

8-25-2005

The Impact of EU Membership on Baltic Investors' Portfolio Management

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Abstract

This paper investigates the impact of European Union membership on Baltic investors' ability to diversify. The research addresses the impact of E.U. membership on effectiveness of country-based diversification versus industry-based diversification strategies for Latvian investors. I compared correlation matrices of country index returns before and after the Baltic entry date of May 1, 2004. Then, I created similar correlation matrices for the Baltic industries. In the pre-unification period, Latvian equity returns were inversely correlated with other European and U.S. indices after translating into the Latvian currency. However, after the joining the EU, cross-country correlations increased dramatically. As a result, Latvian investors have lost substantial ability to diversify internationally. Post-unification industry correlation results are inconclusive due to small sample sizes, indicating lack of ability to achieve diversification across industries. I also tested if the portfolio variance of nineteen equally weighted Baltic securities had increased or decreased after European unification. This test resulted in a lower portfolio risk indicating that as European markets become more integrated risk, decreases.

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Introduction

Throughout the first part of the twentieth century, the New York Stock Exchange (NYSE) was the only significant equity market in the world. In 1974, the NYSE represented sixty percent of a world capitalization of less than a trillion dollars.¹ However, in the last fifty years, European unification has contributed to the transformation of a disparate set of small countries into the world's largest economy, with a stability approaching that of the United States. According to Solnik and McLeavey [2003], Europe currently makes up one third of the world equity market.² While Europe was experiencing economic integration, a drastic change within their financial markets, over this same fifty-year period, Modern Portfolio Theory (MPT) was revolutionizing the field of finance. MPT transformed investment analysis from an ad-hoc set of stipulated rules to a quantitatively focused procedure based on the scientific method. Harry Markowitz was the founder of modern portfolio theory. Markowitz's work concentrated on creating efficient portfolios – “those providing the maximum return for their level of risk, or minimum risk for a certain level of return.”³ In order to generate an efficient portfolio, an investor's assets should be diversified. Diversification is the most important principal of the MPT. Diversification is a portfolio strategy that is designed to reduce exposure to risk by devoting one's assets to a variety of investments such as stocks, bonds, and real estates.⁴ Investing in different types of securities is intended to ensure that asset classes will not move up and down in value at the same time or at the same rate.

¹ Bruno Solnik & Dennis Mc Leavey. International Investments, 5thEd., (New York: Addison Wesley, 2003).

² Ibid.

³ Robert A. Strong, Portfolio Construction, Management, and Protection, 3rd Ed., (United States: Thomson/South –Western, 2003), 126.

⁴ “Diversification,” Investor Words.com, accessed on February 27, 2005 at <<http://investorwords.com>>

If securities are highly correlated, moving at the same time and rate, more risk would be incurred; thus, resulting in a greater loss of profits.

The two most dramatic tools for diversification are based on drawing securities from across countries and across industries. Because the size of European financial markets has increased to one-third of the world market, it is logical to diversify risk in one's portfolio and invest abroad. Nevertheless, some studies suggest that the development of the European Currency Union (the Euro Zone) have caused securities to be highly correlated; hence, indicating that return cannot be optimized by diversifying according to country. Instead, to optimize one's return portfolio managers have suggested diversifying portfolios according to industry.

On May 1, 2004, the Accession Treaty entered into force and ten new countries entered the European Union including such Baltic States as Estonia, Latvia, and Lithuania.⁵ The Baltic States are considered to be an area of emerging markets. Emerging economies offer attractive investment opportunities because risks, such as volatility, liquidity, and political, are higher.⁶ When risks are higher, profits are expected to be larger. However, since the Baltic States are now integrated with the European Union, many believe their economies will be highly correlated with more developed European nations. This high correlation implies that the opportunity to optimize profits according to country diversification will significantly decrease. Because of this decrease in returns, others believe that diversifying by industry will cause an optimization in profits. This paper will examine the impact of the European Currency Union (the Euro

⁵ "History of the European Union," [Europa.com](http://europa.eu.int/abc/history/2004/index_en.htm), accessed on February 27, 2005
<http://europa.eu.int/abc/history/2004/index_en.htm>

⁶ Bruno Solnik & Dennis Mc Leavey, 471.

Zone) on country diversification and industry diversification in the Baltic markets with a primary emphasis on empirical results.

European Union History

The European Union is a supranational organization of European countries that is currently made up of twenty-five member states. In 1992, the Maastricht Treaty established the European Union (EU). However, many aspects and policies of the EU date back to the Post-World War II era. In 1944, as World War II was coming to a close, the Allied Powers met at Bretton Woods, New Hampshire. The purpose of the meeting at Bretton Woods was to create a new post-war international monetary system. A result of the Bretton Woods agreement was the establishment of a U.S. dollar-based international monetary system, which produced two new institutions: the International Monetary Fund and the World Bank.⁷ The International Monetary Fund (IMF) helps countries with payments and problems with exchange rates.⁸ The International Bank for Reconstruction and Development, also known as the World Bank, assisted in funding post-war reconstruction. The World Bank is an institution that continues to support general economic development such as providing loans at preferential rates to member countries that are in financial distress. During the years after World War II and presently, the IMF has become the key institution in the international monetary system.⁹ The IMF assists member countries in attempting to defend their currencies against devaluation due to cyclical, seasonal or random occurrences. Nevertheless, if a country experiences continual deficits, the IMF cannot prevent an eventual devaluation in currency. In addition to the devaluation of currency, the IMF helps countries that exhibit structural

⁷ Michael H. Moffett, Arthur I. Stonehill, & David K. Eiteman. Fundamentals of Multinational Finance, (New York: Addison Wesley, 2003), 26.

⁸ Ibid.

⁹ Ibid.

trade problems. Nevertheless, aid will only be given to these countries provided that they follow certain guidelines that will correct their problems.

Because of the establishment of the IMF and the World Bank, as well as the policies indicated in the Marshall Plan, European states were working in close cooperation to bring political recovery to countries such as France, West Germany, Italy, Belgium, Holland and Norway. “Many Europeans believed that unity in a new ‘European Nation’ could reassert Western Europe’s influence in world affairs.”¹⁰ In 1948 this desire for unification led to the development of the Organization of the European Economic Cooperation (OEEC) and the Council of Europe. European federalists hoped that the Council of Europe would generate into a European Parliament with sovereign rights.¹¹ However, Britain constantly opposed this idea because it would weaken the power of its own empire.

Federalists became frustrated in trying to unify Europe politically. Therefore, instead of taking a political approach European politicians decided to focus on economics as a way of working toward genuine unity. In 1950 French Statesman Jean Monnet and Foreign Minister Robert Schuman took the first steps toward European integration. They called for a special international organization to control and integrate all European steel and coal production.¹² Six member states (Belgium, the Federal Republic of Germany, France, Italy, Luxembourg and the Netherlands) agreed to this proposal, which came to be known as the Paris Treaty. In 1951, the aforementioned countries signed the Paris

¹⁰ John P. McKay, Bennett D. Hill, & John Buckler. A History of Western Society – Since 1300. (New York: Houghton Mifflin Company, 2003), 997.

¹¹ Ibid.

¹² “Europe in Twelve Steps - Historic Steps,” Europa.com, accessed on February 16, 2005 at <http://europa.eu.int/abc/12lessons/index2_en.htm>

Treaty and the European Coal and Steel Community (ECSC) was formally created. The ECSC was divided into establishments: the High Authority and the Common Assembly and Special Council of Ministers and Court Justice. The primary economic goal of the ECSC was to create steel and coal market without national tariffs and quotas.¹³

Furthermore, this treaty restricted subsidizing companies from trading with coal and steel because that would harm the coal and steel industries in the long run.¹⁴

In 1955, the Foreign Ministers of the six members states of the ECSC met in Messina, Italy and discussed their desire to aim for the integration of their countries on the economic front.¹⁵ Thus, in 1957 the ECSC signed the Treaty of Rome, which created the European Economic Community (EEC). The purpose of the EEC was to increase economical growth and gradually reduce tariffs between member countries. Other goals of the EEC were free movement of capital and labor as well as having similar economic policies and institutions. Europeans hoped this would result in creating a market as large as the United States.¹⁶ The Treaty of Rome also formed the EURATOM, an organization created to forbid the use of nuclear weapons for military purposes.¹⁷

During the 1960's common policies on trade and agriculture were created and by July first of 1968, all tariffs between the six countries were completely removed. Because of the success of the Treaty of Rome in 1973 Denmark, Ireland, and the United Kingdom decided to join the EEC. Nevertheless, in 1970's the structure of the currency arrangement negotiated at Bretton Woods was deteriorating due to "widely diverging

¹³ John P. McKay, Bennett D. Hill, & John Buckler.

¹⁴ "How did the European Union Come into Existence?" [European-Union-Clearly.com](http://www.european-union-clearly.com/european-union-history.html) accessed on February 16, 2005 at <<http://www.european-union-clearly.com/european-union-history.html>>

¹⁵ "The History of the European Union," [Europa.com](http://europa.eu.int/abc/history/1955/index_en.htm), accessed on February 16, 2005 at <http://europa.eu.int/abc/history/1955/index_en.htm>

¹⁶ John P. McKay, Bennett D. Hill & John Buckler.

¹⁷ "How did the European Union come into Existence?"

national monetary and fiscal policies, differential rates of inflation, and various unexpected external shocks.”¹⁸ The U.S dollar was the main reserve currency held by central banks and it was vital to the network of exchange rates. At this time the United States was experiencing persistent growing deficits within its balance of payments.¹⁹ The United States were required to finance these deficits, which resulted in a significant outflow of capital. Since capital continued decline, the U.S. had to repay investors and businesses money they borrowed in securities such as bonds. Eventually, foreign investors no longer had confidence in the United States ability to meet its commitment in converting dollars to gold.²⁰ On August 15, 1971, President Richard Nixon suspended official purchases of sales of gold. In essence this mean the dollar’s convertibility into gold was discontinued. The affect of this suspension paralleled with the oil crisis caused great instability in the world market. Also, in March 1973, “exchange rates became much more volatile and less predictable than they were during the “fixed” exchange rate period.”²¹ To help alleviate these predicaments the EEC realized that they needed a monetary union to bring their economies into line with one another. In 1979, the introduction of the European Monetary Union helped stabilize exchange rates and encouraged the member states to implement strict policies that regulated their economies while maintaining mutual solidarity.²²

In the early 1980’s there was a worldwide economic recession. Members of the European Community were discontent and pessimistic of their financial positions. Fortunately, president of the European Commission Jacques Delors and other business

¹⁸ John P. McKay, Bennett D. Hill, & John Buckler.

¹⁹ Ibid.

²⁰ Ibid.

²¹ Ibid.

²² “Europe in Twelve Steps – Historic Steps.”

and political leaders were eager to collaborate in resolving laws between countries and policy inconsistencies.²³ The commission in the European Community analyzed whether a common market would be possible in Europe and what actions would be needed to fulfill these goals. The proposals of this commission became known as the Single European Act of 1986. Goals of the Single European Act included removing barriers between countries, increasing competitiveness of European countries, and operating procedures within the EEC. However, the most important aim was to set out a timetable for completing a European single market by January 1, 1993.²⁴

After the fall of the Berlin Wall and Communism, the political shape of Europe changed dramatically, which in effect significantly impacted the European economy. In 1990 representatives of member countries indicated that there needed to be intergovernmental cooperation and economic and monetary unification. Belgium proposed that the community should hold a conference to address topics such as political union and a single currency.²⁵ Although these conferences began in December 1990, this led to the endorsement of the Maastricht Treaty in 1992. Because of the Maastricht Treaty the EEC was renamed the European Community (EC). “By adding areas of intergovernmental cooperation to the existing Community system, such as fundamental rights, European Convention and the protection of Human Rights and freedoms, the Maastricht Treaty created the European Union (EU).”²⁶ This treaty also proposed a monetary union of a single currency. The single currency would be called the Euro and established by the target date of January 1, 1999. However, if countries wanted to join

²³ Ibid.

²⁴ Ibid.

²⁵ “How did the European Union come into Existence?”

