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SOSYAL BİLİMLER ENSTİTÜSÜ
İŞLETME ANABİLİM DALI
MUHASEBE FINANSMAN (ING) BİLİM DALI

PERFORMANCE EVALUATION OF TURKISH MUTUAL FUNDS: MARKET TIMING AND PERSISTENCE ANALYSIS

Master Thesis

ELNUR ABBASOV

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Danışman: Doç. Dr. ASLI YUKSEL MERMOD

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Sosyal Bilimler Enstitüsü Müdürlüğü

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ABSTRACT

As active participants of the capital market, mutual funds gained great attention of academic researchers in the field of finance since 1960's. With the drastic growth of mutual funds, increasing emphasis has been placed on the question of proper performance evaluation. Although there are a number of academic studies devoted to measuring performance of Turkish mutual funds, few of them focused on the issue of assessment of fund managers' market timing ability that is successfully forecasting the market movements, and analysis of persistence in performance of Turkish mutual funds.

Our research aims to analyze timing ability of Turkish fund managers and to investigate whether persistence phenomenon exists in the Turkish mutual fund universe for the short-term period. In order to explore whether mutual fund managers were successful in forecasting the market movement and how much did the timing ability have impact on earning higher returns, we employed Treynor and Mazuy's model with the quadratic variable and Henriksson and Merton's model with the dummy variable. Testing of performance persistence in the short-run was implemented through application of Carhart's 4-factor model, since it was assumed to capture market anomalies like size, ME/BE ratio and short-term past return.

The results imply that market prediction skill of Turkish mutual fund managers played an important role in earning abnormal returns and staying in the top rank. However, failure of momentum factor to explain the fund excess returns suggested that Turkish mutual funds did not exhibit performance persistence in the short-run.

KEY WORDS: *Mutual funds, Performance evaluation, Market timing, Performance persistence*

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ÖZET

Sermaye piyasasının aktif katılımcıları olarak tanınan yatırım fonları 1960`lardan beri finans bilim dalında birçok akademik araştırmacının ilgisini kazanmıştır. Yatırım fonlarının hızla büyümesi sebebiyle doğru performans değerlemesi konusuna büyük önem verilmiştir. Türk yatırım fonlarının performans ölçülmesi yönünde birçok akademik çalışma yapılmasına rağmen, onlardan çok az bir kısmı fon yöneticilerinin piyasa zamanlaması, başka bir deyişle piyasa hareketinin başarılı şekilde tahmin etmesi kabiliyetinin ölçülmesi, ve Türk yatırım fonlarının performans devamlılığının araştırılması üzerine odaklanmıştır.

Tezin amacı Türk yatırım fonu yöneticilerinin piyasa zamanlaması yeteneğinin ve Türk yatırım fonlarının kısa dönemde devamlılığının incelenmesini hedeflemektedir. Türk yatırım fonu yöneticilerinin piyasa hareketini tahmin etmekte başarılı olup olmadığını ve piyasa zamanlaması kabiliyetinin fonların yüksek getiri kazanmasına ne kadar etki sağladığını araştırmak amacıyla, Treynor ve Mazuy`un karesel değişkenli modeli ve Henrikkson ve Merton`un kukla değişkenli modeli uygulanmıştır. Boyut, PD/DD oranı ve kısa-dönemli getiri gibi piyasa anomalilerini açıklayabildiği farzedildiği için, kısa dönemli performans devamlılığının incelenmesi için Carhart`ın 4-faktörlü modeli kullanılmıştır.

Sonuçlar, Türk yatırım fonu yöneticilerinin olağanüstü getiri kazanmalarında ve en üst sınıfta kalmalarında piyasa zamanlaması kabiliyetinin önemli rol oynadığı fikrini ileri sürüyor. Ancak, moment faktörünün fon ilave getirisini açıklama başarısızlığı, Türk yatırım fonlarının kısa dönemde performans devamlılığı sergilemediği anlamına geliyor.

ANAHTAR KELIMELER: *Yatırım fonları, Performans değerlendirme, Piyasa zamanlaması, Performans devamlılığı*

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INTRODUCTION

The volume of the investment in stocks carried out by mutual funds has risen dramatically, as mutual funds' role increased in world's financial markets since their formation. As the active participants of the capital market, mutual funds gained great attention of academic researchers in the field of finance since 1960's. With the drastic growth of mutual funds, increasing emphasis has been placed on the question of proper performance evaluation.

A number of prerequisites, such as need for professional management, effective diversification of risk, affordability of market securities created fertile environment for emergence of mutual funds. Since individual investors do not have much time and information to form and manage their own portfolios, they need professional and informed managers to take care of their portfolios in institutional manner. In this regard, mutual funds are giving the service of portfolio diversification. They are engaged in investment of a variety of asset classes to satisfy the individual investors' risk and return preferences. Moreover, efficient financial intermediation and more effective systems of corporate governance provided by mutual funds play an important role in development of capital markets.

Individual investors, who provide the funds with their capital and expect mutual fund managers to earn high rate of return, evaluate mutual funds' performance. Mutual funds in their turn try to construct their portfolio through selection of incorrectly priced securities, the effective diversification and the selection of efficient portfolios in the chosen risk class. Moreover, since mutual funds are inclined to get maximum benefit and minimum loss from the market's rise and fall, they always try to anticipate such movements and adjust their portfolio's composition in order to change its volatility accordingly, which is their ability to outguess the market.

In order to properly assess how effectively mutual funds perform their duties, numerous performance evaluation tools were devised by academicians. Many academic studies were dedicated to measure risk-adjusted performance of mutual funds, i.e. return for a certain risk class that a mutual fund chooses. Another group of research is focused on evaluation of mutual fund performance in absolute terms that aims to compare the performance of funds with a certain benchmark performance. Furthermore, some academicians tried to assess the overall fund performance by dividing it to components that are due to microforecasting – stock picking ability and macroforecasting – market timing ability and measuring these two components separately.

Another reason for great interest in studying mutual fund performance evaluation is claims like mutual funds are successful in beating the market, as an active investment institutions funds possess managerial talent in outperforming the benchmark representing passive investment and etc. Such claims are challenging the Efficient Market Hypothesis that performance is expected to be random over time and one cannot rely on past performance to predict performance. These challenging claims attracted many academic researchers' attention to concentrate on the issue whether past performance is related to future performance, whether there is persistence in performance. If past performance is unrelated to future performance, then performance evaluation is of no help when selecting a fund manager. Persistence in performance suggests that some managers possess superior information and managerial skills in selecting right stocks and forecasting the market movements.

The first part gives general information about mutual funds. In this part, definition, investment principles, main characteristics, classification of mutual funds are introduced. The other major points demonstrated in the first part are historical development of Turkish mutual funds, legal process of establishment of mutual funds in Turkey and classification of Turkish mutual funds.

The second part concentrates on literature review on mutual fund performance measurement. Main theories and models that analyze and evaluate the performance from different aspects are introduced. Three traditional methods – Sharpe's measure, Treynor's measure and Jensen's measure, for assessment of performance persistence are demonstrated. Moreover, second part covers three models for evaluating market timing ability of mutual fund performance devised by Treynor and Mazuy, Henriksson and Merton, and Grinblatt and Titman.

The main focus of the fourth part is the persistence phenomenon and academic research on persistence of performance. A number of studies with different nature and methods dedicated to persistence investigation are reviewed in this part. Furthermore, the fourth part covers multifactor models introduced by Fama and French, and Carhart for assessing the performance.

The last part covers application of theories demonstrated in previous parts on Turkish mutual funds. The purpose of research is to measure portfolio performance of A-type mutual funds, and also test the persistence of performance in funds both in short term period. Research aims to answer to three questions:

1) Is there market timing ability of Turkish A-type mutual fund managers and is it corresponding to selectivity ability?
2) Is there relationship between Turkish A-type mutual fund returns and size, style and momentum factors and what is the nature of the relationship?
3) Is there persistence in Turkish A-type mutual funds performance in the short-term period?

Four models discussed in the second and third parts are selected for assessment of performance: one traditional measure – Jensen's alpha; two measures for evaluation of market timing ability – Treynor and Mazuy's, and Henriksson and Merton's models; and one multifactor model for assessment of fund performance and analysis of short-term persistence of mutual funds – Carhart's 4-factor model.

1. INTRODUCTION AND CHARACTERISTICS OF TURKISH MUTUAL FUNDS

1.1 MUTUAL FUNDS

A mutual fund is a special type of company that pools together money from many investors and invests it on behalf of the group, in accordance with a stated set of objectives. Mutual funds raise the money by selling shares of the fund to the public, much like any other company can sell stock in itself to the public. Funds then take the money they receive from the sale of their shares (along with any money made from previous investments) and use it to purchase various investment vehicles, such as stocks, bonds and money market instruments. In return for the money they give to the fund when purchasing shares, shareholders receive an equity position in the fund and, in effect, in each of its underlying securities. For most mutual funds, shareholders are free to sell their shares at any time, although the price of a share in a mutual fund will fluctuate daily, depending upon the performance of the securities held by the fund.

According to CML, "the property established to manage a portfolio of capital market instruments, real estate, gold, or other precious metals by funds collected from the public in return for participation certificates issued in accordance with the provisions of CML, on the account of the holders of such certificates under the principle of distribution of risk and fiduciary ownership is called mutual fund"[1].

In Turkey mutual funds are established in the form of open-end investment companies. They do not have any legal entity and they are operated in terms of the rules stated in the internal statue of the fund, which includes general terms about management of the fund, custody of the assets, valuation principles and conditions of investing in the fund.

According to Principles Regarding Mutual Funds, "a fund is an asset established for managing a portfolio consisting of the capital market instruments in accordance with

[1] Capital Market Board of Turkey. *Capital Market Law*, Law No. 2499, Article 37, 2007, p.23

principles of risk diversification and fiduciary ownership, on behalf of unit holders, with money collected from the public in return for participation certificates"[2].

Throughout 1980's financial system in Turkey witnessed substantial changes for development. Liberalization and market-oriented procedures created a sound environment for prosperity of capital markets. Essential steps were taken regarding the acceleration of the development of financial system. Within this market development framework, Capital Market Law (CML) was enacted in 1981 and independent regulatory body – Capital Market Board (CMB) was established in 1982, in order to form secure, transparent and stable functioning capital markets in Turkey.

According to CML, subject of the law is to regulate and control the secure, transparent and stable functioning of the capital market and to protect the rights and benefits of investors with the purpose of ensuring an efficient and widespread participation by the public in the development of the economy through investing savings in the securities market[3].

With the status of a public legal entity with administrative and financial autonomy CMB was established with the purpose of regulation and supervision of Turkish capital markets. As mentioned in CML principle duties and authorities of the Capital Market Board are listed below[4]:

a) To regulate and control the conditions of the issuance, public offering and sale of capital market instruments with respect to the application of this Law;

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[2] Capital Market Board of Turkey. *Communiqué on Principles Regarding Mutual Funds*, Serial: VII, No: 10, 1996, p.2
[3] Capital Market Board of Turkey, Article 1, 2007, p.1
[4] Capital Market Board of Turkey, Article 22, 2007, p.15

b) To register capital market instruments to be issued or offered to public and to halt the public offering sale of capital market instruments temporarily in case the public interest so requires;

c) To determine standard ratios related to financial structures, and the use of resources of capital market institutions subject to this Law in general or by areas of activity or types of institutions, and to regulate the principles and procedures related to the publication of these ratios;

d) To determine the principles related to independent auditing operations, including when appropriate with respect to use of electronic media in the capital markets; to determine the conditions for establishment and the working principles of institutions engaged in independent auditing operations with respect to the capital market according to Law No. 3568, dated 1 June 1989 by consulting with the Union of Chambers of Public Accountants of Turkey and to publish lists of those who have such qualifications;

e) To make general and special decisions to ensure duly and timely enlightening of the public and to determine and issue communiqués about the content, standards and principles for the publication of financial statements and reports and their audit, of prospectuses and circulars issued at the public offering of capital market instruments, and of important information affecting the value of instruments;

f) To supervise the activities of the issuers subject to this Law, banks with respect to provisions in paragraph (a) of Article 50, capital market institutions and stock exchanges and other organized markets for compliance with this Law, decrees, communiqués of the Board and other legislation related to capital markets by demanding all the necessary information and documents;

g) To monitor all kinds of publications, announcements and advertisements which are related to the capital market made by any means of communications, and to ban those which are determined to be misleading and to inform the related organizations to duly execute what is required;

h) To review the financial statements and reports and other documents obtained by it or submitted to it in accordance with the provisions of this Law, to request reports also from issuers and internal auditors and independent auditors about matters which are deemed necessary and by evaluating the results obtained, to take the required measures as proved in this Law;

i) To determine the principles related to voting by proxy in the framework of the general provisions at the general assemblies of publicly held joint stock corporations and to make regulations related to those who collect proxies or acquire shares in an amount enabling them to change the management of such corporations, or the obligation of purchasing other shares and the rights of the partners who are in the minority to sell their shares to persons or a group which has taken over the control;

j) To make regulations on the specifications and sale and purchase principles of any derivative instruments, including futures and options contracts based on economic and financial indicators, capital market instruments, commodities, precious metals and foreign currency; the rules and principles relating to supervision, obligations and activities of those who shall be employed at the exchanges and markets where these instruments shall be traded; and the principles for margining, clearing and settlement system;

k) To regulate agreements for the purchase or sale of capital market instruments with the promise to resell or repurchase; to adopt market transaction rules related to these contracts; and to determine operating rules and principles related to these transactions;

l) To determine rules and principles related to the borrowing and lending capital market instruments and short selling transactions and, after obtaining the opinions of the Under secretariat of the Treasury and the Central Bank of the Republic of Turkey, to adopt regulations related to transactions involving margin trading ;

m) To make necessary regulations within the framework of related legislation with respect to the issuing and public offering of capital market instruments in Turkey by non-residents;

n) To regulate and supervise the clearing and custody of capital market instruments and the rating of capital market institutions and capital market instruments;

o) To determine the principles of establishment, operation, liquidation and termination of newly established capital market institutions and to supervise them in order to ensure the development of capital market.

p) To perform the examinations requested by the Related Minister; to submit reports to the Related Minister in relation with its activities; to submit proposals to the Related Minister with respect to the amendment of legislation concerning the capital market;

q) To set the qualifications for the appraisal companies which are capable of appraising the real estates, that would engage in appraisal activity in capital markets and to publish the list of the appraisal companies which have met these qualifications, to determine the specifications for the appraisal companies and the appraisers which will appraise the real estate during the process of foreclosure of the receivables arising from housing finance defined in first paragraph of Article 38/A of the Law and during the appraisals which shall be done according to the fourth paragraph of the Article 38/A of the Law and to publish the list of the appraisal companies and the appraisers which have met these qualifications;

r) To determine the rules and principles applicable to persons and organizations engaged in making investment recommendations on the capital market, including in the media and by electronic means;

s) To determine the principles for issuing certificates showing the vocational training and vocational adequacy of persons who shall engage in activities on the capital markets or who shall engage in activities in scope of paragraph (r) of this article and managers and the other employees of capital market institutions and with this objective to establish centers and to determine the principles with respect to the activity;

t) To regulate and supervise public offerings and capital market activities and transactions that are made by means of all kinds of electronic communication tools and media and similar tools including internet and pursuant to general rules to provide for and supervise the use of electronic signatures in activities within the scope of this Law;

u) To make rules and regulations with respect to the method of collective use of voting rights wholly or partly to select members of the board of directors and of company auditors by the general assemblies of stockholders of publicly held joint stock companies subject to this Law;

v) To collaborate in any way and to exchange information regarding the capital market with any equivalent authority of a foreign country responsible for regulation and supervision of their capital markets.

After relevant regulations were established, Istanbul Stock Exchange (ISE) started to operate in 1986 which is the sole securities exchange in Turkey that provide trading in stocks, bonds and bills. Moreover, in 1989 another essential step was taken for the liberation of the financial system, which initiated flow of foreign capital to Turkish markets.

Increase in volume of transactions in the securities and money market, and emergence of new financial instruments in the market till the end of 1986, founded fertile environment for establishment of mutual funds in Turkish markets. In December, 1986, CMB constituted Communiqué on *Principles Regarding Offering of Mutual Fund Participation Certificates* under the Capital Market Law for arrangement of regulations and procedures regarding mutual fund establishment.

1.2 THE PRINCIPLES OF MUTUAL FUNDS

The fundamental principles governing mutual funds are the following:

Risk diversification: Mutual funds provide opportunity to distribute the risk and unpredictability which individual investors are not capable to distribute. Under this principle the individual investors are able to own portfolio of numerous assets with a lot of types. Otherwise, with poor portfolios both in size and types of assets, investors face more risk. Mutual fund investment provides capital owners with risk diversification through allocation of risk into different companies and sectors with low correlation coefficient.

Fiduciary ownership: Generally, there are two types of property ownership systems applied for mutual funds in the world: partner ownership and fiduciary ownership. Since partner ownership system claims that the assets of the fund are owned by the investors, it causes undesired cases like intervening of investors to the fund management. Therefore, fiduciary ownership system was adopted by CMB for Turkish mutual funds. According to fiduciary ownership capital owners grant the founder of the fund with the right to perform all operations regarding the fund and the founder is obliged to manage the fund by protecting the rights of the investors.

Managing a portfolio of securities: Mutual funds are institutions that aim to earn revenue from interest and profit through buying and selling capital market instruments, as well as through investing in cash and precious metals under certain restrictions.

Protection of assets of the fund: As mentioned in Principles Regarding Mutual Funds, assets of the mutual fund may not be used for any other purpose than realization of the obligations and undertaking of responsibilities of the fund. The assets of such funds may not be pledged or provided as guarantee and seized by third parties[5].

Professional Portfolio Management: Generally, capital markets require certain technical information and close investigation for a long-run period. Not all investors expecting high rates of return possess sufficient information and superior portfolio management skill. By analyzing the markets with close observation and high managerial ability and making decisions according to different market conditions, portfolio managers provide the fund investors with the professional management service.

1.3 MUTUAL FUND PARTIES

Although investment relationship through mutual funds differs across different countries, there are four fundamental elements in the mutual fund investing structure[6]:

1) The founder of the fund;
2) Manager of the fund portfolio;
3) Safekeeping organization;
4) Individual investors.

