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Diversification: The concept and application

Diverzifikáció: A fogalom és alkalmazásai

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Introduction

The topic of this paper is related to the concepts and application of diversification. The question that will be comprehensively researched throughout this paper is to what extent diversification can help investors to reduce the risk and whether it is the most effective solution to make investor's portfolio both with the highest possible return and the lowest possible risk exposure. In today's complex and rapidly changing business world our life is full of uncertainty and unpredictable outcomes. For example, investors are caught out by high volatility in their portfolios that might result on large losses.

Throughout this paper the concept of diversification will be developed from a broader sense to a more specific one. Firstly, the definition of risk and different types of risk will be explained. Secondly, a wide range of examples from different fields like gambling industry, insurance, corporate finance will be introduced, then a more specific diversification application will be researched. In the beginning, different types of existing portfolios will be introduced, starting from the most conservative and finishing with the most aggressive ones. Determinants of portfolio performance will be covered in general terms as well. Then, a simple two stock portfolio with different portfolio weights will be analyzed and it will be shown how investor might benefit from this diversification investing of certain amount of his holdings in a particular stock. In addition to different combinations of investing in a portfolio, short selling of a stock in order to invest in another one will be considered and new risk return possibilities will be explored. Furthermore, a third stock will be added to the portfolio analyzed as it opens new possibilities to decrease the risk. Finally, the best risk return possibility from the available options will be found.

On the other hand, some problems that an investor might face applying diversification such as "over diversification" or fallacy of a long run diversification will be introduced. Moreover the concept of concentration that is likely to have an advantage sometimes over diversification strategy will be described as well.

Hypothesis that will be tested is whether the diversification strategy proved to be an affecting tool to protect investor's portfolio from the high risk exposure. The test will be performed with the help of "Modern Portfolio Theory" designed by Harry Markowitz and the concepts of James Tobin. While Markowitz assumed that investors might choose any portfolio on the efficient frontier of risky investments, James Tobin contributed to furthering the theory by considering the implications of allowing investors to combine risky securities with a risk-free

investment. In our case a unique optimal portfolio of risky securities will be identified that does not depend on the investor's risk tolerance.

Why Diversify?

The problem of uncertainty can be met in every aspect of our life. For instance, a lucky gambler has recently won a big amount of money in a horse racing. He is excited with his luck so he is willing to win even bigger amount of money betting on his favourite horse. The problem which rises immediately is that he is not certain if the horse on which he stakes on second time wins the race.

The same kind of uncertainty may be encountered in each aspect of our life. For instance, launching a new product on the market or deciding whether to invest money in a risky project or to buy treasury bonds.

This paper aims to describe and explain some techniques on reducing risks.

Diversification is a strategy which is conducted by financial institutions, personal investors or hedge fund managers with the scope of reducing risks.

The concept of diversification was first introduced by an American economist James Tobin who won the Nobel Prize in Economics in 1981 for his analysis of financial markets and specifically for his development of portfolio-selection theory. He was a Keynesian economist and his research interests included macroeconomics and monetary and fiscal policy as well. He is famous for his phrase: "Don't put all your eggs in one basket".

One of the observations which have been made by Graham Kenny that one of the problems managers face in dealing with diversification is its definition. What stands as a definition of diversification for one manager may be absolutely inappropriate for another. As a result it may lead to confusion what action to take. Because of diversification's complexity, its definition proves to be very controversial.

Let's take an example. For instance, if MacDonald's introduces a new burger or salad, is this diversification? The answer is "no", since it has stayed within its original business – the food industry and has only extended its product line. If the same company went into pharmaceutical business, would this be a diversification? The answer is "yes", since it has moved into a different business.

Still, a lot of arguments may be held about what is diversification. Fortunately, a study has been undertaken to help us identify the dimensions of relatedness/diversification. In 1997 J.L. Stimpert and Irene Duhaime identified 25 dimensions of relatedness. These were derived from

the literature and from interviews with managers. They are shown in Figure 1.1, which provides a broad range of items on which any two businesses in a diversified company may differ. The greater the number of dimensions on which there is variation, the greater the diversity.

Figure 1.1 Dimensions of Relatedness/Diversification

Businesses –

Are cost leaders

Produce commodity products

Emphasize new product development

Are market share leaders

Have strong brand names

Produce high value-added products

Serve niche markets

Share customers

Emphasize advertising

Emphasize customer service

Emphasize product design

Emphasize R&D

Require same raw materials

Are vertically linked

Share manufacturing process

Share distribution network

Share quality emphasis

Share investment requirements

Are about the same size

Similarly impacted by economy

In same stage of life cycle

Share cash flow characteristics

Share management skills

Are required to meet financial targets

Share accounting system

To begin with how to diversify a portfolio, we have to understand how to value the overall risks of the markets. We have to keep in mind that all changes in market prices are caused by the impact of macro economy issues. Therefore we can assess the impact of macroeconomic

events on markets by tracking the rate of return on a market portfolio of all securities. We will define and measure the risk of individual common stocks. As it was mentioned risks depend on exposure to macroeconomic events and can be measured as the sensitivity of stock's returns to fluctuations in returns on the market portfolio. This sensitivity is called the stock's beta. It is often written as the Greek letter β .

By diversification we can eliminate the risks which are unique to individual stocks (risks which affect only a specific company, for instance: competitors, some negative events) but not the risk that the market as a whole may decline. Some stocks are less affected by the fluctuations than others. So we may separate stocks on the markets into two types: defensive and aggressive. Aggressive are more sensible to market fluctuations than defensive. It means that aggressive stocks have high betas, betas that are greater than 1.0, meaning that their returns tend to respond a bigger percentage change to the return to the overall market. The betas of defensive stocks are less than 1.0. The returns of these stocks vary less than one with market returns. The average beta of all stocks is exactly 1.0. (Fundamentals of Corporate Finance Myers et al., 2008)

To reduce risk it is necessary to avoid the inclusion of highly correlated securities in one portfolio. One hundred securities whose returns rise and fall in near unison afford little more protection than the uncertain return of a single security.

