Statistical Behavioral Analysis of Greek Mutual funds

Dimitra Aggelaki

Master in Business Administration

Total Quality Management

University of Piraeus

ΠΑΡΑΡΤΗΜΑ Δ • ΥΠΕΥΘΥΝΗ ΔΗΛΩΣΗ ΕΚΠΟΝΗΣΗΣ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ

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Μεταπτυχιακό Πρόγραμμα Σπουδών στη «Διοίκηση Επιχειρήσεων — Ολική Ποιότητα» με διεθνή προσανατολισμό

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Statistical Behavioral Analysis of Greek Mutual funds

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έχει συγγραφεί από εμένα αποκλειστικά και στο σύνολό της. Δεν έχει υποβληθεί ούτε έχει εγκριθεί στο πλαίσιο κάποιου άλλου μεταπτυχιακού προγράμματος ή προπτυχιακού τίτλου σπουδών, στην Ελλάδα ή στο εξωτερικό, ούτε είναι εργασία ή τμήμα εργασίας ακαδημαϊκού ή επαγγελματικού χαρακτήρα.

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Παράβαση της ανωτέρω ακαδημαϊκής μου ευθύνης αποτελεί ουσιώδη λόγο για την ανάκληση του πτυχίου μου.

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Dedicated to my family

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Statistical Behavioral Analysis of Greek Mutual Funds. Does Prior Performance Affect the Choice of Risk?

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Abstract

In the current study, we collected data from a total of 30 funds, 10 of each different category of the existing categories, including money market funds, bond funds, and equity funds. By using the Sharpe and Treynor indexes, we try to evaluate the performance of each fund and by using the Treynor and Mazuy Model, we evaluate the selectivity and time marketing skills of mutual fund managers. While most of the current literature uses this model to examine the ability of each fund manager separately, by making use of panel regression we evaluate the general ability of the managers for each mutual fund category. Finally, by making use of linear regression, we examine the correlation between the returns of the three kind of funds we chose as well as the degree to which the market index, which was selected, affects the returns of the funds.

We extensively analyze the market of mutual funds as well as their evolution in time not only for the global market but for the Greek market as well. We carefully examine the different types of mutual funds, their advantages and disadvantages and the way in which the mutual fund market works in Greece. Furthermore, we conduct a literature review to point out the conclusions of current literature regarding the question which we investigate and we analyze in detail the portfolio theory and assets evaluation theory in order to understand the process which is used to assess the performance of mutual funds' portfolios.

Finally, after extensively analyzing the techniques that are used in the current thesis we present the results of our study.

Introduction

Mutual funds has been one of the most internationally recognized form of investment for many decades. They are based on the idea that a group of investors, who have the same investment philosophy and common goals, are pooling their money instead of investing them on their own, thus creating a large powerful capital, which is then divided into shares of equal value.

The fund undertakes the task to act on behalf of the investors as a specialized company, which has the appropriate experience and knowledge in the field of investment. This company invests all investors' money in a large number of carefully selected securities (bonds, stocks, high money deposits, money market products, etc.) depending on the type of mutual fund, aiming at achieving the highest possible yields and limiting the assumed risk. The property of the fund is kept in a bank, which acts as guardian.

As will be mentioned in detail later, in Greece the first mutual funds made their appearance at the end of 1972, but this sector did not have an essential development until the early 1990s. The decade began with only one type of mutual fund, the mixed fund, and later on, during the same decade, equity and bond mutual funds were formed, while in 1991 international mutual funds were added.

The purpose of this thesis, as it will be thoroughly explained later on, is to measure the performance of Greek mutual funds for an 8-year period for three different kinds of funds including bond mutual funds, equity mutual funds and asset management mutual funds.

Moreover, the degree of dependency among each type of fund will be examined as well as the effect that the ASE-GI index has regarding the returns of the funds. Finally, the selectivity and timing ability of the mutual fund manager will be examined as well.

Investment Risk and Returns

General Remarks

The term investment relates to the binding of available funds with the main purpose of increasing their value at a given future time period. Each investment involves some degree of risk, which understandably varies depending on its form. Therefore, the two key features of investment are return and risk. Investors need to take both of these variables into account when making their investment evaluation and selection process.

Mutual funds, like any other kind of investment, face a variety of investment risks. In order to efficiently understand the concept of mutual funds, we find it important to analyze the risks that investors are facing when they decide to put money in this kind of assets. Moreover, as mutual funds create a variety of different portfolios for many kinds of investors, we will refer to the portfolio theory, as well as the capital market theory.

Returns

To begin with, in the investment world, two of the most important concepts to consider are : the average return on an investment and its risk in order to achieve this return. The average return shows what the performance of a class of securities is, during a specific period of time. Risk indicates the chances of an annual return on a given period to differ from the average.

Therefore, the risk is the variance that describes negative and positive deviations from the average yield (Cooper and Priestley, 2009).

The performance regarding the various securities means the creation of profit, that is, the increase achieved in the shareholder's money. The risk is associated with performance in a proportional relationship. Where high-risk investments have high-expected returns, lower-performing investments need to be safer and thus they have a lower risk. Obviously, this is not a must since there are investments with low expected returns and high risk.

Consequently, the first main variable to be considered for the assessment of an investment is its performance. The return an investor gets from placing his funds in an investment, for example in shares or bonds, consists of two synthetic parts. The first part is called capital gains /losses and it results from the time development of the value of the investment. The price the investor gets can be positive (earnings), zero or even negative (losses). The positive or (negative) return is created when the final value of the investment is greater (less) than its original value. The second component of the performance is called current income and may include, depending on the type of the investment in question, dividends (for shares or mutual funds) or interest (in the case of bonds) or any other kind of income which is distributed to investors at regular intervals.

Risk

The return of each investment alone cannot be a complete and efficient criterion for the selection of mutual funds.

For this reason, along with the return, the investor must take into account a second equally important parameter, the risk involved when investing in each specific fund.

The notion of risk in an investment is the difference between realized returns in comparison with the expected ones. The risk arises due to the uncertainty surrounding the achievement of a specific return on a mutual fund. And of course, the investors will choose to invest in mutual funds which have risk because the assumption of this risk is what leads to higher returns.

As we can see, the risk is essentially the instability about the realization of a certain result. The total risk consists of two pieces: systematic risk and unsystematic risk. The systematic risk of an investment is the result of political, legal, economic and other factors, which affect all the investments as a whole. The unsystematic risk is the result of factors which concern only the company, share or mutual fund and does not result from the impact of legal, political or other factors.

More specifically, systematic risk is interrelated with the nature of the investment and it cannot be fully confronted. It arises from factors that affect the whole market rather than one specific investment. Systematic risk of an investment, for example, regarding shares, is created simply by participating in the stock market and due to factors that can affect the entire stock market, that is, the total number of traded shares.

Such factors may be political, economic, social etc. It should be noted that the market rewards the investor for the systematic risk that he accepts to undertake by giving him some extra return. This extra return serves as an incentive for the investor in order to withdraw his capital from an investment with a lower risk which also may have a lesser performance.

The unsystematic risk of an investment, for example, a share, is associated with various events such as a company strike, the failure of a corporal investment program or even a change in the company's management. These events will, of course, affect the course of the share of the particular company. To reduce unsystematic risk, the

investor should create a well-structured portfolio with a variety of different shares. Thus, the “negative” events pertaining to a particular share are offset by the “positive” events of another.

Studies have shown that through simple differentiation this particular risk can be eliminated. More specifically, a portfolio of 15-20 shares, randomly selected, is capable of eliminating 80% of its unsystematic risk. The introduction of more shares in the portfolio further reduces this risk. The phenomenon of reducing the total risk from the proper structure of a portfolio is called the portfolio effect.

The most important kinds of risk that can affect both systematic and unsystematic risk are presented below:

Sector Risk

The stock or bond prices of a company may be reduced due to negative developments in its operations or its industry. A basic method for reducing corporate and sector risk is the diversification and dispersion of investments in various securities. However, a significant precondition to be mentioned is, that the investor’s decisions have to be based on actual financial data and not on information of controversial value in order to invest his capital.

Credit Risk

Bonds’ performance can be significantly reduced if their issuer goes bankrupt and cannot therefore pay interest or the capital they owe. As it is expected, if that happens, there will simultaneously be a reduction in the issuer's credit standing.

Market Risk

Investments may lose value because of a generalized fall in stock markets. In times of crisis, even the shares of the best companies lose a significant part of their value. This risk appears to be stronger when the investment horizon is short.

Liquidity Risk

There are cases of declining demand for securities that one may want to liquidate. Then their prices may fall significantly resulting in capital loss.

Country Risk

Political and macroeconomic events may affect a country's capital markets. The fall of a government, changes in economic programs can largely affect the stock markets, leading to serious financial losses for the companies of the country.

Purchasing Power Risk

In times of high inflation investment returns are not satisfactory enough to cover the rise in the prices of goods and services, thus reducing the purchasing power of the money that has been invested over time. In this case fixed income investments, such as bonds and deposits, are more at risk from equity investments due to the price levels.

Interest Rate Risk

In the secondary market, bond prices depend on the level of interest rates with an inverse relationship. High-interest rates reduce the sale price of bonds and vice versa. Therefore, a rise in interest rates in times of crisis can significantly reduce the value of a bond portfolio, whereas in case of a fall to increase it.

Reinvestment risk

Bonds ending in a period of falling interest rates will result to investors re-investing their money in securities with lower interest rates, therefore expecting less profit.

Currency risk

Investments in different countries include the element of exchange rate risk since each country's debt securities are denominated in its currency. The same is true of all foreign currency deposits (Keršytė, 2012).

Hedging of Risk

All investors, with a rational behavior, prefer the highest possible return on their investments. At the same time, however, they seek the certainty that their lining property will be readily available when and if needed. However, studies have shown a very clear relationship between risk, return and investment time. Therefore, if an investor for instance wishes to accept low risk in a short investment horizon, he must avoid capital-intensive equity investments in the short run.

If an investor is prone to invest in a short-term horizon, his assets will be necessarily allocated to deposits and bonds, but if that is the case he will most definitely sacrifice the possibility of higher returns from long-term stocks. If he still insists on investing in shares for short periods of time, his risk will be quite high.

Investors need to have a structured approach to the investment process. They need to understand the magnitude of the risk they undertake with each move, and their investment choices must match their investment goals. Quite often, the perceived risk and expected returns of investors differ significantly from reality and this leads to incorrect choices.

Understanding risks permits investors to get realistic expectations, understand fluctuations in their portfolio and help them avoid misinterpretations. This way they are given the opportunity to always ensure higher yield than the level of risk they are willing to take（Spanò, 2001).

In order to hedge the risk, they are facing and to make an ideal and balanced combination of risk and return, investors, have four major tools at their disposal:

1. The placement of a significant portion of the portfolio in short-term investments such as reports, money market funds, treasury bills and short-term treasury bills.

2. The placement of a significant percentage of the portfolio on fixed income securities such as fixed income and fixed income funds. This investment may be more at risk than the previous investment but it certainly has a much lower risk than equity investment.
3. Investing a part of the portfolio in investment securities of different currencies. By doing this, the reduction of risk that may result from the devaluation of a currency or the large increase in interest rates in one country helps in the reduction of the overall risk. A fund manager has the ability to invest simultaneously in dollars and euros, in shares and bonds, in bitcoins and commodities. In this way, when the dollar rises for example, it usually reduces the value of the euro and thus offsets the potential loss from the dollar's profit.
4. By putting a large part of the portfolio into defensive shares. Defensive shares are considered the ones whose prices have low fall margins, i.e. they are not characterized by strong fluctuations (Doshi, Kumar and Yerramilli, 2017).

Portfolio Theory

Each person's investments could be a collection of a variety of assets such as deposits, bonds, shares and other investment products form a single set, and that is the definition of a portfolio. The composition of a portfolio consists of three investment products, bonds, deposits and shares in different proportions depending on the investment nature and needs of each individual. Forming an optimal portfolio is a dynamic process in which the necessary changes can be made by altering some financial data or by differentiating the personal circumstances of the investor.

Portfolio management includes the following three stages of activity:

1. Security analysis.

2. Portfolio analysis.

3. Portfolio selection.

During security analysis, investors choose only the securities, which offer the highest return. The next step is the portfolio analysis, which includes the evaluation of each portfolio in terms of expected returns and portfolio risk. The final stage is the portfolio selection. During that process, from those portfolios that, in relation to their performance, minimize the risk, one is chosen to suit the particular characteristics of the investor. The characteristics of an investor depend on how much money he wants to invest, on the duration of time he wants to invest, known as the holding time of the portfolio and on the amount of risk that he is willing to accept.

Markowitz created a model regarding the construction of efficient portfolios, consisting of several stocks. The originality of this model, which revolutionized past investment practices, was that it introduced the notion of risk that affects the decisions of the average investor.

According to Markowitz, the average investor is trying to maximize expected return and minimize the uncertainty that is the risk. As a result, an analyst/investor can now use these tools to create effective portfolios that fit perfectly to their own preferences.

The historical return on an investment is calculated as $r = \frac{(P_1 - P_0) + D}{P_0}$, where P_0 is the capital invested at the beginning of the period, P_1 is the value of the capital at the end of the period and D is the dividend received during the investing period. The

expected (average) return on an investment E (r) over a certain period of time is given by the formula: $\bar{r} = E(r) = \frac{1}{v}\sum_{i=1}^{v} r_i$.

All investments face a certain level of risk which arises from the probability that the actual returns will not coincide with the expected ones. This probability is statistically calculated as the percentage of variance of yields around an expected average yield and is measured by variance or standard deviation. If therefore r_i is the investment return and E(r) mean return on investment, the algebraic equation of variance is: $\sigma^2 = \sum_{i=1}^{v}(r_i - E(r))^2$.

In order to compare two different investments, it is necessary to measure and evaluate not only the expected average return but the risk of the investment as well. According to Markowitz, two stocks can be compared by looking at the expected return and standard deviation of each one and the same can be applied to two portfolios.

The expected return of a portfolio of securities is a function of the yields of the securities of which it consists. More specifically, the expected return of a portfolio is a weighted average of the returns of the securities included in a portfolio. The weight of each security is proportional to the percentage of the capital invested in this particular asset. The formula used to estimate the return of a portfolio is: $E(r_p) = \sum_{i=1}^{v} w_i E(r_i)$

where w_i is the percentage of the capital invested in the asset i.

However, unlike the performance of a portfolio, the risk is a little more complicated. This is because the various securities included in a portfolio have some covariance or correlation among them. The correlation measures the extent to which the returns of some securities move together. For example, from a set of securities, suppose we are examining a share X that changes by 1% and at the same time Y moves

by 1.5%, then we will assume that the two shares have a positive correlation. However, if X shares move up by 1% and share Y drops by 1.5%, then those two shares have a negative correlation.

If our portfolio consists of only one security, then the risk would only come from the uncertainty about fluctuations in the yields of the particular share . Now that we have a combination of different shares, the risk arises from two sources. From the uncertainty about the fluctuations in the returns of each share we have in the portfolio and from the uncertainty about collapses or correlations of the returns of all the shares we have in the portfolio.

Correlation may be positive, negative, or zero. The positive correlation between the returns of two securities means they are moving in the same direction. When the returns of the two securities move in the opposite direction and do not move together, then we are referring to the negative covariance. The correlation coefficient (ρ) is often used in order to estimate the correlation, the value of which is between -1 and 1. That is if $\rho = 1$ then we have a perfectly positive correlation and our values will move together, in the same direction and at the same rate. However, if $\rho = -1$ then we have a perfectly negative correlation and the securities will move in the opposite direction and at the same rate.

If the correlation coefficient is between -1 and 0, the assets will move in opposite directions but not at the same rate. If it is between 0 and 1, then the stocks will move in the same direction but not at the same rate.

If we know the covariance, and as a shareholders, we get shares, the correlation coefficient is equal to the covariance of the shares, divided by the standard deviations

of the shares: $\rho_{ij} = \frac{\sigma_{ij}}{\sigma_i \sigma_j}$. The total risk of a portfolio is given algebraically by the equation: $\sigma_p^2 = \sum_{i=1}^{v} w_i^2 \sigma_i^2 \sum_{i=1}^{v} \sum_{j=1}^{v} w_i^2 w_j^2 \sigma_{ij}$.

One of the key conclusions between risk and performance is the positive relationship between them. The higher the yield, the higher the risk of the portfolio.

In general, we can achieve numerous risk and return combinations as long as we differentiate the proportion of the capital we invest in each asset. In this way, an investor, if he has calculated the characteristics of all the securities, has the ability to create infinite hypothetical portfolios and then choose the portfolio that best fits his investment profile. A conservative investor would prefer low-risk portfolios, while a risk-loving investor would prefer high-risk portfolios.

A second key principle governing the creation of a portfolio is that the smaller the correlation between the portfolio securities, the lower the overall risk of the portfolio is. Moreover, if the relationship between the portfolios is negative, then the risk is reduced analogically. Therefore, in order to reduce an investor's portfolio risk, investors should combine securities with as little negative correlation as possible, or preferably with no negative correlation at all.

Markowitz's diversification is not meant to be interpreted as a placement of investors money in many shares in order to share the risk. This is the simplistic perception of differentiation. Markowitz's differentiation implies that a portfolio must not consist of single-sector shares alone, because they have a positive correlation with each other. If, for example, 10 stocks of railway companies are purchased, the portfolio depends on the course of the railways sector alone. While if the same investment is broken down into 4 railway shares, 3 bank shares, and 3 public utility companies, the risk is significantly reduced because there is no interdependence between the shares.

If there are M shares, a great number of combinations can be made between them and thus infinite portfolios formed. But the investor is not obliged to evaluate all the portfolios in order to reach the most ideal for him, thanks to the efficient portfolio theorem.

This theorem tells us that all investors can choose the ideal portfolio, which offers the maximum expected return for various degrees of risk and the minimum risk for different degrees of expected return. All these combinations of all portfolios that meet the above requirements is known as Effective Set or Effective Frontier.