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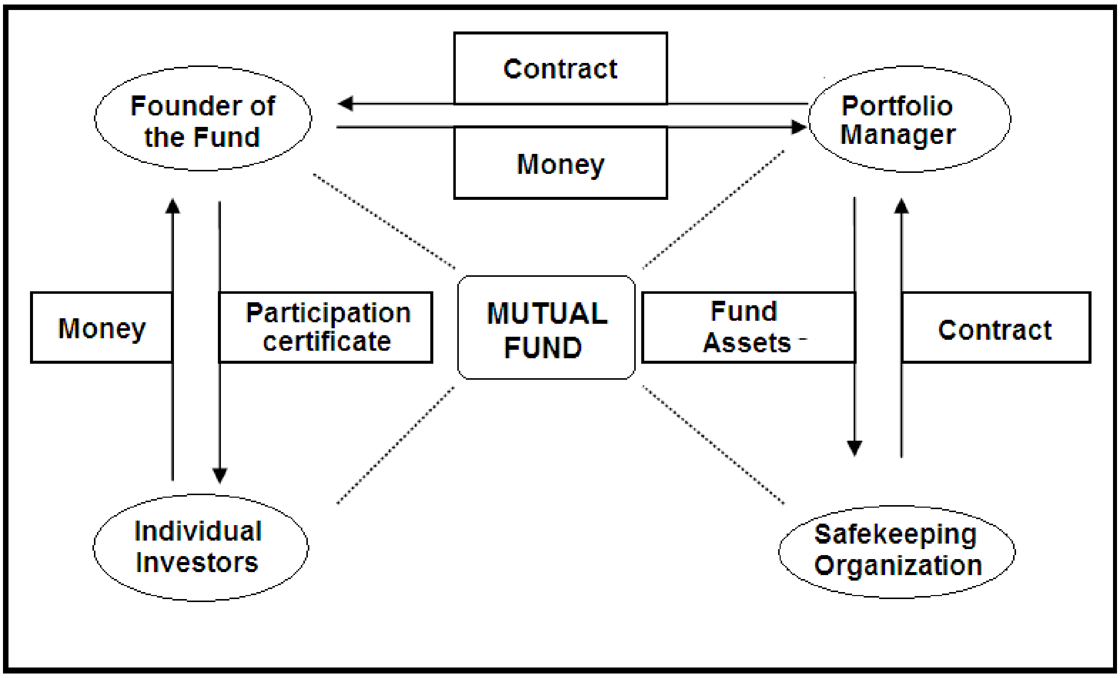
[5] Capital Market Board of Turkey. *Communiqué on Principles Regarding Mutual Funds,* Serial: VII, No: 10, Article 40, 1996, p.17

[6] Kılıç, S., İstanbul menkul kıymetler borsası. *İstanbul Menkul Kıymetler Borsası Yayınları*, İstanbul, 2001, p.6

In accordance with the Principles Regarding Mutual Funds the founder is responsible for the management, representation and custody of the fund which is not a legal entity, considering the principles of risk diversification and fiduciary ownership[7]. The portfolio of the fund is managed by the independent portfolio manager assigned by the founder of the fund. The founder is obliged to supervise all the operations performed by the fund's portfolio manager and is responsible for portfolio manager's operations. Safe-keeper is responsible to store and secure the assets in the fund portfolio, to transfer capital market securities according to the instructions of the fund's portfolio manager and to pass to the individual investors the interest and share profit from the assets of the fund portfolio. Finally, individual investors provide the fund with the capital and expect high rate of return, security and liquidity against their investment. Such typical relationship within the mutual fund can be illustrated as follows[8]:

Figure 1.1 Relationship among mutual fund parties



[7] Capital Market Board of Turkey. *Communiqué on Principles Regarding Mutual Funds*, Serial: VII, No: 10, Article 6, 1996, p.4
[8] Dağlı, H., Sermaye piyasası ve portföy analizi. *Derya Kitabevi*, 2000, p.34

Source: Kılıç, S., İstanbul menkul kıymetler borsası. *İstanbul Menkul Kıymetler Borsası Yayınları*, İstanbul, 2001, p.6

1.4 PARTICIPATION CERTIFICATES

Participation certificates are negotiable instruments kept as a record value, bearing the rights of the owners of the participation certificates against the founder and indicating the number of shares of the owner in the fund. Participation certificates of Type A mutual funds, which are stated in their internal statutes to be bought and sold freely by intermediary institutions other than their founders, are accepted as securities[9]. As a legal note, participation certificates grant an individual investor to claim on the rights and benefits of the mutual fund. Like an owner of share of a corporation who claims right to receive any issued dividend, owner of a participation certificate claims right on the benefits of the fund. However, different from company share participation certificate does not grant the owner with any right to participate in the management of the fund. "*Participation certificates have no nominal value and they can only be sold if the value represented by them is fully paid in cash*"[10].

The price of the participation certificate is calculated by the fund management on a daily basis and this price is valid for the buying-selling of the participation certificate for the following day. Following procedures is used for the calculation[11]:

1) Fund portfolio value is calculated with respect to the market prices of the assets that portfolio contains;

2) Fund's total value is found by adding the receivables to the fund's portfolio value and subtracting the debt (including any transaction and operating cost) from fund's total portfolio value;

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[9] Capital Market Board of Turkey. *Communiqué on Principles Regarding Mutual Funds*, Serial: VII, No: 10, Article 35, 1996, p.15

[10] Ibit, p.15

[11] Erzurumlu, Y., Evaluation of portfolio performance of mutual funds. *Marmara University: Institute of Social Sciences*, Master thesis, 2001, p.18

3) The unit participation certificate price is found by dividing total fund value by number of shares of participation on valuation day.

1.5 COMPONENTS OF MUTUAL FUND PORTFOLIO

According to Principles Regarding Mutual Funds, mutual funds cannot engage in any business other than management of the portfolio consisting of the following instruments[12]:

1) Shares of corporations established in Turkey including the ones that shall be subject to privatization, public and corporate sector debt instruments

2) Foreign public and private sector debt instruments and stocks that can be sold and purchased within the framework of the provisions of Resolution No: 32 on Protection of the Value of Turkish Currency;

3) Gold and other precious metals traded on national and international exchanges and capital market instruments traded on exchanges which based on these metals;

4) Other capital market instruments approved by the Board, repo, reverse repo, futures, options and forward contracts;

5) Transactions made at ISE Settlement and Custody Bank Inc money market for cash realization purposes.

1.6 RESTRICTIONS REGARDING MUTUAL FUND PORTFOLIO

In order to ensure that mutual fund portfolios are sufficiently liquid and well diversified, law and regulations enforce some restrictions on mutual fund portfolios. Some

[12] Capital Market Board of Turkey. *Communiqué on Principles Regarding Mutual Funds*, Serial: VII, No: 10, Article 4, 1996, p.3

of the primary limitations compulsory to be considered upon construction and management of mutual fund portfolios are indicated below[13]:

a) More than 10% of portfolio value of mutual funds cannot be invested in the securities of a single corporation;

b) A single mutual fund cannot own more than 9 % of capital or voting rights in any corporation. A Mutual funds belonging to one founder and, under the management of a manager cannot own more than 20% of capital or voting rights in any corporation;

c) In principle, assets listed in stock exchange are to be taken to the fund portfolio. However, in case that the founder or the manager has intermediated in the off-exchange public offering of the securities, a maximum of 10% of the issued amount, not to exceed 5% of fund portfolio, may be invested in these securities, with the condition that these securities are listed on the Stock Exchange;

d) The stocks, bonds and other debt securities of the founder and manager shall not be purchased for the fund portfolio;

e) The total of securities issued by direct or indirect participations of the founder and manager shall not exceed 20% of fund portfolio;

f) The fund shall not undertake short sales and margin trading transactions;

g) Mutual funds may lend at most 25% of the value of the precious metals in their portfolio in Istanbul Gold Exchange Precious Metals Lending Market or borrow the same amount;

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[13] Ibit, p.18

h) The funds cannot aim to participate in management of the corporations, which they buy the shares of in any way and shall not be represented in the management;

i) Transactions made at ISE Settlement and Custody Bank Inc money market for cash realization purposes shall be done up to %20 of fund portfolio.

1.7 ADVANTAGES OF THE MUTUAL FUNDS

Professional Management: Mutual funds may act as a facilitator for the investors by their regulated professional management under detection of the CMB. Professional managers of the mutual funds do the research, portfolio selection, and monitoring; thus saving time and money for the fund's investors. The capital provided by the individual investors is managed by the professional and trustworthy portfolio managers.

Risk diversification: Investors may lower their risk by diversifying investments across different types of securities. Mutual fund allows the individual investor to buy into a single fund without having to buy shares of each individual company included in the fund. There is one share price for the mutual fund, which is diversified over many companies. Since mutual fund portfolio is largely diversified among exchange, stocks and bonds, risk is considered to be diversified better than individual investors may achieve. For an investor with limited capital, very large transaction costs are required to obtain the same degree of diversification.

Liquidity: The increases in the asset values are reflected daily on the mutual fund prices and the investors can sell their shares at the current asset value easily.

Affordability: Individual investors may buy small amounts of mutual fund shares and benefit from the fund equally with large capital investors. Mutual funds provide investors with the opportunity for making investments in assets with a high premium potential which are hard for small investors to invest due to their large amount of capital requirements.

Flexibility: Mutual funds offer investors a wide range of asset classes and investors through mutual funds can make investment to these asset classes according to their risk and return preference. Furthermore, mutual funds give investors the opportunity to switch from one asset class to another for only a slight commission fee.

1.8 CLASSIFICATION OF TURKISH MUTUAL FUNDS

Mutual funds can be classified in two types:

Type A: Being stated in their internal statutes, funds permanently investing at least 25% of monthly average weighted portfolio value in stocks of corporations established in Turkey, including the ones that shall be privatized, are called Type A.

Type B: All funds other than Type A belong to Type B mutual fund group.

These two types differ from each other according to their risk level, since portfolios of these funds are constructed from assets with different risk level. Moreover, Type A mutual funds are more advantageous in respect of taxation benefits, since unlike Type B mutual funds they are not subject to taxation for premiums from transactions[14]

In accordance with the Principles Regarding Mutual Funds mutual funds can be established under the following categories provided that it has been stated in their internal statutes[15]:

1) Funds with 51% of the portfolio at least, permanently

[14] Erzurumlu, 2001, p.21
[15] Capital Market Board of Turkey. *Communiqué on Principles Regarding Mutual Funds,* Serial: VII, No: 10, Article 5, 1996, p.3

a) invested in public and private debt instruments are called “bonds and bills funds”,

b) invested in stocks of corporations established in Turkey including the ones that shall be subject to privatization are called “stock funds”,

c) invested in securities of corporations belonging to a certain sector are called “sector fund”,

d) invested in securities issued by the subsidiaries defined in Annex 3 of the Communiqué Serial: XI, No: 1 of the Board, i.e. the stocks and bonds of corporations owned by the establisher of the fund, are called “subsidiary funds”,

e) invested in securities of a certain group defined in Article 2 of Communiqué Serial: XI, No: 10, i.e. the stocks and bonds of corporations owned by a group or holding, are called “group funds”,

f) invested in of foreign public and corporate sector securities are called “foreign securities funds”,

g) invested in gold and other precious metals and capital market instruments based on these metals traded on national and international exchanges are called “precious metals funds”, invested in gold and capital market instruments based on gold which are traded on national and international exchanges are called “gold funds”;

2) Funds with the entire portfolio,

h) consisting of at least two of the stocks, debt instruments, gold and other precious metals and capital market instruments based on these and each with at least 20 % of fund portfolio value are called “composite funds”,

i) consisting of highly liquid capital market instruments with at most 180 days to maturity and with weighted average maturity of the portfolio being maximum 45 days are called “liquid funds”,

j) Funds which cannot be included in any of the fund types mentioned above with respect to portfolio limitations are called “variable funds”;

3) Funds with at least 80% of the portfolio permanently,

k) consisting of securities included in an index approved by the Board or a sampled selection of them, where the correlation coefficient is at least 90% between the unit share value of the fund and value of the index and taken as basis within the framework of the calculation in accordance with the formula mentioned in Annex 3 of this Communiqué are called “index funds”.

Funds whose participation certificates allotted to certain individuals and institutions are called “special funds”.

2. EVALUATION TOOLS FOR PERFORMANCE MEASUREMENT

2.1 TRADITIONAL METHODS OF PERFORMANCE ANALYSIS

2.1.1 Sharpe's Measure

Inspired from developments in the capital market theory Sharpe defines the tasks for major participants in investment management world, including mutual funds, as follows: the security analyst's tasks are to provide the required predictions of security performance including the interrelationships among the performances of securities and detect securities that are incorrectly priced; the portfolio analyst's tasks are translating predictions about security performance into predictions of portfolio performance, and selecting from among the large number of possible portfolios those that are efficient; and the investor's task is to select from among the efficient portfolios the one that he/she considers most desirable, based on his particular feelings regarding risk and expected return. So, the selection of incorrectly priced securities, the effective diversification and the selection of efficient portfolios in the chosen risk class are the main functions of the sound mutual fund management[16].

Grounding on the evidence supporting the random walk theory, Sharpe concludes that it becomes hard to select incorrectly priced securities. Besides, from the point of view of mutual funds practically it is almost impossible to determine its different investors' preference patterns representing their desires. Under these conditions, mutual funds functions still combine security analysts' and portfolio analysts' tasks, but these tasks are now modified. Security analysis is directed more toward evaluating the interrelationships among securities - the extent to which returns are correlated. *"And portfolio analysis is*

[16] Sharpe, W. F., Mutual fund performance. *Journal of Business* 39, 1966, p.120

concerned primarily with diversification and the selection of a portfolio of the desired risk"[17].

Sharpe explains the differences in performance of mutual funds basing on the above tasks of mutual funds. In an efficient market a mutual fund's task is to choose among diversified portfolios in an appropriate risk class, as in a perfect market any truly diversified portfolios will be efficient[18]. Considering the fact that the portfolio diversification has become very simple task, it is expected that the likelihood of persistent difference in fund performance is seriously reduced. Sharpe states that the only persistency can be expected in inferior performance, which can be explained by the spending too much on the search of incorrectly priced securities.

2.1.1.1 Theoretical Background

Accepting the assumptions of the CAPM, and the fact that the expected rate of return and variability of risk are the key factors for measuring portfolio performance, we can describe the efficient set of portfolios by the following straight line, which is capital market line – CML[19]:

$$E = p + \left(\frac{E_i - p}{\sigma_i} \right) \sigma$$

Here, E and σ are expected rate of return and risk of the efficient portfolio, respectively, p is riskless interest rate, E_i and σ_i are expected rate of return and risk of the portfolio, respectively. So, the portfolio with the greatest $\left(\frac{E_i - p}{\sigma_i} \right)$ value, which is the risk premium, will be the best portfolio. However, the above formula presents only predicted

[17] Sharpe, 1966, p.121
[18] Ibit, p.121
[19] Ibit, p.122

portfolio performance. But substituting average portfolio rate of return (A_i) for its expected rate of return and standard deviation of its rate of return (V_i) for its risk, we can evaluate ex post performance of the portfolio by the following formula[20]:

$$A = p + \left(\frac{A_i - p}{V_i}\right)V$$

As CAPM implies, any mutual fund holding properly diversified portfolios and/or not spending too much resources on research and administration will generally lie along the above modified (with substituted ex post terms) straight line and the source of any deviations from the line will be transitory effects; and funds failing to properly diversify its portfolio and/or overspending on administration and analysis will violate the relationship and stay below the CML, and thus demonstrate persistently poor performance.

2.1.1.2 Sharpe's Performance Measure

Steepness of the line associated with a fund provides a useful measure of performance-one that incorporates both risk and average return which Sharpe defined as the *reward-to-variability ratio*. The numerator shows the difference between the fund's average annual return and the pure interest rate; it is thus the reward provided the investor for bearing risk. The denominator measures the standard deviation of the annual rate of return; it shows the amount of risk actually borne. The ratio is thus the reward per unit of variability[21].

"Those who view the market as nearly perfect and managers as good diversifiers would argue that the differences are either transitory or due to excessive expenditures by

[20] Ibit, p.123
[21] Sharpe, 1966, p.123

some funds. Others would argue that the differences are persistent and can be attributed (at least partially) to differences in management skill"[22]

To test whether the differences in reward-to-variability (R/V) rankings appear due to persistence in performance or transitory effects/extreme expenses, Sharpe made rankings based on reward-to-variability ratios for two subsequent 10-year periods and plotted the ranking points in the two-period diagram. As a result the ranking points, although not perfectly, lay on an upward trend line, showing that last decade's poor performers stayed as poor performers in the next decade and winners preserved their rankings for two subsequent 10-year periods. To prove the result is statistically significant he calculated Spearmen's rank correlation coefficient. He also did regression analysis for two period's R/V ratios among 34 mutual funds, the correlation coefficient for which was significantly positive.

These results show that differences in performance can be predicted, although imperfectly. However, they do not indicate the sources of the differences. Equally important, there is no assurance that past performance is the best predictor of future performance[23].

2.1.2 Treynor's Measure

Treynor considers the market risk as the main problem in evaluating performance of mutual funds. According to Treynor there are two kinds of risk in a diversified fund.

First is risk produced by general market fluctuations, which Treynor called volatility of the market. During bull or bear markets, more volatile funds will perform

[22] Ibit, p.125
[23] Sharpe, 1966, p.127

better or worse than less volatile funds. In other words, more volatile funds are more sensitive to market movements, thus have higher beta level than less volatile funds.

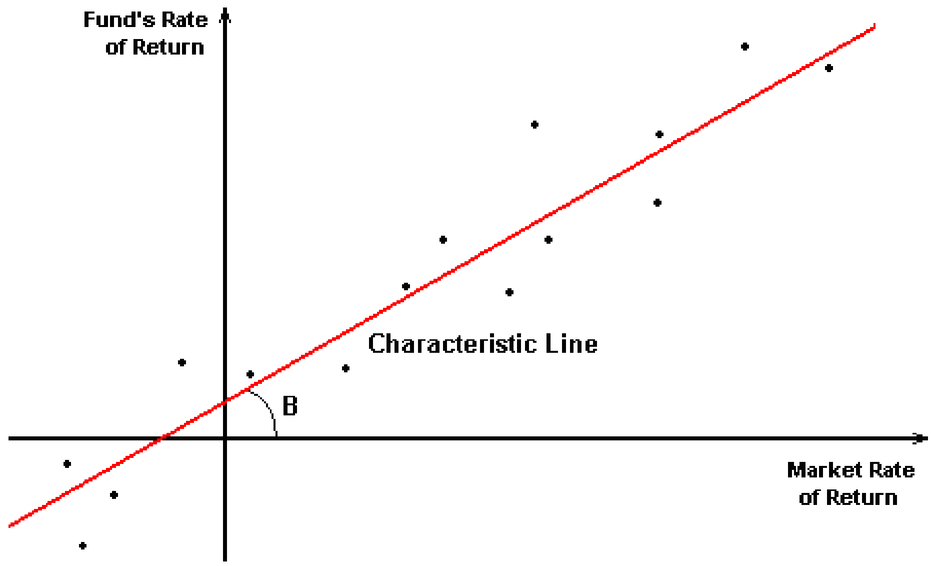
Second kind of risk is coming from particular security movements in the fund. The importance of fluctuations in one or a few stocks from the investor's point of view is apparent when one considers that, after all, if this kind of risk were not important, investors would not diversify. As Treynor points out, if a fund properly diversified, this kind of risk, which is causally unrelated to one security from another, tends to average out.

2.1.2.1 Characteristic Line

To demonstrate the performance of mutual funds Treynor found a device – *characteristic line* – that related fund rate of return to market average return. After constructing characteristic lines for several funds Treynor concluded that most mutual funds demonstrated stable performance when viewed by that graphical device[24].