²⁶ “Europe in Twelve Steps – Historic Steps.”

the European Union they would have to follow strict financial criteria. After achieving monetary union, the treaty provisioned for common policies on defense, and foreign affairs. Upon signing the treaty, members agreed that another conference should take place in 1996 to examine if the integration process was working and what policies should be taken in the future.²⁷ Many Europeans supported the decisions of the Maastricht Treaty and the creation of the European Union. These Europeans believed that the monetary union would give a solution to Europe's ongoing economic problems, impose financial discipline, cut costs and reduce high unemployment.²⁸ However, many investors, outside of Europe, were against European Unification because it reduced opportunities in investing abroad such as decreasing the ability to diversify investments over many different currencies. Although the level of risk significantly decreased, the opportunity to outperform the market has become incredibly difficult to achieve.

In January of 1994 the European Monetary Institute was setup and new procedures were introduced for monitoring EU countries' economies and the unification between them. The European Union met in Amsterdam on June of 1997 to review how the policies from the Maastricht Treaty have been executed. During their meeting in Amsterdam, the European Council adopted two resolutions. The first is known as the 'stability and growth pact,' which means that countries are committed to maintaining their budgetary discipline. This pact indicates that all member countries must monitor other countries so they do not generate excessive deficits.²⁹ The second resolution states that member states and the European Commission are committed to decreasing

²⁷ "How did the European Union come into Existence?"

²⁸ John P. McKay, Bennett D. Hill, & John Buckler.

²⁹ "Europe in Twelve Lessons – Economic & Monetary Union," [Europa.com](http://europa.eu.int/abc/12lessons/index7_en.htm) accessed on February 16, 2005 at < http://europa.eu.int/abc/12lessons/index7_en.htm>

unemployment.³⁰ In December 1997, in Luxembourg, the European Council adopted a third resolution that further coordinated economic policies. The decision declared that ministers of different member countries participating in the Euro-zone could meet to informally discuss shared issues and responsibilities for the single currency.³¹

On January 1, 1999, the eleven currencies of the participating countries: Austria, Belgium, Finland, France, Germany Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain, disappeared and were replaced by the euro, which was trading at a rate of about €1 to 1.18 US dollars.³² By January 1, 2002, euro-denominated coins were put into circulation and all former legal currencies ceased to exist.³³ Thus, in the Euro-zone, the Euro becomes the sole currency. The euro has become the world's second most important currency and "it is being used for international payments and as reserve currency along side the U.S. dollar."³⁴

³⁰ Ibid.

³¹ Ibid.

³² Ibid.

³³ Bruno Solnick and Dennis McLeavy.

³⁴ "Europe in Twelve Lessons – Economic & Monetary Union."

The Role of Diversification in Portfolio Management

The portfolio strategy of diversification is similar to the adage, “Don’t put all your eggs in one basket.” If a person puts all their eggs into one basket, there is a greater chance that the basket will drop and all the eggs will be lost. A portfolio that has a large percentage or that is fully invested in one type of security is similar to carrying all your eggs in one basket.³⁵ There are three outcomes that can occur if one does not broaden their choice of investments. One possibility is that the investment will appreciate dramatically and make a significant amount of money.³⁶ Although this result is beneficial for the investor, it could cause the investor to think that every investment they make will automatically be successful. This belief may obscure their judgment in making careful investment decisions. Unfortunately, the next time the person invests they could lose everything and not be as lucky. The second possibility that occurs because of not diversifying one’s assets is that the security they invested in never moved.³⁷ By the investment not moving, many people think that they did not lose anything; however, in terms of economics this way of thinking is incorrect. Essentially, the investor lost definite income he would have received if he put a percentage of his assets in a bank deposit or in short term governments bonds.³⁸ The third possibility caused by not diversifying would be would be that the sole investment continues to decline in value.³⁹ Usually, when a person invests in security that continues to decline they attempt to rationalize their choice in order to ease their hurt ego. For example, they exercise faulty logic hoping that the security will rebound. These three scenarios indicate the losses that

³⁵ Robert A. Strong.

³⁶ Ibid.

³⁷ Ibid.

³⁸ Ibid.

³⁹ Ibid.

can occur when one does not diversify their portfolio. When investors lose a significant amount of money because of not varying their investments, they become risk averse and learn to understand the importance of diversifying their portfolio.

Most investors are risk averse; yet, this does not mean that they are not willing to take risks.⁴⁰ Risk averse investors are people who avoid risk unless they are adequately compensated for it.⁴¹ For example, a riskier investment needs to have a higher expected return in order for a risk-averse investor to select it. Moreover, by investing in many different securities, an investor has less of a chance of losing of all their assets. Therefore, it is logical that risk averse investors follow the portfolio strategy of diversification. Diversification is intended to reduce risk exposure and achieve a given level of expected return by combining a variety of investments, such as stock and bonds that are unlikely to move in the same direction.

⁴⁰ Ibid.

⁴¹ “Risk –Averse,” [Investor Words.com](http://investorwords.com), accessed on February 27, 2005 at <<http://investorwords.com>>

The Mathematics of Portfolio Diversification

Portfolio Return

A portfolio's earnings ultimately depend on the performance of its components. Therefore, the return on a portfolio is simply a sum of the weighted average of the return on its individual assets. The weight applied to each return is the fraction of the portfolio invested in that asset.⁴² Equation one gives the general expression for the expected return on a portfolio:

$$(1) \quad E(R_p) = \sum_{i=1}^n [x_i E(R_i)]$$

where x_i = proportion of portfolio invested in security i .

Moreover, all portfolio weights must equal one: $\sum_{i=1}^n = 1$

In the notation above the subscript p indicates portfolio, and $E(R_p)$ is the expected return on the portfolio. $E(R_p)$ equals the weighted sum of the component expected returns $E(R_i)$. The constraint that all x 's add to one is necessary because it ensures that every component is counted and invested in an asset.⁴³

Portfolio Variance

The equation above is a forecast for the portfolio's expected return level. In reality the actual return level will deviate from its expected value. This potential return deviation is known as the portfolio's variance. The variance statistic is a useful measure of risk: the quantifiable likelihood of loss or less-than-expected returns.⁴⁴ In addition to measuring a portfolio's actual return from its expected value, variance also accounts for the dispersion between a portfolio's potential return outcome and the expected return.

⁴² Edwin J. Elton & Martin J. Gruber, Modern Portfolio Theory and Investment Analysis. 6th Ed., (United States: John Wiley & Sons, Inc. – 2003).

⁴³ Robert A. Strong.

⁴⁴ "Risk," Investors words.com, accessed on March 13, 2005 at <<http://investorwords.com>>

The variance of a portfolio is merely not a weighted average of individual security variances. In terms of variance of returns, the risk of a portfolio can be determined by solving the double summation for a (n) number of securities:

$$(2) \sigma_p^2 = \sum_{i=1}^n \sum_{j=1}^n x_i x_j \rho_{kj} \sigma_k \sigma_j$$

where σ_p^2 = portfolio variance, x_i is the proportion of funds invested in security i , σ_k is the security's standard deviation and ρ_{kj} is the correlation coefficient between security k and security j .⁴⁵

However, in order to understand the portfolio variance equation, one must understand the standard deviation and correlation coefficient variables within this equation. Standard deviation is also a measure of risk; it is the square root of a security's variance. A smaller standard deviation will result in a narrower range of potential return outcomes. If a security's standard deviation is equal to zero, it is labeled a risk-free security meaning it possesses no risk. Variances and standard deviations provide the ability to evaluate total risk levels of securities.

Even though the absolute risk levels of securities are important, it is also beneficial to measure the risk of one security relative to another security or to the market as a whole.⁴⁶ This notion is known as covariance. Covariance is a statistical measure of the relationship or variance between two returns. Essentially, it quantifies if two securities are moving in the same direction or opposite directions. If the covariance of two securities is positive the relationship between the two returns are positive. For example if one security performs favorably the second will perform favorably as well. A

⁴⁵ Robert A. Strong.

⁴⁶ John Teall, Chapter Five: Expected Return and Risk, Finance 301, Fall 2003.

negative covariance indicates that a profitable performance of one security implies a poor performance by a second security. If the covariance is zero, there is no relationship between the returns of the two securities. Covariance can be computed by two different equations. The first equation is the following:

$$(a) \sigma_{kj} = \sum_{i=1}^n (R_{k,i} - E[R_k])(R_{j,i} - E[R_j]) P_i$$

where $(R_{k,i})$ and $(R_{j,i})$ are the returns of stocks (k) and (j) if outcome (i) is realized and (P_i) is the probability of outcome (i). $E(R_k)$ and $E(R_j)$ are the expected returns of securities (k) and (j).

The second equation that is used to find covariance contains the correlation coefficient term where the standard deviation of security k (σ_k) is multiplied by the standard deviation of security j (σ_j) and the correlation coefficient of security k and j ($\rho_{k,j}$).

$$(b) \text{COV}(k,j) = \sigma_k \sigma_j \rho_{k,j}$$

Usually, it is difficult to understand the intensity of the covariance statistic because the numbers are quite small. Standardization of covariance is needed because it helps decipher the small numbers of covariance; thus, indicating if there is a strong or weak relationship between returns. The correlation coefficient provides the method of standardizing the covariance between two securities.⁴⁷ The correlation coefficient between returns two securities ranges from -1 to $+1$. If the correlation coefficient is positive, the two securities are directly related. However, if the securities move indirectly, the correlation coefficient will be negative. Furthermore, if the two securities always vary in the same proportion and the same direction, the correlation coefficient will

⁴⁷ Ibid.

equal one. Nonetheless, if the two securities fluctuate in the same proportion but in opposite directions, they will have an inverse relationship and the correlation coefficient will always equal negative one. There is no association between returns on two securities if their correlation coefficient equals zero. Rather than using covariance, the correlation coefficient makes it easier to understand the relationship between returns of two securities. The correlation coefficient is simply the covariance between returns on the two securities divided by the product of their standard deviations.⁴⁸ This definition of correlation is the inverse of the covariance equation (b) above:

$$(c) \rho_{kj} = \frac{\text{COV}(k,j)}{\sigma_k * \sigma_j}$$

With the knowledge of standard deviation, covariance, and correlation coefficient one can fully understand the variance portfolio definition that has been previously mentioned:

$$(2) \sigma_p^2 = \sum_{i=1}^n \sum_{j=1}^n x_i x_j \rho_{ij} \sigma_i \sigma_j.$$

The equation represents two securities i and j. Written out fully it would be:

$$(2.1) \sigma_p^2 = (x_i * x_i * \sigma_i * \sigma_i * \rho_{ii}) + (x_i * x_j * \sigma_i * \sigma_j * \rho_{ij}) + (x_j * x_i * \sigma_i * \sigma_j * \rho_{ji}) + (x_j * x_j * \sigma_j * \sigma_j * \rho_{jj})$$

In equation (2.1) the coefficient correlation between any variable and itself will always equal one; thus, (ρ_{ii}) and (ρ_{jj}) in the equation above will equal one. Because the correlation coefficients equal one, the first and fourth set of parentheses in equation (2.1) can be simplified to $(x_i^2 * \sigma_i^2)$ and $(x_j^2 * \sigma_j^2)$ respectively. Parenthesis two and three of

⁴⁸ Ibid.

equation (2.1) above can be combined as well into $(2w_iw_j\sigma_i\sigma_j\rho_{ij})$. Therefore, when a security is comprised of two securities i and j, its portfolio variance can be simplified into the following equation:

$$(2.2) \quad \sigma_p^2 = (x_i^2 * \sigma_i^2) + (x_j^2 * \sigma_j^2) + (2x_i x_j \sigma_i \sigma_j \rho_{ij}).$$

In a two-security portfolio, a specific combination of the two securities will produce the least possible risk. This arrangement is called the minimum variance portfolio. One can find the proportion of the two securities in the minimum variance portfolio by deriving the portfolio variance equation. As previously stated the weights of a portfolio must equal one: $x_i + x_j = 1$. Because there are only two securities, the proportion that is not invested in security i will be invested in security j. This means that $x_j = 1 - x_i$. By substituting this expression for x_j , equation (2.2) can be rewritten as follows:

$$(2.2a) \quad \sigma_p^2 = (x_i^2 * \sigma_i^2) + (1-x_i)^2 \sigma_j^2 + 2x_i (1-x_i) \sigma_i \sigma_j \rho_{ij}.^{49}$$

The next step in finding the minimum variance portfolio is by taking the first derivative and find the proportion of weight i:

$$3) \quad \frac{\delta \sigma_p^2}{\delta x_i} = 2x_i \sigma_i^2 - 2\sigma_j^2 + 2x_i \sigma_j^2 + 2\sigma_i \sigma_j \rho_{ij} - 4x_i \sigma_i \sigma_j \rho_{ij}$$

When one sets the above equation to zero one can then solve for the weight of security i:

$$(4) \quad x_i = \frac{\sigma_j - \sigma_i \sigma_j \rho_{ij}}{\sigma_i^2 + \sigma_j^2 - 2\sigma_i \sigma_j \rho_{ij}}$$

Risk, as aforementioned, is diversified away when two individual securities are combined into a portfolio. Diversification is most effective when the returns of individual securities are fairly unrelated or inversely related.⁵⁰ The way to measure if

⁴⁹ Robert A. Strong.