The Markowitz model, like all mathematical models, was based on certain conditions, which are:

- The stock market is efficient (efficient market).
- The investor has a holding time for a unique period.
- The investor is trying to maximize the return on his capital by minimizing the risk.
- The investor selects a portfolio, based on the average return of its shares and its covariance.
- Holdings of the portfolio must not have positive covariance between them.

Some of these conditions may not be realistic, but in order to build a model, the creator must isolate certain elements, considering them to be stable and only follow the important ones. Besides, a model is not judged to be good, whether its assumptions are realistic, but by its ability to help one understand the processes he describes and make predictions about the future.

Mutual Funds

How the mutual funds work

The purpose of mutual funds is to raise funds from various investors and invest them as a single asset under shared management by a Mutual Fund Management Company, which receives a commission expressed as a percentage of the fund's net assets.

The fund's assets are the total of its portfolio and are principally placed in bonds, stocks and time deposits depending on its type and purpose. The assets of each fund are calculated each day and published by the Mutual Fund Management Company.

The investor who buys units in the fund is therefore called a unitholder and participates in realized profits and losses at a rate proportional to the number of funds he has placed. All investors have the right to receive their capital and their profits by liquidating the percentage they own whenever they decide to do so.

Generally, mutual funds are pools of money that raise funds from a number of investors (individual or institutional). The aim of the investors and therefore of the funds is to invest the accumulated amounts in selected opportunities that will arise in the market in order to maximize the return. By placing their capital in mutual funds, investors grant the right to the fund's management team to invest on their own behalf so long as the conditions for achieving the maximum possible return on the risk of the investment, are met. The investor has the option if he wants to, to withdraw his money from the fund whose investment has failed to meet its target and place it in another fund that has a better chance of success.

The choice of the proper mutual fund is based on the type of investment which the investor wants his money placed at. Short-term or long-term investments, unsafe or safe, fixed income or goodwill, interest rate or equity, Greek or international, are some

of the main types of investment selected by mutual funds. The kind of investment selected by mutual funds is known in advance and is maintained without any substantial change and usually without conversion to another class so as to continue to meet the original investor's goals.

The evolution of the mutual fund industry over the last decade of the twentieth century has been so rapid that it is currently the most successful financial market in Greece. This development coincides with the liberalization of the Greek financial system as well as with the steadily strengthened position of mutual funds worldwide. The main characteristic of this evolution is that the amounts invested in mutual funds of 147 billion drachmas in 1990 increased by 64 times by the end of January 1999 to 9.3 trillion drachmas. The successful macroeconomic policy implemented in the Greek economy had helped to transfer funds from bank deposits. At the end of 1996, the funds invested in mutual funds accounted for 22% of the deposits, while they skyrocketed to 39% in 1997. The corresponding increase in global US mutual funds, accounting for almost 2/3 of the total funds in the sector was about 6 times between 1990 and 1996.

The success of mutual funds is to a large extent due to the advantages of collective investment in relation to the individual. The existence of multiple and independent shareholders allows the fund to maintain sufficient liquidity to meet its needs. Finally, the closely supervised operation of mutual funds guarantees the protection of investors from management abuses and practices that run counter to the spirit of the commitments contained in the fund regulation. Daily disclosure and reference to the value of the fund is a continuous control of the course of investments and assists in the timely identification of deviations from investment objectives. In addition, the continuous control of the value of the investment allows investors to adjust

their investment policy by selling the shares of the X fund and purchasing the shares of the Y asset.

The net value of the investments divided by the number of units held by the investors is the net value of each share. The number of these shares remain unchanged since on daily basis new investors offer money in exchange for shares while old shareholders redeem their shares in return for their cash value. Due to the fluctuation of the funds available to them, mutual funds are considered to be open-ended.

However, there are also closed-end mutual funds. These are known in Greece as Portfolio Investment Companies (HELEX). These companies are also pools of money only the nominal value of their funds does not fluctuate. The invested funds remain unchanged from the formation of the company until the investment company decides to increase the share capital. The market value of the funds of the investment company fluctuates daily, depending on the changes in the value of the securities in the portfolio.

The diversity and specialization offered by mutual funds were the main reasons that led them to be dominant forms of collective investment. In Greece, during 1973 there were two mutual funds and one Investment Company. At the end of 1998, there were one hundred and seventy-eight mutual funds and seventeen investment companies. At the same time, the four hundred billion drachmas invested in investment companies at the end of 1998 accounted for 4.3% of the total invested capital in collective investment.

Categories of mutual funds

Mutual Funds are divided into different categories according to their investment orientation, the policy they apply and the timing of their investments. Depending on the type, they attract investors of different profiles: Those looking for low-risk investments and small returns and those who want to invest with high risk and possible high returns.

In particular, the Funds are divided into these following categories:

Money Market Fund

Money market funds invest at least 65% of their assets in fixed income securities which have a duration of less than one year (treasury bills, time deposits, repos, bonds maturing in less than one year, synthetic swaps, etc.), while their lower assets may be placed longer on long-term securities such as bonds, stocks, etc. Money market funds are internally and externally distinguished, depending on whether they focus their investment interest on Greek short-term securities, or on other equivalent foreign securities.The investment risk for this class of funds is very low.

The expected return on this type of mutual fund is usually higher than the return on competing products, i.e. the returns of repos as well as various flexible bank accounts (savings accounts offering interest rates depending on the amount of the balance of the account). This is due to the very large size of the capital managed by the funds in this category, which helps them achieve better returns than those of an individual investor. It is also favored in times of exchanges and other crises, as it exploits the very high current interest rates that typically prevail during the crisis.

Mutual fund management companies, in cooperation with the bank's dealing rooms, are able, through day-to-day interbank market monitoring, to give some estimates of returns at fixed intervals, which are usually the same as the real ones. Thus,

when interested parties buy money market fund shares, they may know their performance in advance, but this is not fully guaranteed.

This kind of mutual funds is mainly targeted at short-term investors who do not want to bind their money on medium to long-term investments and at the same time seek a relatively satisfactory return. Their basic feature is their easy liquidation at minimal cost. These features have made them very popular. About 65% of funds placed in mutual funds have been invested in mutual fund shares of this class (Jank and Wedow, 2015).

Bond Funds

Bonds or Fixed Income Mutual Funds, as they are formally called, invest most of their assets, over 65% , in multi-year bonds, while the rest of their portfolio is stacked on fixed income securities with a maturity of less than one year (e.g. treasury bills, time deposits, swaps, etc.), as well as other mutual funds or even shares. This stands, if the share of investment in shares does not exceed 10% of their assets.

Bond Funds are called:

- Domestic Bonds, if they invest more than 65% of their assets in Greek government bonds.
- Foreign Bonds, if they invest more than 65% of their assets in foreign government bonds.

These are the funds with the lowest investment risk - lower than the risk of mixed funds and far below the risk of equity funds - since they mostly invest in fixed income securities. Investment risk is limited because portfolio managers of bonded funds apply a range of risk management policies, such as the following:

- A strategy of investing a percentage in risk-limiting bonds, such as index-linked bonds, floating rate bond etc.

- An investment strategy for short and long-term bonds (barbell portfolio) aiming again at addressing a possible increase in interest rates.
- An immunization strategy that ensures a given return on euros in a specific period, regardless of the course of interest rates.

The expected return on bond funds is higher than the yield on the annual Treasury bills for the following reasons:

- Bond funds invest mainly in long-term securities that yield a higher return than the yield on annual Treasury bills.
- Bond funds invest a small portion of the portfolio in shares whose expected return is higher than the yield on the annual Treasury bills.

Bond funds are aimed at conservative investors who are not willing to take a big risk but want a good and steady return at the same time and are willing to invest their funds with a horizon of two to four years (Detzler, 1997).

Mixed mutual funds

Mixed funds follow an interim portfolio management policy by allocating their portfolio investments in such a way that they do not fit into any other fund category.

Typically, they follow a management policy that invests in shares a percentage of its portfolio large enough but smaller than equity funds. The rest of the portfolio is invested in time deposits, fixed yield securities (bonds, etc.), synthetics swaps. Mixed funds are divided internally and externally depending on whether they focus their investment interest in domestic or foreign securities.

Mixed funds are considered reciprocal through investment risk, since the fixed assets contained in their portfolio guarantee a steady return, the final amount of which is tailored to share returns. In this case, however, the risk is real, but it is lower than that

of a mutual equity fund, of which almost all of their assets are in equity and are of course higher than bond funds.

Mixed funds target investors who seek to exploit the opportunities that capital markets offer in the medium to long-term, but they want to take a lower risk than investing in equity funds. In particular, investors who believe that the risk posed by equity funds is large, but are not willing to give up the chance of benefiting from the high returns that may be offered by equity investments can invest in mixed mutual funds (Rajan and R.Sivashanmugam, 2011).

The mutual funds of this category, as we have mentioned, follow a regular investment approach similar to that of the mutual funds, but taking care of a large dispersion of the investment risk. This is achieved by limiting equity investments to the benefit of fixed income investments, such as government securities. Thus, the unitholder who prefers this mutual class knows that he will not fully reap the high returns of the shares if they develop positively, but believes that he will not bear for the entire capital that has allocated the losses from a negative course of shares.

Equity Funds

They invest most of their assets, more than 65 %, in shares, while the rest of their assets invest in bonds, futures, synthetic swaps. Equity funds are divided internally and externally. More specifically, equity funds are divided into:

- Domestic equity mutual funds if they invest more than 65% of their assets in shares listed on the Greek Stock Exchange.
- Foreign equity mutual funds if they have placed more than 65% of their holdings in Foreign Exchange Stocks.

Moreover, equity funds are also distinguished in the following categories:

- Sectoral mutual funds, if they focus their investment interest on shares in one or more relevant industries.
- Mutual funds whose performance is related to the course of a stock market index (e.g. the general stock market index, etc.).

Equity funds, investing most of their assets in equities, are considered to be "those with the highest investment risk" but also those that can achieve the highest returns.

However, the investment risk borne by each mutual fund is shaped according to the investment policy followed by its managers. For example, a mutual fund may invest mostly in shares with a high stock market value (blue chips, ie high capitalization, and quality), such as large banks, large industrial enterprises, etc., whose stock prices are not highly fluctuating at short intervals.

The risk assumed by someone who invests in such a mutual fund is smaller than another of the same category that pursues investment policy and puts capital into stocks with large fluctuations in their prices. It is obvious that equity funds are a form of investment that involves a high investment risk, such as an investment directly linked to the stock market's course. The degree of investment risk of an equity fund is higher than the other fund categories (bond, treasury, mixed). Fund managers, with the implementation of appropriate portfolio management strategies, can significantly limit the investment risk. The individual policies of these strategies are as follows:

- Significant diversification of the equity portfolio into shares of various companies from various sectors of the economy.
- A choice of stocks that have relatively low margins to lower their prices compared to the rest.
- Investing a small percentage of the portfolio in fixed income securities.
- The placement of a small percentage of the portfolio in foreign securities.

- The selection of stocks in upward periods of the Stock Exchange, with a beta factor (b) greater than or equal to the unit (b≥1). Beta (b) is an index that reflects the degree of risk of a portfolio or share, i.e. it indicates the percentage change in the value of the portfolio or its share price when the general index changes by one percentage point. It is obvious that in the upward course of the stock market when the beta (b) is higher than one (b> 1), the rate of increase in the value of a stock portfolio the price of one share is higher than the rate of increase in the general price index. Whereas, when beta (b) is equal to one (b = 1), then the rate of increase in the value of the share portfolio or the share price is equal to the rate of increase in the price of the general index.

Equity funds, as mentioned above, have a higher investment risk but can, with a rational portfolio management, deliver higher returns than other mutual funds.

Depending on the quality of the portfolio's shares, the return/investment risk ratio may increase or decrease. Equity fund managers, with a rational portfolio management, can largely exploit the opportunities of the domestic and international stock market and thus achieve returns that are similar or even higher than the general index Stock Exchange. It has been observed in more stock exchanges in the world that, in the long run, the performance of the general stock market price index, and hence the return on equity funds, is much higher than the return on fixed income securities (Pástor and Stambaugh, 2001).

Equity funds are addressed, as a long-term investment, for all those who wish to have the possibility of maximizing their capital. However, they can also appeal to the category of investors seeking to take on investment risk at the same time, higher short-term returns than other fund categories.

Apart from their type, however, the Funds are also separated according to the geographical distribution of their investments. Therefore, we have Domestic Mutual Funds investing in Greece and Greek investment products, Foreign Funds investing in investment products from other countries except for Greece, and International Funds that invest in and outside Greece.

Mutual Funds Advantages

Mutual funds offer numerous benefits to the investors that singles them out from the other investment options and makes them more attractive to investors.

1. Firstly, they provide professional management regardless the capital size by a specialized company, the Mutual Fund Management Company.
2. Secondly, they provide diversification and are considered a safe choice in comparison with other investment pools, like hedge funds. They place money on various stockbrokers and banks which results to a reduction in investment risk.
3. They offer transparency and flexibility, since the investor is able to have daily information about the course of his capital and freedom as there are many products available, some of which can be an ideal match to the investor's needs and investment orientation. Moreover, the investor can also have the option to take advantage of certain market conditions by transferring his money from one fund to another.
4. They offer the possibility of immediate liquidation, as the companies that manage the funds are obliged by law to redeem everyone’s share within a maximum of five days after the submission of his application.
5. The exchange of shares in stocks or other securities takes place at the Stock Exchange, and it is at the discretion of the Mutual Fund Management Company to accept this exchange or not.

6. The commissions paid by the Mutual Fund Management Company are, as a percentage of the transactions they make, much higher than those paid by individual investors.
7. The way of investing in foreign stock exchanges is easier. Mutual funds are less affected by the exchange restrictions imposed by law in comparison to those an individual has to face. In addition, Mutual Funds Management Company has the specialized knowledge and experience to choose the best investments in foreign markets.
8. They offer significant tax exemptions.
9. They reinvest part of the earnings from shares in new shares, without payment of commission.
10. They offer foreign currency re-export benefits for foreign residents who bought foreign currency shares.
11. They enable the participation of small savers-investors. In most cases, the minimum stake is 146.74 euros (Nikolaos Philippas & Efthymios G., 2017).

Mutual Funds Disadvantages

Despite their many advantages, mutual funds have also some disadvantages that have to be mentioned. One disadvantage is the cost of entry and withdrawal from a fund. In order to participate in such an investment you buy securities for which, together with the net price of the share, you have to pay a commission fee. This commission is called a supply commission. In addition to that, when leaving a mutual fund there is a higher price for the investor, as he is forced to pay a corresponding commission called redemption commission. Therefore, we understand that there is some additional cost involved in participating in a mutual fund.

Another disadvantage is the difficulty the prospective investor encounters in choosing the appropriate fund based on his investment profile. This difficulty is due to the fact that there is a large number of mutual funds that resemble each other. Differences are small but essential. Therefore, a wrong choice can produce the opposite results than what the client wanted from the investment.

In addition, fund management is solely managed by its management company and by investment advisers. Thus, shareholders cannot intervene in the management of the portfolio. Shareholders have no right to choose investment strategies even though they are rightful owners of a part of the total capital.

Finally, the portfolios of mutual funds have a wide spread of risk and this is achieved by a large number of investments they use. This, however, results in long-term investment as well as the stock market (Rao, 2006).

Mutual Funds Market

The market for mutual funds has experienced a big growth in the last decade. More and more investors are turning their interest in mutual funds investment. In 2017, the mutual fund industry amounted to $17.4 billion dollars in assets, which means that it was 10% bigger compared to 2016. Most of these earnings were gained from equity funds (about 20% of them). Because of the global economic uncertainty that prevails the last few years, investors tend to prefer safe fixed-income products despite their low returns. However, still more than half of the mutual fund assets belong to equity funds, with the rest of them being split among money market and bond funds. Moreover, even though the number of mutual funds shanked a bit since its peak on 2001, something that was expected after the crisis in 2007, it has risen again in the last year's amount to 8,049 in 2017 for America alone.

Similarly, the mutual funds market in Greece has grown rapidly. It first appeared in Greece in 1972 with the introduction of two balanced funds. Due to a series of economic and political events, the mutual funds market was stalled and did not experience any growth for another 15 years. From 1989 and onwards, due to institutional changes in Greece and thanks to an increased stock exchange market, mutual funds begun to grow, reaching the current level. According to the recent data of Association of Greek Institutional Investors, nowadays there are more than 34 active mutual funds management companies in Greece, with the assets of mutual funds rising more than €30bn. Only 15 years earlier in 2002, there were 26 management companies and even a decade earlier there were only as many as 7 mutual fund management companies with assets rising to just to €431 million.

At the end of 2013, domestic fund assets rose to 11.34 billion euros, recording an increase of 4.7% compared to the end of 2012. The mutual funds market appears to be equally distributed with more active assets, of mutual funds (20% of the total) of mixed funds (19% of the total) and of money market funds (15% of the total).

Highest average returns per category were held by Greece's bond funds with 39.8%, Greece's share capital by 32.46% and gross shares by 22.8%. It should be noted that 29 out of 37 mutual funds in the Greek Equity Fund category outperformed in relation to the general index of the ASE, which amounted to 28.06%, with returns from 28.3% to 46.5% (Ethe.org.gr, 2018).

With this increasing trend, there is a need for an evaluation regarding the performance of the funds. In the USA various institutions and firms provide ratings and rankings for the performance of mutual funds like Morningstar, Moody's and Standard & Poor's. However, in Greece, there are no such institutions to measure the performance of mutual funds. This is partly because of the fact that evaluation systems

that were developed in foreign countries are based on specific mutual funds categorization that may not fully apply in Greece, so the use of a foreign evaluation system is inefficient. Moreover, an evaluation system for a specific market should be able to take into consideration the characteristics of this market and the economic conditions of its host country, making the creation of a general mutual funds evaluation system near to impossible (Pendaraki, Zopounidis, and Doumpos, 2005).