Common and Specific risks

Consider two types of insurance: theft insurance and earthquake insurance. Each year there is risk that 1% of the houses in the San Francisco area will be robbed and 1% will be destroyed by the earthquake. For instance, an insurance company writes each year 200,000 policies of each type of homeowners in San Francisco.

First, theft insurance will be analyzed. Taking into consideration that there is 1% chance of the theft 2,000 homes will be robbed. The number may fluctuate from year to year but not too much. Let's assume that the number of claims will be between 1,800 and 2,200 (0.9% and 1.1% of the number of policies written). Therefore if insurance company has enough reserves to cover 2,200 claims it can be almost be certain that it can meet its obligations on theft insurance claims. The portfolio of theft insurance has almost no risk, because the number of claims is not correlated to each other. This type of risk is called independent risk now earthquake example will be considered. For this insurance the number of claims can be very risky. On the one hand it will most likely be zero but on the other hand there still remains a 1% chance that insurance company will have to pay claims to all policies it wrote. In this

case, the risk is unpredictable – it can be 0 claims or 200,000. Therefore the risk of any individual claim can't be eliminated. Because of the fact that earthquake affects all the houses simultaneously the risk is perfectly correlated across the homes. This type of risk is called common risk.

Mergers and Acquisitions

Another application of diversification might be mergers and acquisitions. Further explanation will clarify why mergers and acquisitions are considered as a type of diversification. First of all it should be defined what types of mergers exist. Mergers are often categorized as *horizontal, vertical and conglomerate*. By the horizontal merger we consider the acquisition that takes place between two firms in the same line of business; the merged firms are former competitors. So, it can be concluded that by this type of merger a company exercises the economy of scale, it becomes bigger by taking off its competitors and as a consequence, reducing the risk of vice versa.

A vertical merger involves companies at different stages of production. For instance, a car manufacturer may purchase a manufacturer of tires. Thus the car manufacturer can get tires on more favourable price.

Conglomerate mergers involve a lot of unrelated businesses. For instance a conglomerate may have a chain of hotels in France, a manufacturing line of cars in China, a bank in India and a retailer chain in Poland. It should be noted that for several decades the number of conglomerates has been declining.

So, are mergers good for diversification? The problem for this argument is that the diversification for stockholders is cheaper than for corporations. For instance, if we have two companies A and B, it is clear that it would be more expensive for company A to acquire company B than for an investor to buy shares of company B. Hence, it is easier for an individual investor to diversify than for a company.

(Myers et al. Fundamentals of Corporate Finance, ch. 21)

What is Asset Allocation?

It is clear that an investor would probably want his investments to earn as much as possible being in the same time low risk investments. Such kind of outcome is almost impossible, that is why a lot of financial institutions and financial managers have been developing strategies which would meet the criteria of low risks and high returns. Here we would like to talk about

asset allocation, its importance and how it can be constructed for investors with different risk preferences.

First of all it is important to give a definition to asset allocation. It refers to the strategy of dividing your total investment portfolio among different classes of assets such as stocks, bonds and money market securities. So, we can conclude that asset allocation is a type of diversification strategy.

Since we are talking about different asset classes we need to define them. Here are some examples:

“Large-cap stock: These are shares issued by companies with market capitalization higher than \$10 billion.

Mid-cap stock: These are issued by mid-sized companies with market capitalization between \$2 and \$10 billion.

Small-cap stock: These are shares issued by companies with market capitalization less than \$2 billion. Shares of such kind of companies tend to be the riskiest ones and consequently they have higher rates of return in comparison with those mentioned above.

International securities: These are shares which are issued by foreign companies and which are traded on foreign stocks. Such kind of securities allows investors to diversify their portfolios outside of their countries. But these securities are exposed to the macro risks of countries in which they are issued.

Emerging markets: This category represents securities for countries with emerging economies. Usually such kind of securities offers high rates of return but they are exposed to a high level of risks. For instance: political instability, country risk and low liquidity.

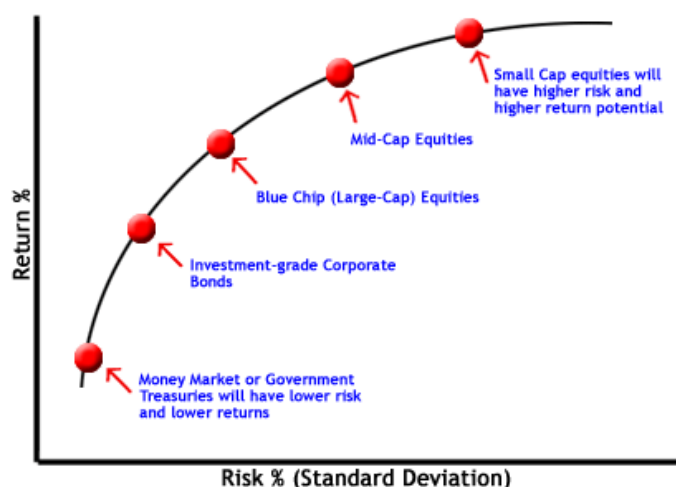
Fixed-income securities: Fixed-income assets comprise debt securities that pay to the debt holder a fixed amount of interest, periodically or at maturity. These securities tend to have low volatility and low risk because of the low income they provide. Fixed-income securities include government and corporate bonds.

Money market: Money market securities are debt securities that are extremely liquid investments with maturities of less than one year. Treasury bills makes up the major bulk of these investments.”

Maximizing return and minimizing risk

As it was mentioned before, the main goal of allocating assets among different securities is to maximize your return for a chosen level of risk. In order to maximize the return and minimize the risk an investor should know the risk-return characteristics of various asset classes. The

higher the risk is, the higher rate of return investors will demand on this asset. The next figure illustrates the relationship between risk and return on different market securities:



(The table was copied from Investopedia; <http://www.investopedia.com/articles/pf/05/061505.asp#axzz1cgETLLV0>, was accessed on October 18, 2011)

As it is illustrated in the above figure the riskiest securities are equities, in the same time the potential return on them

is also the highest one. The safest securities are Treasury Bonds but they offer the lowest rate of return. It is clear that the higher the level of risk, the higher has to be the rate of return. This relationship between risk and return is called risk-return trade-off.