[24] Treynor, J. L. 1965. How to rate management of investment funds. *Harvard Business Review* 43, p.65

Figure 2.1 Characteristic line



Source: Treynor, J. L. 1965. How to rate management of investment funds. *Harvard Business Review* 43, p.65

The characteristic-line method not only contains information about the fund's expected rate of return, but also its systematic risk. The systematic risk or the volatility of the fund is reflected in the slope of the characteristic line. The steepness of the line shows how sensitive the fund's rate of return is to market fluctuations.

Of course, not all points that reflect fund's rate of return for certain market rate of return lie exactly on the characteristic-line. It means that not all of the risk of the fund is explained by the market movements. There are two possible reasons for such kind of deviations from the characteristic line. First, the fund's portfolio is not properly diversified, when its managers bear more risk for no additional return. Second, depending on market movements the fund managers change their policy by changing the fund's volatility[25].

Characteristic-line method also gives information about the fund's ability to earn higher returns than other competitors. If two funds have the same level of volatility, which means their characteristic lines are parallel, then the fund with the higher line will perform better earning higher returns than the other one, independently of the market's rates of return.

Another use of characteristic line is its help in performance management control; fund managers can establish limits above and below the line and watch whether the points fall within the limits or not. If there is a fall-out it requires special scrutiny.

2.1.2.2 Portfolio-Possibility Line

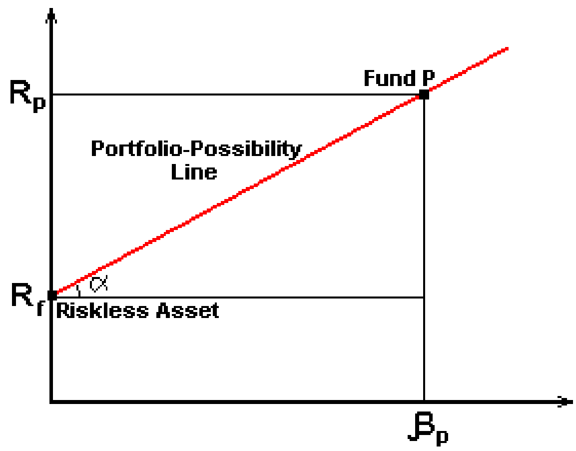
Treynor's another graphical method devised for performance evaluation is *portfolio-possibility line* that relates portfolio containing a certain fund to the portfolio owner's risk preferences. In the risk-return diagram where the risky fund and riskless asset/fixed income instrument are demonstrated as points, the investor has opportunity to invest all of his/her money in the risky fund or in the combination of the fund and riskless asset. This opportunity set can be shown as the straight line connecting the points of riskless asset and the risky fund, which Treynor called portfolio-opportunity line. Here definition of risk that Treynor uses is actually volatility of the portfolio. So, Treynor's portfolio-possibility line has no difference from Security Market Line – SML in the CAPM model.

The portfolio-possibility line presents great advantage for measuring and comparing the fund performance. The slope of the fund's portfolio-possibility line provides

[25] Treynor, 1965, p.66

useful tool for performance evaluation, as for any certain level of volatility the fund with the steeper slope will provide the investor with more rate of return coming from the combination with the riskless asset, than the one with the less steep slope. This will be true for every investor who is risk-averse, quite independently the precise shape of the indifference curve. As the fund's portfolio-possibility line is superior to other's, in terms of portfolio possibilities, the first fund is absolutely superior to other one. The steepness of the portfolio-possibility line associated with a given fund given in Figure 2.2 is a direct measure of the desirability of the fund to the risk-averse investor, no matter whether the fund invests in fixed-income securities or not[26].

Figure 2.2 Portfolio-possibility line



Source: Treynor, 1965, p.69

The performance measure formula can be written as follows[27]:

[26] Treynor, 1965, p.69
[27] Ibit, p.69

$$\tan\alpha = \frac{R_p - R_f}{\beta_p}$$

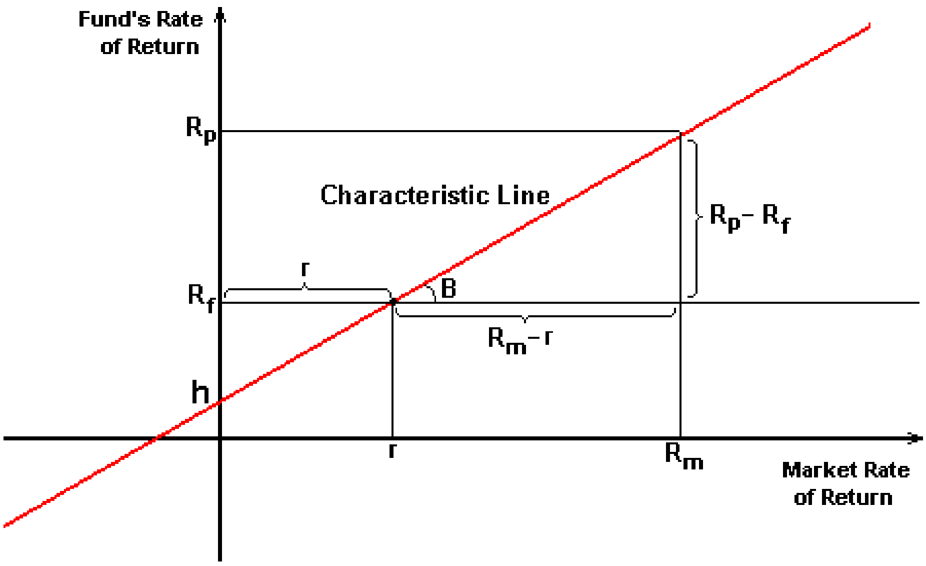
where R_p is the expected rate of return of fund P, R_f is the rate of return for riskless asset and β_p stands for volatility of the fund P, which is provided the slope of the characteristic line.

2.1.2.3 Performance Evaluation Measures and Relation between them

Treynor found simple way to measure performance of mutual funds for ranking purposes, using characteristic lines. It is the level of rate of return for the general market at which the fund in question will produce the same return as that produced by a fund consisting solely of riskless investment. In the market return-fund return diagram it is the market return that is appropriate to the point, which is the intercepting point of the characteristic line with the horizontal line showing the fixed riskless rate of return. It is illustrated in the Figure 2.3, where market rate of return – ***r*** is the performance evaluation measure[28].

[28] Treynor, 1965, p.75

Figure 2.3 Characteristic line and performance measure



Source: Treynor, 1965, p.75

It is not difficult to accept that this evaluation measure, unlike the measure coming from portfolio-possibility line, is oppositely proportionate with the fund performance, as better performing mutual funds will earn riskless rate of return for less market rate of return than poor performing ones. It can be proven as follows[29]. As slope of the line is

$$\beta = \tan B = \frac{R_p - R_f}{R_m - r}$$

where R_p is the expected rate of return of fund P, R_m is the market rate of return R_f is the rate of return for riskless asset and β stands for volatility of the fund P, then substituting the beta term in the previous measure's formula, we get:

[29] Ibit, p.75

$$\tan\alpha = \frac{R_p - R_f}{\beta} = R_m - r$$

As we see these two measures are oppositely proportionate:

$$r = R_m - \tan\alpha$$

We can demonstrate the ***r*** in different way, from another formula of the slope:

$$r = \frac{R_f - h}{\beta}$$

So, ***r*** has the same value independently of the fluctuations in the market.

2.1.3 Sharpe's vs. Treynor's Measure: Ability to Predict Future Performance

In an efficient capital market, where no securities would be incorrectly priced, all properly diversified portfolios will move similarly with the over-all market. Treynor has taken advantage of the relationship between a fund's and market's movements, by using the volatility of a fund as a measure of its risk instead of the total variability used in Shape's R/V ratio. If all mutual funds in a sample hold highly diversified portfolios, rankings made according to these two measures will give almost the same results. However, if some relatively undiversified funds are included, the results could have been significantly different, since the Treynor Index cannot capture the portion of variability that is due to lack of diversification. For this reason it is an *inferior* measure of *past* performance. But for this reason it may be a *superior* measure for predicting *future* performance. "*Thus, given* *some reasonable assurance that a fund will perform its diversification function well, the Treynor Index may provide better predictions of future performance than the R/ V ratio"*[30].

Sharpe made the same ranking comparison for two subsequent decades, except for using R/V ratios for the first 10-year period and using Treynor's measurement method for the second period. The result along with the Spearman's rank correlation coefficient and correlation coefficient show that Treynor's measurement index is more powerful than R/V ratio to predict the future performance of mutual fund returns.

Considering above results supporting persistency in performance, Sharpe interprets the differences in performance under two alternative conditions[31]:

1) If the market is very efficient, then persistence of differences in performance are likely feeding on the differences in expense ratios; the funds spending the least should show the best (net) performance.

2) If the market is not perfect, then differences are coming from the ability of management to find incorrectly priced securities; the funds devoting more resources to research and management may gain enough to more than offset the increased expenditure and thus show better net performance.

Expense ratios were used to test how good these ratios are to predict future performance. Rank correlation coefficients demonstrate that it provides a better prediction than Treynor Index. However, as a result of regression analysis correlation coefficients show that expense ratios have inferior power for future performance prediction when compared with Treynor Index.

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[30] Sharpe, 1966, p.129
[31] Sharpe, 1966, p.131

Fund size also has major impact on expenses, and thus fund performance. Funds with larger assets will have lower expense ratios than funds with fewer assets. In other words, the needed expenditure for research and administration will be smaller as a percentage of larger fund's assets than of smaller one's assets. On the other hand large funds may need substantial resources to be spent for research/administration than small funds. The same research on predictive ability of size demonstrated that size is unimportant factor future performance prediction.

Moreover, Sharpe made regression analysis between R/V ratios and the other above mentioned measures (Treynor Index, Expense Ratio and Size to Net Assets Ratio). Expense ratios account for a substantial portion of the differences in performance, but so does another measure (the Treynor Index). Thus differences in management skill may be important. However, it is important to note that Sharpe didn't considered brokerage expenses in calculating expense ratios.

2.1.4 Jensen's Measure

According to Jensen at least two phenomena define the performance of a mutual fund: first is forecasting ability of fund managers to determine future movements of security prices and thus ability to increase portfolio returns; second is managers' ability to minimize unsystematic risk through properly diversification. However, Jensen concentrates his study on a fund's ability to predict future security prices which produces more return than the expected return for appropriate risk level. The other issue that he aims to present is a new method for evaluating performance by means of the absolute measure. *"Unlike the relative measure which is used for vis-à-vis comparison and ranking purposes, the absolute measure helps to compare the performance of mutual funds with some standard"*[32]. In

[32] Jensen, M., The performance of the mutual funds in the period 1954-64. *Journal of Finance* 23, 1968, p.390

addition, Jensen's measure also takes into account risk effects on the fund returns, which previous measures failed to do.

The measure of performance derives directly from the application of CAPM. As the measure will describe fund managers' predictive ability, it will test whether the fund was successful to earn higher return than its risk level would yield according to CAPM. In other words, this measure will demonstrate if the point for certain fund will lie above the capital market line. But the model contains ex ante values, as the relationship is stated only in terms of the expected returns of the fund and the expected market return. Therefore, Jensen suggests a different model that will restate the CAPM in terms of the ex post security returns and returns on market portfolio. Moreover, in his previous work he proved that the CAPM model can be extended to a multi-period model, in which trading can take place continuously. Below we will demonstrate how the model is modified in order to meet above conditions[33]:

$$\tilde{R}_{jt} = E(\tilde{R}_{jt}) + b_j \tilde{\pi}_t + \tilde{e}_{jt} \qquad j = 1,2,\ldots,N$$

Here $\tilde{R}_{jt}$ is return on security or portfolio, $\tilde{\pi}_t$ is market factor, b_j is parameter which may vary from security to security and it approximately equal to β_{jt} in the original CAPM and N is the number of securities in the market $\tilde{\pi}_t$ and $\tilde{e}_{jt}$ fulfill below conditions:

$$E(\tilde{\pi}_t) = 0$$
$$E(\tilde{e}_{jt}) = 0$$
$$\operatorname{cov}(\tilde{\pi}_t, \tilde{e}_{jt}) = 0$$

[33] Jensen, 1968, p.391

$$\mathrm{cov}(\tilde{e}_{jt}, \tilde{e}_{jt}) = \begin{cases} 0 \\ \sigma^2(\tilde{e}_j), \end{cases}$$

We can write the same equation for market portfolio, considering the fact that the market portfolio's return is value weighted combination of all security returns:

$$\tilde{R}_{Mt} = \sum_j X_j E(\tilde{R}_{jt}) + \sum_j X_j b_j \tilde{\pi}_t + \sum_j X_j \tilde{e}_{jt}$$

Moreover, since market factor is unique only up to a transformational scale, the second term can be shown as $\tilde{\pi}_t$ through scaling this factor and since the expected value of $\sum_j X_j \tilde{e}_{jt}$ is zero and its variance is extremely small, last term will most likely be equal to zero. Therefore,

$$\tilde{R}_{Mt} \cong E(\tilde{R}_{Mt}) + \tilde{\pi}_t$$

Adding $\beta_j \tilde{\pi}_t + \tilde{e}_{jt}$ to both sides of the original CAPM equation and considering the equation for market return, we get:

$$E(\tilde{R}_{jt}) + \beta_j \tilde{\pi}_t + \tilde{e}_{jt} \cong R_{Ft} + \beta_j \left(R_{Mt} - \tilde{\pi} - R_{Ft}\right) + \beta_j \tilde{\pi}_t + \tilde{e}_{jt}$$

Obviously, the left side of above equation is $\tilde{R}_{jt}$. Then we can express the realized excess return as follows:

$$\tilde{R}_{jt} - R_{Ft} = \beta_j\left(\tilde{R}_{Mt} - R_{Ft}\right) + \tilde{e}_{jt}$$

Realized risk premium on any security or portfolio is equal to the product of its systematic risk by realized market premium plus the random error. This equation can be used for estimating the systematic risk of individual securities or unmanaged portfolios. But applying the equation to managed portfolios can be erroneous. In case of superior(unsuccessful) forecasting the random error term in the equation will often be positive(negative), which will result in more(less) than the normal risk premium for a given risk level. Such conditions make it reasonable to include non-zero constant to the equation[34]:

$$\tilde{R}_{jt} - R_{Ft} = \alpha_j + \beta_j\left(\tilde{R}_{Mt} - R_{Ft}\right) + \tilde{u}_{jt}$$

Here the expected value of random error term $\tilde{u}_{jt}$ is zero and it is serially independent.

If the fund manager has superior predictive ability then the intercept of the equation will be positive. The passive buy-and-hold-the-market policy will generally produce zero intercept. A negative intercept demonstrates worse performance than random selection buy-and-hold-the market policy. *"At first glance it might seem difficult to do worse than a random selection policy, but such results may very well be due to the generation of too many expenses in unsuccessful forecasting attempts"*[35].

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[34] Jensen, 1968, p.392
[35] Ibit, p.394

It should also be noted that the suggested performance measure – the intercept of the above equation – can be used for comparison across mutual funds of different risk levels and across differing time periods, since it is not affected by the nature of general economic conditions and particular market conditions over evaluation period[36].

Thus far, we assumed that the systematic risk is static. However, a fund manager may change portfolio's level of risk according to market movements through changing the weights of riskless and risky assets in the portfolio. If a fund manager successfully forecasts the market movements then his portfolio will yield more return as he properly adjusts the systematic risk of the portfolio. Thus, allowing for beta to be non-stationary will let the model to measure fund managers' ability to predict future market movements – timing ability. So, taking into account the variability of the systematic risk Jensen improved the model in order to evaluate fund managers' forecasting ability in broad means, which includes ability to predict both future security movements and general market movements.

If we assume that a fund manager on average aims to maintain the target risk level, the risk can be expressed as follows[37]:

$$\tilde{\beta}_{jt} = \beta_j + \tilde{\varepsilon}_{jt}$$

where β_j is the fund's target level of risk and $\tilde{\varepsilon}_{jt}$ is normally distributed random variable, the expected value of which is equal to zero. Obviously, when the market is expected to rise, fund manager having market timing ability to some extent will increase $\tilde{\varepsilon}_{jt}$ and

[36] Ibit, p.394
[37] Jensen, 1968, p.395

therefore will increase the risk level – $\tilde{\beta}_{jt}$ and vice versa. It means that $\tilde{\varepsilon}_{jt}$ and $\tilde{\pi}_t$ will have linear relationship, as we expressed the market factor by $\tilde{\pi}_t$:

$$\tilde{\varepsilon}_{jt} = a_j \tilde{\pi}_t + \tilde{w}_{jt}$$

where $\tilde{w}_{jt}$ is normally distributed random variable, the expected value of which is equal to zero. In this expression, there is no constant term, since if there were it would be included in the constant β_j. If the fund manager has predictive ability of market movements the coefficient a_j will be positive, else it will be equal to zero. There is no allowance for a_j to be negative, as it is not rational. It is worth to note that the magnitude of a_j does not inform about the quality of the forecasting ability, but about the willingness of the manager to forecast on his/her bets.

Since the improved model looks like as follows,

$$\tilde{R}_{jt} - R_{Ft} = \alpha_j + (\beta_j + \tilde{\varepsilon}_{jt})\left(\tilde{R}_{Mt} - R_{Ft}\right) + \tilde{u}_{jt}$$

as long as the risk level – β is unbiased estimate of the average value β_j, the performance measure – a_j will also be unbiased. Jensen finds that expected value of the β will be:

$$E(\tilde{\beta}_j) = \frac{\operatorname{cov}[(\tilde{R}_{jt} - R_{Ft})(\tilde{R}_{Mt} - R_{Ft})]}{\sigma^2(\tilde{R}_M)} = \beta_j - a_j E(R_M)$$

As seen from the formula, if the manager is unable to forecast market movements then the estimate of the risk level will be unbiased. Therefore, the measure of ability to select individual securities for a fund that lacks market timing ability will also be unbiased. However, if the manager has ability to predict market movements then the estimate of risk will be biased downward and the magnitude of the bias is positively related with the a_j parameter. As beta is biased downward the performance measure then will be biased upward. That is, the performance measure a_j, will be positive for two reasons: first, the extra returns actually earned on the portfolio due to the manager's ability, and second, the positive bias in the estimate of a_j resulting from the negative bias in our estimate of β[38].