According to Sharpe (1998), such measures are only useful for investors that invest in only one fund. As a result, they are inefficient when it comes to measuring the desirability of a fund on a multi-fund portfolio, where the relevant measure of risk is the fund's contribution to the total risk of the portfolio.

There have been studies that are trying to measure the performance of Greek mutual funds over the years, as well as other factors concerning the funds (Babalos, Caporale and Philippas, 2012) (Giamouridis and Sakellariou, 2008) (Dritsakis, Grose and Kalyvas, 2006) (Pendaraki, Zopounidis and Doumpos, 2005). However, the studies regarding the Greek mutual funds are very limited and they only focus on some specific funds (like equity funds) and for very specific characteristics. Moreover, they are generally outdated as most of them were conducted at least 6 years ago. As a result, it is an unexplored area with limited existing bibliography.

How mutual funds work in Greece

Shareholders

Like any money pool, mutual funds are managed and undergone administrative control. Whilst returns on invested capital to other institutional investors (e.g. banks, insurance companies) are not necessarily a feature of retaining or further attracting customers, in the case of mutual funds the performance they achieve in countries with competitive market, mark their course significantly. The reason for this is that in the

case of institutional investors there is a clear separation between clients and shareholders. Customers typically enjoy some solid performance that has been promised to them from the start, while shareholders enjoy the benefits of good management and suffer the damage from a bad one.

In the case of mutual funds, customers and shareholders are the same. The effects of good or bad management that is reflected in returns, affect all unitholders at the same rate and depends on the number of units they hold in absolute terms. The number of shares held by an investor also determines the percentage of ownership entitlement in the fund. Shares are acquired by paying the exact value of each one, on the day of purchase.

This value varies daily as the securities in which the funds are invested are subjected to continuous negotiation and therefore fluctuations. However, the units of the mutual funds are not traded on the stock exchange, such as the shares of investment firms (closed-end mutual funds). The reason for that is, that once the values in which the money of the funds is placed become negotiable, the value of the units that is a function of these negotiable prices is fully determined and publicly announced at the end of the day.

By identifying value as mentioned above, investors are unable to measure managers' abilities. Thus, the units are bought from the mutual fund without any discount or bonus reflecting those capacities. Notwithstanding the satisfactory pricing of units when investments are made in negotiable securities, a significant proportion of investments in non-negotiable securities pose a problem for proper pricing and involve serious investment risks.

AEDAK

In order to buy shares, investors place their money on the fund manager. The fund manager is none other than a management company, AEDAK. This company, which must have the approval of the Hellenic Capital Market Commission to operate, is a public limited company and usually manages the whole family of mutual funds, i.e. mutual funds of different categories. This company has the sole responsibility of placing money in various choices and do a daily intervention on the markets if necessary.

Apart from the executives who design and implement the investment strategies, there is an Investment Committee which, apart from the key management personnel of AEDAK, consists of people with theoretical and practical background who are adapting their investment policy to meet the market and international trends.

The role of the management company is very important in achieving satisfactory performance and bears responsibility for any malpractice. To a great extent, the success of an AEDAK is based on the people in the management team and the experience and talent they have in management.

Investing in mutual funds is one of the best-guaranteed investment options, not so much in terms of returns, but in terms of transparency during money transactions, as well as safeguarding securities and money invested. Both the laws and the depositary assigned to each mutual fund contribute to this. The depositary is responsible for securing the assets on behalf of the unit-holders. This role is particularly important as it guarantees the security of unitholders' money. It thus assumes the responsibility to collect interest and dividends, as well as the cash flows from the sale of shares or other securities while making payments for the purchase of securities.

The role of the depositary lies primarily in banking institutions. This role falls into the nature of their work as they have experience in audit work and are facilitated by the existing payment and collection system. Money retention services offered to mutual funds are standard services that are also offered to other clients. For this reason, the predetermined remuneration for the depositary included in the fund regulation is competitive and at a very low level.

In general, the depositary assumes the duties of a Treasurer and is accountable to the AEDAK and unit-holders for any negligence in fulfilling their obligations. His liability is not transferred in the case of safekeeping of securities to another bank or institution. The depositary is obliged to execute the instructions of the Mutual Fund, except if those are illegal or contradicting to the fund regulations. At the same time, AEDAK is obliged to monitor the depositary for the proper execution of its mandates. With these obligations on both sides, the depository and the AEDAK must act independently from each other and in the interest of the unit-holders.

Greek funds characteristics

The distribution of the shares of a mutual fund is made through the AEDAK. However, AEDAK can use its representatives to sell those shares. In this case, only banks, insurance companies and members of the Athens Stock Exchange can act as agents.

Shares are ownership titles on the net assets of the fund that the unit-holder invests in. These securities are acquired by paying the distribution price to the mutual fund and are only redeemed by the same common fund. However, they can be pledged to secure a claim. It is also allowed in the case of life insurance, and upon agreement, the compensation to be made through the transferring units of funds instead of cash.

Finally, shares are transferred between spouses or relatives of first and second degree in a straight line. Thus, in these ways, greater use is made of the mutual fund shares.

The number of shares when the fund is created is a function of the size of the share capital and the nominal value of each share and is derived from the division of the first of the shares. Due to the fact that the funds are open-ended, the number of units remains unchanged. Whenever new unit-holders are attracted, new shares are created depending on the money they earn. Accordingly, whenever unit-holders sell their units in the fund, the number of shares decreases in proportion to the reduction in assets.

Once the fund is created and approved, it is obligatory to offer new shares on the basis that the price is being determined on that day. For this reason, the candidate shareholder is required to submit a written application to the AEDAK where he accepts the Fund Regulation and pays the cash price, or even securities if AEDAK is in agreement.

The reference price for the value of the units is based on the value of the investments made. More specifically, at the end of the day and at the closing time of the stock exchange, the total value of the securities held by the fund is calculated based on its number and closing price.

For securities that were not traded, the prices of the previous negotiation are used, while for securities that cannot be traded, the acquisition prices are used. These values are added to other values such as money that has not yet been invested, or any deposits and cash available to the fund to execute any acquisitions or payments to third parties that arise. The total of the above values is the value of the fund's assets.

Public Awareness

To acquire mutual fund shares, the potential shareholder must apply to the AEDAK which in turn will accept the mutual fund regulations. AEDAK for its part, must deliver

the fund's prospectus free of charge in order to inform the prospective shareholder about a number of important features of the fund, such as the regulation, its date of incorporation, its management, the other funds that are probably managed by AEDAK, as well as the amount of its own funds, the custodian, any existing external investment advisors and, in general, all the information that will help the candidate shareholder to decide whether to purchase shares or not. For this reason, the latest reports of the semester and the year are offered together with the auditors' report.

More specifically, data relating to the assets of each mutual fund, the shares and the prices of each share (net, participation, redemption) must be published daily and must be in reference to the two previous working days. Also, they must publish daily changes in their net price, as well as their returns from the beginning of each year. At the end of each financial year, a condensed statement of the assets of the mutual fund, the profit and loss account and the manner of disposal of its profits must be published in a daily, financial newspaper of Athens.

In addition, mutual funds must be at the disposal of the investing public within the first two months after the end of each semester and after being audited by chartered accountants and submitted to the Capital Market Commission for a six-month and annual report recording the assets of the mutual fund at the relevant time. The Annual Report has to be drawn up compulsory by AEDAK at the end of each financial year, which coincides with the calendar year except for the first use, which may be less than one year. In particular, these reports include the following:

- The assets of the mutual fund, i.e. the type and quantity of the assets.
- Analytical profit and loss account and any distributed or reinvested earnings.
- Total inflows and outflows, the surplus of investment in the Sub-Fund, and generally all changes.

- Shares of the mutual fund that were sold and redeemed, as well as current shares at the beginning and end of the year. The net price of the share, as well as the number of the mutual fund's liabilities.
- The assets of the mutual fund that are classified according to the specific categories and according to the basic criteria of the investment strategy with reference to the percentage of each category.
- A comparative table of the last three financial years, showing the net values and the value of the net assets at the end of each use.
- The total revenue of the mutual fund (total operating cost to the average of the mutual fund 's net assets).
- Any other important information that allows investors to form an opinion on the mutual fund 's activities and its results.

According to the decisions of the Hellenic Capital Market Commission, AEDAK is obliged to send quarterly information to their client's on the valuation of their investments, which must include the management fees of a mutual fund as a percentage borne by the mutual fund, as well as custody fees. Also, the performance of this year, as well as the three-fund, must be reported.

Institutional framework

Mutual fund was introduced in 1970 with the adoption of the New Democracy Act. 608/70. Under this law, the first two mutual funds of Hermes Dynamic and Delos Mixed were put into operation. However, the 1969/1991 Law on the functioning of mutual funds and portfolio investment companies has been the cornerstone for the institution of mutual funds. This law abolished the ND. 608/70 law.

According to this law, a Greek mutual fund is characterized by the criterion of having its headquarters and head office in Greece.

The authorization for the formation of a mutual fund is granted only if the Hellenic Capital Market Commission approves the mutual fund, the election of the depositary and the fund regulation submitted by the mutual fund. In order for the AEDAK to be approved is required to have a minimum share capital equal to 100 million drachmas, while the minimum initial amount of the fund's assets is set at GRD 400 million. This amount must be paid within three months of the authorization to set up. Otherwise, the authorization to set up the fund is revoked.

Until the fund's authorization is published in the Government Newspaper and the depositary certifies the raising of assets, the fund may not allocate shares to the investing public nor advertise.

Under this law, shareholders are not responsible for acts and omissions of AEDAK and the depositary. On the contrary, AEDAK and the depositary shall be liable to the unit-holders for any negligence in the performance of their duties. The law defines the Capital Market Commission as the main instrument for the control and imposition of fines in the management of AEDAK and in general the proper functioning of the institution, with a view to safeguarding the interests of the unit-holders.

The Capital Market Commission is in charge of issuing regulatory provisions to regulate pending issues that emerge along the way. The decisions of the Capital Market Commission (CMC) are part of the law governing the operation of mutual funds. On November 2, 2004, the new Law 3283/2004 on mutual funds and mutual funds management in Greece was adopted and implemented, which incorporates the relevant EU directives and replaces the oldest Law 1969/1991 as a whole, as well as its amendments.

The new law creates a new dynamic prospect and new opportunities for Mutual Funds and AEDAK, as it facilitates the circulation of products and companies in the

countries of the European Union, creates the conditions for the creation of new products, strengthens transparency in management, increases investor information and, at the same time, further protects their rights. More specifically, AEDAK has the ability to expand their activities in the management of private portfolios and portfolios of insurance funds, the provision of investment consultants, the management of mutual funds of other mutual funds, etc. Furthermore, they have the possibility to market their products in other EU countries, either through cross-border action or through the establishment of branches. In relation to the new products, the funds of funds, Mutual Funds of other Mutual Funds and index funds, Passive Management Mutual Funds that follow the course of an index, are introduced into the Greek money market.

In the field of investor protection, new limitations are imposed on investments, aiming at the greater dispersion of risks and less exposure to them, as well as avoiding the concentration of investment instruments in the parent company and the group owned by AEDAK. Among other significant new elements concerning investor protection, are the new terms set for mutual fund regulations and the information stipulated that the prospectuses and summary newsletters for the mutual funds, which are distributed to prospective shareholders, should be included.

Following the publication of the new law, the Hellenic Capital Market Commission issued a number of regulatory decisions aimed at improving the operation of the mutual funds and the further protection of investors. According to them:

- A new categorization of the mutual funds is introduced, which is divided into domestic and foreign funds and each of these categories is distinguished by the sub-categories of mixed, share, bond, and treasury funds.
- It is determined that the index funds fall into the above categories depending on the composition of their portfolio.

- Treasury bills are prohibited from being placed in shares.
- Mixed Mutual Funds are required to place at least 10% of their assets in shares and 10% in bonds.
- Mutual funds are obliged at the end of each calendar quarter and within 10 calendar days of maturity to publish analytical and average percentage tables of the mutual fund's portfolios that they manage and make them available to unitholders and publish those on their websites within of the same time limit.
- The categories of expenses and fees that the mutual fund is allowed to bear are precisely specified in the Fund's regulations.
- In the quarterly statements of account sent to the unit-holders, the management fee of AEDAK must be stated as a percentage charged to the fund. Also, the three-year performance of the mutual fund must also be reported.

Mutual fund investments

In the course of their investment policy, mutual funds are subjected to certain maximum investment limits on investment categories and follow the types of investment allowed. Minimum required management by AEDAK means respecting those limits set by the laws. Under Article 32 of Law 1969/1991, fund assets may be invested in a number of different investments such as:

- Securities admitted to European Union or other countries' exchanges as defined by decisions of the Ministry of National Economy.
- Newly issued securities that will be listed on a stock exchange within one year.
- Other securities and debt securities if they do not exceed 10% of the net assets.

- Cash, bank deposits, and direct liquid assets if they are not the core business of the fund.

The same article prohibits mutual funds from acquiring precious metals or securities thereof. However, the use of new financial instruments (eg rights, futures, exchanges, etc.) for the efficient management of the financial and investment risks (eg foreign exchange risk, market risk) is permitted. Articles 33 and 34 of the same law define the percentages of the net assets that can be invested in specific investments and issuers.

This allows investment in securities of the same issuer to be up to 10% of the net assets of the fund on the day of acquisition. However, investments over 5% of the fund in securities of issuers must not exceed 40% of the fund's total value.

However, if the issuer is a member state or a local authority of the European Union or they guarantee issuance, the investment rate may be up to 35%. If the issuer is a European Union-led credit institution that is subject to special government control and the issuance of bonds, the fund's net investment in the fund may be up to 25%.

A mutual fund may not acquire units of other funds beyond 5% of its net asset value. This prohibition also applies to mutual funds of the same AEDAK with the sole exception of specialized investments in a particular geographical or economic area. It is also not allowed to acquire more than 10% of the shares of a public limited company or investment advisory firm or, finally, of the Securities Depositary.

However, this restriction also applies to AEDAK. For all the funds it manages, each AEDAK may not invest more than 10% in voting shares of one issuer. This provision aims at avoiding the concentration of a significant percentage of management control in an AEDAK resulting in a significant influence on the management of the company.

Under the Law 3283/2004, the assets of the mutual fund may only be placed in the following investments:

- Transferable securities and money market instruments accepted and traded.
- Negotiable securities after the permission of the Securities and Exchange Commission has been provided and given the fact that the terms of the issue include the obligation to apply for official listing on a stock exchange or any other market for the above and where such admission is effected no later than one year after the issuance.
- Shares of OSEKA in accordance with national legislation harmonized with directive 85/611 / EOK, or other collective investment undertakings, irrespective of whether they are domiciled in a Member State, under certain conditions.
- Deposits with credit institutions attributable to first-time depositors or time deposits of up to 12 months if the credit institution has its registered office in a Member State or, if the registered office of the credit institution is in a third country as defined in a decision of the Capital Market Commission and following an opinion of the Bank of Greece, provided that the institution is subject to prudential supervision, which is at least equivalent to that provided for by Community law.
- Derivative financial instruments, including cash-settled instruments, which are traded on one of the markets listed above, and financial derivative instruments subject to OTC transactions, under certain conditions.
- Money market instruments other than traded on a regulated market where the issuance or issuer of those instruments is subject to investor protection and

savings arrangements and where such instruments meet the requirements of Law 3283/2004.

- Following a license from the Securities and Exchange Commission, the fund may invest up to 10% of its net assets and money market instruments other than those mentioned above.
- The fund is not allowed to acquire precious metals or valuable securities of precious metals.

In addition, the legal framework places restrictions on the percentage of each investment in the mutual fund's composition, with a view to ensuring the wide dispersion of its portfolio. The most important of these are the following:

- Up to 10% of the net assets of the mutual fund may be placed in transferable securities and money market instruments of the same issuer.
- Up to 40% of the net assets of the mutual fund may be placed in transferable securities and money market instruments of issuers, each of which has invested more than 5% of its net assets. This limitation does not apply to deposits and OTC derivative transactions.

Techniques for performance measurement

Many techniques have been used in order to measure the performance of mutual funds. Some of the most famous and widely used indexes are those of Treynor (1965), Jensen (1968) and Sharpe (1996). However, they have some drawbacks like the need of a proper benchmark that is closely related to what constitutes the normal performance of a portfolio. Moreover, they tend to ignore the various costs incurred by the mutual fund's shareholders, which in the real world they can affect the performance of the

mutual funds to a great degree. Such costs include sales charges, operation, and administrative costs. Various different techniques have been developed to overcome these problems such as the Data Envelopment Analysis (DEA, Charnes et al., 1978). DEA constructs an efficient frontier portfolio from a linear combination of the perfectly efficient funds. It then determines fund deviation from that frontier which represents performance inefficiencies. This technique allows us to measure the efficiency of one fund compared to a group of funds.

Another important factor that affects the performance of the mutual funds is the ability of the portfolio managers. A very important factor that contributes to the value of the funds in many ways. First, it is very important whether the manager makes the most effective use of the available resources or he just wastes them with his management. In addition, the performance of the fund manager affects the decision of the investor as to where to invest his wealth.

According to Fama (1972), the ability of the manager can be measured through his selectivity and market timing. Market timing is the ability to forecast changes in the economy and to adjust the portfolio beat accordingly in order to maximize future returns. Selectivity is the ability to evaluate and choose the optimal assets and funds to construct the portfolio. These two skills represent the ability of the manager to act on a macroeconomic and microeconomic level.

Bhattacharya and Pfleider (1983) further argued that if a manager can efficiently forecast market return he is going to hold a better proportion of the market portfolio when the market is high and a smaller when it is low.

Another approach that has been studied to a great extent is the up/down model. This model treats beta as a binary variable. It is constrained to a given value when the market goes up and another one when the market goes down. If the return of the

equity compared to a market benchmark is positive, an upmarket is declared. Otherwise, if the return on the equity compared to a market benchmark is negative, a down market is declared. (Henriksson, 1984), (Chang and Lewellen, 1984) (Chun and Woodward, 1986) (Breen, Jaganathan, and Ofer, 1986) (Cumby and Modest, 1987) (Jaganathan and Korajszyk, 1988) (Koh, Phoon, and Tan, 1993).

