impact globalization has on an investor's portfolio. A separate section to the left lists each asset, and then in the next columns are their respective annual average returns, the annual standard deviation, and lastly the weight of that specific asset in the portfolio. Then to get the annual standard deviation for each asset, use the STDEV function, multiplying it by the square root of 12. This will make it annual, which is important to get an annual indication of portfolio performance; a metric form the American investor is more likely to understand. From there, calculating the correlations can be completed with the data analysis pack in excel, the correlation function, or by hand. For this research, a nine by nine correlation and covariance matrix is the result, with each column and row indicating the index of

reference. Correlations not only indicate how the markets are doing regarding returns, they also demonstrate how integrated the nations involved are. Therefore, depending on how the nations correlate, they demonstrate the effectiveness of using diversification for this specific portfolio, given that period in time.

Next is the Covariance matrix. This matrix is the result of multiplying the array of the each asset's annual standard deviation by the transpose of itself, then by the correlation matrix previously calculated. In the array of cells specifically for the portfolio, will be portfolio returns, standard deviation, and the total weight, which should be one, for those who are not borrowing. Weights are in a percentage, and demonstrate the total amount in that asset relative to the total invested in all assets. These are also for maximizing returns, or minimizing risk, depending on the goal of the investor. Here, the goal is to see how changes in correlations, a statistic used to obtain Standard deviation, affect the overall portfolio, thereby affecting the American investor through demonstrating the benefits and fallbacks of diversification.

In order to see how changes in correlation affect the average investor, the previous portfolio set up with remain constant, and only changes are made to the correlation and covariance matrices. This is because as the correlations between indices change, their covariance matrix changes as well. To simplify the first scenario, all the correlations in the matrix change to the same value, while the correlation of an index with itself always remains one. Then, after calculating the portfolio's return and standard deviation, they go in a listed data table. This data table tells what the return and standard deviation are, given the value of the correlations for this international portfolio. Next to the column with the standard deviations are the percent changes in the standard deviation, based on correlation changes from a correlation of one, to .4.

To take into account realistic changes it is best to multiply the previous correlations by a percent increase or decrease, while maintaining a correlation of 1 for indices in comparison to themselves. The table demonstrates percent changes, returns, and changes in standard deviation for that portfolio. In addition, the formulas already in place to calculate within the original portfolio need to reference the cells containing the new correlation and covariance matrices. In addition, the weights for each are  $1/9$ , since nine assets are present in the portfolio. This will result in each index having an equal effect on the final standard deviation given a change in correlation. Therefore, the average investor will have an understanding of correlations, how simple changes in them affect the total risk assessed for a portfolio, given a certain level of return.

The final data is collected either by continent to show correlations per general area, or by nation to show correlations overall, demonstrating how the S&P correlates with certain continents, and with specific nations within that geographical area. Through this, one is able to understand if the S&P resonates with the rest of the world through correlations and via international integration.

## Chapter 3

### Correlation Results

There are three groups of correlations to address, moving average correlations, correlations by continent or geographic area, and by nation and index. Each are significant, yielding a different perspective into how correlations behave from 2000 until 2015. The moving average correlations give the most accurate depiction of the behavior, where trends are the most visible. Correlation by geographic area are not the best for demonstrating trends, but are best for demonstrating correlation via graph by area to show how the United States is correlated with other general areas. Lastly, correlations by index via matrix give the best numbers for calculations involving portfolios. It also gives the best idea as to how each index moves with another, not just the S&P. Therefore, each form of collecting correlation has its benefit, but moving average correlations give the best visual compared with the S&P. Graphs of correlations by continent show how connected different areas are with the United States, and correlation matrices best portray all relative data.

The correlations by moving average are in several different categories, Mexico and Brazil, Europe and Australia, Asia, and finally with all visible on one final graph. Comparing each index to the United States' S&P gives a baseline for understanding when and in what amounts correlations are changing for a given geographical area.

In the figureXX for Asia, two indices started online data recording after 2000. In India, the data started in 2007, and in China, or CSI, the data started in 2005. China began with correlations in the .2s, dropping to -.2, and then routinely changed during November 2007 until March 2010 with the lowest correlations to the S&P overall. This is a trend occurring later for 2012, and again from November 2013 to July 2015, with ranges of lows near 0, to a high of

around .6. Therefore, China would be a good possible investment if one's goal is to diversify their portfolio since it routinely has lower correlations given certain periods in time.

India is another outlier similar to China. Devoid of data until 2007, this index is rather new. However, its fluctuations at times follow that of Japan's relatively well. During the period of November 2009 to July 2011, India's correlations with the S&P are either significantly higher than Japan's, or significantly lower, resulting in a curved X pattern. This is generally the only time this occurs for the two nations. Other than that, they both tend to be within .05 to .15 from each other, when compared to the S&P. Therefore, if China is of interest, then other areas of Asia should be as well for an individual who would like to diversify, since the majority of the time the correlations for Asia tend to be the lowest overall.

Mexico and Brazil's moving average correlations have the second lowest group of correlations with the S&P. From the figure XX they tend to follow each other rather well. Present, are two main ranges with highs of .7 to almost .9, then back to around to .7 where they continue to drop from 2001 to mid-year 2003. The second stable period for high correlations with the S&P occurs around 2008 to 2012. Another location on the graph where the patterns are relatively similar is after they are drop substantially down to less than .2, around early 2013 until the end of 2014. With correlations for both Mexico and Brazil averaging around .67, they are still a viable option of investing, during bull markets like in 2008 and around 2008, Brazil does tend to increase, while Mexico is on a decline, then shoots up past Brazil during 2009.

The area of Europe and Australia have significantly higher correlations with the S&P, and they also move together in a much tighter fashion than the other two area groupings. They stay relatively close within the boundaries of .1 and almost one, except for March 2013, until July 2015 for Germany and Australia. During that time, England does decrease somewhat, but not

until July 2014, and then it bounces back to over .7 after July 2015. This time span results in similar occurrences for the other nations as well.