If you are a risk averse investor you should allocate assets in your portfolio properly. A diversified portfolio may secure you from the fluctuations of only one asset (of course it won't secure you from the recession of the entire economy, but it may cancel unique risks of an asset). It's up to investor what kind of assets he wants to hold in his portfolio, still asset allocation is a useful tool which helps to reduce some risks no matter how risky assets are in the portfolio. (<http://www.investopedia.com/articles/pf/05/061505.asp#axzz1cgETLLV0>)

Diversification and gambling

It is worthwhile to consider the simplest example that shows how actually diversification might reduce risk. Roulette wheels are typically marked with the numbers from 1 till 36 plus 0 and 00. Each of these outcomes is equally likely every time the wheel is spun. If a gambler bets \$1 and his number is correct he wins \$36, but if not he loses \$1. What is the casino's expected profit? What is the standard deviation of this profit for a single bet?

Because there are 38 numbers on the wheel, the chances that a gambler wins are $1/38$. The casino loses \$35 if he wins and earns \$1 if he loses. Casinos' expected profit is \$0.0526.

Therefore for each dollar bet casino makes approximately 5 cents. However, the standard deviation is \$5.76. This is quite big number in relation to casino's profits on a single bet. However, there is huge number of bets placed in a casino. 9 million bets are placed. In this case the risk will be diversified. Dividing the standard deviation of the casinos' average

revenue by the number of bets the result will be \$0.0019, that suggests the idea that casino do not suffer a lot even if the gamer wins. Of course, such low standard deviation is only possible if the outcome of each bet is independent to each other. For this reason, casinos often impose limits on the amount of any individual bet.

Diversification - benefits and common mistakes

In this section, benefits of diversification will be described and the common mistake among investors related to the long run diversification will be introduced. In this example the performance of the US stocks will be analyzed.

Statistical analyses illustrate that since 1962 on average 50% of the volatility of the individual stocks can be diversified. However, during 1987 market crash and 2008 financial crisis this number fell significantly, so that only about 20% of the volatility of individual stocks might be diversified. In addition, market risk increased seven-fold from 10% to 70% between 2006 and the last quarter of 2008 as a consequence of very weak economic environment. From this numbers it is important to keep in mind that the effectiveness of diversification depends on the market conditions. Even holding a large portfolio of stocks the investor will be exposed to systematic risk that cannot be eliminated by diversification.

One of the questions that need explanation is whether the risk still matter, while investors investing in the long run. Specifically, it will be considered whether it is possible or not to reduce risk while investing in the long run.

In 1925, large US stocks soared by about 30%. In this case, a \$77 investment in 1925 will grow to $77 \times 1.3 = \$100$ by the end of the year. Investing \$100 in the S&P 500 in 1926, investor will receive approximately \$188,000 by the start of 2009. Instead let's suppose that stocks had downward tendency and had dropped by 35% in 1925. Therefore the value of the initial investment will be only $77 \times 0.75 = \$50$ at the beginning of 2006. In this case, if the returns from then on were unchanged the investment will be worth only \$94,000. In the other words, it is half as much in comparison when the initial investment went up by 30%. Thus, despite the long time horizon, the difference in the first year's return still might have a significant impact on the final payoff.

Let's consider another example occurred during the financial crisis in 2008. It will be assumed that an investor invested in the long term \$100 in small stocks in 1925. If the

investment horizon was 82 years, the value of investment would be a little over \$10 million. If instead, her investment horizon was 83 years (end of 2008) the portfolio will be worth a little over \$7 million. These examples suggest the idea that a longer time horizon did not reduce risk.

The only way the length of the time horizon might reduce risk is if today, for instance, the returns are low and in the future it tend to increase growing to above average. This phenomenon is called mean reversion. Mean reversion implies that past low returns might be used in order to predict the future high returns in the stock market.

For the short time horizons of a few years there is no evidence of mean reversion in the stock market. For longer horizons, there was some evidence of this phenomenon historically, but there is lack of evidence whether the pattern will continue in the future. Hence, the optimal strategy for an investor might be investing more in stocks that are predicted to show high returns in the future.

(Corporate Finance second edition, De Marzo, Berk , 2011 Pearson Education.)

Why diversification doesn't work during systematic crises

During the financial crisis 2008 it appeared that diversification didn't work and as a consequence many investors lost their money. It is important to say that during the crisis almost all the returns on assets declined dramatically. Before making any judgements about diversification it would be important to understand that during the financial crises the correlations of all securities tend to increase significantly. However, the safest securities tend to correlate less in comparison to risky securities- as evidence Treasury bonds produced strong positive returns in 2008.

Thus, in order to reduce the losses on a portfolio during crises it is important that portfolio contains a sufficient amount of safe bonds and other fixed income investments to dampen the risk of the overall portfolio to an acceptable level. It is also important to understand that during systematic crises the risky assets are likely to perform very poor. However, when crisis past, risk securities tend to return to the long-term relationship, and the benefits of diversifying risky assets will again become obvious.

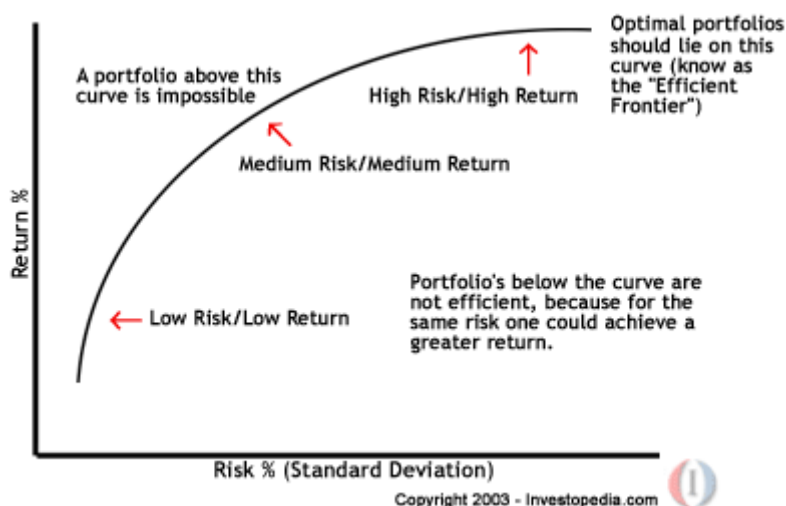
http://www.cbsnews.com/8301-505123_162-37841743/diversification-is-still-alive-and-well/?tag=mwuser)

Modern Portfolio Theory

Optimal portfolios require thorough research from the investor in order to achieve the best possible outcome. They are based on reasonable expectations, not intuition.