Finally, there are other studies that they treat beta as a stochastic variable that undergoes continuous changes in contrast with the binary beat of the up/down model. For example, it can be treated as a random coefficient (Francis and Fabozzi, 1980), as a stochastic autoregressive schemer (Ohlson and Rosenberg, 1982) and with a random walk specification (Alexander-Bensen and Edgar, 1982).

Literature Review

Foreign mutual funds

The evaluation of the performance of mutual funds is an issue that has been explored to a very satisfactory degree by international literature. However, precisely because of this extensive study of the subject from many researchers, the conclusions reached by the authors are not all in the same direction. The findings of one come often to complement those of the past or illuminate a new dimension which had probably not be emphasized by previous authors.

Until the early 1960s, researchers of mutual funds categorized funds according to their risk (for example their standard deviation) into risk categories and then compared the returns between the mutual funds that belonged to the same risk category. However, with the introduction of the Capital Asset Pricing Model, researchers began evaluating the performance of mutual funds on the basis of complex measures combining elements such as performance and the risk.

Treynor (1965), initially, proposed a complex measure of their performance fund, which calculates the risk premium per unit-of-systemic risk. If the measure proposed by Treynor is greater (or less) than the market portfolio performance then that fund had better (or worse) return from that of the market portfolio, in respect l of its systemic risk.

Sharpe (1966) then studied the performance of thirty-four mutual funds for the period from 1954 to 1963 and proposed a measure to evaluate the performance of mutual funds, which calculates the risk-reward per unit of total risk. According to Sharpe, any differences in the returns of mutual funds are the result of their different management costs. Sharpe also came to the conclusion that most of the funds he tested included in his research did not outperform the performance of the market portfolio as derived from the Dow Jones index.

Jensen (1968) evaluated the performance of 115 mutual funds for the period from 1945 to 1964. Like the previous two writers he proposed a complex evaluation method to measure performance, the value of the alpha of a mutual fund, which is the difference between the realized and the required return, which corresponds to the systemic risk of that fund. The alpha index, according to Jensen, expresses the selectivity or selectivity of fund managers. Jensen compared his index for the 115 rated funds with the S & P index, which measures a balanced portfolio. He also concluded that the average annual risk-adjusted return on the respondent's funds was -0.9 %, while when the different management costs and other costs were added to the average returns, the risk-adjusted return was zero. In addition, the managers of these reciprocal funds could not predict stock prices well enough to outperform the “buy and hold” strategy.

Similar results were obtained by McDonald (1974), who used as benchmark index f the NYSE index. McDonald took the 120 monthly returns for a period from 1960 to

1969 of a sample of 123 mutual funds. He evaluated these funds with both the Sharpe index and the Treynor index. From his findings, it emerged that while using the Treynor index, about 50% of the mutual funds examined had a performance that exceeded market yields, using the Sharpe index, this figure declined to just about 30%.

However, Mains (1977) challenged Jensen claiming that the returns he had used were downward / underpriced since he had assumed that fund dividends were paid at the end of the year, ignoring interest income from shares. Thus, Mains analyzed the monthly returns of 70 mutual funds for the period from 1945 to 1964. He concluded that the average risk-adjusted yield of the fund he was looking at was about zero, and when he included management costs in his analysis, he found that the overall risk-adjusted return was around 1%.

A similar methodology was proposed by Ippolito (1989), who used S & P 500 as a benchmark and examined the returns of his sample for the period from 1965 to 1984. Ippolito's empirical findings showed that the mutual funds may show abnormal returns. However, his conclusions may change if another portfolio than the S & P index is used as a benchmark.

In addition to selectivity, Treynor and Mazuy (1966) added another parameter for the evaluation of mutual fund performance, market timing ability. According to the authors if the gamma value of a fund is positive (or negative), then the manager of that fund is deemed capable (or incapable, respectively).

Treynor and Mazuy evaluated the annual yields of 57 selected funds as a sample to look at the assumption that fund managers have the ability to enter the market at the appropriate market timing. In the conclusions of their investigation, they argued that the fund managers they dealt with cannot predict market developments and therefore

place themselves on the market at the right time, effectively altering their positions in mutual funds.

Lehman and Modest (1987) then compared the returns of 130 mutual funds for the period 1968 to 1982 by combining the APT model with Treynor and Mazuy. They concluded that the examined funds had abnormal timing and selectivity returns. Additionally, the authors identified significant differences between the indicators derived from the CAPM and those derived from the APT Model Valuation Model. They also found that performance measurement is quite sensitive to the benchmark that was selected and therefore the choice of the market portfolio is of the utmost importance for the analysis of the returns of the funds being considered. Additionally, the authors identified significant differences between the indicators derived from the CAPM and those derived from the APT Model Valuation Model.

Cumby and Glen (1990) examined a sample of 15 international mutually United States funds for the period from 1982 to 1988, using various performance models. Using the Jensen Index, the authors concluded that the mutual funds in question did not exceed the international equity index they used. However, they managed to prove that the performance of the funds under review exceeded the performance of a domestic stock portfolio in the United States. This is attributed to the profits of the diversification of the underlying portfolio in relation to international securities. Using the Treynor and Mazuy model, Cumby and Glen found that there were conflicting synchronization effects, and at the same time that the managers of the underlying funds were inadequate to correctly predict the future course of the market.

Eun - Kolodny, and Resnick (1991) evaluated the performance of international mutual funds traded in the United States from 1977 to the year 1968. The writers, taking the Sharpe index, found that most mutual funds had performances better than those of

Standard & Poor's (S & P) indices and worse than the international index Morgan Stanley Capital International (MSCI).

In addition, Fama ranked the successful management factors and hence the profitability of a mutual fund in two categories, micro-forecasting skills, and macro-forecasting skills. According to the author, in practice, it is good to separate micro-prediction skills from those of macro-prediction. The above distinction has been particularly important in the modern theory of fund performance evaluation.

Fabozzi and Francis (1979), in turn, checked whether the alpha and/or beta of a fund differ statistically in up and down markets. The two authors looked at the returns of 85 mutual funds during the period from December 1965 to December 1971. For auditing reason, they used three different definitions for the bull and bear markets.

They concluded that the fund managers they were looking at did not leverage the beta of their mutual funds to take advantage of market shifts (transition from upward to downward markets and vice versa). The authors tried to explain this phenomenon by attributing to three reasons. First, a large number of shares have random beta factors. Secondly, managers are not able to anticipate future changes in the market. Third, if managers are able to properly assess the direction the market is about to move, then the cost of changing the pitch of their capital may be much greater than the expected gain of such a move.

Henriksson and Merton (1981), on the other hand, introduced the theoretical background for the ascending and descending model (Up / Down Model). In order to check the ability of the fund managers to synchronize with the market, they have considered market beta to be a binomial variable taking a high price in ascending markets and a low price on the descending markets. According to the authors, returns

will be heterogeneous due to the managers' attempt to “synchronize” the market, even when stock returns are seriously indifferent and similarly distributed in time.

Henriksson (1984) also evaluated the synchronization of 116 fund returns using their monthly data from February 1968 to June 1980. He found that only three of his sample specimens had a synchronization ability for a statistical significance level of 5%. In addition, Chua and Woodward (1986) conducted the same assessment for mutual funds that they traded in Canada, the United States of America and the United Kingdom for the period 1973 to 1983. The findings of their research show that its synchronization performance market for rated funds was generally poor.

Using the Henrikkson and Merton model, Chang and Lewellen (1984) evaluated the returns of 67 mutual funds for the years from 1971 to 1979. Based on the assumption that the correction for heteroscedasticity did not alter the nature of the Henrikkson research results, the two authors did not deal with the existence or non-heteroskedasticity. They also concluded that there was no systematic synchronization on the part of the fund managers and that there was probably a market timing.

Sinclair (1990) assessed the synchronizing ability of the managers of 16 Australian funds by taking the assessment period between January 1981 and December 1987. It concluded that 15 out of 16 of his sample specimens showed systematically negative synchronization abilities.

On the other hand, in 1983, Bhattacharya and Pfeiderer, by correcting the error in Jensen's model, developed a new technique that allows accurate measurement of the ability of synchronization and selectivity of fund managers. The distinction of the model variables approaches that of Treynor and Mazuy.

Later, Lee and Rhaman (1990, 1991) used the model of Bhattacharya and Pfeiderer to examine the monthly returns of 93 mutual funds for the months from

January 1977 to March 1984. The yield of the weighted index CRSP was selected as return on the market portfolio whereas as risk-free interest rate was used as the interest rate on Treasury bills. The investigation revealed that the managers of specific funds were distinguished from their ability to select efficient mutual funds and successful time-to-market placement. In particular, ten of the funds under examination showed selectivity, while four mutual funds had considerable selectivity without synchronization and five mutual funds indicated synchronization without selectivity.

Also, Coggin, Fabozzi, and Rahman (1993) evaluated the performance of pension fund from January 1983 to December 1990. Their empirical results indicate that regardless of the selected market portfolio or the model applied, mean synchronization ability is systematically positive, while mean selectivity is systematically negative. The efficient of pension funds was also evaluated by Bogle (1992), who found that a very large proportion of these funds are systematically lagging behind Standard & Poor's (S & P) returns for the period from 1972 to 1992.

An extension of the Henrikkson and Merton model was proposed by Lockwood and Kadiyala, which includes a more realistic assumption. While in the Henrikkson and Merton model, beta can only take two values, upward and low downward markets, in Lockwood and Kadiyala, managers change beta from period to period according to market conditions. Thus, a manager who is distinguished by a synchronization ability will often change the beta of the portfolio, based on forecasts for the future direction of the market. Lockwood and Kadiyala analyzed the monthly returns of 47 mutual funds for the period from January 1964 to December 1979.
In their conclusions, the authors report that several managers had the ability to choose profitable shares, while none of the fund managers under review had the ability of synchronization.

Greek mutual funds

Concerning the performance of Greek mutual funds and the ability of the managers, current literature is ambiguous. Some studies suggest that mutual funds offer higher returns compared to the market benchmark while others suggest that Greek mutual funds are losing in terms of returns most of the time. Moreover, the majority of the studies agree on the inefficiency of mutual fund managers.

The first attempt to evaluate the Greek mutual funds was made by G. Chantzinikolaou in 1980 for the only two existing mutual funds between Delos and Hermes and for the period 1973-1976. It concluded that the returns of the mutual funds under review were higher than those of the General Index of the Athens Stock Exchange, which was used as a market portfolio. He also found that despite the effects global diversification, the performance of the mutual funds under consideration was lower than that of international stock markets and that only one of the two mutual funds had a consistent effect on its returns.

Then, in 1991, N. Philippe evaluated the performance of three mutual funds for the year if 1990. The criteria he used were those of Treynor and Sharpe. The researchers came to the conclusion that the only one (out of three) privately-funded funds outperformed those of the General Index of the Athens Stock Exchange. The other two, which were of a public nature, had lower returns than the General Index of the Athens Stock Exchange.

Pendaraki, Zopounidis, and Doumpos (2005) make use of an MCDA framework that answers the question of mutual funds' performance through a two-step process. The first step is the evaluation of the performance of mutual future using certain criteria and

selecting the best of them. The second step involves the construction of a portfolio with the funds that were selected in the first step.

For the first step, once all of the criteria have been selected, the UTADIS method is used in order to create a mutual fund evaluation index that is used to find the appropriate funds that will be used in the portfolio (UTilités Additives DIScriminantes; Jacquet-Lagrèze, 1995; Zopounidis and Doumpos, 1999; Doumpos and Zopounidis, 2002).

For the second phase, after the optimal funds have been found, a programming model is used to find the invested proportion of each fund in order to create the optimal portfolio (minimization of the deviations from the ideal levels of the goals) (Harnes and Cooper, 1961). In order to measure the performance of the constructed portfolios, they use the ASE-GI index as a benchmark.

The results of their study indicate that the two constructed portfolios although they had negative returns they still outperformed the market. For the six-month period in 2002 when they were tested, they reached negative returns of -8.11% and -9.28%. However, there was a fall in the Greek market as a whole resulting in an ASE-GI of -13.64%. So despite the negative returns, mutual funds managed to achieve higher returns compared to the market and with a lower volatility.

Eleni Thanou (2008) evaluates 17 mutual funds for the period between 1997 and 2005. Her findings further support the efficiency of Greek mutual funds. She uses the General Index of the Athens Exchange (GI) as a benchmark to compare the performance of the mutual funds. She also measures the timing ability of the Greek mutual fund managers using the CAPM evaluation theory.

Using the Sharp and Treynor indexes, she analyzes the risk-adjusted performance of the funds and ranks all the funds according to these two indexes. After

that, she uses the Spearman Risk Test to compare the obtained rankings. Moreover, to measure the ability of the managers to exceed the performance of the market the Jensen performance index is calculated and used. Finally, by using the Treynor-Mazuy model, she draws conclusions about the timing ability of the managers.

Regarding the performance of mutual funds, most of them followed the performance of the benchmark index closely showing small variation. During the nine years period, some of them managed to outperform the market while others underperformed. However, the number of mutual funds that achieved the higher returns where more than those that suffered low returnees compared to the GI. Therefore, overall, the performance of the mutual was satisfactory, achieving on average the same or slightly higher returns from the GI.

However, the timing ability of the managers appeared to be very poor or even non-existing in most cases. Not only they do not possess a good timing ability but their bad judgment often proved to harm the overall mutual fund performance.

All the other studies seem to support the fact that Greek mutual fund managers do not possess any time marketing and selectivity skills. Studying a period between 2000 and 2008, Alexandros Koulis, Christina Beneki, Maria Adam and Charalampos Botsari (2011) showed again on their study that the managers where inefficient both in terms of selectivity and market timing. Using again the Sharpe and Treynor ratios for 58 mutual equity funds, they found that the managers of the mutual equity funds possess the ability neither to be corrected nor to efficiently select the optimal funds for the portfolio construction.

Nikolaos Philippas and Efthymios G. Tsionas (2002) make once again use of the Jensen index, but in contrast with the other studies, they make additional use of the Lockwood-Kadiyala model (1988). This model suggests a stochastic beta that changes

as time goes by. It is considered a more realistic model by the authors compared to the traditional approach of fixed betas models, where beta takes only two values according to the market performance. Again, they find that managers do not show any market-timing abilities. However, in contrast to some other studies, they find that a number of them of the show a satisfactory selectivity ability, being able to pick undervalued assets.

Regarding the performance of Greek mutual funds, up to now, the results were in favor of the funds. However, the study of Babalos, Caporale, and Philippa (2012) draws a different conclusion. They tried to face two serious problems that the rest of the studies suffer. The first one. The selection of a proper benchmark for the comparison of the mutual funds' performance. The second one is the cost, which although are important no other model considers them when measuring the funds' performance. For that purpose, they used the DEA, which is a non-parametric measure, as was previously mentioned again.

What they find is that majority of the equity funds exhibited significant operation inefficiencies. The total costs have a significant effect on the funds, decreasing the investor's total wealth. Moreover, domestic equity funds failed to eliminate the non-systematic risks of their portfolio, leading to inefficient portfolios and a big productivity loss.

They also find that the size of the fund affects the efficiency of the portfolio. A bigger fund size often pushes the managers in the direction of investing disproportionally in some specific stocks reducing, as a result, the overall fund performance.

Other important studies regarding the characteristics of Greek mutual funds are these of Dritsaki, Grose, and Kalyvas (2006) as well as Gamiouridi and Sakellariou (2008). About the first one, they examine the performance of Greek bond funds and the

impact of fund flows on portfolio returns. Until now most of the studies, concern the equity mutual finds while this one examines the bond funds specifically. They use both unconditional and conditional models, analyzed with and without the fund flows influence. They take into consideration 27 funds for the period 1997-2003.

Using as a benchmark the ASE-GI, before taking the fees into consideration most of the funds tend to outperform the ASE-GI index. However when the fees are accounted the majority of funds underperform, although a 30% of them still have positive and significant returns. In addition, after the fees are accounted only a 30% of the funds shows good market timing skills that are probably connected the 30% of the funds that outperform the market. When fund flows are taken into consideration, although there is a slight improvement, the general conclusions remain the same. The same goes when both conditional and unconditional models are used. All in all the majority of the funds exhibit low returns when compared with the benchmark and the managers have bad market timing abilities.

Regarding the Gamiouridi's and Sakellariou's study, they examine the short-term performance of Greek mutual funds by hypothesizing that the returns earned by the mutual funds are either due to the selectivity of the managers or their market-timing ability. They use the work of Fama and French (1993) for their stock selection procedure and the Treynor and Mazuy model to test the market timing ability.

After the stock selection process, they use some non-parametric test to classify mutual funds in two categories depending on whether they underperform or overperform in comparison with the market. What they find is that mutual fund performance does not persist for any short-term period examined.

Thesis theme and contribution to existing bibliography

General Remarks

Since the market of Greek mutual funds is constantly increasing in terms of mutual funds number and mutual funds types over time, investors now have the option to choose between a great one a variety of mutual funds. The choice, however, of the appropriate mutual fund depending on the investor's particular characteristics is a fairly complex issue since there are a number of factors that need to be taken into account.

Very often the only criterion for selecting a mutual fund seems to be its past performance. Such an approach, however, is oversimplified and it certainly cannot be a prudent and efficient one for addressing the issue of mutual fund valuation. However, as the modern portfolio theory was formulated, the performance of any financial asset began to be evaluated in conjunction with each its assumed risk. Consequently, whole evaluation process started to take place under a more organized effort, in which the strategy of the mutual fund the is taken into account as well as its past performance, its time horizon, the choice of the investor, the desired risk assumed, the ability of the fund manager and any kind of potential restrictions that may be attached to the fund and/or the overall fund market.