2.2 TOOLS FOR MEASURING MARKET TIMING ABILITY

2.2.1 Treynor and Mazuy's Approach

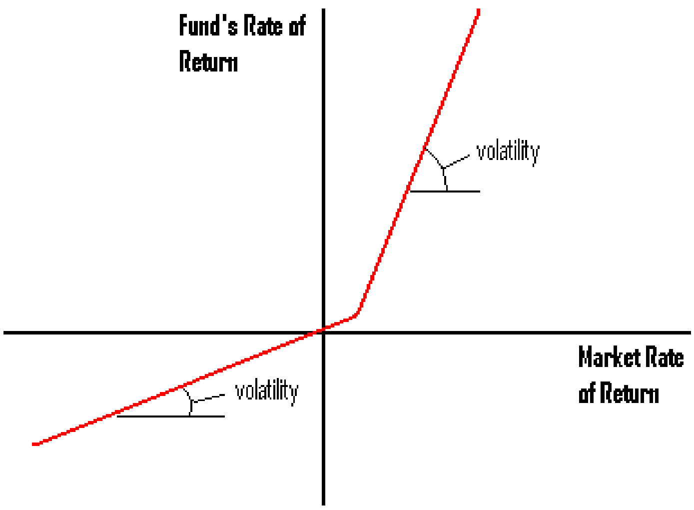
Since one of the key factors of mutual funds' success to earn high rate of return is their ability to anticipate major turns in the market, Treynor and Mazuy devised an effective tool for measuring such market timing ability that answers to critical questions like whether funds are speculating if they attempt to outguess market movements or whether they are negligent when they fail to try. In order to present such a tool, Treynor and Mazuy considered the two irrefutable facts that a market movement is the result of tendency of most common stocks to move up and down together, and that stocks differ from each other in their sensitivity to general market movement, i.e. in their volatility. Since mutual funds are inclined to get maximum benefit and minimum loss from the market's rise and fall, they always try to anticipate such movements and adjust their portfolio's composition in order to change its volatility accordingly, which is their ability to outguess the market. In other words, if they think that the market is going to rise, they shift the composition of the portfolios they manage to more volatile securities and vice versa. Thus, in order to test whether or not a mutual fund manager has actually outguessed the

[38] Jensen, 1968, p.396

market, Treynor and Mazuy asked: *"Is there evidence that the volatility of the fund was higher in years when the market did well than in years when the market did badly?"*[39]

As I noted before, Treynor presented simple, but very useful tool – characteristic line that clearly describes the relationship between an investment fund's volatility to the market movement. If we take into account that the fund manager is changing his/her portfolio volatility according to the market fluctuation there will be two characteristic lines for different market movement expectations: the steep one for the rising market expectations and flat one for the falling market expectations. If the manager is always successful to predict the market turn, i.e. if he/she shifts between characteristic lines with no failure, the relationship between the returns of the fund and market will no longer be demonstrated by a straight line.

Figure 2.4 Broken characteristic line reflecting perfect market timing ability

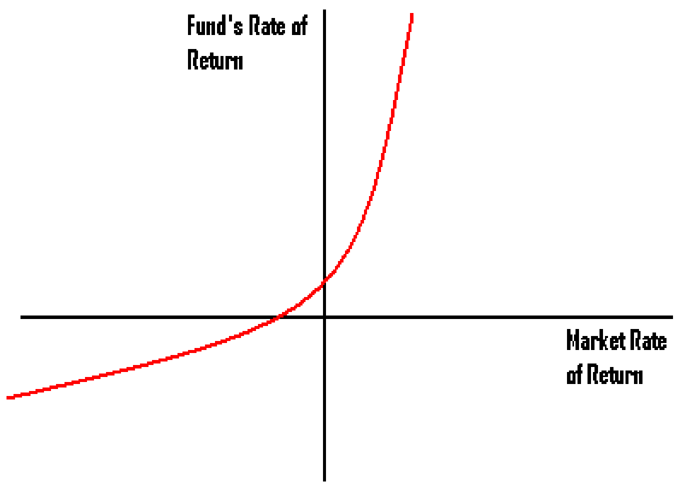


Source: Treynor and Mazuy, 1966, p.133

[39] Treynor, J. and Mazuy, F., Can mutual funds outguess the market? *Harvard Business Review* 44, 1966, p.132

However, as it is an extreme case for perfect market timing, the characteristic line for an investment fund with prediction skills will not be a broken line, but a smoothly curved line. That means, the better the market performs, the more likely management is to have anticipated good performance and to have increased fund volatility appropriately and the larger, on the average, the chosen volatility is likely to be. Treynor and Mazuy's criteria for revealing mutual funds with successful predictive skills is as follows: *"the only way in which fund management can translate ability to outguess the market into a benefit to the shareholder is to vary the fund volatility systematically in such a fashion that the resulting characteristic line is concave upward."*[40]

Figure 2.5 Smoothed characteristic line



Source: Treynor and Mazuy, 1966, p.133

Fund-market return relationship demonstrated by curved line shown above can mathematically be presented by inclusion of quadratic term in the regression model:

[40] Treynor and Mazuy, 1966, p.134

$$R_{pt} - R_{ft} = \alpha + \beta(R_{Mt} - R_{ft}) + \lambda(R_{Mt} - R_{ft})^2$$

Here, R_{pt} is the fund's rate of return, R_{ft} is rate of return of riskless security, α is the excess return from security analysis, R_{Mt} is the market rate of return, β is the systematic risk level and λ is the measure of market timing ability.

As before, alpha will measure selectivity capabilities. The variable lambda will measure market timing ability, where positive lambda will indicate that market outguessing efforts have added value to portfolio performance of the mutual fund.[41] Comparing the lambdas of different funds will indicate the relative importance of market timing skills in their investment policies. The extent of lambda or the degree of curvature depends on how much heavily management bets on its expectations – that is, the degree to which management changes fund volatility when its expectations regarding the market change.

2.2.2 Henriksson and Merton's Model

Fama (1972) assumed that forecasting skills can be divided into two major components: 1) microforecasting – forecasting of price movements of selected individual stocks, which is associated with security analysis that involves the identification of individual stocks which are under- or overvalued relative to equity market; and 2) macroforecasting – foreseeing price movements of the market, which is referred as market timing. Merton in his model simplifies the definition of macroforecasting, as he assumes that macroforecasting attempts to identify when equities in general are under- or overvalued relative to the fixed-income securities[42]. The model of market timing forecasts presented by Merton is based on a simple assumption that the market timer makes predictions either that

[41] http://www.andreassteiner.net/performanceanalysis
[42] Merton, R. C., On market timing and investment performance. I. An equilibrium theory of value for market forecasts. *Journal of Business* 54, 1981, p.364

stocks will earn a higher return than bonds or that bonds will earn higher return than stocks. To test forecasting ability of investment managers with a particular emphasis on the market-timing ability, Henriksson and Merton (1981) devised statistical techniques derived from the basic model of market timing developed by Merton[43].

As noted before, the main point of the model is that the market timer tries to predict when the equity market will provide a greater return than riskless securities and when the riskless securities will yield a greater return than the stock market. In other words, the investment manager forecasts whether $R_{Mt} > R_{ft}$ or $R_{ft} > R_{Mt}$, where R_{Mt} is the one-period return of the market portfolio and R_{ft} is the one-period return of fixed income riskless securities. Based on these predictions, the market timer will make appropriate adjustments to his portfolio changing the proportions of equity and riskless security.

Let $\gamma(t)$ denote the manager's forecast variable, showing his/her prediction made in *t -1* period for the *t* period, where $\gamma(t) = 1$ if the manager forecasted that $R_{Mt} > R_{ft}$ and $\gamma(t) = 0$ if the manager forecasted that $R_{Mt} \leq R_{ft}$. Then the probabilities for $\gamma(t)$, depending on whether or not market outperformed the riskless security, can be defined as follows:

$$p_1(t) = prob[\gamma(t) = 0] \text{ if } R_{Mt} \leq R_{ft}$$

$$1 - p_1(t) = prob[\gamma(t) = 1] \text{ if } R_{Mt} \leq R_{ft}$$

and

[43] Henriksson, R. D. and Merton, R. C., On market timing and investment performance. II. Statistical procedures for evaluating forecasting skills. *Journal of Business* 54, 1981, p.523

$$p_2(t) = prob[\gamma(t) = 1] \text{ if } R_{Mt} > R_{ft}$$

$$1 - p_2(t) = prob[\gamma(t) = 0] \text{ if } R_{Mt} > R_{ft}$$

Therefore, $p_1(t)$ is the conditional probability of a correct forecast, given that $R_{Mt} \leq R_{ft}$, and $p_2(t)$ is the conditional probability of a correct forecast, given that $R_{Mt} > R_{ft}$. As stated in Merton (1981), a necessary and sufficient condition for a forecaster's predictions to have no value is that $p_1(t) + p_2(t) = 1$. Under this condition, an investor would not modify his prior estimate of the distribution of returns on the market portfolio as a result of receiving the prediction and therefore would pay nothing for the prediction[44]. On the other hand, if $p_1(t) + p_2(t) > 1$ then the forecasts of the market timer will have positive value, as in the case of perfect forecasting where $p_1(t) = 1$ and $p_2(t) = 1$ i.e. the market-timer's forecasts are always correct. In the case of $p_1(t) + p_2(t) < 1$, by following a strategy of always doing the opposite of the forecasts that are always wrong, one can achieve a positive value of forecasts. Therefore, a test of a forecaster's market-timing ability is to determine whether or not $p_1(t) + p_2(t) = 1$[45].

For the further development of the model to evaluate the forecasting skills of the investment manager we need to know whether or not the manager's forecasts are observable. Based on this condition Henriksson and Merton devised both non-parametric and parametric test of market-timing ability, where in the former there is no requirement for

[44] Merton, 1981, p.385
[45] Henriksson and Merton, 1981, p.517

any assumptions about the way in which individual security prices are formed, while in the latter it is assumed that the CAPM holds[46].

2.2.2.1 Non-parametric test of market timing

Since $p_1(t)$ and $p_2(t)$ are not known, to test the forecasting ability we need to estimate $p_1(t)+p_2(t)$ and then using these estimates to examine whether we can reject the null hypothesis that the investment manager possesses no forecasting ability:

$$H_0 : p_1(t)+p_2(t)=1$$

"Essentially, this is a test of independence between the market timer's forecast and whether or not the return on the market portfolio is greater than the return from riskless securities"[47]. Let's define N_1 as the number of observations where $R_{Mt} \le R_{ft}$, N_2 as the number of observations where $R_{Mt} > R_{ft}$, N as the total number of observations, n as the number of times forecast that $R_{Mt} \le R_{ft}$, n_1 as the number of successful predictions, given $R_{Mt} \le R_{ft}$ and n_2 as the number of unsuccessful predictions, given $R_{Mt} > R_{ft}$. It is proved that the estimates of $p_1(t)$ and $1-p_2(t)$, which are $E(n_1/N_1)$ and $E(n_2/N_2)$, respectively, have the same expected value under null hypothesis. Considering the fact that the successful and unsuccessful forecasts are independently distributed variables with binomial distributions and using Bayes's Theorem, Henriksson and Merton determined the probability that the number of successful predictions is equal to x, i.e. $n_1 = x$, given N_1, N_2 and, under null hypothesis:

[46] Ibit, p.516
[47] Henriksson and Merton, 1981, p.517

$$P(n_1 = x | N_1, N_2, n) = \frac{\binom{N_1}{x}\binom{N_2}{n-x}}{\binom{N}{n}}$$

The feasible range for n_1 is determined as follows:

$$\underline{n}_1 \equiv \max[0, n - N_2] \le n_1 \le \min[N_1, n] \equiv \overline{n}_1$$

Given the distribution and the feasible range for the number of successful predictions, the confidence intervals for testing the null hypothesis of no forecasting ability can easily be established. The null hypothesis can be rejected, if $n_1 \ge \overline{x}(c)$ or if $n_1 \le \underline{x}(c)$, where c is the confidence level of a standard two-tail test, and $\overline{x}$ and $\underline{x}$ are defined to be the solutions to the following equations:

$$\sum_{x=\overline{x}}^{\overline{n}_1} \frac{\binom{N_1}{x}\binom{N_2}{n-x}}{\binom{N}{n}} = (1-c)/2$$

and

$$\sum_{x=\underline{x}}^{x} \frac{\binom{N_1}{x}\binom{N_2}{n-x}}{\binom{N}{n}} = (1-c)/2$$

So, provided that the forecasts are observable, knowing N_1, N_2 and *n*, we can test the market timing ability of the investment manager.

2.2.2.2 Parametric test of market timing

Since predictions of the mutual funds are rarely observable, it is necessary either to form a proxy for predictions or to make assumptions of a specific generating process for returns on securities. While under certain conditions it is possible to infer from the portfolio return series alone what the manager's forecasts were, such inferences will, in general, provide noisy estimates of the forecasts and these estimates will be especially noisy if the manager's portfolio positions are influenced by his microforecasts for individual securities[48]. Based on the additional assumption that securities are priced according to the CAPM, Henriksson and Merton established a parametric test of market-timing ability requiring only observable time series of realized returns on the portfolio.

According to another assumption for the parametric test of forecasting ability of the market-timer set by Henriksson and Merton, a forecaster switches between two discretely different target risk levels for his/her portfolio, depending on whether or not the market rate of return is predicted to exceed the rate of return on riskless security. Hence, the investment manager chooses one target beta when he/she forecasts $R_{Mt} > R_{ft}$ and another target beta when he/she forecasts $R_{Mt} \leq R_{ft}$.

If $\beta(t)$ denotes the beta of the portfolio at time *t*, and *b* denotes the expected value of $\beta(t)$ unconditional on forecast, then the two target systematic risk levels can be expressed as follows:

[48] Henriksson and Merton, 1981, p.525

1) $\eta_1(t) = b + \theta(t)$, when the forecaster predicts $R_{Mt} \leq R_{ft}$;

2) $\eta_2(t) = b + \theta(t)$, when the forecaster predicts $R_{Mt} > R_{ft}$.

where $\theta(t)$ is the unanticipated and dependent on the forecast component of $\beta(t)$.

The above expressions are based on the assumption that $\beta(t)$ is a random variable, since the target risk levels of an investment manager are not observable. Of course, if $\beta(t)$ were observable at each point of time, then the market-timing forecast is observable, and one could simply apply the nonparametric tests[49].

Considering assumptions mentioned above, the per-period return on the investment manager's fund can be written in the following form:

$$R_{pt} = R_{ft} + [b + \theta(t)]x(t) + \lambda + \xi_{pt}$$

where R_{pt} is the fund's rate of return; $x(t) \equiv R_{Mt} - R_{ft}$; λ is the expected excess return from micro-forecasting or security analysis and ξ_{pt} is assumed to satisfy following characteristics:

$$E[\xi_{pt}] = 0$$
$$E[\xi_{pt} | x(t)] = 0$$
$$E[\xi_{pt} | \xi_{pt-i}] = 0$$

[49] Henriksson and Merton, 1981, p.526

Based on expression of the return generating process shown above, least squares regression method can be applied, in order to estimate contributions from both security analysis and market timing:

$$R_{pt} - R_{ft} = \alpha_p + \beta_1 x(t) + \beta_2 y(t) + \xi_t$$

where $y(t) \equiv \max[0, R_{ft} - R_{Mt}] = \max[0, -x(t)]$.

This estimate is the outcome of Merton's (1981) analysis of market-timing ability, where it was stated that the pattern of returns from market timing has an identical correspondence to the pattern of returns from following "protective put" option strategy. In detail, for each dollar invested in this strategy, $p_1\eta_2 + (1 - p_2)\eta_1$ dollars are invested in the market; $(p_1 + p_2 - 1)(\eta_2 - \eta_1)$ put options on the market portfolio are purchased with an exercise price equal to R_{ft}; and the balance is invested in riskless securities[50]. The market timing will have value, if the $(p_1 + p_2 - 1)(\eta_2 - \eta_1)$ put options are obtained for no cost and $y(t)$ will be the return on one such option.

Using regression specification mentioned above, the estimates of β_1, β_2 and α_p can be expressed as follows:

$$p\lim \hat{\beta}_1 = p_2\eta_2 + (1 - p_2)\eta_1$$
$$p\lim \hat{\beta}_2 = (p_1 + p_2 - 1)(\eta_2 - \eta_1)$$
$$p\lim \hat{\alpha}_p = \lambda$$

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[50] Henriksson, R. D., Market Timing and Mutual Fund Performance: An Empirical Investigation. *Journal of Business* 57, no. 1, pt. 1, 1984, p.77

Here, $p\lim\hat{\beta}_1 = E[\beta(t)|x(t) > 0]$ and in the options strategy it is equal to the fraction that is invested in the market portfolio. If the forecaster has market-timing ability, $p\lim\hat{\beta}_2$ will represent the number of free put options on the market.

β_2 represents investment manager's market-timing ability and it will be equal to zero if either the manager has no timing skill, which is true if $p_1(t) + p_2(t) = 1$ or he/she is not rational and does not act on his/her predictions, that is $\eta_2 = \eta_1$.

2.2.3 Performance Measure suggested by Grinblatt and Titman

Grinblatt and Titman founded a model that revealed several disadvantages of the traditional performance evaluation methods in respect of such important issues like identifying an appropriate benchmark portfolio, failure of informed investors to earn positive risk-adjusted returns because of increasing risk aversion and finally, the possibility of overestimating risk because of market-timing ability[51]. They introduced a new measure – Positive Period Weighting Measure, which is free from the pitfalls noticed above. They mainly focused on the deficiencies of the Jensen measure, which are benchmark inefficiency, statistical power and market timing ability[52].

As evaluation of the portfolio performance based on CAPM requires the use of benchmark, the result of the evaluation will be sensitive to the benchmark choice. Hence, proper selection of the benchmark portfolio is critical step in measuring the performance. Grinblatt and Titman noted that benchmark portfolio should consist only of those assets that can be included in the evaluated portfolio. For instance, portfolio managers who select the oil stocks in a larger portfolio can be evaluated with a mean-variance efficient

[51] Grinblatt, M. and Titman, Sh., Portfolio performance evaluation: Old issues and new insights. *Review of Financial Studies* 2, no. 3, 1989a, p.393
[52] Grinblatt, M. and Titman, Sh., A study of monthly mutual fund returns and performance evaluation techniques. *Journal of Financial and Quantitative Analysis* 29 no. 3, 1994, p.420

benchmark portfolio consisting of only oil stocks[53]. Moreover, Grinblatt and Titman claim that tests using prior beliefs about the determinants of performance may have power to reject the null hypothesis of no performance.

The other drawback of the Jensen measure originates from the statistical bias in the evaluation technique, which assigns negative performance to the successful market timers. Grinblatt and Titman presented graphical illustration of a case where Jensen measure erroneously generates negative performance number to portfolio manager with positive market timing ability[54]. We assume that the portfolio manager has two choices to select a high or low beta efficient portfolio, which are graphically illustrated as steeper and gentler sloped and passing through the origin solid lines. Manager receives one of two signals: benchmark excess return will be *(rh)* which is above its unconditional mean, or it will be *(rl)* which is below its mean. For the first signal the manager will select steeper portfolio and be at point A, and select the gentler portfolio and be at point B, when he receive the second signal. In this case, the portfolio will be represented by the dotted line passing through the points A and B, whose intercept will be negative. As a result Jensen measure will assign negative performance for that informed investor.