Asset allocation deals with investor's decision how much to invest in 3 major asset classes: cash, stocks, bonds. Basically, portfolio performance is determined by asset allocation. A study by landmark Brinson, Hood and Beebower, "Determinants of Portfolio Performance" (1986, 1991) argues that investment policy accounts for approximately 94% of the variation of returns of the portfolio, leaving only 6% for stock selection and market timing which can be explained as the act of attempting to predict the future direction of the market, typically through the use of technical indicators or economic data. This data suggests the idea that it is quite unreasonable to track the market and select individual equities. It can result in higher risk, higher costs and lower returns over time. "Portfolio Selection" theory was developed by Harry Markowitz and published in 1952 in the journal of Finance.

Modern Portfolio Theory states that it is not enough analyzing returns of the stocks, because in this case investors lose the opportunity to reap the benefits of diversification. For the most investors there exists a fear that the return of the stock will be lower than expected. Specifically, they are afraid of the high standard deviation. Each stock has its own standard deviation from the mean, which Modern Portfolio Theory calls "risk".



For every level of risk there is a portfolio with high level of return and high volatility and a portfolio with low level of return and low risk. Two combinations are plotted on a graph which is called the efficient portfolio frontier. A rational investor is likely to hold a portfolio that lies somewhere on the efficient frontier. The maximum level of risk that the investor might take on determines the position of the portfolio on the line.

As each asset class varies at risk and return, it is recommended that an individual's optimal portfolio choice should reflect his risk tolerance and investment objectives.

Over diversification

In the aforementioned sections it was stated that diversification is a method that can reduce risk. But in case of over diversification reality shows that an individual investor is likely to lose more than he will gain. For instance, investing in many mutual funds that contain approximately the same investment holdings will increase the cost of investing, will require additional investment due diligence, reduce the rate of diversification achieved by investing in different securities and consequently reduce investor's profit. Thus the opportunity costs of such an investment strategy are very high.

According to the modern portfolio theory, it is possible to achieve maximum advantage of diversification adding about twenty stocks in a portfolio. The empirical evidence of such a statement is the following. In Edwin J. Elton and Martin J. Gruber's book "Modern Portfolio Theory and Investment Analysis", it was concluded that the average standard deviation of a portfolio of one stock was 49.2% while increasing the number of stocks in the average well-balanced portfolio could reduce the portfolio's standard deviation to a maximum of 19.2% (this number represents market risk). However, they also found that with a portfolio of 20 stocks the risk was reduced to about 20%. Therefore, the additional stocks from 20 to 1,000 only reduced the portfolio's risk by about 0.8%, while the first 20 stocks reduced the portfolio's risk by 29.2% (49.2%-20%).

However, investing in 20 stocks does not mean that an investor receives maximum benefit from diversification. Additional requirement is to invest in stocks that are less correlated to

each other. In addition it is required to invest in different asset classes like bonds, commodities, real estate.

Investing in balanced fund that contains stocks component, bond component and sometimes money market component might be an optimal solution, eliminating the danger of overdiversification. These funds offer better protection for an investor because they contain more than 100 stocks across the entire market.

Investopedia ULC 2011. *The Dangers Of Overdiversifying Your Portfolio*. Available at: <http://www.investopedia.com/articles/01/051601.asp#axzz1bExmu7dT> (Accessed 19 October 2011)

Portfolio Types

Generally speaking, there are two portfolio types: aggressive and conservative. Conservative portfolio usually comprise of the lower-risk assets such as fixed income securities and money market securities. The main goal of the conservative portfolio is to protect its principal value. In other words this strategy is usually called capital preservation, which means that the return on the portfolio should be at least equal to inflation rate. Usually, investors who hold conservative portfolio invest their equity in blue-chip company stock, in order to not to be exposed to high risk.

A moderately conservative portfolio is for those investors who still want to preserve the portfolio principal value, but on the other hand to get some more inflation protection than investors which hold their assets in conservative portfolio.

The asset allocation strategy for these portfolios are to put 55-60% in fixed income securities, 35-40% in equities and 5-10% in money markets.

Next portfolio type is moderately aggressive portfolio, which is also called balanced portfolio. In moderately aggressive portfolios investors hold approximately equal amount of equities and fixed income securities to provide a balance of growth and income.

Aggressive portfolios mainly consist of equities (65-70%), hence they are more risky.

Investors who invest in aggressive portfolios use capital- growth strategy, which means that investor seeks to maximize the value of his portfolio over the long-term.

Very aggressive portfolio is the portfolio which consists entirely of equities. Investor's main goal is to maximize the value of the portfolio over the long time horizon. Because of the fact that this portfolio is very aggressive, it's value might fluctuate widely in the short term.

Investor should take into consideration the fact that it is necessary to review periodically his portfolio. For example, if investor holds a moderately conservative portfolio the value of its assets can go up significantly during the year, increasing the return and making it more risky, hence the portfolio will be transformed into a moderately aggressive which may not be appropriate for investor's risk tolerance.