A very important parameter in evaluating a fund is its comparison with a similar one and not with a different kind of mutual fund. It is inappropriate for example to compare a money market fund with a bond fund. And that's because the evaluation of one portfolio is achieved by comparing its efficiency with another portfolio which is selected as a benchmark. So, for the mutual fund to be comparable with the benchmark

portfolio; it is necessary for the two portfolios to contain the same risk. Otherwise, the two portfolios are not really comparable.

Although the investor's interest is focused on the performance of the fund compared to the risk he is willing to undertake, the comparison of a different kind funds does not allow its effective assessment of the manager. More specifically, the manager of a bond fund can only invest in shares up to 10% of his portfolio, while the manager of a mixed mutual fund can invest up to 60% of its portfolio in shares. That there are so many different limitations on the investment options that makes the comparison of two such portfolios misplaced.

Thesis Purpose

In my thesis, I will first examine the statistic behavior of the Greek mutual funds' performance for an 8-year period. For my study, I will use bond mutual funds, equity mutual funds and asset management mutual funds. Moreover, I will conduct quantitative measurements to check the degree of dependence among the three types of mutual funds. Furthermore, an analysis of the form of distributions of each fund will be applied separately, with particular emphasis on asymmetry and curvature compared to the average numerical. In addition, a simple linear regression will be applied to examine whether the performance of the ASE-GI exerts a significant effect on the returns of the Mutual Funds. Finally, I will measure the selectivity and market-timing ability for the Greek mutual fund managers.

My thesis contributes to the current bibliography in various ways. First, all the studies up to now focus only on one kind of mutual fund, usual equity fund, while my thesis extends this study to three kinds of mutual funds. Also, I examine to what extent

they affect each other. Moreover, my data cover a more recent period while the rest of the studies examine data up to 2007.

In addition, apart from the performance of the mutual funds and the ability of the managers, I examine a variety of other factors regarding the mutual funds, as well as apply quantitative methods to measure the potential effect that the whole market can have on the returns of mutual funds.

Methodology

General Remarks

Regarding the evaluation of mutual funds and others risk portfolios in general, several indicators have been proposed by the international literature whose common feature is that they calculate the risk-adjusted return each time. The three most widely used are a. the Sharpe performance index; b. Treynor's performance index, c. Mazuy model. These indicators will be used then for the purposes of this study, but for the time being it will we briefly refer to the importance of each of the three indicators.

More specifically, for my thesis, I will study the mutual funds for the period 1/1/2008 to 31/12/2017. My data regarding the mutual funds are collected from the Hellenic Fund and Asset Management Association. In my computation I use the monthly returns of 30 mutual funds, choosing 10 for each category, for the above period. As a benchmark, I use the General Index of the Athens Stock Exchange (ASE-GI) which represents the whole market.

For the computation of monthly returns about the funds and the index, the following formula will be used: $R_{p,t} = log \frac{P_{i,t}}{P_{i,t-1}}$ where $R_{p,t}$ is the return for each fund and the ASE-GI for each period. *Pi,t* is the value of the equity fund *i* at the end of the time period (month)*t* and *Pi,t*−1 is the value at the end of the time period $t - 1$.

For the evaluation of the performance of mutual funds, Sharpe and Treynor indexes will be used. The Treynor index is calculated as $\frac{Rp,t - Rf,}{\beta}$which the over is the risk excess performance of the mutual fund free return, divided by the beta (systematic risk) of the fund. Sharpe index is calculated as $\frac{R\ p,t - Rf,}{\sigma}$ which the over is the risk excess performance of the mutual fund free return, divided by the standard deviation.

To measure selectivity and market- timing ability I use the Treynor and Mazuy model. It uses the regression $R_{p,t} - R_{f,t} = \alpha + \beta\ (R_{m,t} - R_{f,t}) + \gamma\ (R_{m,t} - R_{f,t})2 + e_{t..\ Rp,t\ -\ Rf,t}$ is the excess return of the portfolio p on time t, Rm,t − Rf,t is the excess return of the market, α is the estimated selectivity performance, β is the portfolio's estimate of systematic risk, γ is the estimated indicator of market-timing performance and et is the residual excess return on portfolio during period t. For the risk-free rate, I use the 1-month Euribor.

Having collected the data needed, I then analyze the form of distributions of each fund. Finally, using simple linear regression models I will check the potential connection among the three different kind of mutual funds as well as the effect that ASE-GI has on the returns of mutual funds.

Treynor Ratio

Jack Treynor (1965) was the first to create an index for the evaluation of an investment. For it's from the average return on an investment should be subtracted the zero return risk and then, the resulting risk ratio is adjusted to the systemic risk that the portfolio faces. So we have $T_i = \frac{\overline{r_i} - \overline{r_f}}{b_i}$ where:

- T_i is the value of Treynor index
- $\overline{r_i}$ is the average return on the investment

- $\overline{r}_f$ is the average return of the risk-free rate
- b_i is the beta of the investment

Treynor is expressed as a percentage (%). The higher the value of the index, the higher the average yield per unit of systemic risk and the more “capable” are the managers of one investment. It must be noted that this index uses a key variable of the Capital Asset Modeling Model, factor b. Therefore, the non-systematic risk is not taken into account.

To summarize, we will use an example to show how the return for each unit of risk is calculated. Let's say the average annual return of funds X, Y and Z equals 12%, 6%, and 4% respectively. In addition, b values are the following: = 1.4, b_Y = 1.2 and b_z = 1 as well as that the average zero risk return over the same period is equivalent to 5%. Managers are asked to evaluate the above mutual funds, with the Treynor index.

Based on the above data, we have:

- $T_X = \frac{12-5}{1.4} = 5\%$
- $T_Y = \frac{6-5}{1.2} = 0.83\%$
- $T_Z = \frac{4-5}{1} = -1\%$

We conclude that fund X was undergone better management than the other two since it has the largest average return per unit of risk. It is obvious that for a rational investor the rankings of the funds, against in descending order of preference, will be:

1. X
2. Y

3. Z

Sharpe Index

William Sharpe (1966), although he accepted the usefulness of the Treynor index, he argued that standard deviation is the most appropriate tool to measure the risk of an investment. Especially in cases where a significant degree of non-systematic risk exists Treynor index could not efficiently take this kind of risk into account and thus he suggested the following indicator: $S_i = \frac{\overline{r_i} - \overline{r_f}}{\sigma_i}$ where:

- S_i is the value of Sharpe index.
- $\overline{r_i}$ is the average return on the investment.
- $\overline{r_f}$ is the average return of the risk-free rate.
- σ_t is the standard deviation of the investment.

The Sharpe index is a net number (without units of measurement) that expresses the average additional return per unit of total risk. Any increase (decrease) in the value of this index is related to satisfactory (unsatisfactory) management of an investment.

By carefully observing the two above-mentioned indexes, we find that their only difference lies in the way in which the risk is measured. The one uses the factor b and the other the standard deviation. Sharpe, investigated the behavior of the mutual fund market more extensively using one of a sample of 34 mutual funds for the period 1954-1963. The main conclusions of his study were the following:

- There was a positive linear relationship between risk and performance.
- The ranking of mutual funds using both indices was similarly. This suggests sufficient existence of diversification.

- Managers, on average, were unable to achieve returns higher than the market portfolio when the management costs for each fund.were taken into account.

Our interest focuses on the second conclusion regarding the two indexes. On the basis of this, the following results are concluded:

a) When there is sufficient differentiation, ie the non-systematic risk has been completely eliminated, there are no significant differences in the classification of mutual funds with the two indices.
b) In the opposite case, the differences in ranking would be significant. Treynor only includes the systemic risk while the Sharpe index would take into consideration both systemic and non-systematic risk.

Following the previous example, we are given the standard deviation of the three funds. Thus σ_X = 6%, σ_Y = 3% and σ_Z = 1%. The question at hand is whether the managers follow its policy diversification. In order to determine whether this I actually the case, the following calculations are conducted:

- $S_X = \frac{12-5}{6} = 1.16$
- $S_Y = \frac{6-5}{3} = 0.33$
- $S_Z = \frac{4-5}{1} = -1$

As we can see, fund X is once again better managed because it shows the greatest average extra yield per unit total risk. The rank order of the funds, according to the index Sharpe is once again:

1. X
2. Y
3. Z

As it can be seen as a limitation that comes with the use the Sharpe index is the fact that it associates the return from the risk($\overline{r}_i - \overline{r}_f$) risk with overall risk. Thus it is not a problem if the portfolio in question is an efficient one. But in the case where the index Sharpe is used to evaluate inefficient portfolios in the overall, it will also be included the non-systematic risk of the portfolio. However, non-systematic risk can be eliminated through diversification reducing the overall risk to the level of systemic risk. For this reason it is better to use for the performance evaluation an index such as Treynor that takes into account only the systemic risk, since it is quite difficult to know whether a portfolio is indeed effective or not. For that reason, we use both indexes to efficiently evaluate mutual fund performances.

Selectivity and Market- Timing Ability

As mentioned before, a very important parameter in evaluating the performance of mutual funds is the evaluation of the performance of the funds' manager. It is very important for fund unit-holders to know whether or not their managers add value to the portfolios they manage. In recent years this particular issue has been a major concern of the international literature. However, the different investigations have often resulted in conflicted conclusions about whether there is a direct and logical relationship between "charismatic" management and good performance.

Although the performance of a fund may be a sign of high management ability, good or poor performance of a mutual fund may often be due to accidental external factors. It is necessary to monitor the ability of the manager's mutual funds over and over again

to identify capable managers who achieve systematically higher returns from a passive portfolio of equivalent risk.

The presence of “repeatability” appearing in the returns of mutual funds, it is probably a good indicator of managerial ability, as long as the more capable managers are expected to be successful over a long period of time while less able managers are expected to experience recurring failures.

According to Fama, one manager's ability is distinguished by two parameters. The former is referred to as the ability to select securities or 'selectivity', while the second is referred to as to the ability of proper time placement or “market timing”.

Selectivity refers to the ability of the manager to identify and to buy securities that are underestimated as well as stand out and to sell securities that are overvalued. Successful prediction of the price of these individual securities is essential for the performance of fund managers.

Market timing is about predicting the course of the market portfolio in terms of interest rates on fixed-rate securities income. In particular, the manager's ability is shown by whether he has bought securities on time during the bull phases of the stock market and whether the managed to liquidate his securities in time during the bear phases of the stock market in order to invest to safer investments, such as government bonds.

Important factors for the good performance of mutual funds managers are also considered the ability to acquire quality information and their ability to efficiently diversification their portfolios. Managers need to have effective sources of information at their disposal in order to take the appropriate actions for the current placement of available funds. Also, the diversification of the portfolio is necessary in order for the

non-systematic risk is eliminated and the mutual funds are for the mutual fund to be exposed only to systemic risk (changes in its portfolio market).

Treynor and Mazuy Model

A simple way to measure managers' abilities is with the model of Treynor and Mazuy (1966) (6). This model is given by the following formula: $r_i - r_f = a + b(r_M - r_f) + c(r_M - r_f)^2 + e$ where:

- r_i is the return on the investment.
- r_f is the return of the risk-free rate.
- r_M is the return of the market portfolio.
- a,b,c are the parameters of the model.
- e is the random error.

This model is a transformation of the known equation that describes the capital line market, with the addition of a square term. The Treynor-Mazuy model is based on the finding that if a manager has the ability to predict market's movements and make his placements according to them, then the characteristic line which describes the returns of the portfolio it manages will not be straight but it will probably have the shape of hyperbole.

The parameter (a) represents the ability of managers to select the appropriate securities. More specifically, its positive and statistically significant coefficient of this shows the existence of the corresponding ability. Negative and statistically insignificant values suggest the lack of this selective ability. The coefficient (b) measures, the systematic risk of an investment. The coefficient (c) is used as a criterion for measuring the availability of time selecting ability. Positive and statistically significant values for this factor indicate the existence of such an ability. In contrast, negative statistically

significant values and values that are not statistically significant indicate the lack of such ability.

If a manager can choose the time of placement on the market and is expected to change the composition of its portfolio based on those market movements, then if this is the case its characteristic line specific portfolio will not be a perfect line, but a crooked line instead.

In particular, assuming that the portfolio at a given moment is described from its characteristic line with the slope β1, in the case where the manager can anticipate market movement and change accordingly the composition of the portfolio, the line will change taking a steeper slope corresponding to a higher degree of performance per systemic risk unit. Treynor and Mazuy clarify that in the case where a manager is able to make systematically successful forecasts regarding market movement, and hence the characteristic line of the portfolio that he manages is a crooked line, is quite difficult to happen realistically. The most probable result is that a manager is able to predict only part of the market movements by adjusting on average, the composition of its portfolio, respectively, with the market movements. In this case, the shape of the line will coincide with that of the exaggeration, since the coefficient β will gradually vary accordingly with market movements.

Linear Regressions

In order to test the relation between the different type of mutual funds as well as whether the market index affects their returns, we will make use of linear regression models. Simple linear regression is a statistical method used to study the relationship between two quantitative variables of which one is the independent variable X and the other is the dependent variable Y the response. The aim is to develop a linear model that connects X and Y and can predict Y values. The simplest form of linear dependence

is Y=b0+b2X+e where b0 is the value that Y takes when X is zero and b1 is the average change in Y when X is changed by 1 unit. Finally, factor e presents the variability in Y that cannot be described by the independent variable X and which can be attributed either to other independent variables or to random fluctuations. The model operates under the assumption that the errors are independent and that they follow the normal distribution with an average value of 0 and a variation of σ^2 for all values of X (Su, Yan and Tsai, 2012).

Standard linear regression models with standardized estimation techniques make a series of assumptions about prediction variables, response variables, and their relationship. Many extensions have been developed that allow each of these cases to relax, and in some cases will be completely eliminated. Some methods are general enough to be able to relax multiple hypotheses simultaneously, and in other cases, this can be achieved by combining different extensions. Generally, these extensions can make the assessment process more complex and time-consuming and may require more data to produce an equally expensive model.

The following assumptions are the most essential that are made by standard linear regression models with standardized estimation techniques:

- **Homoscedasticity**: It means that the different variables have the same variability in their errors, regardless of the values of the predicted variables. In practice, this assumption is not valid (ie mistakes are heteroskedastic) if the response variables are able to vary over a wide range. In order to decide on the heterogeneous variability errors, or when a stack of variables violates the structure of the homoscedasticity assumptions (where the error is equally variable around the “best-fit line” for all points of x), it is it is prudent to look for a result of the remaining error and the predicted values. We have to mention

that there will be a systematic change in the absolute or square value of the others when they "conspire" at the expense of the intended result. The error will not be evenly distributed on the regression line. Heteroskedasticity will contribute to raising the average of the discrete variables around the points to a single variable that inaccurately represents all the line variables. Consequently, the rest appear accumulated and spread out in their predicted representations for larger or smaller values for points on the regression line, and the meaning of the graph will be wrong.

- **Weak homogeneity:** It means that predictive variables X can be treated as constant values rather than random variables s. This means, for example, that the prediction variables are assumed to be error free - that is, not infected with measurement errors. Although this hypothesis is unrealistic in many settings, it leads to a much more difficult model for error variables.
- **Linearity:** This means that the average value of the variable response is a linear combination of parameters (regression coefficients) and prediction variables. Note that this hypothesis is much less restrictive than may seem initially.
- **Independence of errors:** This assumes that the errors of the response variables are incoherent. (Actual statistical independence is a stronger state than simple lack of correlation and often is not necessary although it can be exploited if known to hold) Some methods are able to handle errors, although they usually require much more data unless some sort of legalization is used to polarize the model to accept unrelated errors. Bayesian linear regression is a general way of handling this issue.
- **Lack of perfect multicollinearity** in the predictors: For the model of least square estimation methods, design matrix X must have a full column pitch p!

Otherwise, we have a condition known as multicollinearity in predictive variables. This may be caused by having two or more perfectly correlated prediction variables (e.g., if the same prediction variable is incorrectly given twice, either without converting one of the copies or by converting one of the copies linearly) (MARILL, 2004).

Having described extensively the required assumptions for a linear regression, we will continue by describing the least squared method that is going to be used in order to do the regression between the two variables.

Suppose that our variables follow a normal Gaussian distribution. Let us additionally assume that for each value of variable x, the corresponding values of y are distributed around an average with some deviation. Although for each value of x there will be a different value of y, we assume that the deviation of the values of y is the same for each value of x.

The process through which we find the best possible line is the following: If there are no random errors, all experimental values of y will be on a straight line with the following equation:

$y = mx + b$

For a given value of x (to be denoted by xi), the corresponding value of y (denoted by yi) will differ from the ideal value, which contains no error, by a quantity $y - (mx + b)$.

Based on the mathematics of the Gaussian distribution, we find that the probability of y taking this value is $P = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(y-(mx+b))^2}{2\sigma^2}}$

The total probability for all y values is given by the product of the individual probabilities. If we have a total of N experimental values of y, the total probability is

$$P = (\frac{1}{\sigma\sqrt{2\pi}})^{N} e^{\sum -\frac{(y-(mx+b))^2}{2\sigma^2}}$$

Then we try to find the values of the slope m and the ordinate b for which the above probability becomes maximum. This happens when the exhibitor of the above performance gets the lowest possible value, so the sum of the squares of the deviations of our measurements is minimal. Based on the above, we get the values of m and b, which are given by the relation $m = \frac{N\sum(xy) - (\sum x)(\sum y)}{N\sum(x^2) - (\sum x)^2}$ (Liu, Chiaromonte and Li, 2016).

Panel Data

Panel analysis technique is used to compute the regressions needed and to examine all the different mutual funds as a whole. A panel ID is assigned for each fund and the regression is computed in a monthly time variable. For each regression, fixed-effect model and a GLS random-effect model are sued in STATA.

The fixed-effect model explores the relationship between predictor and outcome variables within an entity (mutual fund). Each entity has its own individual characteristics that may or may not influence the predictor variables.