⁵⁰ John Teall. Chapter 6 – Portfolio Return and Risk, Finance 301 notes. Fall 2003.

securities are related is by examining correlation coefficients. Therefore, the reduction of portfolio risk is dependent on correlation coefficient between securities included in the portfolio. Uncorrelated securities are the most efficient securities to have in one's portfolio because if one security defaults, the chance of the second security defaulting is unlikely. For example, consider two securities in a portfolio one is Nortel Networks and the other is Juniper Networks. During the late 1990's these two stocks were performing very well because of the high demand for technology. However, in the year 2000, these stocks tumbled to extreme lows. Technology stocks are highly correlated with one another because they are part of the same industry. Many investors lost a majority of their assets because their portfolios were mainly comprised of technology stocks. If the investor diversified his portfolio by investing in stocks that were inversely correlated, such as furniture and technology stocks, he would have lost some but not all of his investment. The lower the correlation coefficient between securities, the lower will be the portfolio risk; consequently resulting in higher diversification benefits.⁵¹ As long as the correlation coefficient between two securities is lower than one, some reduction in risk can be realized from diversification. The most valuable relationships between two securities would be if they were completely uncorrelated. If two securities were uncorrelated within a portfolio, the correlation coefficient would be zero. A correlation coefficient that has the value of zero would cause the third term of equation to drop out, significantly reducing total risk. If the correlation coefficient between two securities is one, diversification will yield no benefits. After explaining how low correlation coefficients lower risks, one can use the portfolio variance and minimum variance

⁵¹ Ibid.

portfolio equations to create portfolios that not only lower risk, but also increase the benefits of diversification.

If there are more than two securities in a portfolio, an investment manager will use a covariance matrix to determine the covariances between the potential portfolio components. The covariance matrix is a tabular presentation of the pair wise combinations of portfolio components.⁵² As previously mentioned, covariance is the expected value of the product of the deviations of two random variables from their means.⁵³ Suppose you have three securities in your portfolio: A, B, and C. One would think that by having three securities in a portfolio, you would need to determine nine covariances. However, the covariance of any one of these securities and itself will be its variance. Moreover, the covariance of A and B will equal to the covariance of B and A. With all of this considered, the required number of covariances for the three securities will be substantially less than the numbers of elements that are represented within the covariance matrix. The actual covariance number needed can be determined from the following equation: $(n^2 - n)/2$. Thus, for a three-security portfolio there are only three covariances needed $[(9-3)/2=3]$ and three variances needed. A covariance matrix can be converted into a correlation matrix by dividing each covariance by the product of the two security's standard deviations: $\rho_{a,b} = \text{COV}(a,b)/\sigma_a\sigma_b$.

⁵² Robert A. Strong.

⁵³ Ibid.

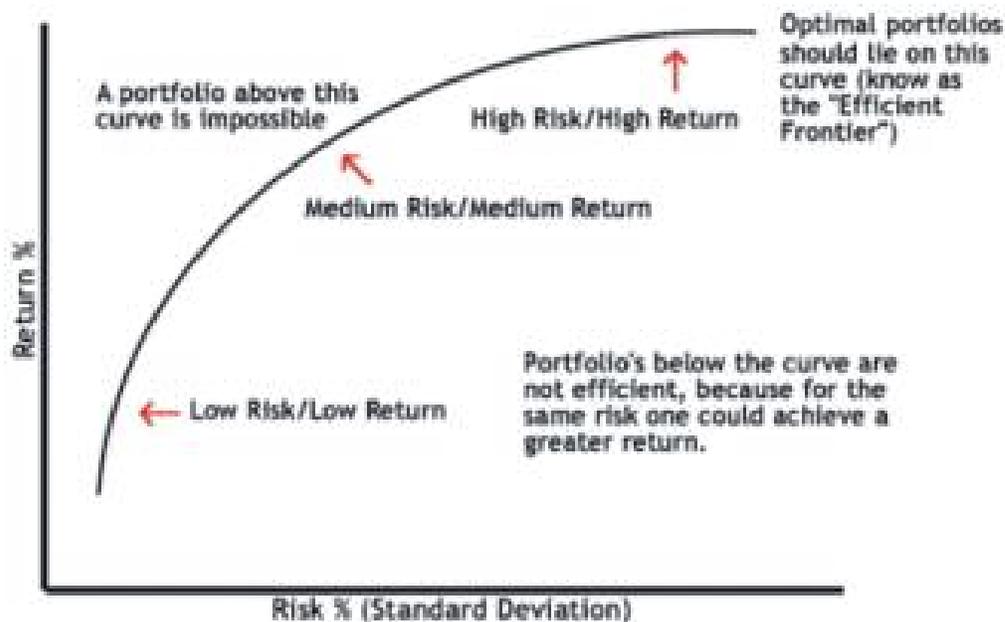
The Efficient Frontier

The goal of diversification is to create a portfolio that optimally achieves a given level of expected return while bearing the least possible risk. The portfolio that achieves this level is known as the dominant portfolio. Dominant portfolios must have a higher return level if it has an identical variance to other portfolios. Moreover, dominant portfolios must have a smaller variance in comparison to portfolios that have identical returns. In order to determine this relationship, one must employ the covariance and correlation matrixes. In 1952, Harry Markowitz's article "Portfolio Selection," which appeared in an issue of the *Journal of Finance* revolutionized portfolio theory. Markowitz's paper proved that for a given level of expected return and for a given security universe (the collection of all possible investments), determining the specific portfolio that dominates all others requires knowing the covariance or correlation relationships between all possible security combinations.⁵⁴ This theory is known as the Markowitz optimization routine. Consequently, the Markowitz's theory created the Efficient Frontier.

The efficient frontier is a computer program that can graph the expected return and risk characters of possible portfolios. The standard deviation of a portfolio is located on the x-axis, while the expected return is located on the y-axis. The efficient frontier forms an up-sloping curve. Suppose that an investor has two securities, A and B. A portfolio manager can create an infinite number of portfolios with different levels of risk and return by adjusting the weights of these two securities. By adding securities to the resultant portfolios, new portfolios will be created. However, many portfolio combinations will be dominated by other portfolios either because those portfolios

⁵⁴ Ibid.

provide lower risk or a higher expected return. The portfolios that are not dominated compose the efficient frontier curve.⁵⁵ To have an efficient portfolio investors must diversify their portfolio by adding a variety of securities. Nonetheless, many investors thought that by adding a plethora of securities to their portfolio they would have been able to avoid risk; yet, the benefits of diversification will reach a limit. The reason diversification benefits decline when there is an excess of securities within a portfolio is because the securities become highly correlated with one another. As previously mentioned, high correlations result in securities mimicking one another and thus hinder the ability to optimize return and lower portfolio risk. In this case, diversification cannot result in more efficient portfolios. Efficient portfolios of risky assets will have risk-return combinations that fall on the efficient frontier.⁵⁶ The Efficient Frontier is represented below:



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⁵⁵ Ibid.

⁵⁶ John Teall. *Chapter 7: Utility and Capital Market Theory*, Finance 301, Fall 2003.

⁵⁷ "Modern Portfolio Theory," *Efficient Frontier Image*. Assessed at www.krakauer.at/.../portfolio/portfolio.htm on March 16, 2005.

The lower left point on the efficient frontier graph above represents the minimum variance portfolio. All portfolios that are on the curve are efficient. Nevertheless, portfolios that lie below the curve are inefficient indicating that for the same risk, an investor could achieve a greater return. It is impossible for portfolios to be plotted above the line because it is highly unlikely that an investor will be largely rewarded for taking a minimum amount of risk. The further an investor travels to the right of the efficient frontier, the more likely it is for him to encounter greater risk. Consequently, if an investor takes this risk he will be compensated with higher returns. The right upper point on the efficient frontier indicates the greatest amount of risk that an investor will incur; at the same time however, the investor will achieve the highest expected return.

The Single-Index Model

If a portfolio manager decides to use the Markowitz optimization model, he must employ the covariance or correlation matrixes to determine the risk relationships between all securities that are components in a portfolio. Unfortunately, if a portfolio consists of one hundred to two hundred securities; thousands of correlation coefficients will be needed. Estimating thousands of correlation coefficients would take a great amount of time. Furthermore, the ability to determine these correlation coefficients is limited by the organizational structures within portfolio analysis.⁵⁸ Therefore, to simplify matters portfolio managers use the single-index model to estimate the correlation matrix. Essentially, the single-index model assumes that the co-movement of stocks is caused by a single common influence or index.⁵⁹ To measure and compare the co-movement of securities, portfolio managers use a single benchmark. This single benchmark is based on the observation of how stocks move in relation to the market. There is a direct relationship between stock prices and market volatility. When the market goes up, stocks tend to increase in price, whereas when the market goes down, stock usually decrease in price.⁶⁰ Thus, security returns might be correlated because of a common response to market changes. Beta, the single index or benchmark, measures how a security moves relative to the overall market movement.⁶¹ Beta can also be defined as the sensitivity of a security to a broad market index. If a beta's value is greater than one, the security tends to fluctuate greater than the market average. On the other hand, if beta's value is less

⁵⁸ Edwin J. Elton and Martin J. Gruber.

⁵⁹ Ibid.

⁶⁰ Ibid.

⁶¹ Robert A. Storg.

than one, the security swings less than the market average.⁶² To solve for beta a portfolio manager should use the following equation:

$$(5) \quad \beta = \text{COV}(R_i, R_m) / \sigma_m^2$$

where R_m is the return on the market index, σ_m^2 is the variance of market returns and R_i is the return on security i .

The beta equation above compares beta to only one security. On the other hand, the beta of a portfolio is a weighted average of the component betas. The weights reflect the percentage of the total investment placed in each security.⁶³ Beta of a portfolio:

$$(6) \quad \beta_p = \sum_{i=1}^n x_i \beta_i$$

With the knowledge of the variance of the market index and the portfolio beta, a portfolio manager can calculate the portfolio variance. The portfolio variance equation with the beta terms is:

$$(7) \quad \sigma_p^2 = \left[\sum_{i=1}^n x_i \beta_i \right]^2 \sigma_m^2 + \sum_{i=1}^n x_i^2 \sigma_{ei}$$

The second term in equation (7) represents unsystematic risk in a portfolio. Unsystematic risk is the risk of a price change due to the unique circumstances of a particular security.⁶⁴ Unsystematic risk differs from systematic risk in that systematic risk refers to risk factors that are common to the entire economy or market.⁶⁵ Unsystematic or firm-specific risk can be eliminated from a portfolio by diversifying one's securities. The reason this occurs is because the e_i terms have zero expected values.⁶⁶ According to the law of averages when more stocks are added to the portfolio, the firm specific elements cancel out. Thus, risk attributable to non-market factors becomes even smaller as the

⁶² Ibid.

⁶³ Ibid.

⁶⁴ Ibid.

⁶⁵ Zvi Bodie, Alex Kane, & Alan J. Marcus, Investments, 5th Ed., (New York: McGrawHill/Irwin, 2002).