Illustrative portfolio analysis

In this section our own calculations will be produced using real market data in order to support "Market Portfolio Theory". The illustrative portfolio analysis has been designed to show the possible outcome of a combination of different stocks with different returns and standard deviations in a portfolio using diagrams. We will describe this type of analysis based on the information derived from the 2 different market securities. We will refer to the securities of Coca-Cola and BMW. In order to construct a diagram which will show the performance of these two companies we will extract the information from the companies' past performances. (It is one of the ways how financial managers predict future companies' returns)

To begin with, we must calculate the rates of return for the 5 previous years.

Year	Coca-Cola	BMW
2010	0.1608=16.08%	0.8771=87.71%
2009	0.2508=25.08	0.4373=43.73%
2008	-0.2527=-25.27%	-0.4641=-46.41%

2007	0.2703=27.03%	-0.021=-2.1%
2006	0.1873=18.73%	0.1705=17.05%

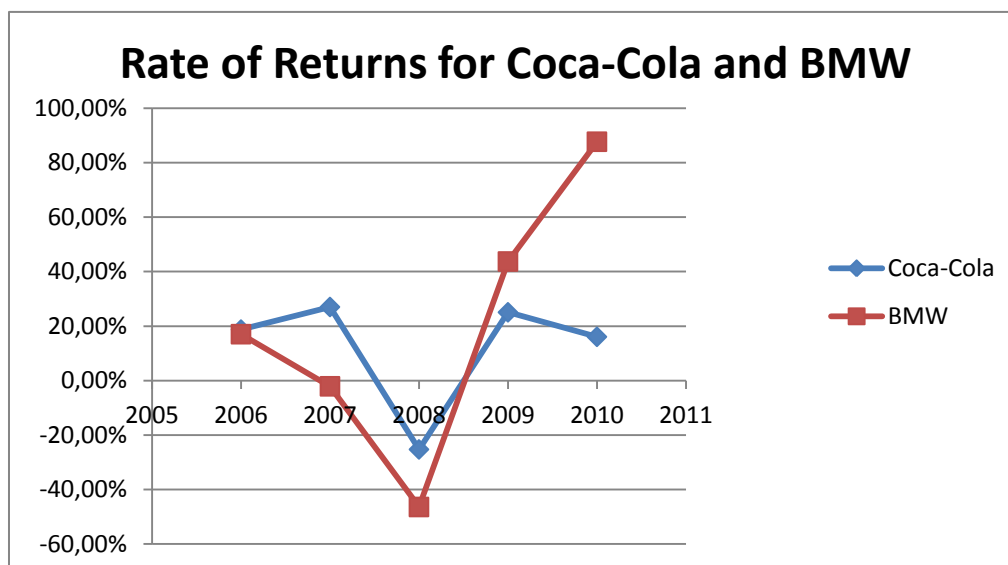
(To see how to calculate Rate of Return check for the formula in Appendix)

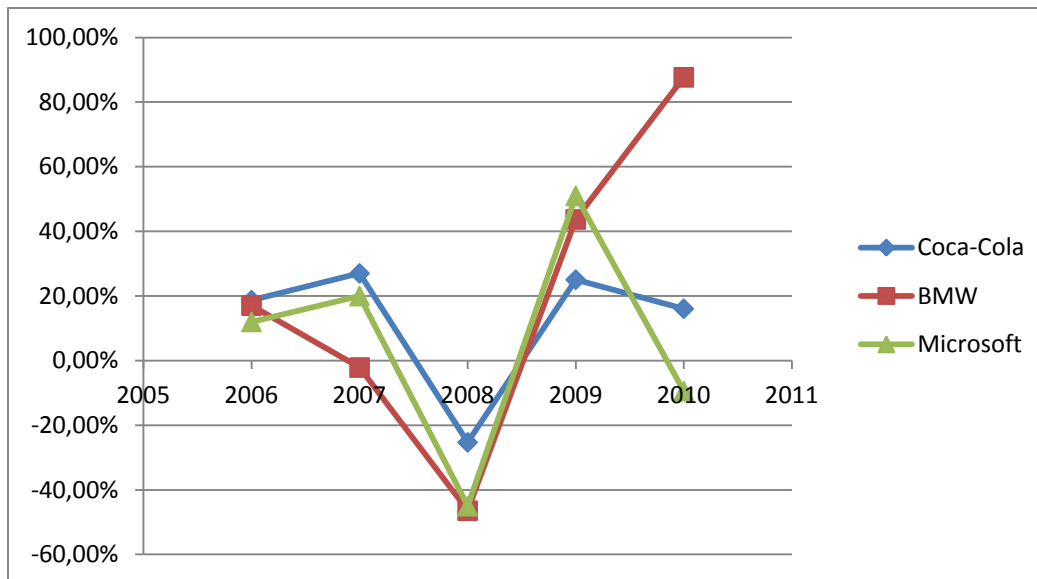
Our portfolio analysis will be based on the assumption that a dollar of realized or unrealized capital gains is exactly equivalent to the rate of return. Such kind of assumption is appropriate for certain investors, for instance, some types of tax-free financial institutions.

When we have finished with the calculations of the rates of return, we must calculate the Standard Deviation of the securities based on our findings. The SD for Coca-Cola and BMW is 0.215 (21.5%) and 0.368 (36.8%) respectively. (Look for the formula of SD in Appendix).

The SD shows for how much the possible return of a security can deviate from a mean.