When using the fixed-effect model, we assume that something within the individual may impact or bias the predictor or outcome variables and we need to control this. This is the rationale behind the assumption of the correlation between the entity's error term and predictor variables. The fixed-effect model removes the effect of those time-invariant characteristics so that we can assess the net effect of the predictors on the outcome variable.

Another important assumption of the fixed-effect model is that those time-invariant characteristics are unique to the individual and should not be correlated with other individual characteristics. Each entity is different, therefore the entity's error term and the constant (which captures individual characteristics) should not be correlated with the others. If the error terms are correlated, then the fixed effect is not suitable, since inferences may not be correct.

In the random-effect model, unlike the fixed-effect model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model.

Random effects assume that the entity's error term is not correlated with the predictors, which allows time-invariant variables to play a role as explanatory variables. In random effects, we need to specify those individual characteristics that may or may not influence the predictor variables. The problem with this is that some variables may not be available, which leads to omitted variable bias in the model.

To decide between fixed or random effects, Hausman test is used, where the null hypothesis is that the preferred model is random effects, while the alternative one is fixed effects. It basically tests whether the unique errors (UI) are correlated with the repressors, the null hypothesis being they are not. Only the results of the model accepted by the Hausman test are presented as well as the result of the Hausman test itself (Fernández-Val and Lee, 2013).

Empirical Results

General Remarks

We will present the empirical results of our current study. First, mutual funds will be rated according to their Sharpe and Treynor indexes, for each type of mutual fund separately, and there will be an analysis regarding the differences that are observed by the use of these two different indexes. The following data were taken directly from the Hellenic Fund and Asset Management Association. After that, by making use of the Treynor and Mazuy model we will evaluate the ability of the mutual fund's managers both in terms of timing and in terms of selectivity.

Finally, we will present the results of the regressions and evaluate the potential relationship between the three kind of mutual funds and the impact that the benchmark index have on their returns.

Sharpe Index

Money Market Funds

On the following table we present the ranks of money markets funds, regarding their shape index:

Mutual Funds	SharpeIndex
Delos Money Plus - Money market fund	1,564936657
CPB Smart Cash Money market fund	0,549315573
INTERAMERICAN Money market fund	0,343552791
ALLIANZ Money market fund	0,209276343
INTERAMERICAN (LF) Global Money Market Fund	0,123282558
PiraeusInvest European Money Market	0,107691015
ALPHA TRUST Hellenic Money Market Funds	0,070431291
EUROBANK (LF) Equity-Greek Equities	0,042473079
MetLife European Money market fund	-0,005967134
EUROBANK (LF) Money Market- Emerging Europe	-0,007211454

The most efficient fund for the time period we examined appears to be ”Delos Money Plus – Money market fund“ which has a Sharpe index equal to 1.56 and regarding the specific methodology we applied, it is the only one whose index is greater than one. That means that it is the most efficient in terms trade-off between risk and expected return and therefore offers high value for the investors. Regarding the rest of them, 7 out of 9 have a Sharpe ratio higher than 0 but only 5 of them greater than 0.1. More specifically, the mutual funds that have a positive Sharpe ratio are considered efficient based on our methodology and as for those whose ratio is very close to zero, they still are accepted since they slightly exceed the return of the risk-free rate.

The rest who have a negative Sharpe index, means that their return is even lower than that of the risk-free rate and they are totally inefficient. This is not to be expected since, according to the valuation theory, the market portfolio should always have a Sharpe index with a price higher than or equal to the respective single portfolio prices. The fact that the market portfolio appears to have a Sharpe index value less than these two mutual funds under review may be due to the fact that the market index used has a low estimate of the real market portfolios. It is important to clarify that past performances are not indicative of future results and investors should not base their expectations and decisions on past performances.

Equity Funds

On the following table we present the ranks of equity funds, regarding their Sharpe index:

Mutual Funds	SharpeIndex
MetLife Greek Equity Medium and Small Cap fund	0,130189153
3K Equity Domestic Mutual fund	0,088118734
ALPHA BLUE CHIPS Greek Equity Classic fund	0,079999563
TRITON Growth Greek Equity fund	0,049200677
Piraeus China Growth Equity fund	0,048745448
ALPHA TRUST New Strategy Domestic Equity fund	0,042924732
ALLIANZ Domestic Equity fund	0,03141557
INTERAMERICAN Dynamic Domestic Equity fund	0,020754025
INTERAMERICAN New Europe Foreign Equity fund	0,006151179
CPB Greek Equity fund	-0,011590164

Here all the funds have a Sharpe index lower than one and only one has an index greater than 0.1. More specifically, the best-performing equity fund indicated by our model is "MetLife Greek Equity Medium and Small Cap" which has an index equal to 0.13. The rest of them seem to have a much lower ratio although the variance among their values is smaller compared to the money market funds. Their returns appear to be too low, but since they are positive they are slightly higher than the risk free rate. On the other hand, we now find that there is only one fund, which has a Sharpe ration lower than zero, and whose return is smaller than the risk-free rate. Generally, equity funds usually underperform, and they offer relatively low returns regarding their overall risk. Andrew Hallam offers a theory regarding the five factors that reduce the returns of actively managed US mutual funds.

- Expense Ratios
- 12B1 Fees
- Trading Costs
- Sales Commissions
- Taxes

It is understandable that not all of these parameters apply in Greek mutual funds, but these are still a few nonstable factors that affect the returns of the funds and since they are constantly changing, one must not invest based on past mutual fund's performance.

Bond funds

On the following table we present the ranks of bond funds, regarding their shape index:

Mutual Funds	SharpeIndex
ALPHA EURO (€)Corporate Bond Classic	0,391209912
ALPHA TRUST STRATEGIC BOND FUND	0,387365101
CPB Eurobond fund	0,380393466
MetLife European Corporate Bond fund	0,342610886
INTERAMERICAN Domestic Fixed Bond fund	0,187595081
ATTICA Foreign Bond fund	0,152189725
THETIS European Bond fund	0,144495849
MetLife Bond fund US dollar	0,064277765
PiraeusInvest European Bond Retail	-0,086411175
EUROBANK GF Global Bond fund	-0,672695842

Once again, the Sharpe ratios of all funds are lower than 1 but still positive, which makes them slightly efficient. However they have ratios bigger than equity funds as for 4 out of 10 equity funds, their shape indexes vary between 0.3 and 0.4 while for 4 of them varies between 0.05 and 0.20.

Their values indicate smaller deviations and generally although bond funds have a ratio smaller than one they manage to maintain a relatively good return-risk relationship.

The most efficient fund is "ALPHA EURO (€) Corporate Bond Classic" while the following two are also very close in terms of efficiency. The mutual funds that ranked lower than 0.01 based on our methodology, have a degree of risk that is much too high in comparison to the return that they offer.

Lastly, the mutual funds that have a Sharpe ratio smaller than one, show us that for the time period we studied, their return was smaller than the one of the risk-free rate and they appeared to be inefficient.

Treynor Index

Money Market Funds

On the following table we present the ranks of money market funds, regarding their Treynor index:

Mutual Funds	TreynorIndex
Delos Money Plus - Money market fund	46,33108057
CPB Smart Cash Money market fund	5,131972085
INTERAMERICAN (LF) Global Money Market Fund	2,631289509
PiraeusInvest European Money Market	0,757546787
EUROBANK (LF) Money Market- Emerging Europe	0,027575029
MetLife European Money market fund	0,021169424
EUROBANK (LF) Money Market	-0,281874018
ALPHA TRUST Hellenic Money Market Funds	-0,40747541
INTERAMERICAN Money market fund	-4,511509149
ALLIANZ Money market fund	-64,67034195

As we can see, the results of the Treynor index take very extreme values and therefore have a very big deviation among the values of the various funds in comparison with the Sharpe index. Moreover, the rank of the funds has now changed significantly. By looking at the Treynor indexes for all three kinds of mutual funds, we observe that this is the case for all of them.

Regarding the different ranking, this is due to the different kind of risk that the two indexes use. While Sharpe index uses the variance of the portfolio, Treynor index uses the beta index, which is the risk of the portfolio in relation to the whole market. The betas of the funds are very small and almost equal to 0.

This means that they do not have any relation with the ASE benchmark and that the movement of the market does not affect the returns of the funds. Moreover, some of them have a negative beta. This indicates that when the market falls these funds will benefit and their returns will increase.

Regarding the extreme values of Treynor index and the big variation in its values, the extreme low or negative values of the portfolio betas once again play a major role. In order to calculate the Treynor index for each fund, we first calculated their Treynor indexes for each month and then calculated the average value. Due to the low betas, which are on the denominator, if the excess return of the fund is higher than beta would lead to a very high Treynor index. As a result, depending on the monthly returns of the fund, if some of them are very high, we could also have very high Treynor indexes and even negative one while they had a positive Sharpe index.

Regarding the money funds, once again "Delos Money Plus – Money market fund" appears to be the most efficient fund since the Treynor index we calculated is equal to 46.33, which is a very extreme value. The following ranks are also quite different in comparison with the Sharpe index, so we establish that the results vary accordingly depending on the methodology we select. For instance, we see that while "ALLIANZ Money market fund" was the fourth best fund according to the Sharpe index it now ranks as the worst one with a Treynor index equal to -64.

Moreover, while "EUROBANK (LF) Money Market- Emerging Europe" and "MetLife European Money market fund" funds had negative Sharpe indexes in our previous computations, they now indicate positive Treynor indexes although very close to 0. Finally, three of the funds that had positive Sharpe ratio they now have a negative Treynor ratio.

As we can see while for two funds the ranking remains the same, for the rest of them the differences are very high and depend heavily on the index that we choose to use and on the risk which we take into account.

Equity Funds

On the following table we present the ranks of equity funds, regarding their Treynor index:

Mutual Funds	TreynorIndex
ALPHA TRUST New Strategy Domestic Equity fund	0,752911091
3K Equity Domestic Mutual fund	0,667072256
ALPHA BLUE CHIPS Greek Equity Classic fund	0,125490908
CPB Greek Equity fund	-0,107808689
ALLIANZ Domestic Equity fund	-0,179803424
INTERAMERICAN Dynamic Domestic Equity fund	-0,206063651
Piraeus China Growth Equity fund	-0,527868738
INTERAMERICAN New Europe Foreign Equity fund	-0,558928826
TRITON Growth Greek Equity fund	-1,011479359
MetLife Greek Equity Medium and Small Cap fund	-1,285468745

Now we notice that the differences in ranking are even higher. While “MetLife Greek Equity Medium and Small Cap fund” was the best fund according to the Sharpe index, now it is the worst with a Treynor index equal to -1.28. Moreover, the best fund is “ALPHA TRUST New Strategy Domestic Equity fund” with a Treynor index equal to 0.75. Only 3 funds have an index higher than 0 and can be considered relatively efficient even though they have values lower than one. Moreover, 7 of them have negative indexes and are inefficient while with a Shape index only one of them have a value smaller than one. However, there are less extreme values in comparison with money funds and we find that the index varies between -1.3 and 0.8 from this methodology.

Bond Funds

On the following table we present the ranks of bond funds, regarding their Treynor index:

Mutual Funds	TreynorIndex
EUROBANK GF Global Bond fund	34,06872102
CPB Eurobond fund	4,740282222
ALPHA TRUST STRATEGIC BOND FUND	2,373519013
ALPHA EURO (€)Corporate Bond Classic	2,005098986
ATTICA Foreign Bond fund	0,918187674
PiraeusInvest European Bond Retail	-0,131907242
MetLife Bond fund US dollar	-0,365124464
THETIS European Bond fund	-0,748401296
MetLife Bond fund US dollar	-2,593451763
INTERAMERICAN Domestic Fixed Bond fund	-9,296757783

Once again, the differences between the rankings are very big depending on the index we use and the risk which we take into account. While only two funds have negatives Sharpe ratios and are inefficient, according to Treynor index half of the funds now have negative values.

More specifically, while according to Sharpe ratio "EUROBANK GF Global Bond fund" had a Sharpe ratio smaller than zero and it was considered the worst fund, according to Treynor index it appears to be the best and most efficient one, when the betas are taken into consideration. "CPB Eurobond fund", "ALPHA TRUST STRATEGIC BOND FUND" and "ALPHA EURO (€) Corporate Bond Classic" remain among the best performing funds, with Treynor index much bigger than 1 even though their ranking has changed slightly.

Treynor and Mazuy Model

Money Market Fund

Using the Treynor and Mazuy model, we will evaluate the selectivity and timing abilities of the hedge fund managers. As explained before, the model, which will be estimated, is the following: $r_i - r_f = a + b(r_M - r_f) + c(r_M - r_f)^2 + e$. After calculating the above values, we run the appropriate regressions. In our study, we run the regression of each of three type of mutual funds instead of each mutual fund separately. Thus our findings relate to the bond, equity and money market funds as a whole. For this kind of study, we use panel data analysis for each kind of fund.

On the following table we present the results regarding the money market funds. After conducting the Hausman test, we use the fixed-effect model.

```
Fixed-effects (within) regression               Number of obs      =       460
Group variable: ID                              Number of groups   =        10

R-sq:  within  = 0.0543                         Obs per group: min =        46
       between = 0.0000                                        avg =      46.0
       overall = 0.0540                                        max =        46

                                                F(2,448)           =     12.87
corr(u_i, Xb)  = -0.0000                        Prob > F           =    0.0000
```

rtrf	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rMrf	1.40294	.4037193	3.48	0.001	.6095215	2.196359
rMrf2	-333.3939	74.18753	-4.49	0.000	-479.1927	-187.5951
_cons	.0099443	.00274	3.63	0.000	.0045594	.0153292
sigma_u	.00327787					
sigma_e	.04241405					
rho	.00593715	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(9, 448) =     0.27              Prob > F = 0.9813
```

While on a typical regression we would evaluate all the aspects of the regression, including the R-square, the overall coefficient of the model as well as the p-value of each independent variable separately, currently we care only for a and c variables in order to test the abilities of the fund managers.

Regarding the selectivity, factor rate is positive and statistically significant with a p-value equal to 0. This indicates that the managers of money market funds have a good selectivity ability and they are able to create efficient portfolios. Even though the value of factor a is very low, it is still positive and thus the managers have this ability even in a low grade.

Regarding their timing ability, the factor c is statistically significant with a p-value equal to 0(rMrf2). However is negative and equal to -333.39. A negative c factor indicates the lack of the corresponding ability. As a result, the managers of money market funds even though they can create efficient portfolios they are not good in watching the developments of the market and adjust accordingly in order to create the best possible value for their portfolio.

Equity Fund

On the following table are presented the results regarding the equity funds. After conducting the Hausman test, we use the fixed-effect model.

```
Fixed-effects (within) regression               Number of obs      =       460
Group variable: ID                              Number of groups   =        10

R-sq:  within  = 0.1313                         Obs per group: min =        45
       between = 0.4144                                        avg =      46.0
       overall = 0.1310                                        max =        47

                                                F(2,448)           =     33.87
corr(u_i, Xb)  = 0.0050                         Prob > F           =    0.0000
```

rtrf	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rMrf	3.756183	.6697778	5.61	0.000	2.439886	5.072479
rMrf2	-899.6894	123.0762	-7.31	0.000	-1141.568	-657.8111
_cons	.021392	.0045456	4.71	0.000	.0124586	.0303253
sigma_u	.00512611					
sigma_e	.07036326					
rho	.0052794	(fraction of variance due to u_i)				

Once again the a factor is positive and statistically significant with p-value equal to 0. The managers of the equity funds have the ability to select the appropriate stocks and create optimal portfolios. This ability is low once again even though it exists and it is bigger in comparison with the money market funds. Moreover, regarding the c factor, it is statistically significant with p-value equal to 0.However its value is negative and almost equal to -900. Once again, the managers of the equity funds even though they are able to select efficiency the stocks for their portfolio, they are no able to adjust in the changes of the market neither to make efficient predictions regarding the current and future market trends.

Bond Fund

On the following table are presented the results regarding the bond funds. After conducting the Hausman test, we use the fixed-effect model.