⁶⁶ Ibid.

portfolio becomes larger. Because unsystematic risk can be diversified away and is negligible, market risk remains and thus the variance of a portfolio, equation (7), can be simplified into the following:

$$(8) \quad \sigma_p^2 = \beta_p^2 \sigma_m^2$$

The return on a stock using the benchmark beta can be computed as the following:

$$(9) \quad R_i = \alpha_i + \beta_i R_m + e_i$$

where:

α_i is the alpha of security i , β_i is the beta of security i , R_i is the return on security i , and e_i is unsystematic risk of security i . Alpha is “a coefficient measuring the risk-adjusted performance, considering the risk due to the specific security, rather than the overall market.”⁶⁷ A large alpha signifies that the security has performed better than would be expected given its beta.

Similarly, the return for a portfolio of securities can be written as:

$$(10) \quad R_p = \alpha_p + \beta_p R_m + e_p$$

where:

$$\alpha_p = \sum_{i=1}^n x_i \alpha_i$$

$$\beta_p = \sum_{i=1}^n x_i \beta_i$$

$$e_p = \sum_{i=1}^n x_i e_i$$

As previously stated the e_p term, firm specific risk, becomes zero since it is insignificant to the portfolio's return. Therefore equation (10) can be written as:

$$(10.a) \quad R_p = \alpha_p + \beta_p R_m$$

By using the single index model, an investor can easily forecast the co-movement between stocks in relation to the market's influence. The method that portfolio managers use to predict portfolio performance is by estimating future betas. Future betas can be

⁶⁷ “Alpha,” [Investorwords.com](http://www.investorwords.com), accessed on March 23, 2005 at <<http://www.investorwords.com/183/alpha.html>>

estimated by using historical data. It has been proven that historical betas provided useful information about future betas that result in optimized portfolios.⁶⁸

⁶⁸ Edwin J. Elton & Martin J. Gruber.

Multi-Index Models

The single-index model is useful in understanding why security returns change; however, analysts believe that there are influences beyond the market that causes simultaneous stock movement. Thus, researchers decided to extend the single-index model and create a more accurate model that accounts for non-market factors that cause securities to move together. This model is the multi-index model. Non-market influences are economic factors or structural groups that account for the correlation of securities beyond what the market index explains.⁶⁹ A structural group that is of particular interest to portfolio managers is industries. Multi-index models that include industry effects refer to factors associated with a specific line of business. Industry classification is important to portfolio managers because securities that share certain industry characteristics tend to move in similar directions.⁷⁰ For example, consider that the market is suffering from a recession. Customers can no longer afford the prices of luxury goods such as MP3 players, therefore, the audio and video equipment industry will suffer a decline causing companies such as Sony, Apple and Panasonic to lose profits. However, the retail grocery industry will not suffer a loss because during a recession people continue to buy food.

The general multi-index models include factors, besides the market, that affect the covariance between securities such as interest rates, and industries. Financial analysts find it mathematically convenient if the indexes are uncorrelated because it simplifies the computation of risk and aids in selecting optimal portfolios.⁷¹ Therefore, the return of a multi-index model can be written as follows:

$$(11) \quad R_i = a_i + b_{i1}I_1 + b_{i2}I_2 + b_{i3}I_3 + \dots + b_{iL}I_L + c_i \quad ^{72}$$

⁶⁹ Ibid.

⁷⁰ Robert A. Strong.

⁷¹ Edwin J. Elton & Martin J. Gruber.

⁷² Ibid.

where all I_j are indexes that are uncorrelated with each other, and $b_{i,j}$ measures the sensitivity of the return on stock i to changes in the index j . Also, a_i is the expected value of the security's unique return. Similar to the single-index model's e_i , c_i is the random noise component, or error term, of the multi-index model. c_i also has an expected value of zero. A mean of zero implies that stocks only vary together because of the correlation they have with the indexes specified in the multi-index model.⁷³ Therefore, the multi-index model can be simplified as:

$$(11.a) \quad R_i = a_i + b_{i1}I_1 + b_{i2}I_2 + b_{i3}I_3 + \dots + b_{iL}I_L$$

To find the variance and covariance of the multi-index model a portfolio manager would use the following:

$$(12) \quad \text{Variance:} \quad \sigma_i^2 = b_{i1}^2\sigma_{I1}^2 + b_{i2}^2\sigma_{I2}^2 + \dots + b_{iL}^2\sigma_{IL}^2 + \sigma_{ci}^2$$

$$(13) \quad \text{Covariance:} \quad \sigma_{ij} = b_{i1}b_{j1}\sigma_{I1}^2 + b_{i2}b_{j2}\sigma_{I2}^2 + \dots + b_{iL}b_{jL}\sigma_{IL}^2 \quad 74$$

One of the most popular multi-index models is the industry index-model. The industry index-model includes market influences combined with industry effects. This industry index-model can be written as:

$$(14) \quad R_i = a_i + b_{im}I_m + b_{i1}I_1 + b_{i2}I_2 + \dots + b_{iL}I_L$$

where

I_m = is the market index

I_j = are industry indexes that are to be uncorrelated with the market and uncorrelated with each other.

Thus, the assumption behind this model is that the market and many different industries can affect returns.⁷⁵ Two different covariances are used for the industry index model.

For firms in the same industry, the covariance between securities i and k can be written as:

⁷³ Ibid.

⁷⁴ Ibid.

⁷⁵ Ibid.

$$(15) \quad \sigma_{ik} = b_{im}b_{km}\sigma_m^2 + b_{ij}b_{kj}\sigma_{Ij}^2.$$

For firms in different industries covariance between securities I and k can be written as follows:

$$(16) \quad \sigma_{ik} = b_{im}b_{km}\sigma_m^2.$$

Researchers, such as Elton and Gruber, have found that adding more indexes to a model leads to a better explanation of the historical correlation matrix.⁷⁶ Nevertheless, the multi-index model led to a poor prediction of the future correlation matrix in that each risk level tended to have lower returns.⁷⁷ Essentially, the multi-index model added more random noise as opposed to real information. Since traditional industry classifications may not produce optimized returns in relation to the multi-index model, analysts believe there may be an alternative way to group securities besides the market or industries. Multi-index models, as aforementioned, were developed to understand the correlation between securities that is not already explained by market factors. Therefore, the portfolio manager should remove the market index from stock returns and examine the correlation of residuals.⁷⁸ Stocks that have highly correlated residuals can then be combined into pseudo-industries.⁷⁹ This correlation can lead to pseudo-industries indexes, which can be used in a multi-index model. A researcher named Farrell indicated that if pseudo-industries are stable and are composed of homogeneous groups, the multi-index model would outperform the single-index model. This suggests that the multi-index model provides more detailed information when assessing expected return and risk. On the other hand, there are mixed reviews about the multi-index model in that at some risk levels superior performance is demonstrated while at others, the multi-index model is inferior to the single-index model.

⁷⁶ Ibid.

⁷⁷ Ibid.

⁷⁸ Ibid.

⁷⁹ Ibid.

International Diversification

For much of the twentieth century, the North American Equity market represented sixty percent, a majority, of world capitalization. As markets emerged abroad and European countries unified their economies, Europe, by 2001, made up one-third of the world market.⁸⁰ Because of this international economic growth, it is logical for portfolio managers to invest globally. International diversification not only allows investors to reduce total risk within their portfolio, but by investing in foreign securities, it is possible for investors to gain additional profits. The reason that investors can achieve additional profit potentials abroad is because unlike domestic markets most foreign market do not move in the same direction. When securities move in the opposite direction, investors can spread risk since securities will not react identically to monetary announcements, interest rates, or budget deficits.⁸¹ Thus, portfolios will not lose all their assets when there is a decline in the market.

The following section will present the advantages and disadvantages for international diversification, as well as the case for investing in emerging markets. The case against international diversification will be discussed because European integration has caused positive correlations between securities; thus, decreasing portfolio optimization. The case for investing in emerging markets will be presented to understand why portfolio managers diversify in Baltic markets.

⁸⁰ Bruno Solnik & Dennis McLeavey.

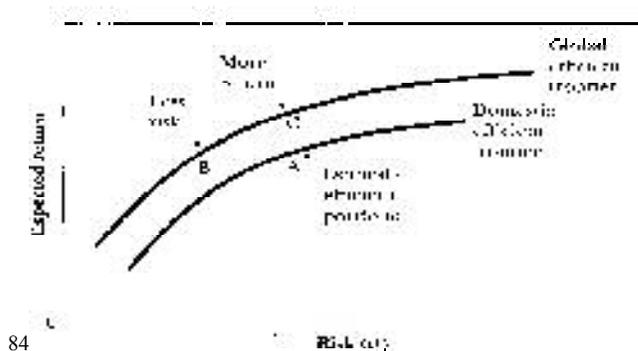
⁸¹ Ibid.

Advantages for International Diversification

Diversifying internationally allows for portfolio managers to invest in securities that have low correlations with one another. Low correlations, as previously, stated, reduce risk in an investor's portfolio. Although stock markets abroad are volatile and there is currency risk involved in foreign investments, the addition of risky foreign assets into a domestic portfolio can significantly reduce total risk because correlations between these securities are lower than one.⁸² (Securities with a correlation of one provide no diversification.)

Efficient Frontier – International

The efficient frontier, as stated above, indicates the highest level of expected return for a given level of risk, or the lowest level of risk for a given level of expected return. If one combines all domestic stocks in an efficient mean-variance manner they would be able to derive the domestic efficient frontier. Similarly, if all domestic and international stocks combine into efficient mean-variance manner, one would be able to create the global efficient frontier.⁸³ The domestic and global efficient frontier can be viewed in the following graph:



⁸² Ibid.

⁸³ Ibid.

⁸⁴ Ibid.

This graph conveys the risk and return trade off of internationally diversified portfolios versus domestic-only portfolios. The global efficient frontier, represented above, is to the left of the domestic efficient frontier. By being to the left of the efficient frontier, a global portfolio has increased return opportunities. Moreover, the global efficient frontier indicates that there are greater risk diversification benefits because the global portfolio encompasses many more securities than the domestic portfolio.⁸⁵ For instance, portfolio A lies on the domestic efficient frontier and portfolio B lies on the global efficient frontier. Portfolio B offers less risk to the investor for the same return.⁸⁶ Furthermore, Portfolio C, on the global efficient frontier, provides the same amount of risk as portfolio A, but offers more return.⁸⁷ The reason global portfolios provide increased return opportunities and lowers risk levels is because of the independent price behaviors between capital markets.⁸⁸ If the U.S. market moved in conjunction with the European markets, such as the Baltic markets, an investor's ability to diversify would not exist.

Correlation Coefficients of Stocks Markets

Since correlation coefficients between international markets continuously vary, portfolio managers always have the ability to reduce risk and diversify abroad. The next section will examine the correlations between countries' stocks markets. The matrix below presents the correlations across selected national stock markets from January 1992 – January 2002. The returns on the bottom left part of the matrix are measured in U.S. dollars, while the top right part of the matrix gives the correlation when all foreign

⁸⁵ Ibid.

⁸⁶ Ibid.

⁸⁷ Ibid.