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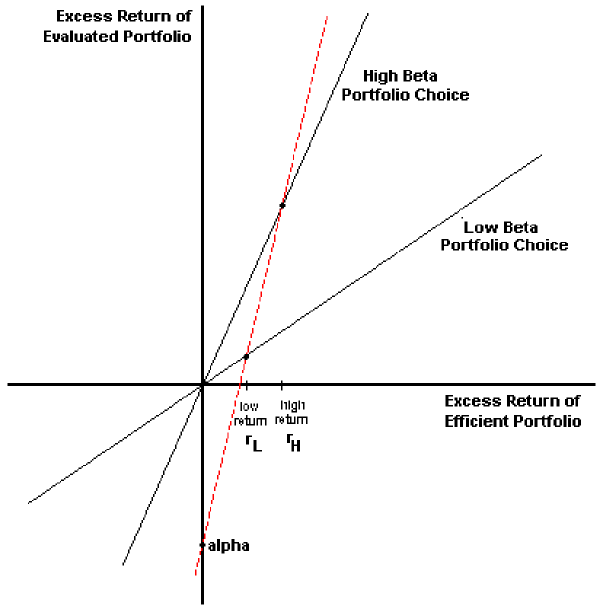
[53] Grinblatt and Titman, 1989a, p.411
[54] Ibit, p.394

Figure 2.6 Example for failure of Jensen's measure to capture market timing ability



Source: Grinblatt and Titman, 1989a, p.395

In order to better demonstrate the bias in timing component of Jensen measure and to correct this bias in nature of new measure, it is desirable to decompose the Jensen measure into certain components. According to CAPM the excess return of the investor's portfolio can be expressed as

$$\tilde{r}_{pt} = \tilde{\beta}_{pt}\tilde{r}_{Et} + \tilde{\epsilon}_{pt},$$

where $\tilde{r}_{pt}$ is portfolio excess return, $\tilde{\beta}_{pt}$ is the portfolio beta, $\tilde{r}_{Et}$ is the excess return of the portfolio of risky assets that is mean-variance efficient from the perspective of an uninformed observer and mean of $\tilde{\epsilon}_{pt}$ is zero. Using this equation, the limiting large-sample mean of the excess return of the portfolio can be expressed as[55]:

$$\hat{r}_p = \text{plim}\left[\frac{1}{T}\sum_{t=1}^{T}(\tilde{\beta}_{pt}\tilde{r}_{Et} + \tilde{\epsilon}_{pt})\right] = \hat{\beta}_p\hat{r}_E + \text{plim}\left[\frac{1}{T}\sum_{t=1}^{T}\tilde{\beta}_{pt}(\tilde{r}_{Et} - \hat{r}_E)\right] + \hat{\epsilon}_p$$

where $\hat{r}_P$ and $\hat{r}_E$ are the probability limit of the sample mean of portfolio returns and the efficient portfolio returns, respectively, for the evaluated period of time.

The Jensen measure can be demonstrated as follows:

$$J = \hat{r}_p - b_p\hat{r}_E$$

where b_P is the probability limit of the least squares slope coefficient from the time-series regression of excess returns of the evaluated portfolio against the excess returns of the efficient benchmark portfolio.

Considering the decomposed expression of the limiting large-sample mean of the excess return of the evaluated portfolio, Jensen measure can be modified as follows:

$$J = (\hat{\beta}_p - b_p)\hat{r}_E + \text{plim}\left[\frac{1}{T}\sum_{t=1}^{T}\tilde{\beta}_{pt}(\tilde{r}_{Et} - \hat{r}_E)\right] + \hat{\epsilon}_p$$

55 Grinblatt and Titman, 1989a, p.398

Such decomposition of the Jensen measure sheds light on the source of the problem of not identifying successful market timers. The three terms in this equation will be referred to as respectively as the component of performance that results from large sample biases I estimated beta, the component that results from timing, and the component that results from selectivity[56]. The timing measure is defined as the sample covariance between the portfolio beta and the excess return of the benchmark portfolio[57]:

$$TM = \text{plim}\left[\frac{1}{T}\sum_{t=1}^{T}\tilde{\beta}_{pt}(\tilde{r}_{Et} - \hat{r}_E)\right]$$

where $\tilde{\beta}_{pt}$ is the portfolio beta, $\tilde{r}_{Et}$ is the excess return of the portfolio of risky assets, $\hat{r}_E$ is the probability limit of the sample mean of the efficient portfolio returns

As a minimum requirement, an appropriate performance measure should assign zero performance to the portfolios of uninformed investors. Based on equations shown above, Grinblatt and Titman proved that the portfolio of an investor who lacks timing information exhibits zero performance with timing measure[58]. Although both positive and negative deviations from zero performance according to evaluation measures can be accepted as an indication of superior information, it is desirable to demonstrate that generally performance measures get positive value for investors that utilize superior information, since performance measure may have negative value also due to transaction costs and embezzlement. In order to demonstrate this, Grinblatt and Titman, developed a model, where conditions are determined under which unconditional means of the random variables $\tilde{\epsilon}_{pt}$ and $\tilde{\beta}_{pt}(\tilde{r}_{Et} - \bar{r}_E)$ get positive values[59]. The return of the mean-variance efficient portfolio and the return of any asset can be characterized as

[56] Grinblatt and Titman, 1989a, p.398
[57] Ibit, p.399
[58] Ibit, p.400
[59] Grinblatt and Titman, 1989a, p.402

$$\tilde{r}_E = \bar{r}_E + \tilde{m} + \tilde{y}$$

and

$$\tilde{R}_j = \beta_j \tilde{r}_E + \tilde{s}_j + \tilde{z}_j,$$

where ***m*** and $\tilde{s}_j$ are timing and selection signal respectively, observed by the informed investor, which are private information signals with zero mean; ***y*** and $\tilde{z}_j$ are the realizations of uncorrelated random noise. The information structure for the evaluated portfolio is summarized by the following equation:

$$\tilde{r}_p = \tilde{\beta}_p(\bar{r}_E + \tilde{m} + \tilde{y}) + \tilde{s}_p + \tilde{z}_p$$

Considering above assumptions, the random vector $(\tilde{\epsilon}_1, \ldots, \tilde{\epsilon}_N, \tilde{\epsilon}_H, \tilde{r}_E)$ will have unconditional mean - $(0, 0, \ldots, 0, \bar{r}_E)$ and mean $I = (s_1, \ldots s_N, s_H, \bar{r}_E + m)$ conditional on private information. Based upon the information structure, the optimality condition for the evaluated portfolio can be expressed as follows:

$$E(\tilde{\mathbf{R}} \mid I) = a(I) W_0 \mathrm{cov}(\tilde{R}_p + \tilde{R}_H, \tilde{\mathbf{R}} \mid I)$$

where W_0 is the investor's wealth for investment in managed assets at the beginning of the evaluated period and $a(I)$ is the investor's Rubinstein measure of absolute risk aversion. Grinblatt and Titman proved that if an investor has independent timing and selectivity information and non-increasing Rubinstein absolute risk aversion, then $\partial\beta_p/\partial m > 0$, which means that investor always increases his beta as his information about the market becomes more favorable[60]. With non-increasing Rubinstein absolute risk aversion, information that increases the investor's utility function will decrease $a(I)$. Moreover, it was shown that if $\partial\beta_p/\partial m > 0$ for all realizations of the signals of an investor with timing information, the "timing component" will be positive. Taking into account the last propositions, it follows that the timing component of the portfolio of an investor is positive,

[60] Grinblatt and Titman, 1989a, p.403

with independent timing and selectivity information and non-increasing Rubinstein absolute risk aversion[61].

If we assume that the investor's portfolio beta is monotonically increasing in response to market timing signal, then it can be demonstrated as

$$\tilde{\beta}_p = \hat{\beta}_p + f(\tilde{m})$$

where $f(\tilde{m})$ holds following conditions:

$$f(m) = -f(-m),\ f(0) = 0 \text{ and } f'(m) = \partial\beta_p/\partial m > 0.$$

Based upon such expression of evaluated portfolio beta, Jensen measure can be modified to be demonstrated as follows[62]:

$$J = \left(1 - \frac{\bar{r}_E^2}{\sigma_E^2}\right)\text{cov}(\tilde{\beta}_p, \tilde{r}_E)$$

With such expression, it is easy to indicate the pitfall of the Jensen measure to fail identify successful market timers. Let's assume that the investor being evaluated has positive forecasting ability of market movements, in other words, $\text{cov}(\tilde{\beta}_p, \tilde{r}_E) > 0$. Under this assumption, whenever $\bar{r}_E > \sigma_E$ is true for the benchmark portfolio, then, as seen from the last expression, the Jensen measure will assign negative performance for that investor. This case is equivalent to the case where in the decomposition of the Jensen measure

[61] Ibit, p.409
[62] Ibit, p.404

demonstrated above, the "bias in beta" component is negative and exceeds the "market timing" component in absolute terms.

To correct this shortcoming Grinblatt and Titman developed a general class of performance measures called "period weighting" measures. As their main feature, these measures are constructed as the weighted sum of the evaluated portfolio's excess returns by periods, where with the same weights these measures will assign zero performance to the mean-variance benchmark portfolio[63]. This measure will look like

$$\alpha^* = \sum_{t=1}^{T} w_t r_{pt}$$

and

$$\sum_{t=1}^{T} w_t r_{Et} = 0$$

where $w_t = w(r_{Et}, T)$.

To ensure that the measure's variance converges to zero as ***T*** approaches infinity, the weights are scaled to sum to one and each weight is assumed to approach zero at a sufficiently rapid rate as the time series gets large[64]:

$$\sum_{t=1}^{T} \tilde{w}_t = 1 \text{ and } |\text{plim}[Tw_t]| < \infty.$$

[63] Grinblatt and Titman, 1989a, p.405
[64] Ibit, p.405

Grinblatt and Titman proved that Jensen measure is indeed the special case of the class of period weighting measures. In terms of new measure, the defect of Jensen measure to determine market timers can be explained, as follows: for a positive market timer, the large positive portfolio returns that tend to occur when the benchmark's return is extremely high are multiplied by negative weights, reducing the Jensen measure and possibly making it negative. To overcome this shortcoming, Grinblatt and Titman stated an additional requirement for the new measure, which is replacing the negative weights with positive weights and adjusting the other weights accordingly. If the period weights additionally satisfy $\tilde{w}_t > 0,\ t = 1, \ldots, T$, and if $\partial\beta_p/\partial m > 0$ for all realizations of the private information signals, then $\text{plim}[\tilde{\alpha}^*] > 0$ [65].

To construct the weights of the measure, following steps should be implemented[66]:

1) Utility optimal combination of the portfolios in the benchmark and the risk-free asset is found, i.e., γ is searched for maximizing $E(W) = -\Sigma_t \left(1 + r_{ft} + \gamma\tilde{R}_{It}\right)^{-7}$:

$$\gamma = \underset{\gamma}{\text{argmax}}\{E(W)\}$$

Here a risk aversion parameter of 8 was chosen.

2) Time series of gross returns of the optimal portfolio are calculated:

$$1 + r_{ft} + \gamma\tilde{R}_{It}.$$

3) Assuming the gross returns as wealth levels, marginal utility of this wealth level with the power functions is calculated:

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[65] Ibit, p.406
[66] Grinblatt and Titman, 1994, p.439

$$\mathrm{MU} = 7\left(1 + r_{ft} + \gamma \bar{R}_{It}\right)^{-8}$$

4) Marginal utilities are rescaled to be weights that sum to one:

$$w_t = \frac{\left(1 + r_{ft} + \gamma \bar{R}_{It}\right)^{-8}}{\Sigma_t \left(1 + r_{ft} + \gamma R_{It}\right)^{-8}}$$

The weights used in this measure can be interpreted as the marginal utilities of an uninformed investor with power utility[67]. According to this interpretation, the requirement of this measure's equality to zero for mean-variance efficient benchmark portfolio becomes first-order condition for maximizing the expected utility of an uninformed investor who holds the benchmark portfolio and the measure itself becomes this investor's marginal change in utility from adding a small amount of the evaluated portfolio's excess return to his existing portfolio. If this quantity is positive, it means that an uninformed investor wishes to add some of the evaluated portfolio to his unconditionally optimal portfolio.

It is important to note that in their research Grinblatt and Titman identified that Jensen measure and Positive Period Weighting Measure demonstrated similar values for evaluated mutual funds and the reason for such similarity was explained by the failure of the most mutual funds to successfully time the market. For some mutual funds the measures demonstrated different values. To test whether the difference originates from market timing component, Grinblatt and Titman regressed the difference between the Jensen and Positive Period Weighting Measures against the Treynor-Mazuy Timing Measure and found statistically significant relation between the variables[68] The result implies that the mutual funds assigned with different Jensen and Positive Period Weighting Measures indeed demonstrated market timing ability.

[67] Ibit, p.423
[68] Grinblatt and Titman, 1994, p.432

3. EVALUATION AND INVESTIGATION OF PERFORMANCE PERSISTENCE

3.1 WHAT IS PERSISTENCE?

Mutual fund managers are expected to consistently outperform a benchmark. Investors who invest to these funds and people who evaluate money managers have to rely on past performance data. Therefore, whether mutual fund managers and funds that have performed well in the past will continue to outperform in the future, in other words whether mutual funds will demonstrate persistence in performance is the question of concern for investors. If past performance can predict future performance, then a portfolio consisting of best performing managers should consistently outperform a randomly selected portfolio of money managers[69]. Performance is said to be persistent when a fund that performs well (or badly) in one year also performs well (or badly) in subsequent years, due to fund manager skill, momentum or level of market risk assumed by the fund manager[70]. Much of the theoretical debate on mutual fund performance persistence has been conducted with reference to the efficient market hypothesis, since the efficient market hypothesis implies that, on a risk-adjusted basis, it is impossible to generate superior returns consistently or that, in the long run performance persistence should disappear. Momentum – tendency of rising asset prices to rise further, another possible reason for persistence, is also violation of market efficiency, since according to efficient market hypothesis such increase is warranted only by changes in demand and supply of new information.

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[69] Kazemi, H., Schneeweis Th. and Pancholi D., Performance persistence for mutual funds: Academic evidence. *Center for International Securities and Derivatives Markets*, 2003, p.1
[70] Blake, D. and Timmermann. A., Performance persistence in mutual funds: an independent assessment of the studies prepared by Charles River Associates for the Investment Management Association. *Financial Services Authority*, 2002, p.44

3.2 ACADEMIC RESEARCH ON PERSISTENCE

There was extensive academic research regarding the performance persistence. In their research targeting to identify whether managerial skill exists, Goetzmann and Ibbotson tried to address three major issues to interpret performance[71]:

1) need for risk adjustment;
2) possibility of survivorship bias;
3) cross-sectional dependence of fund returns across any single period of time.

They split the mutual fund sample into high- and low-variability funds, since high-variability funds cause selection bias. They used Jensen's alpha as a risk-adjusted standard of relative fund performance and expected any persistence in alphas to be the result of relative levels of management skill. According to regression results for five periods, they concluded that there is persistence in relative fund performance[72]. Moreover, in order to ensure that the persistence is not due to long-term phenomenon, Goetzmann and Ibbotson randomly selected the monthly returns and then re-performed persistence test. This randomization preserves the cross-sectional relationship for each month, but destroys the time series relationship[73]. The authors conclude that persistence of performance is due to fund managers' timing strategies and fees and is consistent with differences in managerial skill[74].

Similar results of persistence due to fund managers' ability to earn abnormal returns were noted by Grinblatt and Titman. They categorized the funds' performance into four groups, where the total performance is reviewed in two 5-year sub-periods: 1) good in the first half, good in the second half, 2) good in the first half, bad in the second half, 3) bad

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[71] Goetzmann, W. and Ibbotson, R., Do winners repeat? *Journal of Portfolio Management*, 1994, p.10
[72] Ibit, p.14
[73] Ibit, p.16
[74] Ibit, p.17

in the first half, good in the second half, 4) bad in the first half, bad in the second half. While first and last cases indicate positive persistence, third and fourth cases indicate negative persistence. If these cases are equally likely, one will find no persistence. As a tool for measuring the persistence they proposed to estimate the slope coefficient in a cross-sectional regression of abnormal returns computed from last five years of data on abnormal returns computed from the first five years of data. A significant positive t-statistic for the slope coefficient in this regression would reject the null hypothesis that past performance is unrelated to future performance[75]. However, since the t-statistics for the measure will be biased due to highly correlated residuals because of similar portfolios held by majority of mutual funds, Grinblatt and Titman chose to perform another procedure with the same objective but now without bias. They 1) computed abnormal returns (Jensen's alpha) for each fund in excess of average abnormal return throughout the first sub-period; 2) constructed weights by dividing these abnormal returns to cross-sectional variance of abnormal returns; 3) computed weighted average of returns of each fund for the second sub-period, by applying weights obtained in the previous step; 4) regressed these returns against the excess return of the benchmark portfolio. The intercept from such kind of time series regression will be algebraically identical to the slope coefficient from the cross-sectional persistence regression proposed before[76]. The test results imply that the past performance has power to predict the future performance. As in Goetzmann and Ibbotson's research, Grinblatt and Titman re-performed the test by constructing sub-sample from randomly selected months and the other sub-sample from the remaining months. Test results once more confirmed the persistence in performance, by ignoring the cause of persistence in mutual fund performance as long-term persistence in stock returns. Moreover, the authors performed the same test for passive portfolios and noted the same

[75] Grinblatt, M. and Titman, Sh., The persistence of mutual fund performance. *Journal of Finance* 47, 1992, p.1979
[76] Ibit, p.1980

result in slope coefficient. This result brought the authors to conclusion that positive slope coefficient for mutual funds is not entirely due to persistence of managerial skill[77].

Contrary to Goetzmann and Ibbotson's research methodology where results from different time periods are aggregated, Brown and Goetzmann break the analysis down on a year-by year basis. They defined Winner-Winner (WW) performance as the last year's top performers' superior performance in the subsequent year, Winner-Loser (WL) performance as the last year's top performers' bad performance in the subsequent year, and so on. Brown and Goetzmann devised a simple performance persistence measurement tool – Cross-Product Ratio, which is the ratio of the number of repeat performers (WW and LL) to the number of those that do not repeat (WL and LW), that is (WW*LL)/(WL*LW). The null hypothesis that performance in the first period is unrelated to performance in the second period corresponds to a Cross-Product Ratio of one[78]. However, Grinblatt and Titman noted that survivorship requirements are most likely to eliminate funds in Loser-Loser group, since the poor performing funds are most likely to close down, which will eventually bias the remaining funds towards negative persistence[79]. Furthermore, Brown and Goetzmann noted that fund attrition and cross-fund dependencies are also significant factors that tend to bias the Cross-Product Ratio test toward rejection and the degree of such bias depends on the correlation structure of the mutual fund universe and on attrition rate[80]. Since fund disappearance is the major factor having huge impact on persistence test results, Brown and Goetzmann investigated major determinants of fund disappearance and found that fund size and age are negatively related to fund disappearance, and expense ratio is positively related to fund disappearance. Another key factor affecting the fund disappearance, according to authors, is past performance over several years, as funds having poor lagged returns are less likely to survive[81]. Since Cross-Product Ratios in majority of years have values significantly above one, Brown and Goetzmann came to

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[77] Ibit, p.1981
[78] Brown S. and Goetzmann, W., Performance Persistence. *Journal of Finance* 50, 1995, p.686
[79] Grinblatt and Titman, 1992, p.1978
[80] Brown and Goetzmann, 1995, p.687
[81] Ibit, p.686

conclusion that in most years winners and losers repeat. Besides in several years they observed negative persistence that is statistically significant. These reversals suggest that there are two possible reasons for persistence: 1) persistence is correlated across managers, which is likely due to a common strategy that is not captured by conventional investment styles or risk adjustment procedures; 2) persistence originates from survivorship bias, when poor performing funds with high probability of disappearance are not eliminated from the mutual fund universe and are still in business, thus contributing to the pattern of relative persistence[82]. Brown and Goetzmann note that persistence is probably not due to managerial talent. "*Whatever the cause of winning, it is evidently a group phenomenon, which could be consistent either with herding behavior or correlated portfolio strategies*"[83]. Moreover, an analysis of abnormal returns of repeat-winners suggests that although best performers demonstrate positive alphas, they bear a high level of total risk which is not diversifiable due to cross-sectional correlation among the mutual fund strategies[84]. After eliminating persistent losers from the sample Brown and Goetzmann re-performed their persistence test and witnessed insignificant results of persistence, which led the authors to conclude that much of the persistence is due to funds that repeatedly lag passive benchmarks.