```
Fixed-effects (within) regression               Number of obs      =       498
Group variable: ID                              Number of groups   =        10

R-sq:  within  = 0.0034                         Obs per group: min =        46
       between = 0.1369                                        avg =      49.8
       overall = 0.0009                                        max =        65

                                                F(2,486)           =      0.83
corr(u_i, Xb)  = -0.2606                        Prob > F           =    0.4361
```

rtrf	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rMrf	.0128877	.0142822	0.90	0.367	-.0151748	.0409502
rMrf2	.0774942	.0818018	0.95	0.344	-.0832347	.2382232
_cons	.0022343	.0005514	4.05	0.000	.0011509	.0033176
sigma_u	.00166495					
sigma_e	.01196215					
rho	.0190042	(fraction of variance due to u_i)				

Concerning factor a, it is positive and statistically significant with p-value equal to 0. The managers of bond funds have a good selective ability and are able to invest in the required bonds to create optimal portfolios.

Regarding factor c, now it is positive, but it is statistically insignificant. It has a p-value equal to 0.344, which makes it statistically insignificant for any significance level. Thus, all three kinds of funds have in common the fact that even though their managers have good selectivity ability they are lacking heavily in market timing ability.

Correlation among Different Funds

Market Money Fund

We will conduct three different panel regression in order to test the correlation among the three kinds of funds, as well as the ASE index. Each time we set as dependent variable one of the three kinds of mutual funds and as independent variables the rest of them. During our first regression, we set as the dependent variable the returns of money market funds. The results are presented in the table below:

```
Fixed-effects (within) regression               Number of obs      =       459
Group variable: ID                              Number of groups   =        10

R-sq:  within  = 0.2891                         Obs per group: min =        45
       between = 0.3750                                        avg =      45.9
       overall = 0.2833                                        max =        46

                                                F(3,446)           =     60.47
corr(u_i, Xb)  = -0.0529                        Prob > F           =    0.0000
```

MoneyMarket	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Equity	.3096964	.0233286	13.28	0.000	.2638487	.355544
ASE	.0387249	.3869328	0.10	0.920	-.7217131	.7991629
Bonds	.0566912	.1332348	0.43	0.671	-.2051547	.3185372
_cons	.0011608	.001757	0.66	0.509	-.0022922	.0046138
sigma_u	.00448319					
sigma_e	.03676891					
rho	.01464887	(fraction of variance due to u_i)				

The first thing that we notice is that the R-squared is equal to 0.2833, which means that 28.33% of the changes in the dependent variables can be explained by changes in the independent variables. It is a good indicator that our model has a good explanatory power and that there is a good possibility for the existence of a correlation between the variables.

By looking at the p-values, we see that bond funds and ASE index are statistically insignificant while equity funds are statistically significant. More specifically, equity funds have a p-value equal to 0 and they are statistically significant with a 99% confidence level. It has a positive value, which means that equity funds and money market funds tend to move the same way. When the returns of equity funds increase by 1 then the return of money market funds increase by 0.31, which is a pretty strong relationship that indicates a strong impact of equity funds on the returns of money market funds.

On the other hand, bond funds have p-value equal to 0.671 and ASE index a p-value equal to 0.920, which means that they are both statistically insignificant and they do not seem to have any kind of impact on the returns of money market funds. While the equity funds and money market funds seem to have a strong dependency among each other, money market money funds are totally independent of the movements of the bond funds returns and the movement of the market.

Equity Funds

During our second regression, we set as the dependent variable the returns of equity funds. The results are presented in the table below:

```
Fixed-effects (within) regression               Number of obs      =       459
Group variable: ID                              Number of groups   =        10

R-sq:  within  = 0.3003                         Obs per group: min =        45
       between = 0.3811                                        avg =      45.9
       overall = 0.2944                                        max =        46

                                                F(3,446)           =     63.81
corr(u_i, Xb)  = -0.0585                        Prob > F           =    0.0000
```

Equity	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
MoneyMarket	.9145418	.06889	13.28	0.000	.7791525	1.049931
Bonds	.0461826	.2289917	0.20	0.840	-.403854	.4962193
ASE	1.779799	.6595649	2.70	0.007	.4835576	3.07604
_cons	-.0011898	.0030202	-0.39	0.694	-.0071254	.0047458
sigma_u	.0075236					
sigma_e	.06318506					
rho	.01398004	(fraction of variance due to u_i)				

The R-squared of our model is equal to 0.2944, which means that 29.44% of the changes in the dependent variable can be explained by changes in the independent variables. Once again, our model has a good explanatory power, as the R-squared is very close to the one found in the first regression, as it was expected.

Money market funds are statistically significant and their returns affect the performance of equity funds, as it was expected based on the previous regression, but furthermore, the trend in the market they also seem to affect the returns of funds. Bond funds remain once again statistically insignificant and their returns are independent of the returns of equity funds.

More specifically, money market funds have a p-value equal to 0 which makes them statistically significant with a 99% confidence level.

This indicates a positive relationship between the two variables and if the returns of money market funds increased by 1 then the returns of equity, funds increase by 0.91. We observe that money market funds have a stronger impact on equity funds than the other way round. If the returns of the money market funds change for any reason, the returns of equity funds will tend to follow these changes identically.

The market index is also statistically significant for the dependent variable with a 99% confidence level. If ASE increases by one then the returns of equity funds will increase by 1.7. While the market index did not have any kind of impact on money market funds, it seems to have a strong effect on the returns of equity funds. A positive or negative trend in the returns of the market will tend to move the returns of the equity funds in the same way and lead to a multiplied increase or decrease respectively.

The return of bond funds is statistically insignificant with a p-value equal to 0.84 and they do not have any kind of impact on the returns of equity funds.

Bond Funds

During our third regression, we set as the dependent variable the returns of bond funds. The results are presented in the table below:

```
Fixed-effects (within) regression               Number of obs      =       459
Group variable: ID                              Number of groups   =        10

R-sq:  within  = 0.0010                         Obs per group: min =        45
       between = 0.0265                                        avg =      45.9
       overall = 0.0010                                        max =        46