⁸⁸ Ibid.

currency risk is fully hedged using forward agreements; yet, there is little difference between the hedged and un-hedged stock market correlations.⁸⁹

Correlation of Stock Markets, January 1992–January 2002
Monthly Returns in U.S. Dollars (bottom left) and Currency Hedged (top right)

	USA	Canada	U.K.	France	Germany	Italy	Switz.	Japan	Hong Kong	Europe	EAFF	World	S&P/LFCG
USA	1.00	0.80	0.69	0.58	0.59	0.31	0.80	0.39	0.71	0.69	0.68	0.56	0.50
Canada	0.79	1.00	0.38	0.63	0.59	0.42	0.55	0.59	0.58	0.67	0.66	0.76	0.62
U.K.	0.66	0.51	1.00	0.74	0.62	0.39	0.69	0.56	0.53	0.74	0.68	0.71	0.50
France	0.58	0.66	0.72	1.00	0.82	0.64	0.68	0.36	0.60	0.74	0.68	0.67	0.54
Germany	0.61	0.59	0.61	0.77	1.00	0.61	0.65	0.31	0.64	0.70	0.76	0.63	0.56
Italy	0.32	0.41	0.34	0.50	0.48	1.00	0.45	0.51	0.29	0.48	0.44	0.44	0.40
Switzerland	0.81	0.42	0.61	0.58	0.50	0.29	1.00	0.30	0.43	0.65	0.55	0.63	0.52
Japan	0.40	0.52	0.46	0.39	0.31	0.27	0.26	1.00	0.17	0.40	0.50	0.62	0.85
Hong Kong	0.51	0.63	0.48	0.40	0.41	0.22	0.37	0.24	1.00	0.49	0.50	0.56	0.76
Europe	0.69	0.65	0.85	0.91	0.81	0.56	0.72	0.45	0.49	1.00	0.87	0.87	0.55
EAFF	0.68	0.65	0.78	0.77	0.70	0.53	0.65	0.73	0.50	0.87	1.00	0.93	0.50
World	0.66	0.76	0.89	0.76	0.72	0.48	0.64	0.63	0.56	0.87	0.93	1.00	0.62
S&P/LFCG	0.56	0.60	0.46	0.48	0.49	0.35	0.30	0.32	0.59	0.55	0.56	0.62	1.00

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The matrix above, for the period between 1992 and 2002, indicates that the correlation between Europe and United States Stocks are 0.69. In order to understand stock price movements common to European and U.S. stocks one would need to find the common variance between the two markets. Common variance between two markets can be calculated by squaring the correlation coefficient. Therefore, 0.69 squared would be 48%. This 48% signifies that European and U.S. stock prices move together only forty-eight percent of the time. Usually the common variance between U.S. and other markets is less than thirty percent.⁹¹ For example the common variance between the U.S. and Italy is 10% ($0.32^2=10\%$). The greater the two economies are inter-related the larger

⁸⁹ Ibid.

⁹⁰ Ibid.

⁹¹ Ibid.

the covariance will be; thus, countries that are part of the European Union will be highly correlated.

Also, the matrix above provides the correlation of each national market with four international indexes: Europe, World, EAFE, and S&P/IFCG. The Morgan Stanley Capital International Inc computes the Europe, World and EAFE indices in U.S. dollars. The World index is a weighted index of the all the major stock markets in the world.⁹² The EAFE index, is the non-American world index, made up of stock markets from Europe, Australia, and the Far East. The Europe index is composed of stock markets from Western Europe. Lastly, “the S&P/IFCG composite index is a U.S. dollar market cap-weighted index of emerging stock markets.”⁹³ Originally, the International Finance Corporation of the World Bank computed this index, but now it is computed by the S&P.⁹⁴ If one examines the EAFE index, the common variance between the U.S. and non U.S. stock markets is 40% ($.63^2$). In theory, portfolio managers can benefit from diversifying internationally because 60% of global securities move independently from domestic U.S. stocks; hence, resulting in lower risk.

A stock market’s independence is directly related to a country’s economic and governmental policies.⁹⁵ Regulations and constraints imposed by governments concerning fiscal and monetary policies, technological specialization, and cultural or sociological factors can contribute to a market’s independence. The greater two economies differ, the more independent and less correlated they will be; thus, lowering

⁹² Ibid.

⁹³ Ibid.

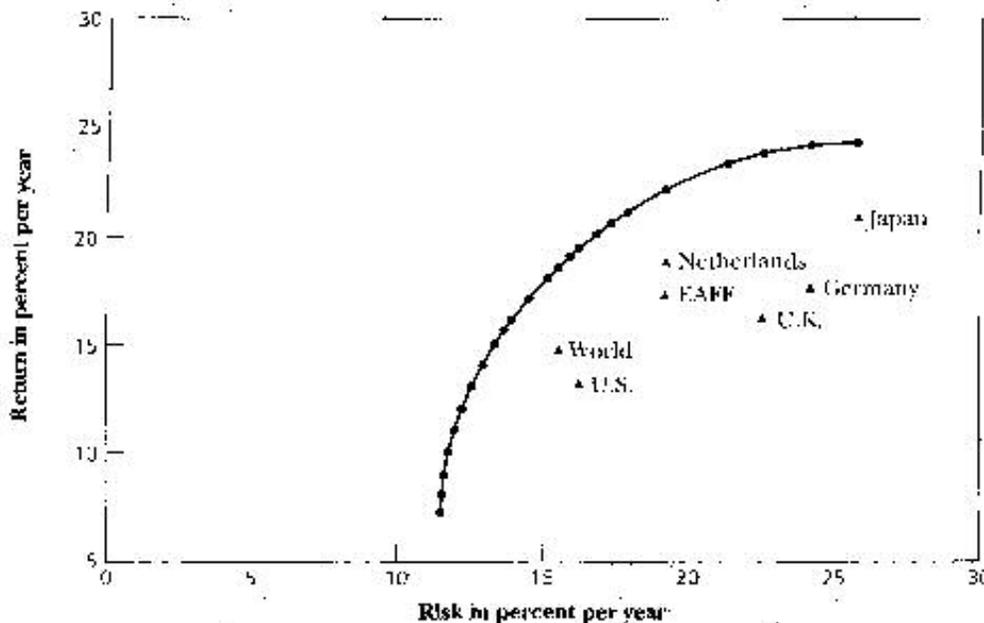
⁹⁴ Ibid.

⁹⁵ Ibid.

an investor's risk. European countries, on the other hand, are highly correlated with one another because their economic policies are integrated.

Optimizing Portfolio Return and the Efficient Frontier

Reducing risk is not the only reason a portfolio manager diversifies internationally. If a portfolio manager's primary goal was to reduce risk, he could have easily invested in treasury bills, risk-free assets. Nonetheless, in an efficient market, investing in a risk-free asset would lower expected returns.⁹⁶ On the other hand, international diversification can decrease risk without reducing expected return. The reason higher expected returns may result from international investment is because of growing economies, changes in governmental policies, the creation of new firms worldwide, or currency gains.⁹⁷ An example of this is presented in the following graph for the Efficient Frontier of stocks from (1980-1990).



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⁹⁶ Ibid.

⁹⁷ Ibid.

⁹⁸ Ibid.

During the 1980's the United States stock market had a variance of 16.2 percent and annualized return of 13.3 percent.⁹⁹ Global stock markets and international indices were more volatile. Global economies were riskier because of political changes such as the fall of communism in Eastern European. The collapse of communism created new markets, which in turn were uncertain environments to invest in. Because of government changes and emerging economies, there was significant currency risk. According to the efficient frontier, when securities or portfolios pose greater risk, one should be compensated with greater return. The global indices illustrated above depict this situation. For example, the EAFE has about 19.5% of risk per year with a return of about 17% annualized return. If the U.S. stock portfolio included international investments, its return would increase significantly without affecting risk. A global stock portfolio with the same level of risk, according to the efficient frontier in the graph above, could achieve a total return of about 19 percent.¹⁰⁰ In comparison to only investing in U.S. portfolios, investing abroad increases return considerably, about six percent.

⁹⁹ Ibid.

¹⁰⁰ Ibid.

The Case Against International Diversification

Although many analyst strongly believe that international diversification lowers risks and increases expected return, other analysts disagree stating that international diversification may hinder portfolio performance. In Bruno Solnik's International Investments, Solnik cites three reasons why international diversification may impede a portfolio's performance. The first reason is that international diversification strongly overstates risk benefits.¹⁰¹ Secondly, skeptical investors have analyzed that historical performance of the domestic market has outperformed foreign markets.¹⁰² Lastly, numerous physical barriers of international investing produce costs that cannot be compensated by foreign expected return.¹⁰³ These arguments will be described in further detail.

Increase in Correlation Coefficients

In the past decade, analysts have observed that international correlations have become more highly correlated.¹⁰⁴ As markets become coordinated the benefits of international diversification, such as reduced risk and increased expected returns, extensively disappear. Over the last half of the twentieth century, economies and financial markets have become increasing integrated; thus, causing high correlations of international security prices.¹⁰⁵ Economic and financial integration has occurred because of the following. First, many capital markets are being deregulated.¹⁰⁶ Deregulation creates global asset opportunities for foreign investors. With deregulation foreign

¹⁰¹ Ibid.

¹⁰² Ibid.

¹⁰³ Ibid.

¹⁰⁴ Ibid.

¹⁰⁵ Ibid.

¹⁰⁶ Ibid.

markets are no longer segmented; instead, they become integrated with other markets. When foreign securities become highly correlated with domestic securities, an American's portfolio will not be optimized by diversification because the two securities will react in a similar fashion. Secondly, capital mobility among developed countries has increased considerably.¹⁰⁷ Capital mobility increases commonality of funds across stock markets; thus, markets again become highly correlated. A third reason that international correlations have increased over time is because national economies are becoming more synchronized.¹⁰⁸ For example, the development of the Europe Union has created the European Central Bank, in which every member country must follow the ECB's monetary policy.¹⁰⁹ Because EU countries follow the same monetary policies, correlations between countries are directly related; thus, decreasing diversification opportunities. Furthermore, organizations such as the EU and NAFTA are allowing free trade within their economies.¹¹⁰ These free trade agreements also result in high correlations between foreign markets.

The globalization of the economic environment prompted many corporations to invest in opportunities worldwide. Thus, correlations between countries have increased because companies have become increasingly global in their operations.¹¹¹ Global operations include increased exports, international growth of a company, and foreign acquisitions.¹¹² A prime example of foreign acquisitions is mergers and acquisitions across countries. If a U.S. corporation acquires an Estonian company, their stock price

¹⁰⁷ Ibid.

¹⁰⁸ Ibid.

¹⁰⁹ "Europe in Twelve Steps - Historic Steps."

¹¹⁰ Bruno Solnik & Dennis McLeavey.

¹¹¹ Ibid.

¹¹² Ibid.

will become highly correlated with the Baltic market. This occurs because the U.S. company is affected by the fiscal and monetary policies in Estonia. In addition to this, U.S. ownership will affect the economic environment in Estonia, causing the market to behave similar to American markets. Therefore, the legal nationality of a corporation becomes less important, causing benefits of diversifying by country to disappear and the correlation of national stock markets to increase.¹¹³

Economies are also synchronized and create high correlation coefficients when markets are volatile. The efficient frontier assumes that investors will be compensated for taking risk with a fair level of expected return. This assumption relies on the fact that the market is following a normal distribution.¹¹⁴ However, markets can be inefficient in that they deviate from the projected normal distribution. For example, markets can be inefficient by generating abnormal expected returns. Abnormal returns are returns that either outperformed or under-performed the expected return level on the efficient frontier. Markets are also inefficient, in that volatility of the U.S. market may spread to foreign markets causing unstable stock prices.¹¹⁵ Consider the U.S. stock market crash of October 1987. When the U.S. stock market crashed in October 1987, the British, Japan, and German markets also experienced significant declines.¹¹⁶

¹¹³ Ibid.

¹¹⁴ Ibid.

¹¹⁵ Ibid.

¹¹⁶ Ibid.

Historical Performance may not Indicate Future Performance

Investment managers believe that they will continuously optimize their portfolio if they internationally diversify. Nevertheless, some analysts believe that investing purely in a domestic market will generate better returns.¹¹⁷ For example, during the 1970's and 1980's the Japanese equity markets outperformed the rest of the world.¹¹⁸ By diversifying in many countries and not focusing on Japanese stocks, many investors lost money. Investing in one country can prove to be profitable; however, this may not be a theory to rely on because, as stated previously, economic markets are inefficient. Consider the Japanese equity market during the 1990's, their stocks performed poorly in comparison to the United States market that saw extensive profits.¹¹⁹

Barriers to International Investments

Investing internationally can prove to be beneficial for many portfolio managers; nonetheless, other investors do not diversify internationally because of the following potential barriers.

Familiarity with Foreign Markets:

Investing internationally may be intimidating to portfolio managers because they may be unfamiliar with foreign customs and markets.¹²⁰ Hence, investors may feel uneasy about different languages, time zones, and the way countries proceed in business or present project.¹²¹ To avoid these uncomfortable feelings managers invest

¹¹⁷ Ibid.

¹¹⁸ Ibid.

¹¹⁹ Ibid.

¹²⁰ Ibid.

¹²¹ Ibid.

domestically. Many investors believe that diversifying internationally would be more risky because foreign markets are unfamiliar.