Overall, the correlations in these moving average graphs depict higher correlations with the S&P for Europe, Australia, and about half of the time with Mexico and Brazil. Though they are higher, they have the tendency to fluctuate depending on market conditions. During the crash of 2008, for markets other than Asia, the correlations with the S&P continue at an upward trend. This indicates as to why Asia is a hot spot for international investing, and why areas like Europe or the United States with higher correlations are less effective. Two significant and sudden decreases in correlation occur within the last three years of the analysis. The periods between March 2013 and July 2013, and November 2014 and July 2015, will need to be the subject of future research, to figure out what might have occurred to result in such a sudden and significant decrease in correlation.

The same correlations just averaged and placed on bar graphs show a different overall story. This gives a basic understanding of around what area the correlations on average range between, given that index or area. These are gross estimations and give a basic idea as to numerically where each continent or nation stands depending on the correlation that nation has with the S&P.

The bar graphs and correlation charts with continents or related areas tell a different story. In the graphs, Australia and Central/South America are very close, both rounding to a .73. In the moving average correlations, Australia looks significantly higher, whereas in the same set of graphs, Central and South America look more volatile with the changes in correlations, and the average looking almost .07 lower. This discrepancy is most likely the result of averaging. Europe is the outlier, because it has a much better depiction of the moving average correlations

then the other bars. In the correlation matrices, Europe and the indices in it and Australia are routinely higher than the other nations within the Americas and Asia. This is again mostly likely due to different economies in different periods of growth, trading factors, available investments, government styles, and economic regulation.

## Chapter 4

### How Current Correlations Impact Diversification

The benefits of diversifying are a necessity for the average investor. With this form of analysis, an investor is either able to maximize return or minimize risk. It allows customization at a level where the majority of people will be able to understand how it is going to affect their portfolio. With an increase in correlation, the portfolio's total risk given a certain level of return will increase. The lower the correlation, the better, since now when certain economic events occur, the returns will no longer have the same tendencies. Therefore, if there are benefits to diversification, they are a result of changes in correlation; and the argument is that these fluctuations vary depending on geographical location, by how often it fluctuates, and depending on current economic conditions at the time.

Correlations are one of the more influential aspects of diversification when putting together assets in a portfolio. A change for the worse where all markets or indices in a portfolio result in negative returns is an investor's worst fear. It is important to remember that according to the efficient market hypothesis, this paper will not aid one in trying to beat or out earn the markets presented. This is simply a method of minimizing risk, via correlations. The assets, or in this case, indices of choice are included to demonstrate how connected the world specific to certain Geographical areas are connected to the United States. Investors from other nations are able to perform this analysis with a country of their choice to compare other indices. Therefore, the goal of diversification here is to see how changing correlations change the level of risk, given a specific expected return. To decide how the average investor benefits, I look at different ways adding certain indices or geographical areas will add or detract from a portfolio including the

S&P of the United States. Consequently, after presenting this information, it is up to the investor to decide which areas and indices best fit their tolerance for risk, and desired return.

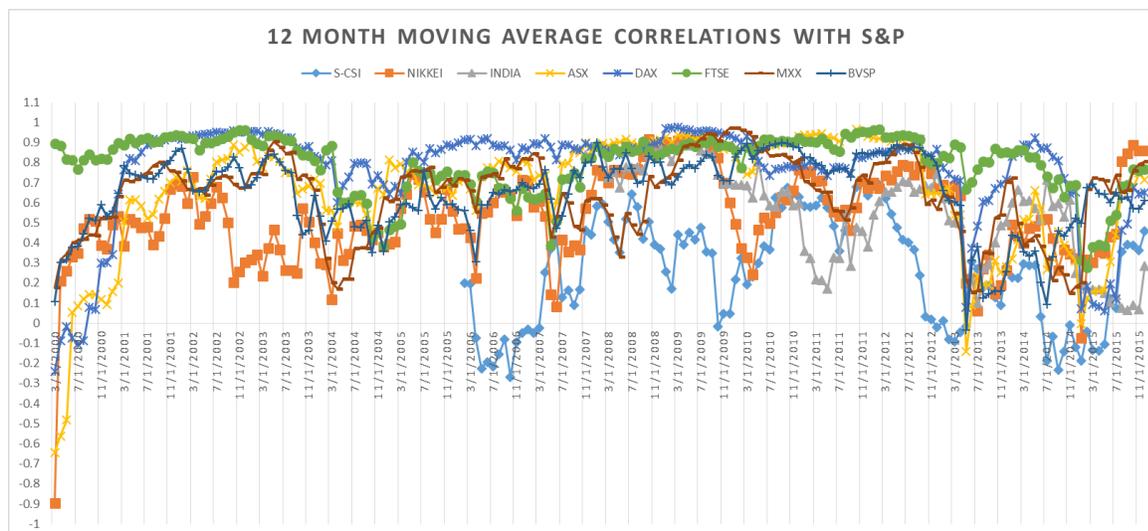


Figure: I

From the period of July 2007 to the start of 2009, United States, Europe, and Australia experience relatively high correlations around over .9. This was during the Housing market crash within the United States. Therefore, this period is an example of prior research, justifying claims that during period of economic distress, correlations have the tendency to jump. However at any given point, none of the correlations reached one.

Another occurrence during a known period of market distress is between March 2012 and July 2015. At this time, markets around the world were experiencing a significant amount of changes. Europe is not doing as well as prior due to over spending and the probability of default in Greece, China is beginning to slow down in terms of growth and production, yet all over in nations such as Australia, mining for natural resources continues, and gas prices in America begin to decrease. However, correlations with the S&P range from negative values, to .9. At two main areas the moving average correlation, actually takes a nosedive down to .1 and below. This

goes against prior research. If the majority of the world is experiencing such tumultuous changes, the correlations should be higher, and less likely to change on a dime. Since Europe has been the more stable geographical area thus far, more research into the results at this time is necessary due to such sudden and significant drops in value for more developed areas.

Fluctuations occur though the moving average correlation graphs, but more frequently in some geographical areas more than others. In Europe and Australia, significant fluctuations are relatively rare compared to the rest of the areas. There were two main different occurrences resulting in different trends, but the fluctuations notably increased. During the periods of November 2003 and March 2005 are when all the correlations have a downward trend, but fluctuate relatively higher than the average. For the second area, from 2013-2015, the fluctuations are the greatest and most frequent, and the trends are all over the place, however two visible dips result. This scenario is the same for Mexico, Brazil, and Asia. Therefore, the lows and highs from the correlations during that period demonstrate a global connection.