3.3 PERIOD OF PERSISTENCE

Many academic studies focus not only on whether the performance is persistent, but also on the issue of how long the performance persists. Remarkable research on continuation period of performance was done by Hendricks et al. (1993), Jegadeesh and Titman (1993) and De Bondt and Thaler (1985). Hendricks et al. find that the persistence of relatively superior performance proves to be significant, although it is predominantly a

[82] Brown and Goetzmann, 1995, p.680
[83] Ibit, p.689
[84] Ibit, p.697

short-run phenomenon, peaking at roughly four quarters[85]. According to their study result, funds that perform best in the most recent year continue to be superior performers in the near term, where such funds were referred as "hot hands". *Moreover, "icy hands" phenomenon also appears in the testing performed by Hendricks et al.: loser funds in the last year stay as inferior performers in the next year. Indeed, they are more inferior than hot hands are superior, which means that most weight of performance persistence falls on the "icy hands"*[86]. The authors presented the persistency phenomenon as the violation of efficient market hypothesis. A null hypothesis of an efficient market for mutual funds implies that historical performance cannot be used to identify mutual funds that will be top performers in the future. According to CAPM the excess return of mutual fund *i* can be demonstrated as

$$R_{it} - R_{ft} = \beta_i (R_{mt} - R_{ft}) + \xi_{it} \ ,$$

where ξ_{it} is the residual return realized in period *t*. Since efficient market hypothesis asserts that ξ_{it} is unpredictable, then it can be stated as follows:

$H_1 : E(\xi_{it}) = 0$, for all *i* and *t*.

Hendricks et al. proposed an alternative hypothesis of violation of weak form of market efficiency, i.e. short-run persistence of residual returns, as below[87]:

$H_2 : E(\xi_{it}) \neq 0$, for some *i* and some *t*.

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[85] Hendricks, D., Patel, J. and Zeckhauser, R., Hot hands in mutual funds: Short-run persistence of relative performance, 1974-1988. *Journal of Finance* 48, 1993, p.94
[86] Ibit, 122
[87] Hendricks et al., 1993, p.96

Since this hypothetical statement implies that mutual fund residual returns demonstrate nonzero serial correlation for some periods, it can be restated in the following liner structure:

$$H_2^{'} : E(\xi_{it} \mid \xi_{it-1}, \xi_{it-2}, \xi_{it-3}, ...) = \sum_{j=1}^{J} p_{ij} \xi_{it-j};\ p_{ij} \neq 0 \text{ for some i and j,}$$

where J is the overall performance period from $t–J$ to t, where performance persistence can be expected. If p's are positive, then $H_2^{'}$ implies that funds have hot (icy) hands – that is, funds' recent relative performance will persist, at least in the near future[88]. In order to test whether persistence exists in mutual fund performance Hendricks et al. analyzed the slope coefficients in the following cross-sectional regression[89]:

$$R_{it} - R_{ft} - \beta_i (R_{mt} - R_{ft}) = k_t + \sum_{j=1}^{J} a_{ij} R_{it-j} + u_{it}$$

where R_{it} is the mutual fund return, R_{mt} is the market rate of return, R_{ft} is the riskless rate of return and R_{it-j} are the mutual fund returns for the previous periods. Under H_1 hypothesis the a coefficients should be zero, and under alternative hypothesis $H_2^{'}$ the a coefficients will be different from zero. The test results conducted by authors rejected the hypothesis of no predictability in residual returns, since a coefficients for the first four quarters were significantly greater than zero. Another point worth to note is that the coefficients reach negative values after four quarters, which means that the performance persistence is a short-term phenomenon that in a long run turns into performance reversal. The persistence fades away beyond a year, which is consistent with a hot (icy) hands phenomenon. Such conclusion was supported by the test results performed by De Bondt

[88] Ibit, p.96
[89] Ibit, p.99

and Thaler (1985). They show that during 3- to 5- year holding periods stocks that performed poorly over the previous 3 to 5 years achieve higher returns than stocks that performed well over the same period, suggesting that contrarian strategies (buying past losers and selling past winners) achieve abnormal returns. De Bondt and Thaler explained that such long-term reversal derives from stock price overreaction to information. Consistent with the predictions of the overreaction hypothesis, portfolios of prior "losers" are found to outperform prior "winners"[90]. However, Hendricks et al. interpret short-term nature of persistence and reversal of performance as follows[91]:

- superior analysts get bid away once they build a track record;
- new funds flow excessively to successful performers, which then leads to bloated organization and fewer good investment ideas per managed dollar;
- urgency and drive are diminished once reputation is established;
- market feel of managers is limited to evanescent market conditions;
- salaries and fees rise to capitalize on demands arising from recent successes.

Moreover, the authors also investigated the seasonality of performance inspired by the popular January effect in equity returns. According to test results they concluded that

[90] De Bondt, W. and Thaler, R., Does the stock market overreact? *Journal of Finance* 40, 1985, p.804

[91] Hendricks et al., 1993, p.102

seasonality in performance persistence is not due to January effect, since the hypothesis of equal coefficients across subsamples of quarters two, three and four was rejected[92].

Another research on predictability of performance was done by Jegadeesh and Titman (1993), where performance of zero-cost portfolio is investigated that is constructed through buying top-performer stocks and selling poor performer stocks and similar conclusions close to results reached by Hendricks et al. (1993) was made. Out of 36 months following portfolio formation date in first 12 months the portfolio realizes positive returns. However, the longer-term performances of these past winners and losers reveal that half of their excess returns in the year following the portfolio formation date dissipate within the following 2 years[93]. According to additional test results Jegadeesh and Titman argue that the performance persistence cannot be attributed to differences in systematic risk and to lead-lag effects that result from delayed stock price reactions to common factors. It is indeed can be explained by the delayed stock price reactions to firm-specific information. Two key possible interpretations were suggested by Jegadeesh and Titman for short-term persistence and thereafter reversal in stock prices[94]:

1) transactions by investors who buy past winners and sell past losers move prices away from their long-run values temporarily and thereby cause prices to overreact;

2) market underreacts to information about the short-term prospects of companies, but overreacts to information about their long-term prospects, which can be explained by the different natures of information related to companies' short- and long-term prospects.

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[92] Ibit, p.102
[93] Jegadeesh, N. and Titman, Sh., Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance* 48, 1993, p.89
[94] Ibit, p.89

3.4 MULTIFACTOR EXPLANATIONS FOR PERFORMANCE

It is important to note that risk adjustment is one of the key issues to be considered in performance persistence analysis. Since raw fund returns provide a simple measure of performance, many academic papers tried to address the risk adjustment issue by using Jensen's alpha as a risk adjusted performance measure. Although Jensen's alpha presents useful tool for measuring performance considering different systematic risk levels, substantive academic research was devoted to the issue of which factors affect common stock returns. Previous work shows that average returns on common stocks are related to firm characteristics like size, earning/price (E/P), cash flow/price (C/P), book-to-market equity (BE/ME), past sales growth, long-term past return, and short-term past return. These characteristics are frequently referred to as anomalies, since CAPM is insufficient to explain such patterns in average returns. Thus upon analyzing performance persistence, it is critical to take into account the anomalies that are not captured by the CAPM, and therefore not captured by Jensen's alpha. Elton et al. (1996) also focus on the issue of risk adjustment for measuring and comparing the performance. Failure to include an index of firm size as a risk index leads to a substantial overestimate of the performance of funds that hold small stocks and an incorrect inference concerning average performance[95].

Several previous academic studies on persistence of mutual fund performance took risk-adjustment measures for such anomalous patterns. For instance, Grinblatt and Titman (1992) and Hendricks et al. (1993) used Jensen's alpha as performance measurement computed relative to the eight-portfolio benchmark, P8, constructed in Grinblatt and Titman[96]. Formation of such benchmark is based on the fact that various firm characteristics are correlated with their stock return's factor loadings. Hence, portfolios formed from stocks grouped by firm characteristics can be used as proxies for the factors. Since eight-portfolio benchmark – P8 consists of portfolios mimicking important factors

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[95] Elton, E., Gruber, M. and Blake, C., The persistence of risk-adjusted mutual fund performance. *Journal of Business* 69, no. 2, 1996, p.137
[96] Grinblatt, M. and Titman, Sh., Mutual fund performance: An analysis of quarterly portfolio holdings. *Journal of Business* 62, 1989b, p.399

like firm size, dividend-yield and past returns, performance persistence tests employing this benchmark will consider different risk levels due to mentioned factors.

Fama and French (1996) presented three-factor asset pricing model, which captures majority of CAPM average-return anomalies. According to three-factor model the expected return on a portfolio in excess of the risk-free rate is explained by the sensitivity of its return to three factors[97]:

1) the market premium – $R_m - R_f$;

2) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks – *SMB (small minus big)*;

3) the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks – *HML (high minus low)*.

Accordingly, the multifactor asset pricing model can be represented as below:

$$E(R_i) - R_f = \beta_i [E(R_m) - R_f] + s_i E(SMB) + h_i E(HML),$$

where $E(R_m) - R_f$, *E(SMB)* and *E(HML)* are expected premiums and β_i, s_i and h_i are corresponding factor loadings. Elton et al. argue that using differential returns as risk factors has two benefits[98]:

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[97] Fama, E. and French, K.. Multifactor explanations of asset pricing anomalies. *Journal of Finance* 51, 1996, p.55

[98] Elton et al., 1996, p.137

1) this method produces indexes that are almost completely uncorrelated with each other;

2) the impact of these indexes on risk-adjusted performance is easy to understand, since they are zero-investment portfolios.

Fama and French state that the three-factor model substantially captures much of the cross-sectional variation in average stock returns. They interpret *HML* factor as proxy for relative distress, since weak firms with persistently low earnings tend to have high BE/ME and positive slopes on *HML* and strong firms with persistently high earnings have low BE/ME and negative slopes on *HML*. Elton et al. (1996) argues that since mutual fund styles, i.e. growth and value are highly correlated with BE/ME ratios, *HML* can be characterized as the premium for buying value funds and selling growth funds. A failure to account for this influence might result in confounding the temporary performance of a type of fund (e.g.. a "value" fund) with management skill[99].

Furthermore, the authors show that *HML* factor also has explanatory power of variation in returns of firms with different E/P, C/P and sales growth characteristics. Strong firms with low E/P, low C/P and high sales growth tend to have negative loadings on *HML* and weak (relatively distressed) firms with high E/P, high C/P and low sales growth tend to have positive loadings on *HML*[100]. As a multifactor equilibrium pricing model SMB and HML mimic combinations of two underlying risk factors. Therefore, abnormal returns (alpha) according to this model will be more reliable performance measure in terms of risk adjustment, in order to more properly investigate the performance persistence.

[99] Ibit, p.137
[100] Fama and French, 1996, p.56

De Bondt and Thaler's (1985) long-term reversal of performance is also captured by the three-factor model: poor performing stocks in the long-term tend to have positive *SMB* and *HML* slopes, since they are smaller and relatively distressed and will have higher future average returns; long-term top performers, on the other hand, tend to be strong stocks which have negative loadings on *HML* and lower future returns.

However, Fama and French's three-factor model is powerless to capture the short-term persistence in performance documented by Jegadeesh and Titman (1993). One of the possible explanations for the drawback of the model to capture short-term return continuation is similar to explanation presented by Jegadeesh and Titman (1993): asset pricing is irrational and investors underreact to short-term past information, which produces return continuation, but they overreact to long-term past information, which produces return reversal[101]. Model's shortcoming can also be explained by the fact that the model is missing an additional risk factor that encompasses the persistence of short-term returns.

Another multifactor model similar to Fama and French's three-factor model was presented by Elton et al. (1996). The only difference between the models is inclusion of additional factor – the excess return on a bond index. Elton et al. measured risk-adjusted performance of a mutual fund as the intercept (alpha) from a four-factor model:

$$E(R_i) - R_f = \beta_i[E(R_m) - R_f] + s_i E(SMB) + h_i E(HML) + b_i[E(R_b) - R_f],$$

where R_b is the return of a bond index and b_i is the loading of the factor. They compute one-year and three-year alphas for the mutual funds both for "selection period" where initial rankings are made according to past performance and for "performance period"

[101] Fama and French, 1996, p.81

where the performance of mutual funds is evaluated. Thereafter, test of rank correlation is made.

As a result of research Elton et al. found evidence of performance persistence, as the rank correlation coefficients got values slightly below one, which are statistically significant. The investigation was extended in order to properly evaluate the continuation of fund rankings. The authors eliminated the funds for which the model fails to explain variation in performance, i.e. the funds for which R^2 is below 80%. Failure to explain the performance patterns of these funds may derive from market timing or from very low diversification. As an extension of the performance analysis, funds with high expenses were eliminated to see whether differences in expenses rather than differences in management performance were picked up[102]. However, none of the additional tests changed the result of persistence in fund ranks. While high expenses cause common stock funds to be in the lowest performance rank, they do not explain ranking across other ranks. The result of performance persistence was not also changed significantly after eliminating several top performing funds from the sample in order to ensure that previous results were not due to extraordinary and persistent high performance of these top mutual funds. It is important to note that ranking techniques involving 1 year of past data generally perform much better than ranking techniques involving 3 years of past data, when using the 1-year performance evaluation period, which is consistent with the results found by Hendricks et al. (1993)[103].

Elton et al (1996) also focused on the issue whether the persistence should fade away due to increase in expenses. The increase in expenses could reduce subsequent excess return, resulting in no persistence in performance, even when managers have an ability to construct superior portfolios. Results of research performed by Elton et al. imply that the

[102] Elton et al., 1996, p.142
[103] Ibit, p.144

fees of top-performing funds exhibit at most a slight increase in years subsequent to their top ranking, and clearly not enough to affect performance. On average then, managers of successful funds increase their total revenues by having the sizes of their funds increase, not by increasing expenses[104].

3.5 CARHART'S 4-FACTOR MODEL

Carhart (1997) constructed 4-factor model based on Fama and French's (1996) 3-factor model, which relieves shortage of 3-factor model to capture the short-term continuation of performance. *Carhart found that "Fama and French's 3-factor model performance estimates on mutual funds are more precise, but generally not economically different from the CAPM"*[105]. The 4-factor model was developed by adding to 3-fator model an additional factor encompassing Jegadeesh and Titman's (1993) one-year momentum anomaly – short term return continuation. The model can be specified as follows:

$$E(R_i) - R_f = \beta_i[E(R_m) - R_f] + s_i E(SMB) + h_i E(HML) + p_i E(PR1YR)$$

where $PR1YR$ – is the premium from the portfolio mimicking one-year momentum and p_i – is the sensitivity of expected excess return to the factor. Specifically, *PR1YR* – was constructed as an equal-weighted average of firms with the highest 30% eleven-month returns lagged one month minus the equal-weighted average of firms with the lowest 30% eleven-month returns lagged one month.

As a market equilibrium model it may be interpreted as a performance attribution model, where the coefficients and premia on the factor-mimicking portfolios indicate the proportion of mean return attributable to four elementary strategies: high versus low beta

[104] Ibit, p.155

[105] Carhart, M., On persistence in mutual fund performance. *Journal of Finance* 52, 1997, p.61

stocks, large versus small market capitalization stocks, value versus growth stocks, and one-year return momentum versus contrarian stocks[106]. Since factor mimicking, zero-investment portfolios exhibit high variance and low correlation with each other, it implies that 4-factor model is capable of capturing substantial portion of the variation in mean return. While Fama and French's 3-factor model abnormal returns (alphas) are significantly negative for last year's poor performers and significantly positive for last year's top performers, Carhart's 4-factor model significantly reduces abnormal returns due to significant loadings on one year momentum factor. Moreover, Carhart demonstrated that his model is more advantageous than P8 benchmark introduced by Grinblatt and Titman (1989b) in explaining mean return cross-sectional variation. As evidence that omission of a momentum factor is significant, the intercept from the regression of *PR1YR* factor on the P8 benchmark yields a statistically significant intercept of 0.46 percent per month, with an R^2 of only 0.6[107].

After evaluation and comparison of mutual fund performance by both CAPM and 4-factor model, according to the intercepts and sensitivities to factors Carhart identified that 4-factor model accounts for much of the variation in mean return. While CAPM alphas exhibit as much dispersion as simple returns between top and bottom mutual funds, alpha spreads are notable decreased by the 4-factor model. If CAPM correctly measures the risk, both the best and worst performing funds possess differential information, yet the worst performing funds appear to use this information perversely to reduce the performance[108]. According to regression results Carhart noted that size and one-year momentum factors play major role in explaining the mean return variation, since there is huge spread in *SMB* and *PR1YR* loadings among best and worst performing funds. It suggests that top performers hold more small stocks and follow momentum strategy more than poor performers do.

106 Ibit, p.61
107 Carhart, 1997, p.76
108 Ibit, p.63

Substantial portion of variation in abnormal returns is almost entirely concentrated in between bottom worst performer deciles, which is consistent with the results of the previous academic studies. It suggests that 4-factor model fails to explain short-term persistence in poor performance of the worst performing mutual funds. To explain such difference in performance persistence Carhart investigated the difference in expense ratios and turnover. As a result he found that expenses and transaction costs do not totally encompass the variation in abnormal returns between the worst performing funds, though they explain certain portion. *As a possible explanation for underperformance of bottom mutual funds, Carhart also found that "worst performing funds mostly hold illiquid stocks suggesting higher transaction costs, since the illiquid stocks are more costly to trade"*[109].

Although as high *PR1YR* slopes suggest that mutual funds in the top decile follow momentum strategy, Carhart show that funds following this strategy actually do not earn substantially higher returns than contrarian funds. Strong pattern in one-year momentum factor is explained by an assumption that these funds don't follow momentum strategy, but hold last year's winner stocks by chance[110].