Political Risk:

Many emerging markets have experienced political, economic, and monetary crises that have caused the value of investments to decrease significantly.¹²² Because of these economic disasters investors do not want to invest abroad. For example, in Brazil during the years of 1997 and 1998, the government artificially maintained the value of the Brazilian real. The government did this to instill the idea that the Brazilian economy would achieve strong economic growth and stability.¹²³ However, the government could not resolve continuing account deficits and domestic inflationary forces.¹²⁴ Eventually, the Brazilian real devalued at a drastic rate. Because the economy did not rebound and the government was unstable, investors were unsettled by this turn of events and returned to domestic diversification.

Market Efficiency:

Many foreign markets are not efficient because investments lack liquidity. A liquid asset is an asset that can be easily convertible to cash. Since some markets are very small, it may be difficult to trade large volumes of stocks. Moreover, at the end of an investment term, small foreign markets may find it difficult to convert stocks back into cash. This inflexibility is a risk to many portfolio managers, because they need to ensure that they can obtain their client's investment. The imposition of capital controls is another liquidity risk.¹²⁵ Capital controls limit the sale of foreign assets to portfolio

¹²² Ibid.

¹²³ Michael H. Moffett, Arthur I Stonehill, & David K. Eiteman.

¹²⁴ Ibid.

¹²⁵ Bruno Solnik & Dennis McLeavey.

managers and the repayment of portfolio proceeds.¹²⁶ Consider that a portfolio manager wants to invest in a specific foreign security. Unfortunately, the portfolio manager cannot invest in this asset fully because the foreign market prevents him from making this transaction. This capital control, limits the portfolio managers from achieving the return he desired. Also, this restriction is perceived as a risk to the investor since he cannot obtain his preferred return. Limiting what the investor can take back to his home country is an additional capital control. Again, this restricts the return a portfolio manager can make. Since liquidity risks regulate returns, a portfolio manager may be intimidated and discontinue diversifying internationally.

Many foreign markets are inefficient because they do not provide timely and reliable information on investment and market activity.¹²⁷ Investors avoid these markets because they do not want the added risk. Some foreign markets are also inefficient because of they are laidback in terms of price manipulation, insider trading, and corporate governance.¹²⁸ For example, majority stockholders in a careless country can control the interest of a stock with the intention of destroying a smaller investor's potential return.¹²⁹ Countries that do not regulate this behavior force portfolio managers to stop investing in these countries because they cannot control the added risk.

Regulations:

Some countries regulate the amount of foreign investment that portfolio managers can assume.¹³⁰ For example, consider that a portfolio manager can only have one third of a Baltic stock within his portfolio, whereas the other two-thirds of the portfolio must be

¹²⁶ Ibid.

¹²⁷ Ibid.

¹²⁸ Ibid.

¹²⁹ Ibid.

¹³⁰ Ibid.

invested in U.S. securities or other countries. On the other hand, some countries may regulate the amount of foreign investment in national corporations.¹³¹ These regulations may be a barrier to portfolio managers because they cannot optimize their portfolio.

Transactions Costs:

Transaction costs are usually higher for international portfolios in relation to domestic portfolios. The most common transaction cost is the brokerage commission. Market deregulations have caused commissions to decrease considerably. However, when dealing with foreign securities trade is a large component of transaction costs.¹³² Transaction costs can also be higher in smaller foreign markets because liquidity is limited on large issues. Another reason that transaction costs are larger on international investments rather than domestic investments is because it is more difficult and more costly to manage a foreign portfolio. For example, managers have to subscribe to international databases, collect data and research corporations and the environment abroad, utilize an international accounting system, and incur communication cost such as: international telephone, computer links, and travel.¹³³

Custody costs are higher for international investments as well. The reason custody costs are higher for international investors is because there needs to be a two-level custodial agreement. A two level custodial agreement essentially puts a master guardian in charge of the investments and then the master communicates with sub-guardians for every country.¹³⁴ More costs are incurred because there needs to be a multi-currency system of accounting, reporting, and cash-flow collection. Transactions

¹³¹ Ibid.

¹³² Ibid.

¹³³ Ibid.

¹³⁴ Ibid.

costs and custody costs limit international diversification benefits because the cost may significantly decrease the expected return. By diversifying domestically, portfolio managers may attain the same level of return or higher return without incurring higher transaction costs.

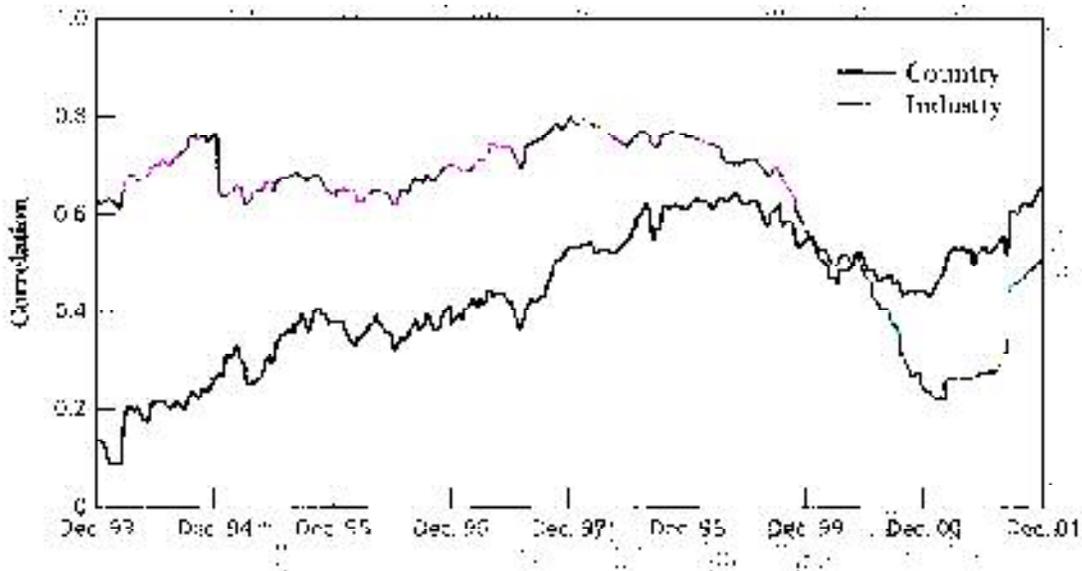
Currency Risk:

Currency risk can be a barrier to international diversification because foreign markets can be volatile. Although currency hedging can reduce this risk, hedging leads to additional administrative and trading costs.¹³⁵

¹³⁵ Ibid.

Diversifying by Industry

As markets become more global, countries become highly correlated limiting portfolio diversification. Some studies have proven that diversifying by industry results in higher returns than when investors diversify by country. The reason this is occurring is because portfolios diversified according to industry have lower correlations than portfolios diversified by countries.¹³⁶ As stated earlier, lower correlations imply larger diversification benefits. The graph below created by UBS Global Asset Management confirms that industries correlations, in the past few years, are lower than country correlations.



Source: UBS Global Asset Management

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¹³⁶ Ibid.

¹³⁷ Ibid.

Diversifying by Country

Although industries appear to have lower correlations than countries, a portfolio manager should still consider regions when diversifying.¹³⁸ For example, a corporation that is invested abroad and at home is influenced by both countries. Diversifying one's assets at home and in foreign markets is beneficial because it does not leave an investor vulnerable to the dangers of one market. Nonetheless, diversifying one's portfolio across industries and across countries is the most beneficial approach because it fully captures the risk benefits of international diversification.¹³⁹

¹³⁸ Ibid.

¹³⁹ Ibid.

Emerging Markets

In emerging markets volatility, liquidity, and political risks are higher; yet, these risks increase expected returns over the long run.¹⁴⁰ Thus, emerging markets offer attractive investment opportunities. Over the period of December 1987 to August 2002, the Emerging market index outperformed the World index.¹⁴¹ Even though the emerging market index performs better than the world index, the two indices are positively correlated. If a portfolio is made up securities from developed markets and emerging markets, some risk is diversified away due to the low correlation between the two markets.¹⁴² Thus, emerging markets can have a positive influence on a portfolio because it appears that expected returns would outperform their risk levels.

Factors that Affect Risk and Returns in Emerging Markets

The three factors that affect expected returns in emerging markets are volatility, correlations, and currency risk. Volatility is the trait of being unpredictable or irresolute. Emerging markets are significantly more volatile than developed markets. Hence, standard deviation is not a satisfactory measure of market risk in emerging markets because there is always the possibility of a catastrophe.¹⁴³ Most emerging markets arise from political reform or the liberalization of a country from previous laws or restrictions. These changes may cause emerging countries to have political and social instability, which results in erratic returns. Emerging countries that experience considerable economic growth may be incapable of handling increases in wealth because conflicts

¹⁴⁰ Ibid.

¹⁴¹ Ibid.

¹⁴² Ibid.

¹⁴³ Ibid.

between social classes will ensue.¹⁴⁴ For example, poor citizens of emerging markets may resent the wealthy and react negatively. This unrest can pose a threat to the market and cause negative or unpredictable returns.

In emerging countries underdeveloped infrastructures can limit economic growth.¹⁴⁵ Infrastructures includes the facilities and services that are needed for a functioning society such as transportation and communication systems, and institutions such as schools, banks, post offices and prisons. For example, many countries are unable to train their workers in understanding the international culture and techniques of conducting business.¹⁴⁶ Because of this educational weakness, emerging markets may fall behind developed economies; hence, lowering returns to unknown levels. Since education systems are inferior to developed countries, the quality of goods produced will be below international standards.¹⁴⁷ By producing goods that do not satisfy international standards, investors face a volatile market with more risk and irregular returns.

Corruption is another reason why emerging markets are volatile. In many emerging markets family ownership favors friends and family over other foreign and domestic stockholders' interest. Furthermore, politicians and corporation managers conspire to get the best return for themselves while damaging the best interest of the shareholder. Unlike developed countries, the banking sectors of emerging markets are poorly regulated and lack the sophistication of modern financial operations.¹⁴⁸ Also, many banks in emerging countries assume risk and provide money to customers even when they do not have the funds to lend. Because companies act arrogantly toward

¹⁴⁴ Ibid.

¹⁴⁵ Ibid.

¹⁴⁶ Ibid.

¹⁴⁷ Ibid.

¹⁴⁸ Ibid.

shareholder's needs and banks are negligent in managing investor's funds, the emerging market responds in a more volatile manner than it would in a developed country. Some portfolio managers may not invest because they are suspicious that their investment will not materialize.

Since the environment of emerging markets is unstable, crises tend to be larger and longer than crises in developed markets.¹⁴⁹ These crises usually spread to other emerging markets in the same region; hence causing higher correlations between the markets. When the markets have higher correlations, it is more difficult to diversify risk and generate higher returns. However, crises in emerging markets generally do not spread to developed markets; thus, the low correlations between developed and emerging markets is sustained allowing for stability in risk and return trade-off.¹⁵⁰

The last fact that can affect expected returns in an emerging market is currency risk. Developed markets display a negative correlation in relation to the value of their currency.¹⁵¹ For example, if a developed stock market level increases, the value of the local currency will depreciate. Emerging markets, on the other hand, experience the opposite. When emerging market increase in value, so does the value of their currency and visa versa. Consider that an emerging market experiences a crisis. This crisis will result in significant decrease in returns. At the same time, the currency of the emerging market will decrease drastically. This positive correlation in emerging markets indicates that foreign investors will suffer doubly from currency risk.¹⁵²

¹⁴⁹ Ibid.

¹⁵⁰ Ibid.

¹⁵¹ Ibid.

¹⁵² Ibid.

Portfolio Return in Emerging Markets

Emerging markets wish to become developed markets. To become a developed market, an emerging market must actively attract global investors.¹⁵³ These international investors will enable the market to grow, hopefully leading to higher returns.