Now we can construct a table which will show the behaviour of our securities

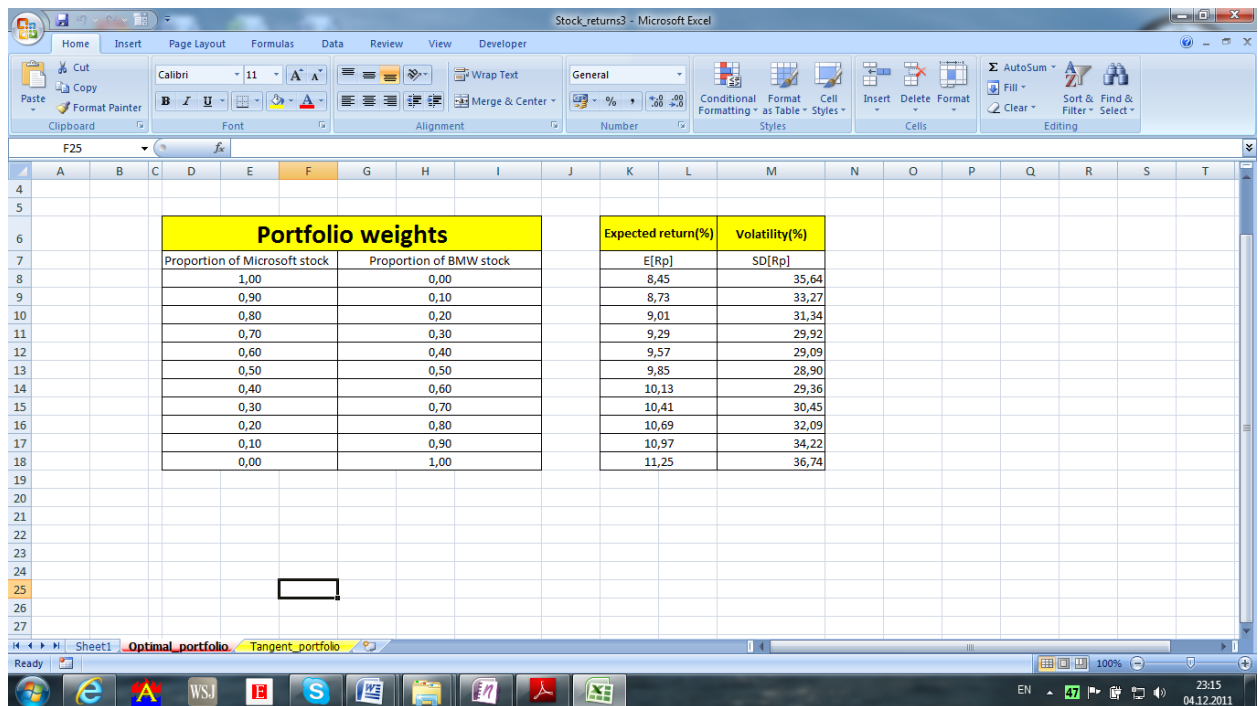




As we can observe from the graphs these two securities have different correlation i.e. their rates of return hadn't been moving in the perfect unison. If they had moved up and down in exact lock-step, the perfect correlation would have been 1. If the rise or fall of one stock doesn't affect a second one, it means that their correlation is 0. So, the more two series tend to move up and down together the more is their coefficient of correlation. It is important to mention, that when securities are perfectly correlated the benefits of diversification are less obvious. But since in the real life it is impossible to find two perfectly correlated stocks, the assumption about two perfectly correlated stocks won't be considered in our further essay.

When the standard deviation of each security and the amount invested is known, we compute the covariance of the portfolio which is as correlation a measure of the degree to which returns on two risky assets move together. The higher the correlations among security returns, the greater is the standard deviation of the portfolio as a whole. Or, putting it in another way, the more the returns on individual securities tend to move up and down together, the less do variations on individual securities cancel out each other. Hence the variability of return on the portfolio is greater. But in general it is best to avoid buying stocks in a down-trending market unless they belong to an industry sector showing strength despite the market.

Basically our work will be concentrated on a diversification of an imaginary portfolio. The simplest example will help to understand the power of this method. For our research the following companies were chosen: Microsoft and BMW. These examples are considered suitable for the research because the two companies are from the two different industries.



Picture 1.

For instance, let's assume that an investor wants to invest \$20,000. From the picture 1 it is obvious that if he invests the whole amount of money in Microsoft stock or only in BMW our portfolio will be very risky. Due to diversification investor can increase the return and decrease the volatility. Portfolio that is concentrated in Microsoft is considered inefficient because it is possible to get better return with the lower level of risk investing, for example 70% in Microsoft and 30% in BMW. Proportions of Microsoft stock above 70% and proportions of BMW stock above 30% are considered efficient.

Now let's assume another example. Consider investor short selling stocks. Before positive investments (long positions) were considered. Now, short selling (borrowing) stocks will be analyzed. Short selling is profitable when an investor is expecting the stock price to decline in the future. On the other hand, short selling may be advantageous even if the stock price will rise in the future because investor is investing in a stock with an even higher expected rate of return. Consider investor borrowing \$10,000 worth of Microsoft stock and investing the proceeds in BMW stock. So, the value of investment in BMW will be \$30,000(20,000+10,000).

According to the formula 7 from the appendices the corresponding portfolio weights will be - 50% for Microsoft (because of the borrowing) and 150% for BMW. Performing the necessary calculations using formulae 2 and 3 from the appendices an investor will receive higher rate

of return 12.65% and higher risk 53.06%. Short selling is a strategy for investors who are willing to undertake high risks.

As it was mentioned before two-stock portfolio was analyzed. Now, third stock will be analyzed. Let's assume that Coca-Cola stock was added to the portfolio. Coca-Cola stock is less risky, because it has lower standard deviation. Standard deviation of Coca-Cola stock is 21.5%. However, it has less expected return, because of the lower beta; therefore it is less responsive to market movements than BMW and Microsoft stocks. Let's assume that an investor is investing \$4000 in Microsoft, \$4000 in BMW and \$2000 in Coca-Cola. According to the formula 7 from the appendices the corresponding portfolio weights will be 40% for Microsoft, 40% for BMW and 20% for Coca-Cola. Calculating the expected return on three stock portfolios we get 8.94%. Volatility of the portfolio will be 25.66%. The new portfolio provides new risk and returns possibilities for an investor and should not be ignored.

Industry analysis

In the previous topic we have discussed different possibilities of diversification based on the 3 companies which operate in different industrial areas. This topic discusses how to choose among different securities of different industries. First of all it is necessary to find out what the company does. What product or services does it sell? All the necessary information about companies which are traded on stocks may be found on yahoo.finance.com or money.msn.com.