Furthermore, in Figure II Asia tends to fluctuate the most, and more frequently than any of the other geographical areas. Since these indices are the newest, more studies in the next several years would give more insight into how often they vary, and if they are increasing over time. From the data below, there is no discernable increase over time. In fact, the highest points for the correlations essentially form a trend line cap at the top of the graph around .9, indicating no discernable increase over the 2000 to 2015 timespan, especially starting around early 2012, where they look as if they are decreasing on average. The majority of the correlations are below this line, especially regarding Asia, Mexico, and Brazil. Furthermore, India and Japan follow each other relatively well, yet in the correlation matrix, they only have an average correlation of

.345. It is possible this correlation is off base since it is not relative to the entire period of 2000 to 2015.

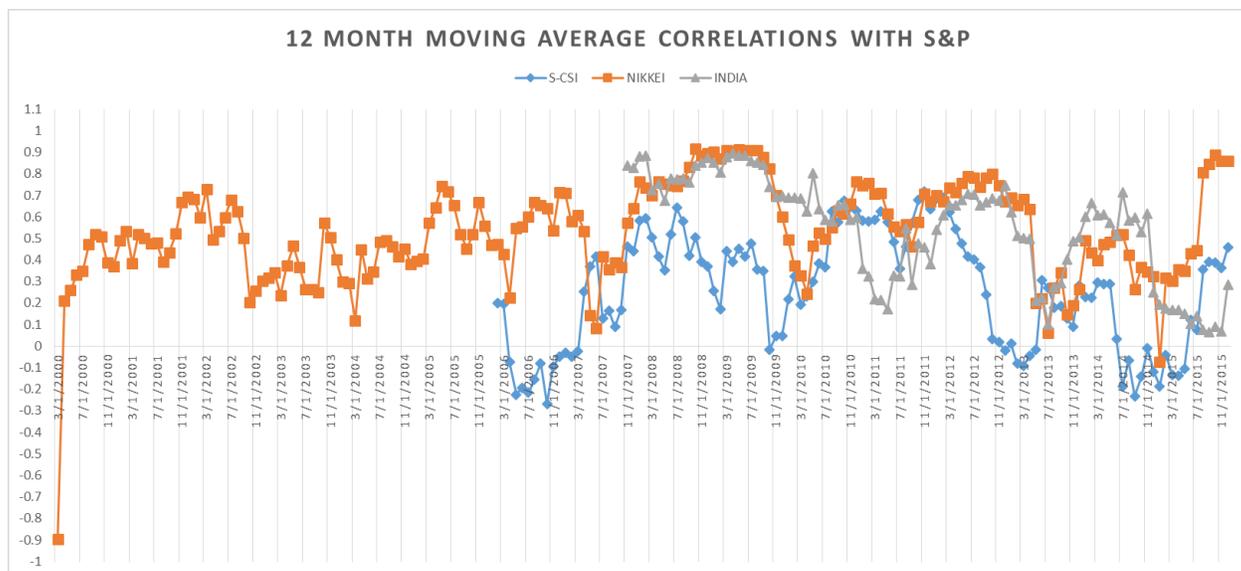


Figure: II

Mexico and Brazil follow the trends of Asia, except they have higher moving average correlations with the S&P. The two nations of Mexico and Brazil experience an extended minor dip from 2003 to 2007, then Brazil increases, while Mexico decreases, then Mexico begins to increase again in 2009.

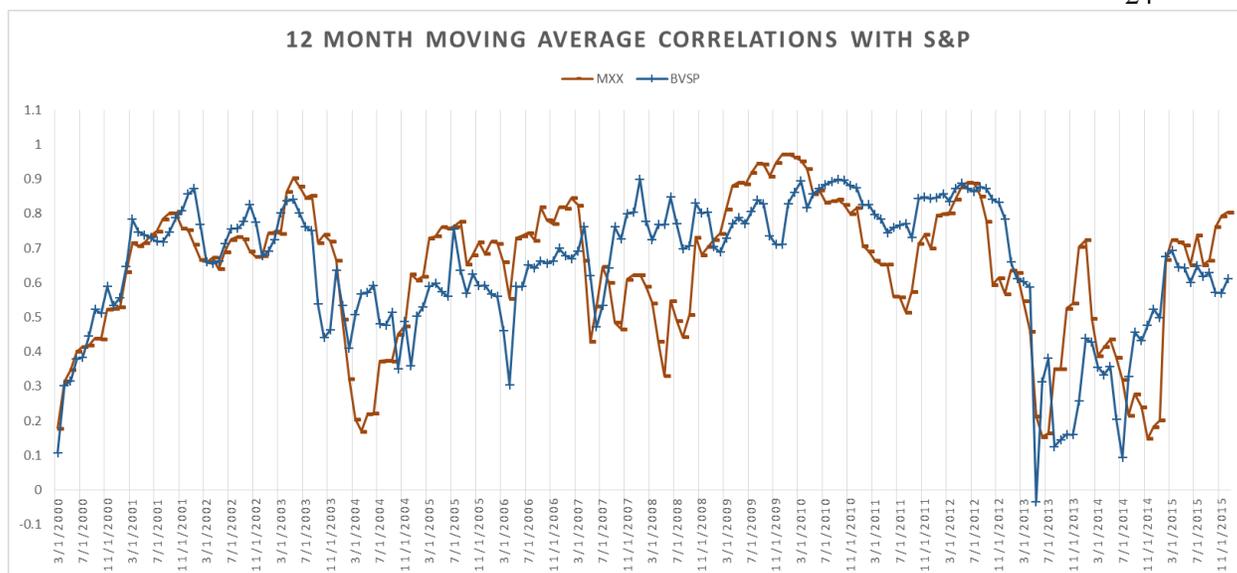


Figure: IV

Depending on if one goes by the correlations from the bar graphs, or from the moving averages, the total portfolio level of risk is the only area to change as correlations change. In the Appendix, is a chart demonstrating to what level of volatility or risk it changes to, given a certain correlation, as well as how much of a change in risk is made, comparing it to the original value for standard deviation where correlation between all the assets are equal to one. Furthermore, for each calculation the weights for each asset are equal. This ensures each asset will evenly affect the change in correlation, thereby measuring the effectiveness of diversification given changes in correlation for this specific portfolio. The original is a portfolio with no benefits to diversification, or has correlations of one for each asset; it is the first row. For example, if the correlation jumps down from one to .5 for this portfolio, the change in the form of a percentage from the original standard deviation is about 6.57%. That means if for this specific portfolio the correlation decreases by half, the standard deviation for the portfolio decreases by 6.57%. That significant change means that for the same level of return, it is now 6.57% less risky.