Nonetheless, the success of an emerging market depends on its ability to compete with other world markets. To compete sufficiently with developed markets, emerging markets must have a lower cost structure. Therefore, emerging markets should utilize the liberalization of international trade to achieve this goal.¹⁵⁴ With liberalization of international trade emerging markets would be able to lower labor cost, lower production costs compared to developed countries, and lower levels of unionization.¹⁵⁵ By having a lower cost configuration, emerging markets will be able to maximize returns for investors. Emerging markets could also maximize returns by regulating corruption in the government and financial industry. By enforcing stricter policies and prohibiting monopolies, markets will become more efficient. If emerging markets are successful in converting themselves into developed markets, higher returns will be realized.

Investing in Emerging Markets

Most emerging markets are lenient in allowing foreigner invest in their securities; however, foreign investors, from time to time, face many restrictions. For example, emerging markets can limit a foreigner from investing in a company. The reason emerging markets put a maximum on the percentage that can be invested is because they do not want foreign stakeholders to own a share large enough that will enable the foreign

¹⁵³ Ibid.

¹⁵⁴ Ibid.

¹⁵⁵ Ibid.

investor to take over the company. Repatriation of income is another restriction placed on investors of emerging markets. For example, investors must return capital to countries especially in times of severe economic crisis. Another restriction placed on investors of emerging markets are discriminatory taxes. Discriminatory taxes are only applied to foreign investors.¹⁵⁶ This may make a foreign portfolio manager not want to invest because it is an added risk that can lower return. Foreign currency restriction is an additional risk that can discourage investors. For instance, the Chinese market has a dual currency system; where the Chinese apply one currency rate to domestic investors and a higher rate to foreign investors.¹⁵⁷ Some emerging countries only allow authorized investors to participate in their market.¹⁵⁸ This constraint can restrict a portfolio manager from properly diversifying his portfolio; hence, losing the chance to lower risk and increase return. The last major problem of investing abroad is the lack of liquidity within the emerging market. Since emerging market are instable and crises can occur frequently, it is more difficult to convert securities back into cash. Risk averse investors are unwilling to take this chance because they may lose their entire investment. Although emerging markets exhibit higher volatility than developed markets, have increasing correlations during times of crisis, and pose restrictions to foreign investors, these higher risks compensate investors with even higher returns; thus, making it worthwhile to invest in emerging markets.

¹⁵⁶ Ibid.

¹⁵⁷ Ibid.

¹⁵⁸ Ibid.

Hypothesis

This study will test whether industry-based diversification strategies will obtain higher diversification benefits than country-based strategies in the Baltic area markets. At the same time, the study will examine, which portfolios country or industry become more highly correlated after the Baltic states, Estonia, Latvia, and Lithuania, joined the European Union. In essence, have Baltic countries joining the European Union increased correlations; hence, causing a decrease in diversification benefits for the Baltic investor? This study will also examine whether the variance of a portfolio, made up of nineteen Baltic securities, increased or decreased. Essentially, has Baltic association into the European Union changed the Efficient Frontier? Has the Efficient Frontier shifted in our out? Therefore, to understand these correlation differences, this paper will examine and compare the performance of portfolios from a pre-convergence period of August 1, 2003 - May 1, 2004 and post-convergence period of May 1, 2004 – February 11, 2005. This study will focus on a Latvian investor's point of view.

Results & Conclusions

Country Correlation Matrix

As previously stated, diversifying one's assets at home and in foreign markets is beneficial because it does not leave an investor vulnerable to the dangers of one market. With the development of the European Union, all member states must abide by the monetary policies set by the European Central Bank. By following the same monetary policies, European economies become more synchronized. In theory it is presumed that after entering the EU, Latvian securities will be highly correlated with EU member markets and other developed countries; thus, causing a decrease in diversification opportunities. To test this assumption, two different correlation matrices were created. The first matrix consists of correlation coefficients between countries for forty weeks before the European Union accession day of May 1, 2004. The second matrix consists of correlation coefficients between countries forty weeks after EU membership, May 1, 2004 through February 11, 2005. Each matrix is made up of nine different country indices: United State's S&P 500, the Baltic's BALTIX, Latvia's RIGSE, Estonia's TALSE, the United Kingdom's FTSE, Italy's MIBTEL, France's FCHI, Germany's GDAXI, and Vanguard's European Index VEURX. The BALTIX index is calculated on a daily basis using the most recent official prices of all shares listed on Latvia's Riga Stock Exchange, Estonia's Tallinn Stock Exchange, and Lithuania's Vilnius Stock Exchange.¹⁵⁹ Lithuanian indices and securities were going to be included in the data of this paper; however, the Vilnius Stock Exchange did not list securities older than January 1, 2004. The VEURX index indicates how European markets move together as a whole.

¹⁵⁹ "Calculation of BALTIX," [The OMX website](http://files.ee.omxgroup.com/oigusaktid/en_baltix.pdf). Accessed on May 3, 2005 at <http://files.ee.omxgroup.com/oigusaktid/en_baltix.pdf>

The first step in creating the correlation matrix was to find each country indices' adjusted close for forty weeks before and after the accession date of May 1, 2004. Once these prices were obtained, they needed to be converted into Latvian Lats (LVL). The closes for the BALTIX, TALSE, MIBTEL, FCHI, GDAXI and VEURX were originally in euros. The United State's S&P needed to be converted from U.S dollars to LVLs, while the United Kingdom's FTSE needed to be converted from British pound to LVLs. When converting a close, one needs to take the original price and multiply that price by the conversion rate. These conversions can be seen in the tables provided in the appendix.¹⁶⁰

The second step was to find the return for each country's index. The calculation of the indices returns is the following:

$$r = (\text{Today's Price} - \text{Yesterday's Price}) / \text{Yesterday's Price}$$

After the returns were calculated, finding the expected return for each index before and after May 1, 2004 was the next step. The portfolio return equation was used to find the expected return. Once the expected return is established, the variance for each index can be easily obtained. For example, in calculating the variance for BALTIX's pre-convergence period, I took the return for each week and subtracted that value by the expected return. This result was then taken to the second exponent and divided by thirty-nine. After that, the calculations for each week were added together. This sum represents the BALTIX's variance for the pre-convergence period August 1, 2003 – May 1, 2004. This procedure was repeated for the other eight country indices. To find the variance for the period after convergence, May 1, 2004 – February 11, 2005, this process

¹⁶⁰ Each index has its own table, which shows how conversions, returns, variances, covariances, and correlations were calculated.

was also followed. However, in calculating the variances for indices after May 1, 2004, I needed to divide by forty instead of thirty-nine. The reason I divided by forty instead of thirty-nine was because the post-convergence data consisted of one more week.

Calculating the covariances between the nine indices was the next course of action. Using the formula $(n^2-n)/2$, the actual number of covariances needed was thirty-six. $[(9^2-9)/2 = 36]$ To find the covariances, I created a table that lists the weeks of pre-convergence and post convergence. In the following columns, I calculated the difference between each index's return and expected value; hence creating nine columns. The next thirty-six columns represent the pair wise combinations or covariances of the indices. In order to calculate the covariance between two indices, such as the S&P and the BALTIX, the difference between the S&P's return and expected value would be multiplied by the difference between the BALTIX's return and expected value for each week. The products of these weeks were then added together and divided by either thirty-nine or forty depending on the convergence period. This process was repeated for each pair wise combination.

After finding the covariance, the last step was to calculate the correlation coefficients between the nine indices for the period before and after European unification. As mentioned previously, the correlation coefficient is simply the covariance between returns of two securities divided by the product of their standard deviations: $\rho_{kj} = \text{COV}(k,j) / \sigma_k * \sigma_j$. When these calculations were completed, the correlation matrix was created.

The *Country Correlation Matrix*, located in Table 1, depicts the correlation matrices for the period before entering the European Union, August 1, 2003 – May 1,

2004 and after integration, May 1, 2004 – February 11, 2005. The correlation between any index and itself is one. Also, the reason that only half the matrix is filled is because the correlation between RIGSE and BALTIX is the same as BALTIX and RIGSE. In analyzing the impact of the European Union on cross-country diversification, I focused on the increases or decreases of correlation coefficients concerning Riga's RIGSE, BALTIX, and Tallinn's TALSE's. The Correlation Matrix of May 1, 2004 – February 11, 2005 illustrates these results. The correlations highlighted in yellow specify that correlations increased after the Baltic's entered the EU. Correlations highlighted in blue signify that correlations between countries decreased after European unification. Pink highlighted correlations indicate that there were slight decreases in correlations after May 1, 2004.

If one looks at the Riga column in the Correlation Matrix August 1, 2003 – May 1, 2004, Riga's correlations with the United Kingdom, Italy, France, Germany and Vanguard's European indices are all negative. These negative correlations signify that before entering the European Union, correlation coefficients between European country index returns were inversely correlated. However, after the Baltic entry date of May 1, 2004, cross-country correlations increased significantly not only for correlations between Riga and European countries, but also for correlations between Riga and the United States, and Riga and the BALTIX index. The percent increase in these correlations varies anywhere from 39% to 304%. For instance, before EU membership the correlation between Riga's index and the Vanguard indices was -.226. Nevertheless, after European integration, the correlation between the two indices was .33044. This is a 242% increase in the correlation coefficient between RIGSE and VEURX. BALTIX correlations have

also increased with other countries such as the United Kingdom, Germany, and the Vanguard European index. Tallin has increased correlations with Germany and the Vanguard European index as well. The reason for this increase in correlations may be due to the fact that EU member countries' economies are becoming more synchronized. For instance, when a country enters the EU they must follow the monetary policies set by the European Central Bank. Before EU membership the Baltic markets were small and segmented. This segmentation provided high risk, which investor's hoped would result in high returns. However, because of entrance into the EU, economies became deregulated making it easier for foreign investors to gain access to the Baltic markets. Because of the deregulation, markets became integrated with other European markets; and are thus generating positive correlation coefficients.

Another reason that cross-country correlations have increased in the Baltic area is because foreign exchange risk has decreased. On January 1, 2005, the Bank of Latvia pegged the lat to the euro. By pegging the Latvian lat to the euro, uncertainty and currency risk are reduced. These reductions in risk foster greater international investment and international trade; thus, turning the Latvian market into a global economy.¹⁶¹ Since pegging to the euro causes less currency risk, a greater number of people are likely to invest in the Baltic area. Before EU membership, the Baltic economy was considered a small emerging market, where investors could benefit from high risk and hopefully be rewarded with even higher returns. By becoming global and pegging their currency to the euro, Latvian investors' opportunity to diversify by country decreases.

¹⁶¹ "The Current Monetary Policy: the Lat is Pegged to the Euro," [The Bank of Latvia](http://www.bank.lv/eng/print/?40678&PHPSESSID=cc87cad6b36dbbfc1e6f788037935312). Accessed on May 3, 2005 at <<http://www.bank.lv/eng/print/?40678&PHPSESSID=cc87cad6b36dbbfc1e6f788037935312>>

Nonetheless, in the correlation matrix May 1, 2004 – February 11, 2005, there are correlations that have decreased after the Baltic countries became members of the EU. For example, the correlation between the BALTIX and the Tallinn index decreased from .7204 to .5689. Although this is a twenty percent decrease, the correlation between the two indices is still highly positive. One reason that the correlation could have decreased is because the Baltic countries: Latvia, Estonia, and Lithuania, see themselves as competitors. For example, in May 2004, the Lithuanian government rejected a bid from Estonia's Eesti Energia for a controlling stake in Rytu Skirstomieji Tinklai, a power distribution company.¹⁶² The reason Lithuania rejected this bet was because it did not want to see a major industrial company fall into the hands of a rival state. Nevertheless, the correlation remains at a high .5689 because the Riga, Tallinn, and Vilnius Stock markets all operate on the OMX exchange.

The correlations between the S&P and TALSE and the S&P and BALTIX have decreased significantly. This decrease may be due to the fact that the U.S. dollar has depreciated against the euro making the U.S. and European markets deviate from one another. Furthermore, the correlations between the BALTIX and France's index and the BALTIX and Italy's index have decreased slightly. The unstable government in Italy and the volatile governmental and economical policies in France may cause these slight correlation decreases. However, there are a greater number of correlations that increase after EU membership. Overall, one can conclude that cross-country correlations have increased significantly due to EU membership. Therefore, Latvian investors have substantially lost the ability to diversify internationally.

¹⁶² Tim Buerkle, "Europhoria," Institutional Investor. New York: (May 2004), 1.