Once the company's features of business are understood, the next step is to understand the industry in which it operates starting with its growth prospects. It is reasonable to start with assessing the growth perspectives of a business since each investor intends to gain profit from his or her investments. "If the industry is not growing, your picks will have to grow earnings by cutting costs, by taking market share from competitors, or by acquiring other industry players. Many firms have successfully practiced these strategies, but they are inherently riskier than participating in a growth industry." (Harry Domash, "Fire your stock analyst!", Industry growth outlook, pg. 92)

Usually competition is less intense on the fast-emerging markets because it is believed that there is plenty of business for all participants. When an industry matures and growth slows, companies switch their attention on raising their capital share from competitors, by acquiring other participants of the industry. "Many firms have successfully participated these strategies, but they are inherently riskier than participating in a growth industry." (Harry Domash, "Fire

your stock analyst!” Industry growth outlook, pg. 92)

In general we can characterize growth industries as industries which constantly increase their profits, but it is fairly hard to forecast such growing and as a result find such industries.

Identifying and improving the Tangent Portfolio

Generally speaking, to earn the highest possible expected return for any level of volatility an investor should find the portfolio that generated the highest Sharpe ratio. The Sharpe ratio was introduced by William Sharpe as a measure to compare the performance of mutual funds. This ratio measures the ratio of reward-to-volatility provided by a portfolio. The portfolio with the highest Sharpe ratio is called tangent portfolio. Furthermore, tangent portfolio provides the biggest reward per unit of volatility of any portfolio available.

The tangent portfolio is efficient, and once a risk-free investment is included, all efficient portfolios become combinations of risk-free investment and the tangent portfolios. Moreover, the optimal portfolio of risky investments no longer depends on how conservative or aggressive the investor is, it is recommended for every investor to invest in the tangent portfolio independent on his or her taste for risk. Actually, it does not matter whether the investor is an aggressive or a conservative one, both of them will hold the same portfolio of risky assets, the tangent portfolio.

In this paper, the efficient portfolio with the highest Sharpe ratio is the portfolio which comprises 30% investment in Microsoft and 70% in BMW (See the formula 6 in the Appendices and check Appendix B).

Now, the following case regarding optimal portfolio choice will be considered. Consider, that investor has \$100,000 in his disposal and invests in portfolio N, which has an expected return of 7% and volatility of 27%. The risk free rate is 3% and tangent portfolio (with the highest Sharpe ratio mentioned above) has an expected return of 10.41% and a volatility of 30.45%. The task is to recommend the portfolio for an investor which will maximize expected return without increasing its volatility.

The best portfolios are combinations of the risk free investment and the tangent portfolio. If an investor invests an amount x in the tangent portfolio T, the expected return and volatility are:

$$E[R] = 3\% + x \cdot (10.41\% - 3\%)$$

$$SD(R) = x \cdot (30.45\%)$$

So to maintain the volatility at 27%, $x = 27\%/30.45\% = 88.7\%$. In this case an investor should invest \$88,700 in the tangent portfolio T and the remaining \$11,300 in the risk free investment. Thus, investor's expected return will be $3\% + (88.7\%)(7.41\%) = 9.57\%$, the highest possible given with this level of risk.

Alternatively, to keep the expected return to the value of 7%, x must satisfy $3\% + x(7.41\%) = 7\%$, so $x = 54\%$. In this case an investor should invest \$54,000 in tangent portfolio and \$46,000 in the risk free investment, lowering the volatility level to $(54\%)(30.45\%) = 16.4\%$, the lowest possible level given the expected return of 7%.

The Efficient Portfolio and Required Returns

In previous section tangent portfolio with the highest Sharpe Ratio was identified. In this section there will be given an explanation how it is possible to improve the Sharpe ratio. Firstly, it is necessary to introduce the required return. Required return is the expected return that is necessary to compensate for the risk investment of a new security will contribute to the portfolio. The required return for an investment equals to the risk-free rate plus the risk premium of the current portfolio multiplied by the sensitivity of this new security to the portfolio. If the expected return, exceeds the required return then adding more of this new security will improve the performance of the portfolio.

Assume that an investor invested in the Vanguard International Fund which has an expected return of 16% and volatility of 21%, as well as in risk free treasuries paying 3%. Investor thinks that it will be worthwhile to invest in a real estate fund that has an expected return of 10% a volatility of 30% and a correlation of 0.15 with the Vanguard International Fund. Will adding the real estate fund improve investor's portfolio?

Let R_{re} be the return on real estate fund and R_v the return of the Vanguard International Fund. From the equation the beta of real estate fund with the Vanguard International Fund is $(30 \cdot 0.15)/21 = 0.2143$ (See formula 8 in the appendices).

Using the equation 9 from the appendices it is possible to determine the required return that makes the real estate fund an attractive addition to the portfolio which consists of holdings in Vanguard International Fund:

$$r_{re} = 3\% + 0.2143 \cdot 13\% = 5.78\%.$$

It is worth investing some amount in real estate because, the expected return of 10% is bigger than the required return. Hence the portfolio Sharpe ratio might be increased.

Concentration vs. Diversification

- One of the biggest concerns nowadays is whether the diversification is more advantageous method than concentration. Concentration tends to be the opposite strategy of diversification. An investor who owns concentrated portfolio might own only couple of stocks rather than owning an index fund. Another method of concentration might be investing in certain sectors of the market rather than entire market. For instance, Dow Jones Total Market Index is broken down into the following ten sectors (with their ETF symbol in parenthesis): Basic Materials (IYM); Consumer, Cyclical (IYC); Consumer, Noncyclical (IYK); Energy (IYE); Financial (IYF); Healthcare (IYH); Industrial (IYJ); Technology (IYW); Telecom (IYZ); Utilities (IDU).

If an investor is considering that certain sectors will go up in value he can invest money in those sectors rather than the entire market. However, investing money in concentrated portfolio may contribute to very high risk exposure. For instance, if during 2008 financial crisis investor's portfolio was concentrated in government bonds it is likely to perform well. On the other hand, if investor's money was concentrated in AIG, Citicorp or General Motors it might have been a tragedy.