Since the Asian countries average around .5 according to the table of Figure IX, adding these to a portfolio would be beneficial to increase the effectiveness of diversification for the average investor, essentially making risk cheaper. There is a downside to this addition. Though the correlations measured are lower, these nations experience a situation not common in more politically democratic or advanced economies. Brazil has recently undergone several scandals regarding political corruption. China's growth has begun to slow down. India is currently China's greatest competitor in terms of cheap labor and technology. Japan is experiencing deflation and begun adopting negative interest rates in January of 2016, according to *The Japan Times*. All these circumstances create variability in the market, which the correlations could be resulting from. The geographical area of Asia also includes the youngest indices used in this research paper. China's CSI begins in 2003 and India's S&P begins in 2007. These occurrences can sway investors due to the influx of negative information regarding Asia and the investment opportunities it has to offer. Even taking these instances into account, adding Asian nations to diversify a portfolio if one is comfortable with it, is a clear method to obtain the maximum benefits of diversification that investor has access to at this point and time. This is specifically referencing that correlation data on Asian indices.

However, nations like England and Germany for the majority of the trends in the moving average correlation graphs show the opposite within Figure III. For a significant portion of the graph, except for several outliers, Europe has a high correlation with the S&P. A portfolio of only their correlations would only decrease the standard deviation between 1.75 and 1.15%. This is from the first correlation analysis where the overall correlation for all assets is the same. Though Europe sounds as if it might not make the best addition to a portfolio, it depends on what the investor would like. If the investor were looking for other nations similar to the United States

due to things like economic stability, then Europe or some indices in Europe are a viable option.

On average, yes, they have higher correlations than other geographical areas, but it does experience periods of irregular correlations like 2012 to 2013. This is contrary to nations containing or related to emerging markets. Europe would be an acceptable addition.

Consequently, yes, Average American investing overseas will get a benefit still from diversifying, but it is not as substantial as one led to believe if the trends indicated in previous papers persist.

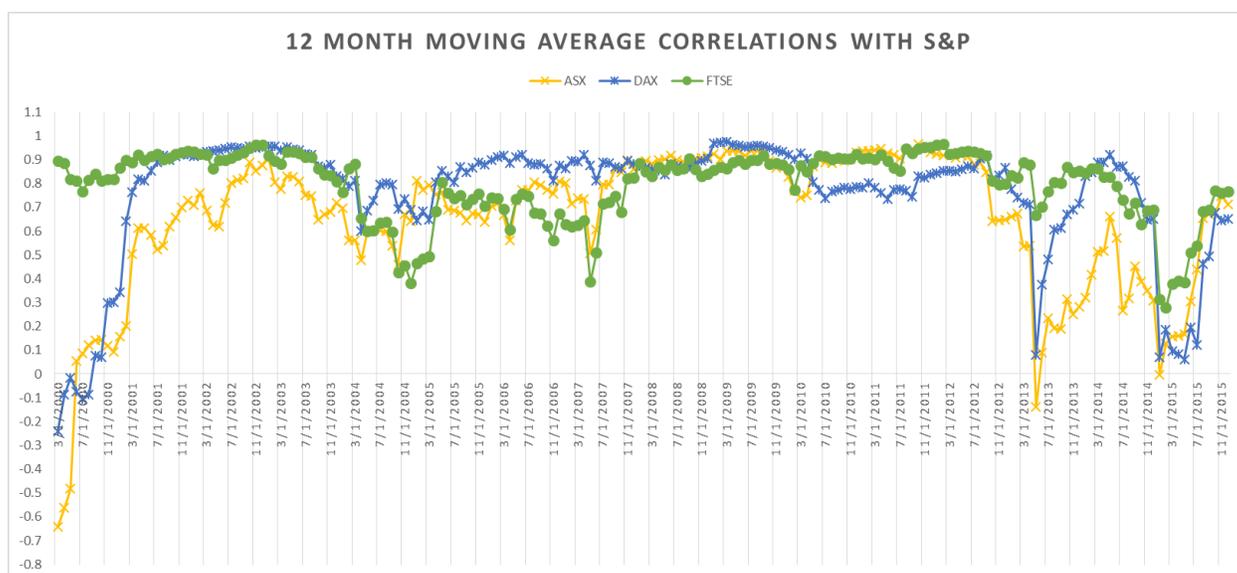


Figure: III

This will result in each index having an equal effect on the final standard deviation given a change in correlation. Therefore, the average investor will have an understanding of how changes in correlations will affect the total risk for a portfolio, given a certain level of return.

Consequently, to add to the previous assumptions regarding the effects of correlation changes on the portfolio within the Figure V below demonstrate possible standard deviations. This figure notes the changes of correlation by percentages, than the standard deviation one can expect for the overall risk of the portfolio. For minimal increases in correlation such as ten or

five percent, investors should only expect a percentage increase in standard deviation by .79%.

This results by subtracting the original portfolio standard deviation with equal weights of 15.986% from the standard deviation, which is a result of a 10% increase in correlation, or 16.766%. A negative 10% change in correlation results in the standard deviation decreasing by .82%. For a 15% increase in correlation, the difference is 1.157%, whereas for a 15% decrease in correlations, the portfolio standard deviation is 1.248%. This means that the same percent change in correlation has a greater effect on reducing the standard deviation if correlations are decreasing than increasing. Therefore, percent increases in correlation do not have the same impact on a portfolio as decreases in correlations. As correlations increase, they begin to have less of an impact on the overall portfolio. These are only differences in percent, not percent changes like the other table. However, this clearly indicates the importance of finding and maintaining a portfolio with correlations as low as possible if the consumer is interested. This is the main component.