Furthermore, Carhart constructed contingency table which demonstrates the probability of mutual funds in a certain rank for previous year to stay in the same rank for the subsequent year. If alpha measures mutual funds' managerial skill, they should maintain their ranking in the next period. However, as results demonstrate that very few funds stay in their initial ranking suggesting lack of managerial skill. Last year's winners frequently become next year's losers and vice versa, which is consistent with the gambling behavior by mutual funds[111]. However, according to Berk and Green, lack of persistence in returns or underperformance with regard passive benchmarks should not imply that

[109] Ibit, p.70
[110] Carhart, 1997, p.73
[111] Ibit, p.71

differential ability across managers is non-existent[112]. When the track of persistence in ranks is extended for several years, it is evident that performance persistence is eliminated after one-year, which is consistent with the findings by Hendricks et al. (1993). Except for the persistent underperformance by the worst funds, mean returns and abnormal performance across deciles do not differ statistically significantly after one year[113].

[112] Berk, J. and Green, R., Mutual fund flows and performance in rational markets. *Journal of Political Economy* 112, no. 6, 2004, p.1291

[113] Carhart, 1997, p.72

4. RESEARCH ON TURKISH MUTUAL FUND PERFORMANCE

4.1 DATA

Performance of Turkish mutual funds is analyzed over the period January, 2004 to December, 2009. The length of the research period is limited due to poor availability of the data. Therefore, it is aimed to involve as large data set as possible by choosing the time interval starting from the last available data and going backward.

Our research sample consists of A-type mutual funds in Turkey. The reason for focusing on A-type mutual funds is explained by the benchmark chosen for performance evaluation. Since ISE-100 index is selected as benchmark for comparison and measurement of mutual fund performance, we aim to investigate the performance of A-type funds, which by definition are the funds that at least 25% of their portfolio consists of Turkish stocks. Since evaluation of B-type mutual fund performance using the stock market index is expected to yield no reasonable result, we exclude B-type funds from our sample. Our data set is free of missing data in respect of time-series continuity, except for February, 2009 for several funds. For this period we use the average of past and future data, i.e. January, 2009 and March, 2009 data, for the sake of continuity of data.

Totally 172 A-type mutual funds are included in the sample. We obtained monthly closing share prices of selected mutual funds for January, 2004 – December, 2009 period from the database of Capital Market Board[114]. The reasons for using monthly data are as follows:

[114] http://www.cmb.gov.tr/apps/aylikbulten/index.aspx

1) Working on short-term period data (e.g. daily or weekly) is not desirable, since detection of superior performance in the short-run would be highly vulnerable to the noise from chance factors[115]. It would be almost impossible to conclude whether the performance measure result was due to manager's effect on the performance or it is the result deriving just by chance or from other factors. Therefore, using monthly data will zero out such serially independent noise factors.

2) Yearly data may yield biased results, since the management skill level or strategy for the fund is likely to change[116].

3) Quarterly data would leave only 24 observations for each fund that is too few for significant statistical testing. Moreover, for proper evaluation of portfolio performance at least 36 observations should be involved to analysis[117].

4) Quarterly data may display highly fluctuating data with rapid changes.

Return of *i*'th mutual fund for *t*'th month is calculated as

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}}$$

where R_{it} is the fund return for *t*'th month, P_{it} is mutual fund share price in the end of *t*'th month and P_{it-1} is mutual fund share price in the end of *(t-1)*'th month.

For analysis of short-term persistence in performance we calculate yearly return of each mutual fund as below:

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[115] Hendricks et al., 1993, p.105
[116] Goetzmann and Ibbotson, 1994, p.11
[117] Cesari, R. and Panetta, F., The performance of Italian equity funds, *Journal of Banking & Finance* 26, 2002. p.111

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}}$$

where R_{it} is the fund return for *t*'th year, P_{it} is mutual fund share price in the end of *t*'th year and P_{it-1} is mutual fund share price in the end of *(t-1)*'th year.

Market rate of return for each month is calculated based on ISE-100 stock market index values obtained from the official web-site of Istanbul Stock Exchange[118]:

$$R_{mt} = \frac{ISE100_t - ISE100_{t-1}}{ISE100_{t-1}}$$

where R_{mt} is the market rate of return for *t*'th month, $ISE100_t$ is the stock market index value in the end of *t*'th month and $ISE100_{t-1}$ is the stock market index value in the end of *(t-1)*'th month.

We use Government Debt Securities (GDS) index for 2004-2009 period for calculation of risk-free rate. Monthly values of GDS index for 3-month debt securities (T-bills) are obtained from Istanbul Stock Exchange database[119]. Risk-free rate is reached by calculating the relative monthly change of the GDS index for T-bills:

$$R_{ft} = \frac{GDS_t - GDS_{t-1}}{GDS_{t-1}}$$

[118] http://www.imkb.gov.tr/Data/StocksData.aspx
[119] http://www.imkb.gov.tr/Data/Consolidated.aspx

where R_{ft} is the risk-free rate for *t*'th month, GDS_t is the T-bill index value in the end of *t*'th month and GDS_{t-1} is the T-bill index value in the end of *(t-1)*'th month.

In order to apply Carhart's 4-factor model to the Turkish mutual funds for the purpose of assessing performance of mutual funds and analyzing the persistence in performance, we need to determine the factor values other than market premium. Calculation of the returns of portfolios mimicking size, style and momentum factors requires monthly stock data. Monthly stock price data are obtained from the database of Istanbul Stock Exchange[120]. Portfolios reflecting size and style factor are constructed based on yearly market capitalization and Market Equity / Book Equity (ME/BE) ratios, respectively, that are also obtained from Istanbul Stock Exchange database.

Companies that lie in the upper 30% according to their market capitalization are defined as "big" companies and companies that lie in the lower 30% according to their market capitalization are defined as "small" companies. Accordingly, stocks with the highest 30% ME/BE ratio are referred to as "growth" stocks and stocks with the lowest 30% ME/BE ratio are referred to as "value" stocks.

Size factor portfolio return – SMB (Small minus Big) in *t*'th month is calculated by subtracting the return of equally weighted portfolio of "big" stocks from the return of equally weighted portfolio of "small" stocks:

$$SMB_t = \frac{\sum Small_t}{N_{st}} - \frac{\sum Big_t}{N_{bt}}$$

[120] http://www.imkb.gov.tr/Data/StocksData.aspx

where SMB_t is the return on zero-investment portfolio mimicking size factor in the end of t'th month; $Small_t$ and Big_t are the returns of the "small" and "big" stocks in the end of t'th month, respectively; N_{st} and N_{bt} are the number of the "small" and "big" stocks in the end of t'th month, respectively.

Style factor portfolio return – HML (High minus Low) in t'th month is calculated by subtracting the return of equally weighted portfolio of "value" stocks from the return of equally weighted portfolio of "growth" stocks:

$$HML_t = \frac{\sum Value_t}{N_{vt}} - \frac{\sum Growth_t}{N_{gt}}$$

where HML_t is the return on zero-investment portfolio that mimic style factor in the end of t'th month; $Value_t$ and $Growth_t$ are the returns of the "value" and "growth" stocks in the end of t'th month, respectively; N_{vt} and N_{gt} are the number of the "value" and "growth" stocks in the end of t'th month, respectively.

It is well known that momentum investment strategy is based on buying last year's "winner" stocks and selling last year's "loser" stocks with the expectation of persistence of stock performance. Therefore, momentum factor portfolio return – PR1YR in t'th month is calculated by subtracting the return of equally weighted portfolio of stocks with the highest 30% eleven-month returns lagged one month from the return of equally weighted portfolio of stocks with the lowest 30% eleven-month returns lagged one month:

$$PR1YR_t = \frac{\sum Winners_t}{N_{wt}} - \frac{\sum Losers_t}{N_{lt}}$$

where $PR1YR_t$ is the return on zero-investment portfolio that mimic momentum factor in the end of t'th month; $Winner_t$ and $Loser_t$ are the returns of the stocks with the best and worst one-year past performance, respectively; N_{wt} and N_{lt} are the number of the stocks with the best and worst one-year past performance, respectively.

4.2 METHODOLOGY

Our research aims to evaluate the performance of Turkish mutual funds, to analyze timing ability of fund managers and to investigate whether short-term persistence phenomenon exists in the Turkish mutual fund universe for the period over January, 2004 to December, 2009.

In order to assess the performance as well as market timing ability of mutual funds, we group our fund sample into ten decile portfolios according to their past performance. In other words, each mutual fund is included into one of the ten equally weighted portfolios, based on the fund's last month returns. Funds with the highest 10% returns are included into the first decile portfolio, funds that lie in the second highest 10% in respect of monthly returns are included into the second decile portfolio and so on. We are inclined to use one traditional method – Jensen's alpha for assessing the performance of mutual funds. Jensen's alpha for different deciles is examined in order to verify whether it is corresponding to the rank of the portfolio and is used for comparison with the other performance measures. In order to evaluate whether mutual fund managers were successful in forecasting the market movement, i.e. demonstrated market timing ability we employ two methods: 1) Treynor and Mazuy's model with the quadratic variable and 2) Henriksson and Merton's model with the dummy variable. We aim to answer to the question whether performance of the mutual funds are related to the market timing ability of the fund managers and how much does the timing ability have impact in earning higher returns.

Testing of performance persistence in the short-run is implemented through application of Carhart's 4-factor model, since it is assumed to capture market anomalies like size, ME/BE ratio and short-term past return. We distinguish between two time periods: the period where we rank and select funds – the "selection period" and the period following the selection period, where we evaluate our selections of mutual funds – the "performance period". We choose one year as the selection period. Like in other performance measurement techniques we construct ten equally weighted portfolios. However, for persistence analysis we base our selection not on one-month returns, but one-year returns. We replicate the same methodology used by Carhart to measure the performance[121]. On January 1 of each year, we construct portfolios using reported returns, hold the portfolios for one year and then re-construct them. Funds with the highest 10% last year returns are included into the first decile portfolio, funds that lie in the second highest 10% in respect of last year returns are included into the second decile portfolio and so on. We evaluate the fund performance on monthly basis. Such investigation results will answer to the question whether funds included to certain rank portfolio will stay in the same rank in subsequent periods, i.e. last year winners (losers) will stay as winners (losers) in subsequent months.

4.3 RESEARCH FINDINGS

4.3.1 Jensen's alpha

According to tests results performed on SPSS we find that Turkish A-type mutual funds demonstrate abnormal returns, since regression analysis yields statistically significant constants – alphas that are different than zero for each decile portfolio. Test results imply that funds in the upper deciles exhibit significantly positive alphas, while poor performers in the lower deciles exhibit significantly negative alphas. First, according to model summary it is evident there is significantly positive linear relationship between market

[121] Carhart, 1997, p.63

premium and the mutual fund portfolio excess returns, and time-series data is free from autocorrelation, since the R square is above 0.7 and Durbin-Watson value is above 0.8, respectively for each portfolio:

Table 4.1 Model Summary for 1st decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.855(a)	.732	.728	.026336149	1.550

Table 4.2 Model Summary for 2nd decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.941(a)	.886	.885	.018500328	2.082

Table 4.3 Model Summary for 3rd decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.961(a)	.923	.921	.015142270	2.297

Table 4.4 Model Summary for 4th decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.965(a)	.931	.930	.014029238	2.414

Table 4.5 Model Summary for 5th decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.964(a)	.929	.928	.014021023	2.370

Table 4.6 Model Summary for 6th decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.959(a)	.921	.919	.015027152	2.303

Table 4.7 Model Summary for 7th decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.949(a)	.900	.899	.017415658	2.175

Table 4.8 Model Summary for 8th decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.937(a)	.878	.876	.019629800	2.146

Table 4.9 Model Summary for 9th decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.918(a)	.843	.841	.022550691	2.054

Table 4.10 Model Summary for 10th decile portfolio (Jensen' alpha)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.846(a)	.715	.711	.029233158	1.885

Moreover, SPSS test results lead us to conclude that the market premium factor has significant explanatory power on equally weighted mutual fund portfolio excess returns, since ANOVA p values are below 0.05, and p values for coefficients and the alphas are below 0.05 for each decile:

Table 4.11 Coefficients for 1st decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.065	.003		20.422	.000		
	Market Premium	.475	.034	.855	13.820	.000	1.000	1.000

Table 4.12 Coefficients for 2nd decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.035	.002		15.571	.000		
	Market Premium	.563	.024	.941	23.345	.000	1.000	1.000

Table 4.13 Coefficients for 3rd decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.023	.002		12.577	.000		
	Market Premium	.570	.020	.961	28.879	.000	1.000	1.000

Table 4.14 Coefficients for 4th decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.014	.002		8.138	.000		
	Market Premium	.563	.018	.965	30.798	.000	1.000	1.000

Table 4.15 Coefficients for 5th decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.005	.002		3.091	.003		
	Market Premium	.554	.018	.964	30.304	.000	1.000	1.000

Table 4.16 Coefficients for 6th decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.003	.002		-1.492	.140		
	Market Premium	.558	.020	.959	28.486	.000	1.000	1.000

Table 4.17 Coefficients for 7th decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.011	.002		-5.143	.000		
	Market Premium	.571	.023	.949	25.157	.000	1.000	1.000

Table 4.18 Coefficients for 8th decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.019	.002		-8.017	.000		
	Market Premium	.574	.026	.937	22.413	.000	1.000	1.000

Table 4.19 Coefficients for 9th decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.029	.003		-10.686	.000		
	Market Premium	.570	.029	.918	19.374	.000	1.000	1.000

Table 4.20 Coefficients for 10th decile portfolio (Jensen' alpha)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.053	.004		-14.987	.000		
	Market Premium	.506	.038	.846	13.265	.000	1.000	1.000

If we glance at alphas generated from tests we can conclude that although the portfolio excess returns are adjusted by their systematic risk, the mutual fund portfolios still stay in their ranks according to their abnormal returns, Jensen's alpha is higher for top performers and lower for poor performers:

Table 4.21 Summary of Jensen's alphas per deciles

Portfolio rank before evaluation	Jensen's alpha		Portfolio rank before evaluation	Jensen's alpha
1	0.065		6	-0.003
2	0.035		7	-0.011
3	0.023		8	-0.019
4	0.014		9	-0.029
5	0.005		10	-0.053

Such kind of result leads us to conclude that the top performers possess managerial skill and they are successful to outperform the benchmark.

4.3.2 Treynor and Mazuy's measure

We performed test of market timing ability of A-type mutual funds by employing Treynor and Mazuy's model, by adding quadratic variable to the CAPM model. Funds with the timing ability are expected to exhibit statistically different than zero coefficients on the quadratic variable. Test results per SPSS suggest that market premium and timing ability component together have more explanatory power on the mutual fund portfolio excess returns than sole market premium component, since R square values are above 0.85 for each fund and except two deciles R square values are above 0.9. Again Durbin-Watson values above 0.8 rejects any autocorrelation among the data in the model.

Table 4.22 Model Summary for 1st decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.935(a)	.875	.871	.018121288	1.862

Table 4.23 Model Summary for 2nd decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.961(a)	.924	.922	.015216187	2.197

Table 4.24 Model Summary for 3rd decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.966(a)	.934	.932	.014093586	2.369

Table 4.25 Model Summary for 4th decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.965(a)	.932	.930	.014072907	2.416

Table 4.26 Model Summary for 5th decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.966(a)	.934	.932	.013621477	2.414

Table 4.27 Model Summary for 6th decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.970(a)	.942	.940	.012962593	2.501

Table 4.28 Model Summary for 7th decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.973(a)	.947	.945	.012843300	2.547

Table 4.29 Model Summary for 8th decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.973(a)	.947	.946	.013003822	2.597

Table 4.30 Model Summary for 9th decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.972(a)	.944	.943	.013503047	2.546

Table 4.31 Model Summary for 10th decile portfolio (Treynor and Mazuy's measure)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.933(a)	.871	.867	.019827316	2.009

Coefficients generated by the SPSS program suggest that A-type mutual funds demonstrated market-timing ability in the period over 2004 to 2009. Except for 4th decile portfolio, timing components (quadratic variable) have statistically significant explanatory power over mutual fund performance. Moreover, VIF statistics below 10 indicate that there is no multi-collinearity between the independent variables.

Table 4.32 Coefficients for 1st decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.051	.003		19.353	.000
	Market Premium	.470	.024	.847	19.893	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	1.584	.178	.378	8.880	.000

Table 4.33 Coefficients for 2nd decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.027	.002		12.227	.000
	Market Premium	.561	.020	.937	28.253	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	.880	.150	.195	5.872	.000

Table 4.34 Coefficients for 3rd decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.019	.002		9.157	.000
	Market Premium	.569	.018	.958	30.948	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	.477	.139	.106	3.436	.001

Table 4.35 Coefficients for 4th decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.013	.002		6.243	.000
	Market Premium	.563	.018	.965	30.680	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	.104	.139	.024	.752	.454

Table 4.36 Coefficients for 5th decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.008	.002		3.910	.000
	Market Premium	.555	.018	.965	31.234	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	-.305	.134	-.070	-2.273	.026

Table 4.37 Coefficients for 6th decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.003	.002		1.427	.158
	Market Premium	.560	.017	.963	33.122	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	-.639	.128	-.146	-5.007	.000

Table 4.38 Coefficients for 7th decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.003	.002		-1.337	.186
	Market Premium	.574	.017	.953	34.268	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	-.977	.126	-.215	-7.727	.000

Table 4.39 Coefficients for 8th decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.009	.002		-4.538	.000
	Market Premium	.577	.017	.942	34.027	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	-1.218	.128	-.263	-9.514	.000

Table 4.40 Coefficients for 9th decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.016	.002		-8.282	.000
	Market Premium	.574	.018	.925	32.585	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	-1.494	.133	-.319	-11.235	.000

Table 4.41 Coefficients for 10th decile portfolio (Treynor and Mazuy's measure)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.038	.003		-12.981	.000
	Market Premium	.511	.026	.854	19.746	.000
	Quadratic variable for Treynor and Mazuy's model [sqr(Rm-Rf)]	-1.780	.195	-.394	-9.120	.000

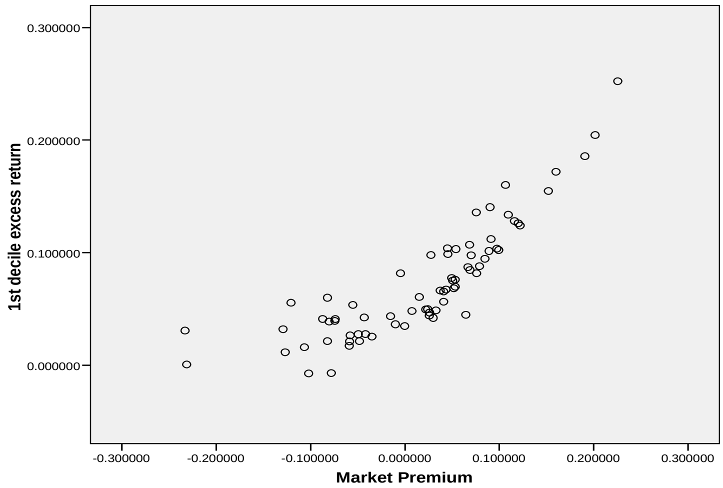
Summary of alphas and timing components (i.e. slopes of the quadratic variable) leads us to conclude that the mutual funds included into the rank portfolios do not change their rank in respect of their market timing ability measure.