Probably the biggest setback of concentration method is that if the stocks will do poorly, investor might lose more than he planned. It was suggested during the bull market of the 1990's that if an investor applying diversification tool, he might lose the possibility to receive high returns on his portfolio. Furthermore, it was stated that if the investor identified the very competitive company and it can become the future Microsoft it does make sense "to put his eggs into that one basket". However, it requires much effort and high stock picking skills to identify such company. Moreover, even the highly qualified investor cannot predict the precise future stock price. So the stock that might be considered as the future Microsoft, might turn out to be an awful choice as it was the case with Micro Strategy. That former market star went from \$3,130 per share in March 2000 to \$15.10 at year-end 2002, an apocalyptic loss of 99.5%. Therefore diversifying his portfolio an investor increases his odds being right in detecting the next very successful company, and decreasing his odds being wrong about it.

(Graham, J. Zweig 2002; revised edition)

On the other hand, as it was stated by some investment professionals one of the advantages of concentration might be that it is easier for an investor to keep track of his portfolio and make rational investment decisions on that basis. In addition, they suggest the idea that investors which hold diversified portfolios don't have sufficient knowledge about their stocks.

Taking into consideration all the ideas mentioned above, concentration method might be useful for those investors who are willing to dedicate much time on analyzing and picking stocks that they consider worth the effort. Otherwise, for inexperienced investors, concentrating money in couple of stocks might turn out to a big loss, during market crisis.

Conclusion

On the basis of the paper we would like to conclude that diversification is a useful tool in reducing the risks in investor's portfolio. This might be obtained by investing in stocks which belong to different industries. Different types of portfolios were covered from the most conservative till the most aggressive. Portfolio choice depends on investor's risk attitude. In our example, aggressive portfolio was analyzed, comprising of equities only. Market Portfolio Theory was applied which shows how to increase the rate of return of a portfolio and reduce the risk simultaneously choosing the best proportion of a particular stock in a portfolio. In addition, practical example was taken in order to show how effectively combine tangent portfolio with risk free investments.

On the other hand some problems with diversification were mentioned such as over diversification and long run diversification, which suggests the idea that today even if there are many methods to assess the risk of an investment, it is impossible to make an accurate prediction of the performance of the entire economy and in particular, stock market behaviour. Another method, the opposite of diversification was covered as well. Basically, concentration strategy might be more profitable than diversification; however it might bear much more risk, if the securities in which the investor's money is concentrated show poor returns.

All in all, we hope that this paper might give a good framework for an investor in order to make smart investment decisions in the long run. Hence, the hypothesis that we wanted to test

at the beginning of our paper is proved, because diversification method from the examples mentioned in this paper showed that it might mitigate the risks that investor usually face while investing in securities.

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De Marzo, Berk 2011. *Corporate Finance*. 2nd edition. Boston: Pearson

This book gave us all the necessary theoretical background in order to understand properly the concept of diversification and its applications in today's complex business environment. In addition it served us as a starting point that helped us to produce all the necessary calculations in order to justify our statements.

Graham, Zweig 2002. *The intelligent investor*. Revised edition.

The material from this book helped us to understand the concept of concentration from negative perspective. It described how an investor might fail, while seeking a company to concentrate his or her money in.

Appendices

Appendix A

$$\text{Percentage return} = \frac{\text{Capital gain} + \text{dividend}}{\text{initial share price}} \quad (1)$$

$\text{VAR}(R) = x_1^2 * SD(R_1)^2 + x_2^2 * SD(R_2)^2 + 2 * x_1 * x_2 * COV_{12}$ This formula calculates the variance of a two stock portfolio where x_1 and x_2 are portfolio weights. (2)

$$SD(R) = \sqrt{VAR(R)} \quad (3)$$

$$VAR(R) = x_1^2 * SD(R_1)^2 + x_2^2 * SD(R_2)^2 + x_3^2 * SD(R_3)^2 + 2 * x_1 * x_2 * COV_{12} + 2 * x_1 * x_3 * COV_{13} + 2 * x_2 * x_3 * COV_{23} \quad (4)$$

This formula calculates variance of three stock portfolios.

$$E[R_{xT}] = r_f + x * (E[R_T] - r_f) \quad (5)$$

This formula calculates expected return of a combined portfolio of risky-free securities and the tangent portfolio.

$$\text{Sharpe Ratio} = \frac{E[R] - r_f}{SD(R)} \text{ where } r_f \text{ is risk-free rate.} \quad (6)$$

$$\text{Portfolio weight} = \frac{\text{Value of investment in a stock}}{\text{Total value of portfolio}} \quad (7)$$

$$\text{Beta} = \frac{SD(R_x) * \text{Corr}(R_x, R_y)}{SD(R_y)} \quad (8)$$

$$r_{re} = r_f + \beta_{re}^V * (E[R_v] - r_f) \quad (9)$$

Appendix B

Stock_returns3 - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
4				Sharpe Ratio												
5			Portfolio 1 (100% investment in Microsoft)	0,1529												
6			Portfolio 2 (90% investment in Microsoft, 10% in BMW)	0,1722												
7			Portfolio 3 (80% investment in Microsoft, 20% in BMW)	0,1918												
8			Portfolio 4 (70% investment in Microsoft, 30% in BMW)	0,2102												
9			Portfolio 5 (60% investment in Microsoft, 40% in BMW)	0,2259												
10			Portfolio 6 (50% investment in Microsoft, 50% in BMW)	0,237												
11			Portfolio 7 (40% investment in Microsoft, 60% in BMW)	0,2428												
12			Portfolio 8 (30% investment in Microsoft, 70% in BMW)	0,2433												
13			Portfolio 9 (20% investment in Microsoft, 80% in BMW)	0,2396												
14			Portfolio 10 (10% investment in Microsoft, 90% in BMW)	0,2329												
15			Portfolio 11 (100% investment in BMW)	0,2246												
16			Portfolio 12 (Short-selling Microsoft stock and investing the proceeds in BMW)	0,1819												
			Portfolio 13 (40% investment in Microsoft, 40% in BMW)	0,2311												

Sheet1 Tangent_portfolio

Ready

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