Correlation Change	Returns	Standard deviation
15%	5.114%	17.143%
10%	5.114%	16.766%
5%	5.114%	16.381%
0%	5.114%	15.986%
-5%	5.114%	15.581%
-10%	5.114%	15.166%
-15%	5.114%	14.738%

Figure: V

Correlation	Level of Return	St. Deviation	% Change in value from original
1	5.012%	22.430%	
0.95	5.012%	21.862%	0.568%
0.9	5.012%	21.279%	1.151%
0.85	5.012%	20.679%	1.751%
0.8	5.012%	20.062%	2.368%
0.75	5.012%	19.425%	3.005%
0.7	5.012%	18.766%	3.664%
0.6	5.012%	17.374%	5.056%
0.5	5.012%	15.860%	6.569%
0.4	5.012%	14.186%	8.244%

Figure: VI

Now, if an investor indicates they care about the cost of risk possibly increasing in the short term, then it is ideal to re-balance an international portfolio as changes in the direction of an economy or market rise. The marginal benefit of trying to optimize an investor's risk via diversification for minimal changes in correlation is more beneficial in a semi-annual manner, than in the end, over several years without changes, especially if the changes in correlations taken into account are monthly. Since the data from analyzing correlations changes constantly, and at times drastically, the average investor is better off making changes to their portfolio depending on current events with semi-annual or quarterly portfolio re-balancing. However, this is only for the investor who holds concerns on receiving the optimal amount of benefits properly diversifying has to offer. For the investor who would rather not put forth effort or concern into the handling of their portfolio, similar returns for relatively similar risk is also an option, since some investors encounter more stress or could rack up more cost depending on the services already available to them via the firm they invest through. In short, it is only beneficial to hold concerns over changing assets in portfolios if over the next 15 years correlations stay relatively similar, or have the tendency to increase,(this is not observed in the calculations presented,) if the investor believes they benefit from maximizing the benefits of diversification, and other options

with low correlations below .6 are nonexistent. Analyzing correlations to improve diversification is not beneficial when correlations change minimally yet investors demand routine change of assets in portfolio, if the cost of more analysis on correlations per customer via the financial analyst or planner lacks in making up via less risky returns as a result of more information, or if the customer themselves is uninterested. Therefore, the actual benefit one receives from changes in globalization and correlation depends on other attributes if correlation changes are minimal.

Regarding the rebalancing of a portfolio, first, the customer must see the benefits from this rebalance in order to rationalize paying for it. Second, if a portfolio manager rebalances portfolios depending on economic and market conditions, it is best to do so only when domestic events transpire that are likely to have an effect on the domestic and international indices they already invest in. Third, rebalancing via the use of moving average correlations gives a better indication of recent trends, making it the best visual representation of correlation changes over time, especially when comparing the effects certain assets with have on a portfolio's level of risk.

Even though past data is not indicative of future trends, it gives insight into how past occurrences affect certain correlation behaviors, which can indicate larger results such as globalization, mergers, economic health, and lastly how the assets under analysis tend to behave during this period of exposure. Taking into account these three points, the portfolio manager and the investor can decide if they benefit from a semi-annual re-balance, annual, or economic shock based re-balance.

On another note, researchers must look into other forms of investments such as real assets and derivatives. The lack of research on the implication investing internationally via real assets or derivatives have on diversification is a significant problem. These asset mediums are an

integral part of trading today. However, much of the research available on diversification or correlation is on simple portfolios, or have minimal application to the present other than explaining patterns of the past. This is because previous research maintains a focus on interpreting future trends by interpreting patterns in historical data. Furthermore, the economic models contain a restrictive range of criteria, while also using past data to make inferences on the present, a reality that does not match the model's restrictive criteria. To take the inferences even further, historical data for specific geographical areas in some research claims to be representative of areas where data during that era is not present.

The literature review indicates that researchers tend to focus on smaller areas of distinction like companies rather than countries. This is due to the data and breadth of reasons why the correlations change is more complex than the models and graphs are able to demonstrate. More importantly, the lack of moving averages present in modern research is one of the larger setbacks. Without the ability to see how correlations change over time, it is difficult to determine the effectiveness of diversification as an investment tool. As a result, outliers and patterns in data that present comparisons lack representation. Furthermore, it is through international indices in comparison to the S&P that increase effectiveness in visualizing relationships and recognition of outlier correlations, specifically depending on the nation and its geographical area.

Before 2000 and the ease of accessing return data online was present, these calculations would not have been possible. Asia and the Middle East are areas where obtaining data on index returns is exceedingly difficult. China, India, and Japan are some of the only nations with data obtainable directly from Yahoo.com closest to 2000, and partially the reason why they are used.

This paper is to represent what the average investor has access to, not necessarily a financial planner. With this in mind, the calculations and their respective graphs also represent this level of simplicity. This is how the average international investor can benefit. By reading this paper, average American investors now have a baseline on financial planning, diversification, risk, how correlations change the aspects of diversification, and the idea that all assets are attractive, depending on the goals of said investor.

## Chapter 5

### Complications and Conclusion

Diversification is a focal point of modern investing. However, as the world begins to connect through technology, corporations, and media, instances in one area of the world can have a drastic effect elsewhere. The goal of this paper is to demonstrate globalization with indices and their correlations. Then, to use those correlations in a portfolio to demonstrate the effects of diversification within the same international portfolio as correlations increase or decrease. This paper is a step in the correct direction on lifting the veil of international integrations since this is the first paper comparing indices from Asia, Europe, Australia, and Central and South America to that of the S&P of the United States. Looking from 2000 to 2015, correlations tend to behave more depending on their geographical area than have steady increases or decreases. This is beneficial to an investor, yet can be harmful in situations like 2008 to 2010 where correlations were relatively unchanging in Europe and Australia. Due to these findings, the average American investor might find it optimal to revisit and rebalance their portfolio depending on economic conditions or location of investment. This way they are able to use diversification to its maximizing potential in a constantly changing environment.