                                                F(3,446)           =      0.15
corr(u_i, Xb)  = 0.0065                         Prob > F           =    0.9296
```

Bonds	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
MoneyMarket	.0071576	.0168218	0.43	0.671	-.0259021	.0402174
Equity	.0019745	.0097905	0.20	0.840	-.0172668	.0212158
ASE	-.0264349	.1374831	-0.19	0.848	-.29663	.2437603
_cons	.0017068	.0006194	2.76	0.006	.0004896	.002924
sigma_u	.00116232					
sigma_e	.01306494					
rho	.00785258	(fraction of variance due to u_i)				

R-squared is now very small and equal to 0.001. Only a merely 0.1% of the changes in the dependent variable can be explained by the changes in the independent variables. The explanatory power of our model is not just weak but virtually not existent. Thus we expect that none of the explanatory variables will be statistically significant.

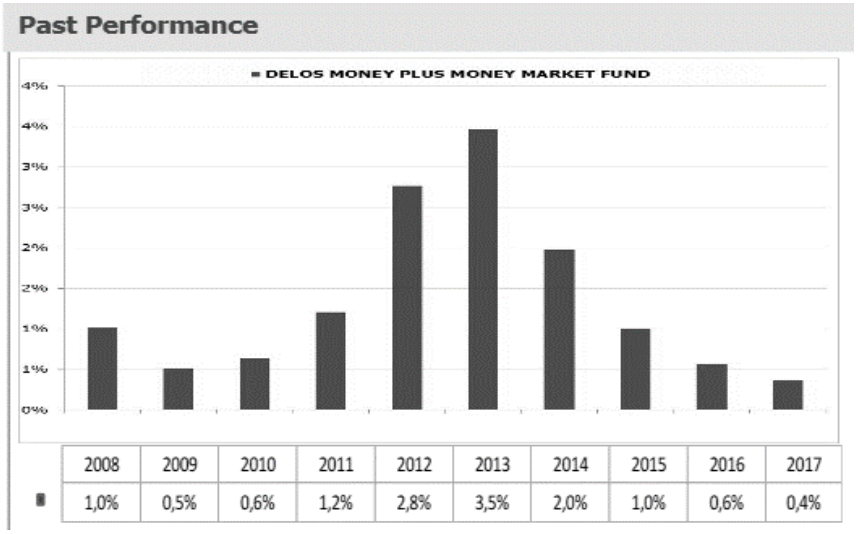
By examining the p-value of each variable separately, we can see that all of them are statistically insignificant and they do not have any impact on the returns of bond funds. While equity funds and money market funds have some kind of interaction and correlation among themselves and with the market, the returns of bond funds seem to be totally independent and to not be affected neither from the trends of the market nor from changes in the returns of the other kind of funds.

Mutual funds characteristics, performance and risk

Below, we will examine the main characteristics of the three mutual funds of each category with the highest Sharpe and Treynor index. Specifically we will see information about their issuer, risk profile, previous performance and their structure.

Money market funds

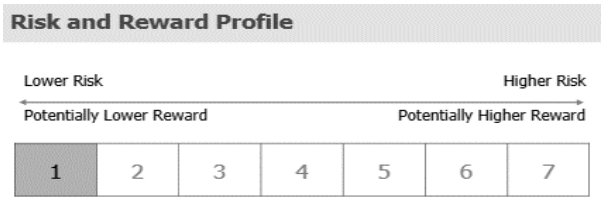
1. ” Delos Money PlusMoney market fund”



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
■	1,0%	0,5%	0,6%	1,2%	2,8%	3,5%	2,0%	1,0%	0,6%	0,4%

Graph 1: Mutual fund performance

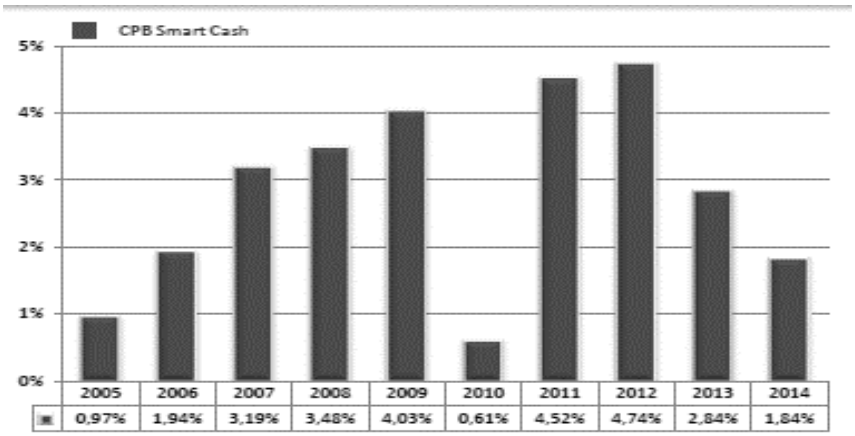
Source: www.ibg.gr



Graph 2 : Mutual fund risk scale

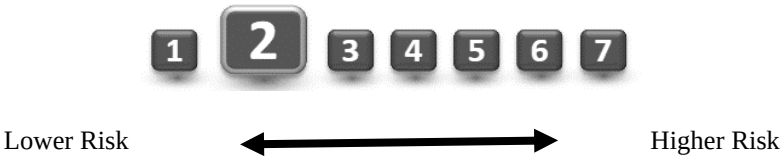
Source: www.ibg.gr

2. ‘’CPB Smart Cash Money market fund”



Graph 3: Mutual fund performance

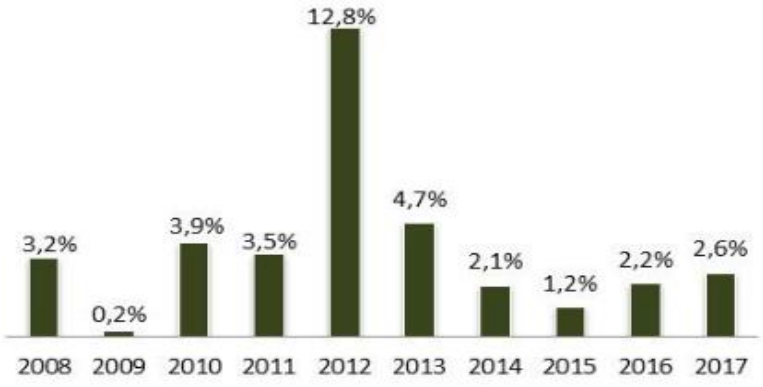
Source: www.cpbaedak.gr



Graph 4: Risk scale

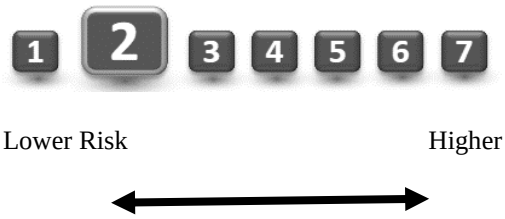
Source: www.cpbaedak.gr

3. “Interamerican Money market fund’’



Graph 5: Mutual fund performance

Source: www.interamerican.gr

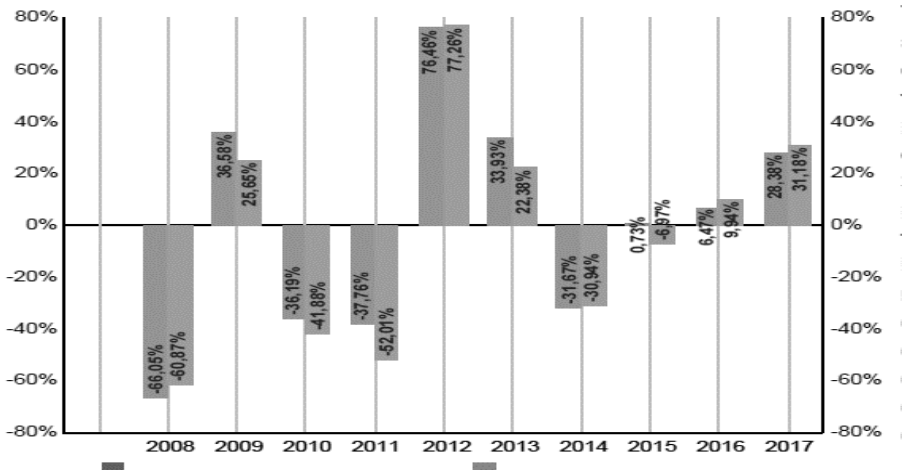


Graph 6: Mutual fund risk scale

Source: www.interamerican.gr

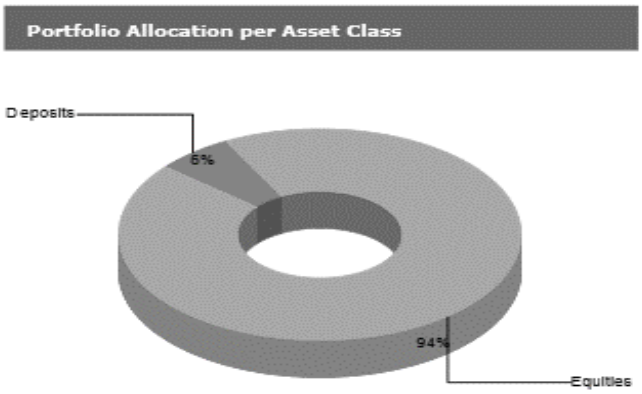
Equity funds

1. "MetLife Greek Equity Medium and Small Cap"



Graph 7: Mutual fund performance

Source: www.metlife.gr



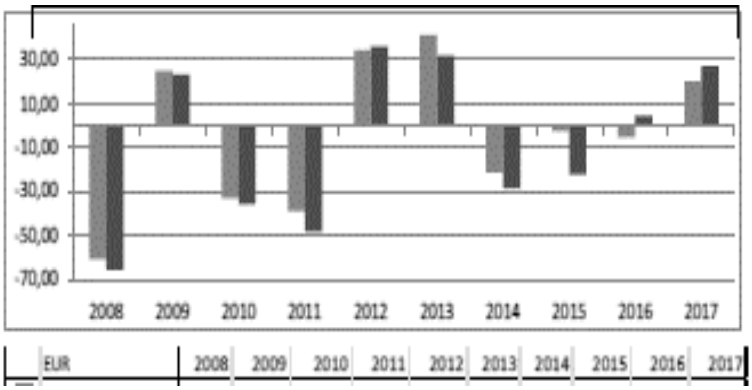
Graph 8: Mutual fund structure

Source: www.metlife.gr

Graph 9: Mutual fund risk scale

Source: www.metlife.gr

2. “3K Domestic Equity fund”



Graph 10: Mutual fund performance

Source: www.3kip.gr

Equities		%
1	IKTINOS HELLAS	8,10%
2	JUMBO SA	6,30%
3	TERNA ENERGY SA	5,86%
4	HELLENIC PETROLEUM	4,28%
5	AUTOHELLAS SA	3,92%
6	MYTILINEOS S.A.	3,92%
7	IASO SA	3,41%
8	STELIOS KANAKIS	3,20%
9	GEK TERNA SA	3,20%
10	EUROPEAN RELIANCE	3,03%

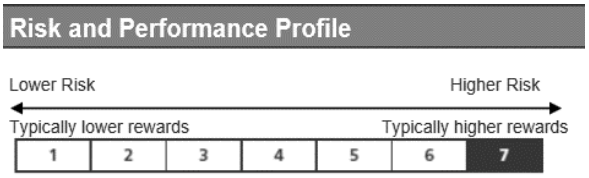
Portfolio Allocation

Country	%
Greece	98,22
Cyprus	1,78

Sector	%
Banks	2,32
Personal & Household goods	13,47
Chemicals	5,64
Industrial Goods & Services	8,98
Technology	1,55
Travel & Leisure	6,57
Food & Beverages	7,56
Retail	3,51
Real Estate	4,63
Insurance	5,41
Construction and Materials	16,38
Oil & Gas	4,86
Basic Resources	6,40
Utilities	8,86
Health	3,87

Graph 11: Mutual fund structure

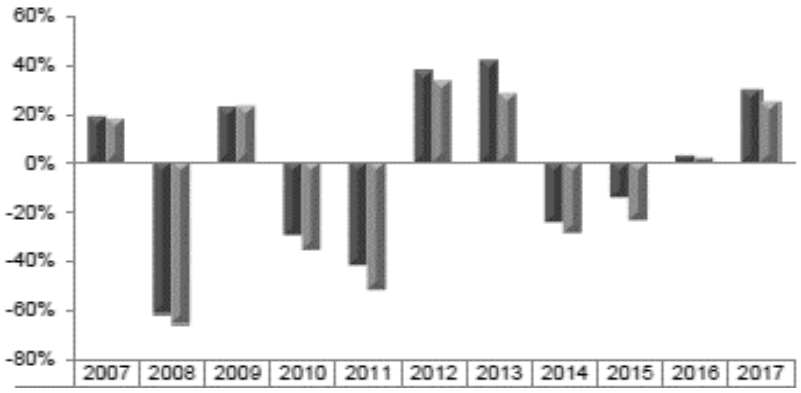
Source: www.3kip.gr



Graph 12: Mutual fund risk scale

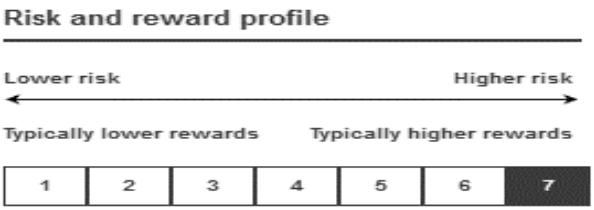
Source: www.3kip.gr

3. ‘’Alpha Blue chips Domestic Equity classic’’



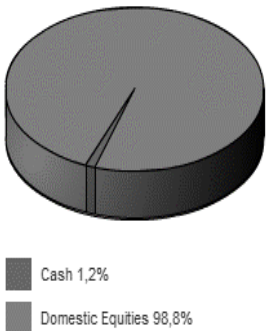
Graph 13: Mutual fund performance

Source: www.alphamutual.gr



Graph 14: Mutual fund risk scale

Source: www.alphamutual.gr



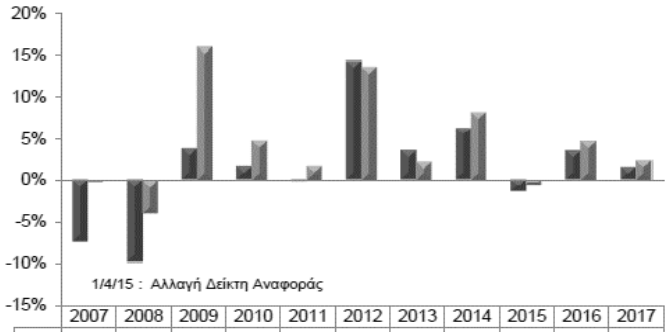
TOP HOLDINGS	30/9/2018
Coca Cola HBC	8.4%
OTE	8.0%
ALPHA Bank	6.0%
MYTILINEOS	5.8%
OPAP	5.4%
REGION BREAKDOWN	
GREECE	100,0%

Graph 15: Mutual fund structure

Source: www.alphamutual.gr

Bond funds

1. "Alpha Corporate Bond fund"

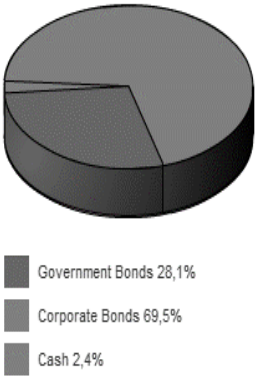


Graph 16: Mutual fund performance

Source: www.alphamutual.gr

Graph 17: Mutual fund risk scale

Source: www.alphamutual.gr



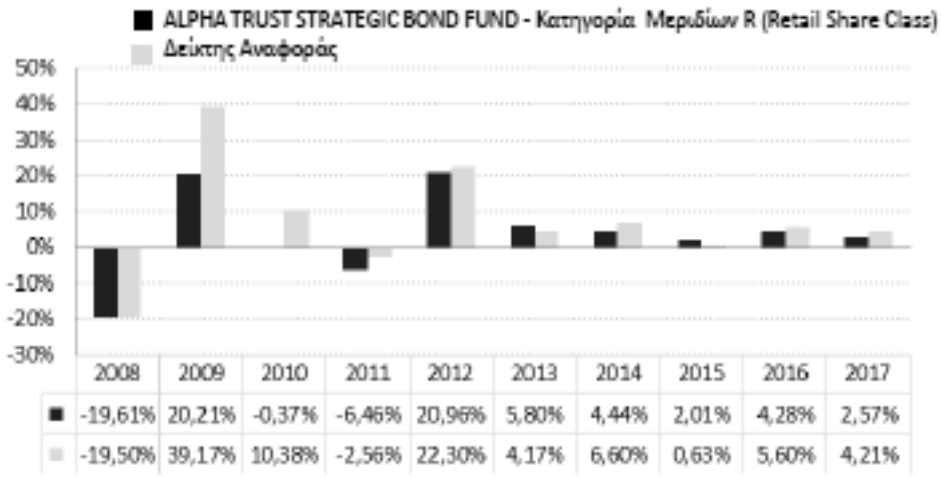
TOP HOLDINGS	30/9/2018
ELPEGA 4 7/8 10/14/21	9.0%
GGB 4.2 01/30/42	8.4%
PPCGA 5 1/2 05/01/19	7.6%
MOHGA 3 1/4 04/01/22	7.0%
MOHGA 3 05/11/23	6.1%

SUB ASSET CLASSES	
Government	28,1%
Utilities	17,1%
Industrial	12,8%
Energy	9,0%
Consumer, Cyclical	8,6%

Graph 18: Mutual fund structure

Source: www.alphamutual.gr

2. “Alpha trust strategic bond fund”



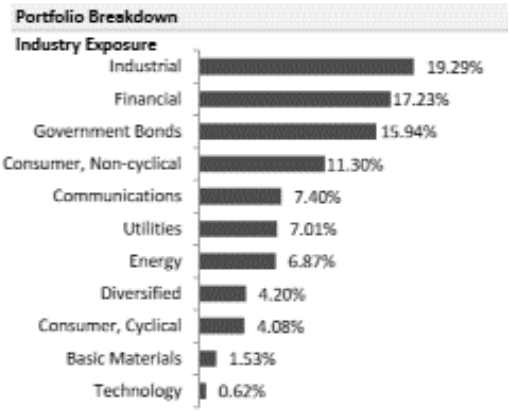
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
■	-19,61%	20,21%	-0,37%	-6,46%	20,96%	5,80%	4,44%	2,01%	4,28%	2,57%
	-19,50%	39,17%	10,38%	-2,56%	22,30%	4,17%	6,60%	0,63%	5,60%	4,21%

Graph 19: Mutual fund performance

Source: www.alphamutual.gr

Graph 20: Mutual fund risk scale

Source: www.alphamutual.gr



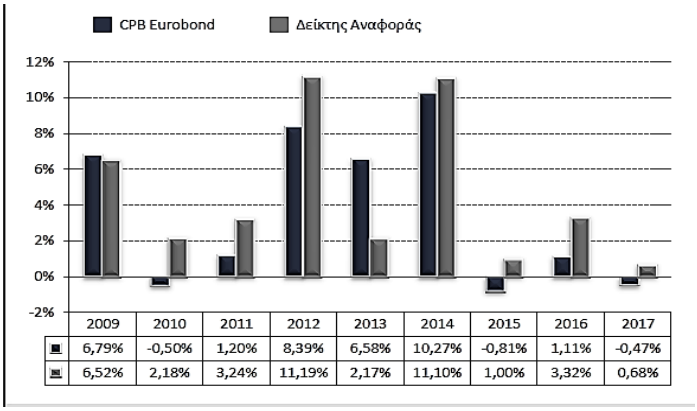
Top 10 Holdings

Issuer	Maturity	%
MOTOR OIL	01/04/2022	4.20%
TITAN GLOBAL	17/06/2021	3.91%
RABOBANK	perpetual(2049)	3.15%
OTE PLC	09/07/2020	3.13%
BANK OF AMERICA	26/07/2023	2.98%
EDP FINANCE	18/01/2022	2.80%
HELLENIC PETROL	14/10/2021	2.37%
NBG	19/10/2020	2.31%
HELLENIC PETROL	04/07/2019	2.30%
EUROBANK	02/11/2020	2.29%
% of Top 10 Holdings		29.45%

Graph 21: Mutual fund structure

Source: www.alphamutual.gr

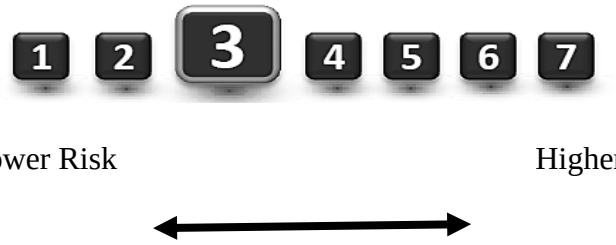
3. “CPB Eurobond”



	2009	2010	2011	2012	2013	2014	2015	2016	2017
■	6,79%	-0,50%	1,20%	8,39%	6,58%	10,27%	-0,81%	1,11%	-0,47%
■	6,52%	2,18%	3,24%	11,19%	2,17%	11,10%	1,00%	3,32%	0,68%

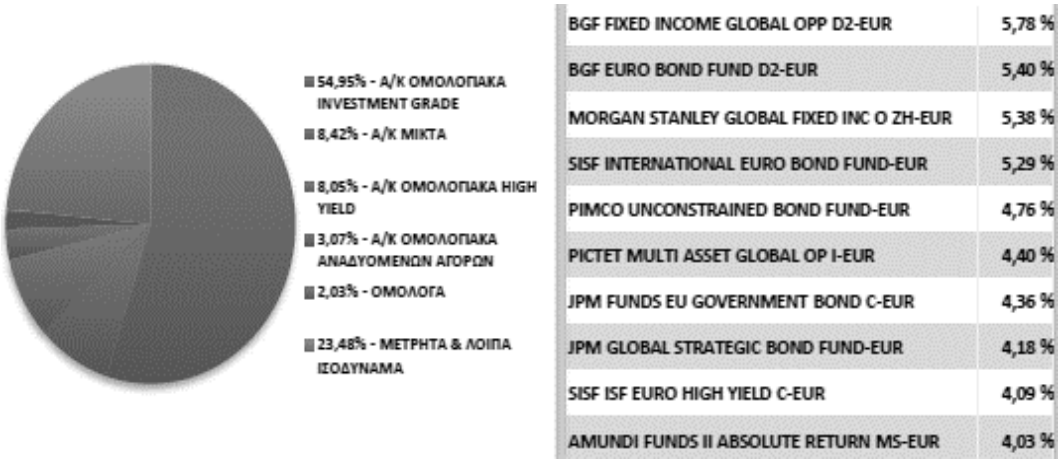
Graph 22: Mutual fund performance

Source: www.cpbaedak.gr



Graph 23: Mutual fund risk scale

Source: www.cpbaedak.gr



Graph 24: Mutual fund structure

Source: www.cpbaedak.gr

Kruskal wallis test analysis

We will perform the Kruskal wallis test for three mutual funds of each category with the highest Sharpe and Treynor index for the year 2016-2017, that were presented above.

Analysis of Variance

Analysis of variance (ANOVA) refers to a statistical method that is used to analyze the differences among group means in a sample. ANOVA is the most appropriate method to test practical problems since it eliminates most type I errors and generalizes the t-test. In order to effectively apply ANOVA, we must fulfil the parameters given below:

1. Independent random samples of observations

2. Normality of the distributions, where the means could differ but the variance of our data in groups should be the same (homoscedasticity)

In case that the degree of the asymmetry of the distributions is high then ANOVA is not to be used. The appropriate method is the non-parametric «Kruskal-Wallis».

Kruskal–Wallis test

The Kruskal–Wallis is a non-parametric method used to examine whether the samples come from the same distribution or not. It is primarily used to locate the differences among independent samples regardless their sizes. The Kruskal–Wallis test does not require normality of distribution of the residuals, contrary to the one-way analysis of variance. The only assumption made is that the samples are selected randomly and independently from our data.

Null hypothesis: the medians of all samples originate from identical populations and are equal.

Alternative hypothesis: at least one of the medians of a sample comes from a different population and differs from the population median of at least one other group.

In order to accept the Ho then the p-value must be ≥ 0, 01 therefore if Ho is not rejected then there is not a statistically significant difference among the medians of the groups, we examine for a 99% level of confidence.

Results

The methodology followed for the Kruskal Wallis test, started by ranking all data from all groups together and followed by applying the formula given below:

$$H = (N-1)\frac{\sum_{i=1}^{g} n_i(\bar{r}_{i\cdot} - \bar{r})^2}{\sum_{i=1}^{g}\sum_{j=1}^{n_i}(r_{ij} - \bar{r})^2}$$, where:

- n_i is the number of observations in group i
- r_{ij} is the rank (among all observations) of observation j from group i
- N is the total number of observations across all groups
- $\bar{r}_{i\cdot} = \frac{\sum_{j=1}^{n_i} r_{ij}}{n_i}$ is the average rank of all observations in group i
- $\bar{r} = \frac{1}{2}(N+1)$ is the average of all the r_{ij}.

The level of significance is 99% and the degrees of freedom for the calculation of the critical value is 2 since we examine 3 columns of data (n-1).

Below we will find that the bond and equity funds are not statistically significant since the p-value is greater than 0,01 therefore we accept the null hypothesis, whereas for the money market funds we find that the p-value is less than 0,01 and we have to reject the null hypothesis.

1. Equity funds

MetLife Greek Equity Medium and Small Cap	3K Domestic Equity fund	ALPHA BLUE CHIPS Greek Equity Classic				
-0,0536	-0,0074	-0,0101				
-0,0791	-0,1038	-0,1107				
-0,0635	-0,0847	-0,0771				
0,0719	0,0447	0,0787				
0,0165	0,0117	0,0181				
0,0968	0,0970	0,1057				
-0,0781	-0,1521	-0,1378				
0,0414	0,0311	0,0425				
0,0045	0,0018	0,0090				
-0,0158	-0,0181	-0,0127				
0,0394	0,0368	0,0336				
0,0126	0,0498	0,0389				
H0	All populations are distributed in the same way					
H1	At least one one of the populations is distributed differently					
Ranks						
10	15,0	14,0				
6,0	4,0	3,0				
9,0	5,0	8,0				
32,0	30,0	33,0				
21,0	19,0	22,0				
34,0	35,0	36,0				
7,0	1,0	2,0				
28,0	23,0	29,0				
17,0	16,0	18,0				
12,0	11,0	13,0				
27,0	25,0	24,0				
20,0	31,0	26,0				
223	215	228	T			
12	12	12	n		N=	36
4144,083333	3852,083333	4332	12328			
K=	0,064564565					
Critical value=	9,210340372					
P-value=	**0,968233228**					

2. Bond funds

ALPHA EURO (€) Corporate Bond Classic	CPB Eurobond	ALPHA TRUST STRATEGIC BOND FUND				
-0,0096	-0,0082	-0,0153				
0,0009	0,0074	-0,0107				
0,0030	0,0030	-0,0118				
0,0149	0,0044	0,0173				
0,0034	-0,0035	0,0036				
0,0047	0,0044	0,0181				
0,0052	0,0084	0,0027				
0,0128	0,0024	0,0087				
0,0016	-0,0020	0,0064				
-0,0014	0,0006	-0,0041				
-0,0075	-0,0119	0,0015				
-0,0119	-0,0103	0,0063				
H0	All populations are distributed in the same way					
H1	At least one one of the populations is distributed differently					
Ranks						
7	8,0	1,0				
15,0	30,0	5,0				
21,0	20,0	4,0				
34,0	25,0	35,0				
22,0	11,0	23,0				
26,0	24,0	36,0				
27,0	31,0	19,0				
33,0	18,0	32,0				
17,0	12,0	29,0				
13,0	14,0	10,0				
9,0	2,0	16,0				
3,0	6,0	28,0				
227	201	238	T			
12	12	12	n		N=	36
4294,083333	3366,75	4720,333333	12381			
K=	0,542042042					
Critical value=	9,210340372					
P-value=	0.762600466					

3. Money Market funds

ΑΗΛΟΣ Money Plus - Money market fu	CPB Smart Cash Money market fund	INTERAMERICAN Money market fund				
0,00070138	0,00077083	0,00220058				
0,00047758	0,00037419	0,00038177				
0,00052354	0,00074796	0,00243164				
0,00042325	0,00072543	0,00191230				
0,00045383	0,00065902	0,00020541				
0,00062272	0,00083414	0,00360826				
0,00086809	0,00111841	0,00271809				
-0,00013055	0,00006575	0,00100974				
0,00099789	0,00135786	0,00239277				
0,00032218	0,00089693	0,00192025				
0,00055974	0,00076504	0,00316190				
0,00037554	0,00113554	0,00200142				
H0	All populations are distributed in the same way					
H1	At least one one of the populations is distributed differently					
Ranks						
15	19,0	31,0				
10,0	5,0	7,0				
11,0	17,0	33,0				
8,0	16,0	28,0				
9,0	14,0	3,0				
13,0	20,0	36,0				
21,0	25,0	34,0				
1,0	2,0	24,0				
23,0	27,0	32,0				
4,0	22,0	29,0				
12,0	18,0	35,0				
6,0	26,0	30,0				
133	211	322	T			
12	12	12	n		N=	36
1474,083333	3710,083333	8640,333333	13825			
K=	13,54504505					
Critical value=	9,210340372					
P-value=	0,001144803					

The results indicate that the bond and equity funds are not statistically significant since the p-value is greater than 0,01 therefore we accept that the medians of all samples originate from identical populations and are equal. On the contrary for the money market funds we find that the p-value is less than 0,01 and we have to accept that at least one of the medians of a sample comes from a different population and differs from the population median of at least one other group.

Conclusions

In the current study, we collected data from a total of 30 funds, 10 of each different category of the category, including money market funds, bond funds, and equity funds. By using the Sharpe and Treynor indexes we try to evaluate the performance of each fund and by using the Treynor and Mazuy Model we evaluate the selectivity and time marketing skills of mutual fund managers. While most of the current literature uses the model to examine the ability of each fund manager separately, by making use of panel regression we evaluate the general ability of the managers for each mutual fund category. Finally, by making use of linear regression, we examine the correlation between the returns of the three kind of unds as well as the degree to which the market index which was selected affects the returns of the funds.

Firstly, our findings indicate that depending on whether we use the Sharpe or Treynor index the grade and efficiency of the funds changes. While using Sharpe ratio, most of the funds from all categories seem to be relatively efficient having a ratio higher than zero, but most of them also have a ratio smaller than 1 which means that even though they are efficient their performance is not that great in terms of return-risk tradeoff.

When Treynor index is used, most of the funds have a ratio smaller than zero and seem to underperform, while the grade of the funds also changes greatly compared to the results of Sharpe index. This is due to the fact that Treynor index takes into account the beta of the funds as a risk indicator, and the betas for most of the funds were close to zero or even negative, leading to these huge differences.

Regarding the abilities of the managers, the results of the Treynor and Mazuy Model indicate the regardless of the fund type, they tend to have a good selectivity ability while their market timing ability is negative or non-existent. This means that while the

managers are able to efficiently choose the appropriate securities in order to create optimal portfolios, they are unable to keep in touch with the trends of the market and forecast future movements, thus they are unable to take correct investing decisions for their portfolios. Regarding the current year, we examine three mutual funds of each category by applying the Kruskal Wallis test. The results indicate that for the bond and equity funds the medians of all samples originate from identical populations and are equal. On the contrary for the money market funds we find that at least one of the medians of a sample comes from a different population and differs from the population median of at least one other group.

Finally, our results indicate that the market index which we chose, ASE, only affects the returns of equity funds and does not have any impact on the returns of money market funds and bond funds. Moreover, there is a positive correlation between the returns of equity funds and money market funds while bond funds are strongly independent and their returns are affected neither by the market trends nor by the returns of another kind of funds.

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