Table 1: Country Correlation Matrices

Country Correlation Matrix August 1, 2003 - May 1, 2004

Country	S&P	BALTIX	Riga	Tallin	United Kingdom	Italy	France	Germany	Vanguard
S&P	1								
BALTIX	0.1995222	1							
Riga	0.0100166	0.5713881	1						
Tallin	0.2522226	0.7204398	0.13996305	1					
United King	0.5149582	0.13923426	-0.2173556	0.2710445	1				
Italy	0.5076188	0.26800445	-0.1379039	0.3760859	0.720350773	1			
France	0.6579295	0.27364383	-0.1763527	0.3376734	0.848398237	0.881	1		
Germany	0.7000654	0.22826887	-0.1568113	0.3565013	0.718290763	0.8809	0.9223	1	
Vanguard - Europe	0.2246738	0.19849197	-0.2260027	0.3282379	0.686238349	0.7457	0.7026	0.67791	1

Country Correlation Matrix May 1, 2004 - February 11, 2005

Country	S&P	BALTIX	Riga	Tallin	United Kingdom	Italy	France	Germany	Vanguard
S&P	1								
BALTIX	-0.103605	1							
Riga	0.024148	0.79522964	1						
Tallin	0.0092814	0.56887361	0.24196592	1					
United King	0.2904486	0.17755071	0.12609583	0.1495426	1				
Italy	0.4337508	0.24977945	0.28169041	0.2863967	-0.002876836	1			
France	0.2881138	0.22636498	0.17993259	0.1293811	0.922986927	0.0194	1		
Germany	0.6412133	0.23655312	0.20539081	0.3630013	0.296569533	0.6212	0.3873	1	
Vanguard - Europe	0.193328	0.46894039	0.33043826	0.3823264	0.436140181	0.2427	0.5466	0.63095	1

Individual Security Covariance Matrix

In theory, market risk will decrease if an economy is integrated with other well-developed economies. To test this theory I created an equally weighted portfolio of nineteen Baltic securities and calculated the portfolio variances for the period before and after Baltic entry into the European Union. The procedure to finding covariances and variances between securities is identical to the above process of finding covariances and variances between country indices. However, for this test I will need one hundred and seventy-one covariances and nineteen variances $[(19^2-19)/2=171]$. After calculating these covariances and variances, a covariance-variance matrix was created. This matrix is needed in order to compute the portfolio variance. Generating a weight vector was the next step in this process. The weight vector consists of nineteen elements since there are nineteen securities. Because the portfolio is equally weighted, each weight will equal .052632. The weight vector is then multiplied by each column of the covariance-variance matrix; thus, calculating nineteen products. After this step, the results are multiplied by the weight vector. This product represents the portfolio variance. The portfolio variance for the pre-convergence period of August 1, 2003 – May 1, 2004 is .14206; and the portfolio variance for the post convergence period of May 1, 2004-February 11, 2005 is .0535. (See Matrices in appendix) Thus, these results follow the theory that as markets become synchronized, risk levels decrease. Although these results may just be statistical artifacts due to the short testing period, there is evidence that can validate the smaller portfolio variance.

To confirm that the portfolio variance of nineteen equally weighted securities is lower after European unification, one must check to see if the Baltic markets are more

liquid after integration. I used the deals, volume, and turnover columns for each security to determine if securities were more or less liquid after EU membership. For example, after analyzing the GRD1R security, a pharmaceutical company, it appears that this security made forty-two more deals after unification. Although trading volume decreased by 182,737, turnover increased by 90,377.30. An increase of the number of deals and the turnover indicates that a security is more liquid. Liquidity may exist because of the integration of European markets and the significant decreased currency risk. Overall, twelve securities out of the nineteen, (GRD1R, OLF1R, FRM1R, BAL1R, KLV1T, RLK1T, LSC1R, RRF1R, BLT1T, DPK1R, VSS1R, and LME1R) made a higher number of deals after integration. Six securities traded a greater number of shares than it did before integration (FRM1R, BAL1R, KLV1T, RLK1T, LSC1R, and HAE1T). About half of the securities, eight, had a greater number of turnovers (GRD1R, OLF1R, FRM1R, BAL1R, KLV1T, RLK1T, LSC1R, and HAE1T). Thus, about half of the securities in this test are more liquid than they were before the accession of the Baltic states. However, more than half of the securities traded at a lower volume after European unification. A decrease of trading volume will normally cause a decrease in covariances and these low covariances may have contributed to the smaller portfolio variance.

On October 1, 2004, the Riga stock exchange launched the Liquidity Provider program. The purpose of this program is to enhance the trading efficiency of the Riga market; hence, giving extra assurance to investors. Moreover, the securities listed on the “Liquidity Provider” are market makers. Market makers are those securities that continuously or nearly continuously maintain quotes within specified spreads. The limit price spread of “liquidity providers” is .01 LVL. The securities that meet this criteria are

LSC1R, DPK1R, GRD1R, LME1R, OLF1R, RKB1R, RTF1R, and VSS1R.

Furthermore, these securities or “liquidity providers” made more deals after integration with the exception of RKB1R whose deals decreased by one. Consequently, more liquidity exists after the Baltic’s entered the EU; thus, verifying the lower portfolio variance between the nineteen equally weighted securities.

Another reason liquidity may have increased after integration is because of the Norex Alliance that took affect on April 7, 2004. The Norex Alliance integrates the Copenhagen, Iceland, Helsinki, Stockholm, Riga and Tallinn markets. By being fully integrated there is increased liquidity, more efficient member access, broader service range, and lower costs. In September 2004, the Tallinn and Riga stock exchanges launched the Saxess trading model. All members of the Norex Alliance of Scandinavian and Baltic exchanges now use the same trading system. This trading system allows for the simultaneous transaction of a security that is traded on different exchanges. Also with this system, transaction orders can be matched automatically without the direct involvement of a broker; thus, lowering transaction costs. If the Baltic’s did not enter the European Union, the alliances between the Baltic and Scandinavian exchanges probably would not occurred. Therefore, these systems give the investors a feeling of safety and create market efficiency that appears to lead to a lower portfolio variance.

During 2004, Latvian export revenues rose about 24% while foreign investment in Estonia increased by 40%. Base metals are important export items in Latvia. This may be the reason why the security LME1R had more deals after unification. The greater foreign investment in LME1R causes greater liquidity and may have contributed to the lower portfolio variance after EU membership. Lower volumes of LME1R may have

occurred because of global price rises in metals. Increases in the price of metal may be the reason why the Telecommunications securities experienced a lower number of deals in ETLAT and HAEIT; and also the reason why manufacturing companies experienced lower volumes. As stated previously lower volumes generate smaller covariances. On the other hand, the demand for communication in the Baltics is increasing and that may be the reason why volume and turnover increased for the telecommunication security HAEIT. HAEIT's increase in volume and turnover produces greater liquidity, which ultimately lower portfolio variance.

Another reason that cross-country correlations have increased in the Baltic area is because of the globalization of the economic environment. Globalization has caused many corporations to become increasingly international in their operations. For example, in 1999, Estonian Telecom (ETLAT), a telecommunications company, was "one of the few big and liquid stocks for sale."¹⁶³ During this time, Estonian Telecom was listed as a global depository receipt on the London Stock Exchange. Because of this listing, portfolio managers were able to avoid liquidity problems in domestic markets.¹⁶⁴ Thus, Estonian Telecom emerged as the most commonly held in regional stocks. However, after the Baltic entry into the EU, the Estonian Telecom stock now follows ECB's monetary policies. Hence, Estonian Telecom, will now react in a similar fashion to European economical factors. Because Estonian Telecom no longer exists on a segmented market, the risk or variance of the stock greatly decreases.

The lower portfolio variance after European integration can also be explained by the following factors. The apparel manufacturing sectors has experience significant

¹⁶³ Oonagh Leighton, "All to play for on the Baltic fringe," Central European, (October 1999), 19.

¹⁶⁴ Ibid.

decreases in volume and turnover. Estonians' decline in demand for textiles may be the reason why volume and turnover has reduced.¹⁶⁵ This reduction may contribute to the lower portfolio variance. Overall, I think that portfolio variance decreased upon joining the EU, because the Latvian market became more systematic and opened itself up to a larger investor base. By having a larger investor base and no longer being segmented, the Baltic markets must now compete with similarly constructed European markets. Competition with other markets may cause trading volumes to decline; and thus, generate smaller covariances leading to a lower portfolio variance. Furthermore, since the lat is pegged to the euro, there is less foreign exchange risk, which may also be an explanation why the portfolio variance decreased.

¹⁶⁵ "Latvia economy: Richer and more import-hungry," [EIU Views Wire](#). New York: (July 16, 2004).

Industry Correlation Matrix

The third experiment tests if investing across industries give greater diversification benefits than investing across countries. In essence, I tested if the correlations of industries decreased after Baltic entry into the European Union. Because the Riga and Tallinn stock exchanges offer a rather small amount of securities, it was difficult to create a significant number of industries. As a result I created four industries, each industry consisted of at least four securities. The first industry is the Pharmaceutical industry, which is made up of GRD1R, OLF1R, FRM1R, and TFA1T. The second industry is the Agriculture/Food and Beverage industry. This industry is made up of five securities that include, SKU1T, BAL1R, KLV1T, RLK1T, and VNU1T. The third industry is the Shipping/Manufacturing/Production industry, which is consists of six companies that are either cargo shippers, manufacturers of apparel, or vehicle parts. RKB1R, LSC1R, RTF1R, BLT1T, KLEAT, and DPK1R are the securities that make up the Shipping/Manufacturing/Production industry. The last industry is the Telecommunication/Glass & Metal industry. This industry contains four securities, ETLAT, HAE1T, VSS1R, and LME1R. The reason glass and metal are included in this industry is because glass and metals are used to produce telecommunication equipment.

After creating industry indices the next step was to find the correlations between each industry before and after Baltic entrance into the European Union. Thus, I used the same procedure as the country correlation mentioned above. However, finding the return for each industry was a bit different. For instance, in calculating the return for the Pharmaceutical industry I found the average of the four securities for each week. Then I added those returns of each week and divided by thirty-nine or forty depending on the

convergence period. To calculate the variance and the covariance for the industries the country correlation process described above was used. This time only six covariances and three variances needed to be computed.¹⁶⁶ Correlation coefficients were calculated by dividing the covariances by the product of standard deviations. The *Industry Correlation Matrices*, in Table 2, indicates that after joining the European Union, it appears that diversifying across industries results in lower correlation coefficients. These lower correlations indicate that there are greater opportunities for a Latvian investor to diversify according to industry. However, the post convergence industry correlation matrix results are inconclusive due the small sample size of each industry's index. For example, two securities in the Pharmaceutical industry had poor performances during the forty-week period after Baltic entry into the EU; thus negatively affecting the industry returns. Also, the negative correlation after unification can be attributed to the rise in prices of agriculture, food, and metal products, as well as the decrease in demand for the manufacturing of textiles. These high prices and low demand are a risk and maybe the reason why industries are inversely related to one other. Because statistical significance cannot be established, it cannot be concluded whether which diversification strategy, industry or country, better optimizes a Baltic investor's portfolio.

¹⁶⁶ The calculations for variances, covariances, and correlations can be viewed in the appendix.

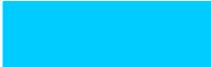
Table 2: Industry Correlation Matrices

Correlation Matrix August 1, 2003 - May 1, 2004

Industry	Pharm	Agr/Food	Ship/Manuf/Prod	Telecomm/Glass&Fe
Pharm	1			
Agr/Food	0.31669326	1		
Ship/Manuf/Prod	0.457176186	0.2571901	1	
Telecomm/Glass&Fe	0.532946011	0.3314507	0.559360456	1

Correlation Matrix May 1, 2004 - February 11, 2005

Industry	Pharm	Agr/Food	Ship/Manuf/Prod	Telecomm/Glass&Fe
Pharm	1			
Agr/Food	-0.060828627	1		
Ship/Manuf/Prod	-0.044327678	-0.080657	1	
Telecomm/Glass&Fe	0.107290136	0.2417794	0.457145337	1

 = Lower Correlation

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