Prior research indicates that correlations have the tendency to increase during periods of economic distress, and that over the past 100 years; they have been increasing over time. During this research though, a steady long-term rise between the United States and Europe might be the case, it is not during short periods of 15 years. By indication of the moving average correlations, one can see their behavior varies by location, age of index, similarity to the United States, and by year depending. During the last 4 years, indices took a significant drop not once, but twice. This is purely indicative of correlations that are on average higher, but tend to move depending on

market conditions of the day, month, or year. With this in mind, further research should recognize the significance of correlation matrices as indicators of correlation averages for a given period, while moving average correlations must be preferred when trying to decipher trends in data, or correlation progressions over time.

Since the purpose of this paper is to only use tools the average investor has access, more research is imperative to understand what integration is, what diversification means to the average investor, their preferences, and correlations of the past for Asia, Middle East, Africa, and Central and Southern America. Advances in these areas, as well as agreed upon definitions or forms of measurement is the first step to estimating integration. Researchers do have the capability to bring more information to light, as long as data collection is possible for previous industries, countries, indices and assets; or alternatives exist to compare to the present.

The difficulty that presents itself in this area is simply the lack of information from different periods. In addition, if one can obtain the information, restrictions on investing may be present. For example, the Asian nations as well as the Middle East, and nations in Africa lack data whether it be reliable or not. This means that for further research regarding international correlations, first other means of measuring integration in these areas could provide differing conclusions.

In conjunction, another beneficial form of research would be to analyze correlation behavior by season or month. This could result in disclosing certain patterns or discovering better periods of the year to invest in certain areas, given a certain portfolio of assets. These findings will not be useful to try to beat the market, but will indicate the present and past benefits of diversification available to investors.