Table 4.42 Summary of Treynor and Mazuy's measure per deciles

Portfolio rank before evaluation	Jensen's alpha	Timing measure		Portfolio rank before evaluation	Jensen's alpha	Timing measure
1	0.051	1.584		6	0.003	-0.639
2	0.027	0.88		7	-0.003	-0.977
3	0.019	0.477		8	-0.009	-1.218
4	0.013	0.104		9	-0.016	-1.494
5	0.008	-0.305		10	-0.038	-1.78

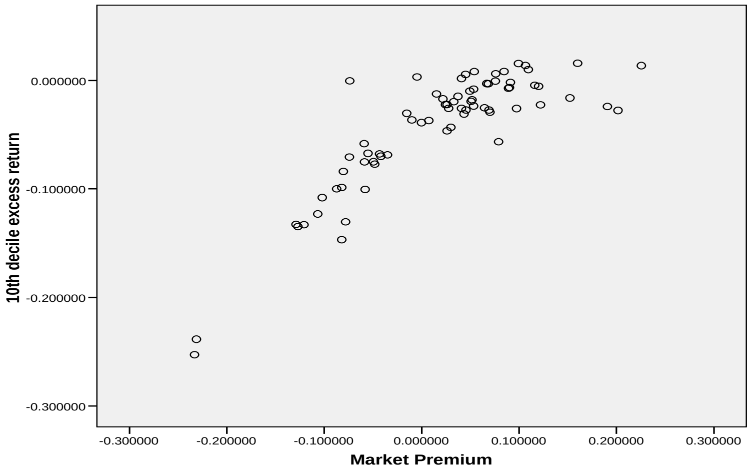
As in the previous model we witness the monotonically decreasing performance measures according to fund portfolio ranks. For comparison with Jensen's alpha measure per CAPM model and per Treynor and Mazuy's model, it is important to note that the difference between the abnormal returns (alphas) of highest and lowest decile was considerably decreased from 0.118 (per CAPM) to 0.089 (per Treynor and Mazuy's model). Such decrease is explained by the inclusion of the quadratic variable reflecting timing component into the CAPM model. The results imply that market prediction skill of Turkish mutual fund managers plays an important role in earning abnormal returns and staying in the first rank. Another evidence for existence of market timing ability of best Turkish A-type mutual fund managers is demonstrated by the scatter-dot graphical illustration.

Figure 4.1 Scatter plot of 1st decile excess return and market premium



The 1st decile portfolio excess return – market premium relationship pattern suggests that mutual funds in the highest decile were successful to forecast the market movements, since in bull market period they invested in stocks with high market-sensitivity and in bear market period they included into their portfolios mostly lower beta stocks. The opposite pattern is observed for poor performing mutual funds.

Figure 4.2 Scatter plot of 10th decile excess return and market premium



Funds in the lowest decile failed to correctly forecast the market movements, since while they expected market rise and invested in high beta stocks, the market exhibited decrease actually and vice versa, and therefore negatively affected the performance of these funds.

4.3.3 Henriksson and Merton's measure

The same principle is applied to assess the market timing ability of the mutual funds with Henriksson and Merton's approach. However, dummy variable is added to the CAPM model instead of quadratic variable as a market forecasting ability component. R square values exhibit the same pattern as in Treynor and Mazuy's model and still above 0.85 suggesting significant explanatory power of the model factors including timing component. Durbin-Watson statistics imply absence of the autocorrelation among the data in the model.

Table 4.43 Model Summary for 1st decile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.936(a)	.876	.873	.018007040	1.770

Table 4.44 Model Summary for 2nd decile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.963(a)	.928	.926	.014854844	2.217

Table 4.45 Model Summary for 3rd decile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.967(a)	.935	.933	.013950731	2.386

Table 4.46 Model Summary for 4th decile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.966(a)	.932	.930	.014035835	2.418

Table 4.47 Model Summary for 5th decile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.966(a)	.933	.931	.013733597	2.408

Table 4.48 Model Summary for 6th decile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.970(a)	.940	.938	.013143903	2.496

Table 4.49 Model Summary for 7th decile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.972(a)	.945	.943	.013074795	2.516

Table 4.50 Model Summary for 8th decile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.973(a)	.946	.945	.013124157	2.566

Table 4.51 Model Summary for 9th decile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.971(a)	.944	.942	.013584319	2.486

Table 4.52 Model Summary for 10thdecile portfolio (Henriksson and Merton's model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.933(a)	.871	.868	.019796987	1.995

Coefficients generated by the model through SPSS application present almost the same monotonically decreasing pattern in respect of portfolio ranks. However, according to Henriksson and Merton's model timing ability measure has more explanatory power to explain mutual funds performance than the market timing ability measure suggested by Treynor and Mazuy. As standardized coefficients more properly reflect the explanatory power of independent variable, we witness notable increase in absolute terms in standardized coefficients for market timing component. Except for 4th decile, *p* values below 0.05 reject the hypothesis that the timing component has no explanatory power over mutual fund excess returns. Moreover, VIF statistics below 10 indicate that the independent variables in the model are free from multi-collinearity.

Table 4.53 Coefficients for 1st decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.037	.004		9.727	.000		
	Market Premium	.830	.046	1.496	18.046	.000	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	.737	.082	.745	8.985	.000	.261	3.836

Table 4.54 Coefficients for 2nd decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.019	.003		5.940	.000		
	Market Premium	.768	.038	1.284	20.254	.000	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	.426	.068	.399	6.291	.000	.261	3.836

Table 4.55 Coefficients for 3rd decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.014	.003		4.804	.000		
	Market Premium	.683	.036	1.150	19.161	.000	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	.233	.064	.220	3.670	.000	.261	3.836

Table 4.56 Coefficients for 4th decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.011	.003		3.863	.000		
	Market Premium	.593	.036	1.016	16.549	.000	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	.062	.064	.059	.967	.337	.261	3.836

Table 4.57 Coefficients for 5th decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.010	.003		3.438	.001		
	Market Premium	.494	.035	.860	14.086	.000	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	-.125	.063	-.121	-1.990	.051	.261	3.836

Table 4.58 Coefficients for 6th decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.008	.003		2.913	.005		
	Market Premium	.421	.034	.724	12.551	.000	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	-.284	.060	-.274	-4.743	.000	.261	3.836

Table 4.59 Coefficients for 7th decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.006	.003		2.172	.033		
	Market Premium	.358	.033	.595	10.722	.000	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	-.443	.060	-.412	-7.429	.000	.261	3.836

Table 4.60 Coefficients for 8th decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.002	.003		.812	.420		
	Market Premium	.304	.034	.496	9.070	.000	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	-.560	.060	-.512	-9.359	.000	.261	3.836

Table 4.61 Coefficients for 9th decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.003	.003		-1.025	.309		
	Market Premium	.238	.035	.383	6.851	.000	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	-.689	.062	-.622	-11.131	.000	.261	3.836

Table 4.62 Coefficients for 10th decile portfolio (Henriksson and Merton's model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.021	.004		-5.167	.000		
	Market Premium	.108	.051	.181	2.139	.036	.261	3.836
	Dummy variable for Henriksson and Merton's model [max(Rm-Rf)]	-.825	.090	-.773	-9.145	.000	.261	3.836

The difference between the alphas representing selectivity component of top-performing and worst-performing funds is further shrank from 0.089 (per Treynor and Mazuy's model) to 0.058 (per Henriksson and Merton's model). This implies that Henriksson and Merton's model suggests that Turkish A-type mutual funds performance depends from market timing ability of fund managers more than suggested by the Treynor and Mazuy's model, leaving less portion for selectivity ability in explaining the performance.

Table 4.63 Summary of Henriksson and Merton's measures per deciles

Portfolio rank before evaluation	Jensen's alpha	Timing measure		Portfolio rank before evaluation	Jensen's alpha	Timing measure
1	0.037	0.737		6	0.008	-0.284
2	0.019	0.426		7	0.006	-0.443
3	0.014	0.233		8	0.002	-0.56
4	0.011	0.062		9	-0.003	-0.689
5	0.01	-0.125		10	-0.021	-0.825

4.3.4 Carhart's 4-factor model

We employ Carhart's 4-factor model for performance evaluation and analysis of persistence in performance. The model is assumed to capture each anomaly in fund returns that are failed to be explained by the CAPM model. Therefore, we expect 4-factor model to explain substantial portion of the variation in mutual fund excess returns. 3 factors – size, style and momentum, are involved in the model. However, after implementing regression analysis for the 4-factor model on SPSS application we witnessed that momentum factor has statistically insignificant power to explain the mutual fund performance. *p* values above 0.05 for each decile lead us to accept the null hypothesis that momentum factor variable has no explanatory power over mutual funds portfolio excess returns. Since momentum factor was formed in order to capture Jegadeesh and Titman's one-year performance persistence anomaly, failure of momentum factor to explain the fund excess returns suggests that Turkish mutual funds does not exhibit performance persistence in the short-run.

We excluded momentum factor from the model and re-performed the regression analysis to indicate whether the Fama and French's 3-factor model will succeed to explain the variation in mutual fund performance. Our research yields statistically significant results which imply that we can rely on size and style factors to properly measure the performance of Turkish A-type mutual funds. R square values are above 0.75 and except 10th decile portfolio overall portfolio R square values are above 0.8 implying that market premium, size and style factors are statistically powerful to explain at least 80% of variation of mutual funds excess returns. Durbin-Watson statistics above 0.8 indicate that the residual values of the variables are free from autocorrelation.

Table 4.64 Model Summary for 1st decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.898(a)	.806	.798	.028699650	1.429

Table 4.65 Model Summary for 2nd decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.914(a)	.835	.827	.025672982	1.632

Table 4.66 Model Summary for 3rd decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.930(a)	.865	.859	.022168613	1.867

Table 4.67 Model Summary for 4th decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.906(a)	.820	.813	.022154401	1.839

Table 4.68 Model Summary for 5th decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.937(a)	.878	.873	.01687	1.933

Table 4.69 Model Summary for 6th decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.946(a)	.895	.890	.016679754	2.048

Table 4.70 Model Summary for 7th decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.915(a)	.838	.831	.019816775	2.276

Table 4.71 Model Summary for 8th decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.916(a)	.839	.832	.021416114	1.972

Table 4.72 Model Summary for 9th decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.908(a)	.825	.817	.024006020	2.246

Table 4.73 Model Summary for 10th decile portfolio (3-factor model)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.878(a)	.771	.761	.031934246	1.959

VIF statistics imply that there is no multi-collinearity, since their value is below 10. Although middle deciles (4th, 5th, 6th and 7th) produce statistically insignificant results, overall the regression analysis results demonstrate strong pattern in explaining the performance variation across mutual funds.

Table 4.74 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.005	.005		-1.073	.287		
	Market Premium	.656	.039	.935	16.646	.000	.902	1.108
	Size factor (small minus big)	.147	.068	.121	2.162	.034	.903	1.108
	Style factor (high minus low)	-.287	.106	-.149	-2.692	.009	.933	1.072

Table 4.75 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.006	.004		-1.369	.175		
	Market Premium	.644	.035	.949	18.281	.000	.902	1.108
	Size factor (small minus big)	.145	.061	.124	2.393	.019	.903	1.108
	Style factor (high minus low)	-.192	.095	-.103	-2.017	.048	.933	1.072

Table 4.76 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.003	.004		-.882	.381		
	Market Premium	.625	.030	.965	20.538	.000	.902	1.108
	Size factor (small minus big)	.139	.052	.125	2.659	.010	.903	1.108
	Style factor (high minus low)	-.164	.082	-.092	-1.997	.050	.933	1.072

Table 4.77 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.002	.004		.642	.523		
	Market Premium	.529	.030	.941	17.403	.000	.902	1.108
	Size factor (small minus big)	.134	.052	.138	2.559	.013	.903	1.108
	Style factor (high minus low)	-.133	.082	-.086	-1.623	.109	.933	1.072

Table 4.78 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.004	.003		1.412	.163		
	Market Premium	.497	.023	.957	21.461	.000	.902	1.108
	Size factor (small minus big)	.076	.040	.085	1.908	.061	.903	1.108
	Style factor (high minus low)	-.027	.063	-.019	-.432	.667	.933	1.072

Table 4.79 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.008	.003		2.919	.005		
	Market Premium	.514	.023	.929	22.453	.000	.902	1.108
	Size factor (small minus big)	.003	.039	.003	.068	.946	.903	1.108
	Style factor (high minus low)	.128	.062	.084	2.062	.043	.933	1.072

Table 4.80 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.010	.003		2.977	.004		
	Market Premium	.460	.027	.868	16.898	.000	.902	1.108
	Size factor (small minus big)	-.065	.047	-.072	-1.393	.168	.903	1.108
	Style factor (high minus low)	.188	.074	.129	2.558	.013	.933	1.072

Table 4.81 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.011	.004		3.070	.003		
	Market Premium	.488	.029	.851	16.616	.000	.902	1.108
	Size factor (small minus big)	-.102	.051	-.103	-2.020	.047	.903	1.108
	Style factor (high minus low)	.245	.079	.155	3.081	.003	.933	1.072

Table 4.82 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.014	.004		3.589	.001		
	Market Premium	.503	.033	.817	15.279	.000	.902	1.108
	Size factor (small minus big)	-.122	.057	-.115	-2.151	.035	.903	1.108
	Style factor (high minus low)	.377	.089	.222	4.230	.000	.933	1.072

Table 4.83 Coefficients for 1st decile portfolio (3-factor model)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.016	.005		3.103	.003		
	Market Premium	.547	.044	.762	12.469	.000	.902	1.108
	Size factor (small minus big)	-.153	.075	-.123	-2.022	.047	.903	1.108
	Style factor (high minus low)	.538	.119	.273	4.540	.000	.933	1.072

By focusing on the factor sensitivities we can indicate the nature of the winner and loser mutual funds, thus can explain the spread in mutual fund performance. Regression analysis results demonstrate that size and style factor sensitivities change in a large range across mutual funds: the difference between top and worst mutual fund sensitivities for size factor is 0.30 and for style factor is 0.825. However, the difference between betas is 0.109. This leads us to conclude that sizable portion of cross-sectional variation in mutual fund portfolio excess returns is explained by size (SMB) and style (HML) factors. 3-factor model alphas exhibit little spread of 0.021 from -0.005 to 0.016. Such a short range is explained by the fact that the factors capture substantial part of the fund return spread explanation, leaving very little portion to alphas, i.e. abnormal returns and thus lead to conclusion that almost no managerial skill exists to explain performance variation. Although the abnormal returns (alphas) are too small, it is worthy to have a look at new ranks of the portfolios in respect of these abnormal returns. 3-factor model alphas as performance measure suggest that last year winner mutual funds become losers in subsequent periods and vice versa, since they are increasing from negative value (-0.005) to positive value (0.016) across deciles as the decile ranks are increasing.

Furthermore, test results demonstrate that top decile portfolios appear to hold more small stocks than the bottom deciles. On the other hand, the returns on the top decile funds are strongly, positively correlated with the style factor, while the returns on the bottom decile funds are strongly, negatively correlated with the factor. It means that past top performers mostly invest in growth stocks, while past poor performers invest in value stocks.

Table 4.84 Summary of 3-factor model performance measures per deciles

Portfolio rank before evaluation	Jensen's alpha	Market premium sensitivity (beta)	Size factor sensitivity	Style factor sensitivity
1	-0.005	0.656	0.147	-0.287
2	-0.006	0.644	0.145	-0.192
3	-0.003	0.625	0.139	-0.164
4	0.002	0.529	0.134	-0.133
5	0.004	0.497	0.076	-0.027
6	0.008	0.514	0.003	0.128
7	0.01	0.46	-0.065	0.188
8	0.011	0.488	-0.102	0.245
9	0.014	0.503	-0.122	0.377
10	0.016	0.547	-0.153	0.538

CONCLUSION

Research results found in the fourth part lead us to conclude following points:

1) Although the portfolio excess returns are adjusted by their systematic risk, the mutual fund portfolios still stay in their ranks according to their abnormal returns, i.e. Jensen's alpha is higher for top performers and lower for poor performers. It suggests that the top performers possess managerial talent and they are successful to outperform the benchmark;

2) The mutual funds included into the rank portfolios do not change their rank in respect of their market timing ability measure. The results imply that market prediction skill of Turkish mutual fund managers plays an important role in earning abnormal returns and staying in the first rank. Mutual funds in the highest rank are successful to forecast the market movements, since in bull market period they invest in stocks with high market-sensitivity and in bear market period they include into their portfolios mostly lower beta stocks. The opposite pattern is observed for poor performing mutual funds. Funds in the bottom rank failed to correctly forecast the market movements. While they expected the market to rise and invested in high beta stocks, the market exhibited decrease actually, and vice versa, and therefore negatively affected the performance of these funds.

3) It is evident that Henriksson and Merton's model suggests that Turkish A-type mutual funds performance depends from market timing ability of fund managers more than suggested by the Treynor and Mazuy's model, leaving less portion for selectivity ability in explaining the performance.

4) Momentum factor variable has no explanatory power over mutual funds performance. Since momentum factor was formed in order to capture Jegadeesh and Titman's one-year performance persistence anomaly, failure of momentum factor to explain the fund excess returns suggests that Turkish mutual funds do not exhibit performance persistence in the short-run.

5) After eliminating the momentum factor from the model it demonstrates strong pattern in explaining the performance variation across mutual funds, as sizable portion of cross-sectional variation in mutual fund portfolio excess returns is explained by size and style factors. Short spread in alphas according to 3-factor model is explained by the fact that the size and style factors capture substantial part of the fund return variation, leaving very little portion to alphas, i.e. abnormal returns and thus lead to conclusion that almost no managerial skill exists to explain performance variation.

6) Top decile portfolios appear to hold more small stocks than the bottom deciles. On the other hand, the returns on the top decile funds are strongly, positively correlated with the style factor, while the returns on the bottom decile funds are strongly, negatively correlated with the factor. It means that past top performers mostly invest in growth stocks, while past poor performers invest in value stocks.

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BIOGRAPHY

I was born in 1985 in Azerbaijan Republic. In 2002 I have accomplished my education in Baku secondary school no.245 and in 2006 graduated from the faculty of Economic Cybernetics of Baku State University with honours diploma. In the same year I have applied to the interstate students program between Azerbaijan and Turkey, and won the TCS scholarship. In 2007 I began my masters education in Business Administration department of Social Sciences Institute of Marmara University. In 2008 I started my master thesis research focused on "Performance Evaluation of Turkish Mutual Funds: Market Timing and Persistence Analysis" under Associate Professor Aslı Yuksel Mermod's advisement.

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