## Appendix A

### Other Data or Tables

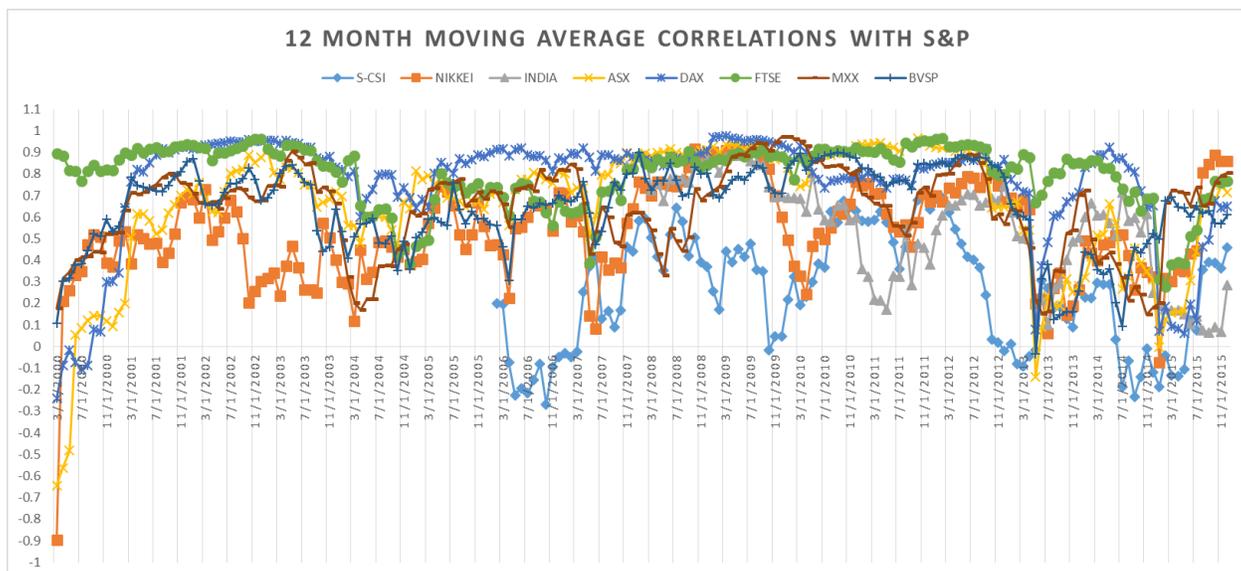


Figure: I; 12 Month Moving Average Correlations With S&P, All Geographical Areas

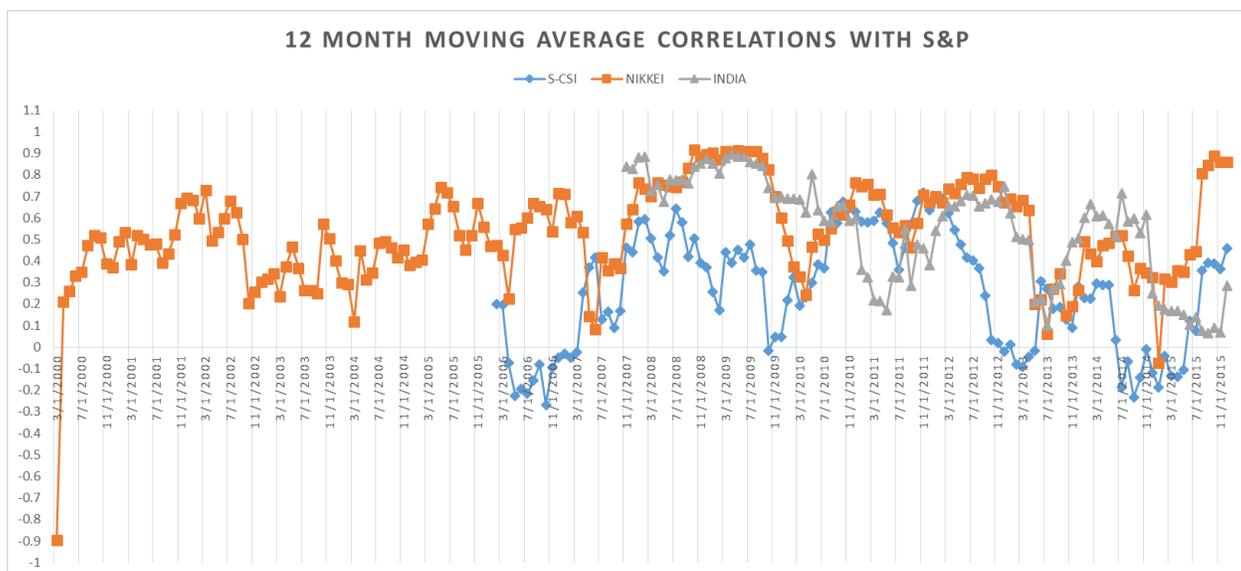


Figure: II; 12 Month Moving Average Correlations With S&P, Asia

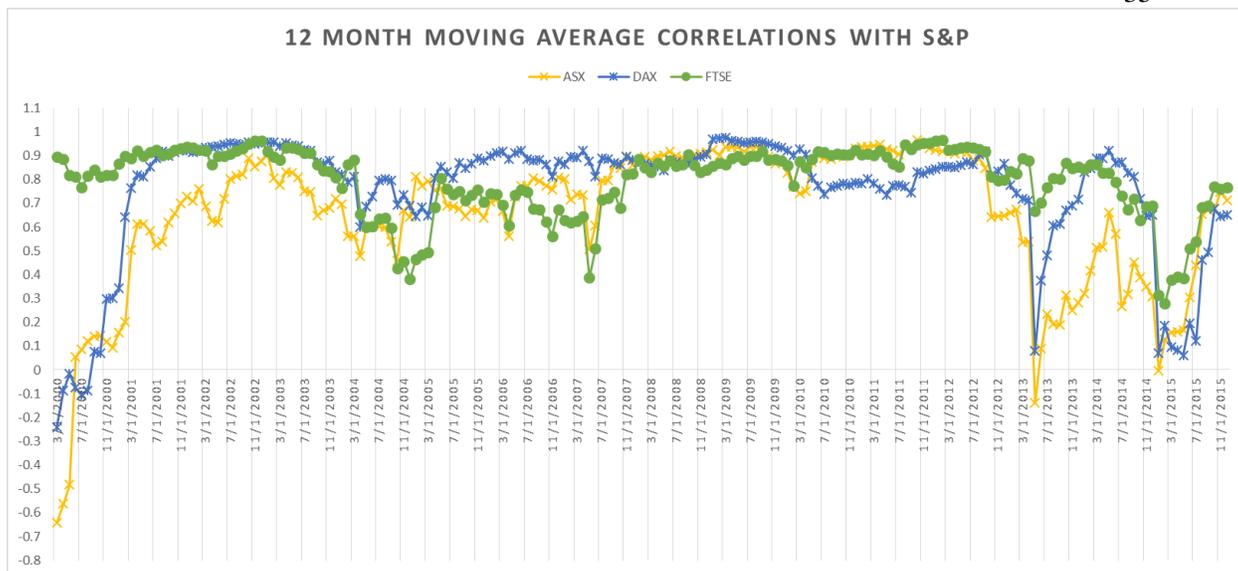


Figure: III; 12 Month Moving Average Correlations With S&P, Europe and Australia

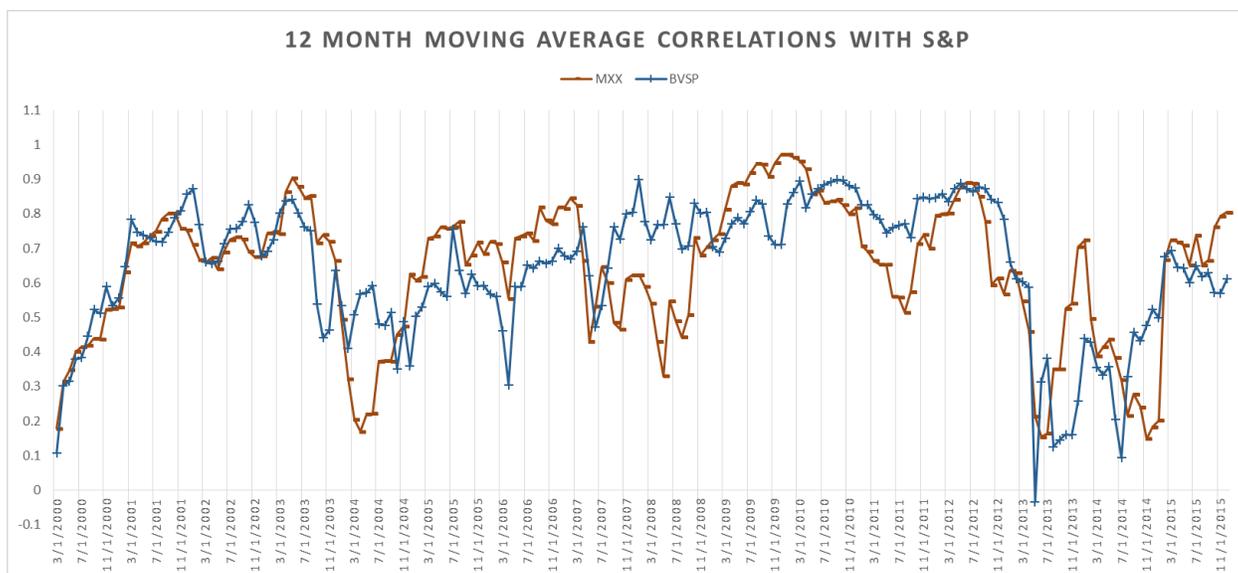


Figure: IV; 12 Month Moving Average Correlations With S&P, Central and Southern America

Correlation Change	Returns	Standard deviation
15%	5.114%	17.143%
10%	5.114%	16.766%
5%	5.114%	16.381%
0%	5.114%	15.986%
-5%	5.114%	15.581%
-10%	5.114%	15.166%
-15%	5.114%	14.738%

Figure: V; Correlation Changes and Effect on Standard Deviation

Correlation	Level of Return	St. Deviation	% Change in value from original
1	5.012%	22.430%	
0.95	5.012%	21.862%	0.568%
0.9	5.012%	21.279%	1.151%
0.85	5.012%	20.679%	1.751%
0.8	5.012%	20.062%	2.368%
0.75	5.012%	19.425%	3.005%
0.7	5.012%	18.766%	3.664%
0.6	5.012%	17.374%	5.056%
0.5	5.012%	15.860%	6.569%
0.4	5.012%	14.186%	8.244%

Figure: VI: Predicted Standard Deviation if All Assets are a Specific Correlation

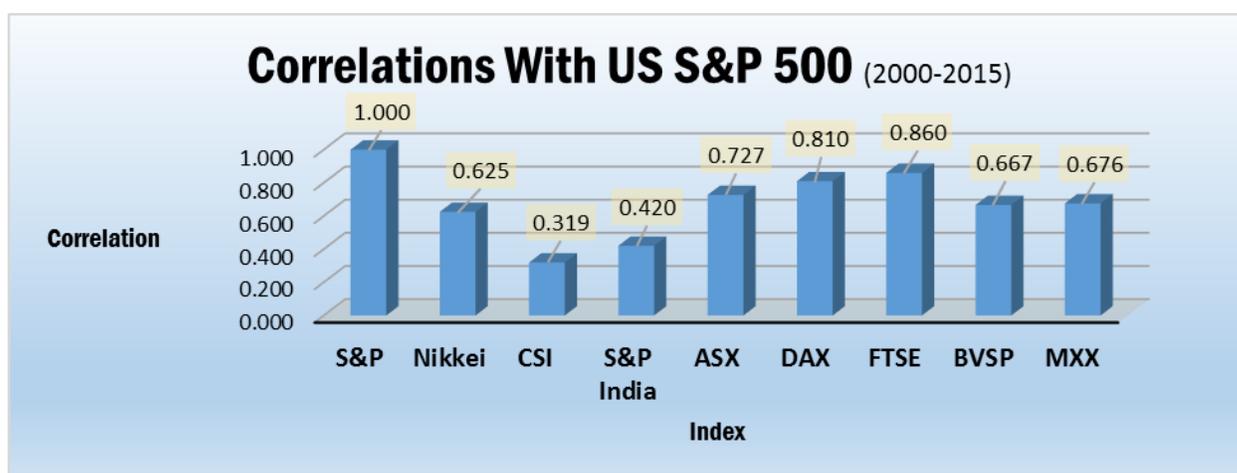


Figure: VII; Correlations With the S&amp;P Via Index



Figure: VIII Correlations with the S&amp;P Via Geographical Area

Correlation Matrix									
	S&P	Nikkei	CSI	S&P India	ASX	DAX	FTSE	BVSP	MXX
S&P	1.000	0.625	0.319	0.420	0.727	0.810	0.860	0.667	0.676
Nikkei	0.625	1.000	0.288	0.345	0.587	0.561	0.570	0.463	0.508
CSI	0.319	0.288	1.000	0.014	0.369	0.323	0.281	0.421	0.267
S&P India	0.420	0.345	0.014	1.000	0.342	0.420	0.434	0.513	0.397
ASX	0.727	0.587	0.369	0.342	1.000	0.645	0.731	0.622	0.599
DAX	0.810	0.561	0.323	0.420	0.645	1.000	0.804	0.589	0.601
FTSE	0.860	0.570	0.281	0.434	0.731	0.804	1.000	0.634	0.598
BVSP	0.667	0.463	0.421	0.513	0.622	0.589	0.634	1.000	0.670
MXX	0.676	0.508	0.267	0.397	0.599	0.601	0.598	0.670	1.000
Covariance Matrix									
	S&P	Nikkei	CSI	S&P India	ASX	DAX	FTSE	BVSP	MXX
S&P	0.0227	0.0185	0.0155	0.0270	0.0165	0.0265	0.0178	0.0250	0.0172
Nikkei	0.0185	0.0387	0.0182	0.0290	0.0174	0.0239	0.0154	0.0226	0.0169
CSI	0.0155	0.0182	0.1039	0.0019	0.0179	0.0226	0.0125	0.0337	0.0145
S&P India	0.0270	0.0290	0.0019	0.1819	0.0220	0.0388	0.0254	0.0543	0.0286
ASX	0.0165	0.0174	0.0179	0.0220	0.0227	0.0211	0.0152	0.0233	0.0153
DAX	0.0265	0.0239	0.0226	0.0388	0.0211	0.0470	0.0240	0.0317	0.0220
FTSE	0.0178	0.0154	0.0125	0.0254	0.0152	0.0240	0.0189	0.0216	0.0139
BVSP	0.0250	0.0226	0.0337	0.0543	0.0233	0.0317	0.0216	0.0617	0.0281
MXX	0.0172	0.0169	0.0145	0.0286	0.0153	0.0220	0.0139	0.0281	0.0285

Figure: IX; Original Covariance and Correlation Matrix without Alterations

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**WORK EXPERIENCE**

**Lockheed Martin**

*College Non-Tech Specialist, Syracuse NY, 2015*

Completed contract closeouts through the use of SAP and ran actuals through the use of SAP and multiple excel based spreadsheets to track the scheduling and financial performance of a BOA over a period of time

**LEADERSHIP & ACTIVITIES**

**Lockheed Martin**

*College Non-Tech Specialist, Syracuse NY, 2015*

Organized two charity events, volunteering at the Samaritan Center, and a sandwich preparation session to allow the interns of Lockheed Martin to donate both time and meals to the less fortunate of Syracuse New York

**Honor Bus**

*York PA, 2010-2012*

*Co Founder of Northeastern High School's Division, Head of Marketing, Promotion, and Paperwork*

Devised methods of communication and fundraising in order obtain enough money to take 50-80 World War II veterans to the World War II Memorial in Washington D.C for free and oversaw all foundational planning and logistics during the first and second year of the organization, ensuring all medical, legal, and monetary concerns were adequately addressed

**Net Impact**

*State College PA, 2015*

Engaged in Small Steps Big Win, and a KPMG sponsored community service event to spread awareness for corporate and social responsibility

**HONORS/AWARDS**

2<sup>nd</sup> Place in a Marketing Plan Competition

3 awards for academic excellence in Spanish

Dean's List (7/7) semesters

Lifetime member of Honor Society Beta Gamma Sigma, PHI KAPPA PHI, and The Golden Key International Honor Society