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BACHELOR THESIS

Collective investment in the CEE region: risk and return comparison

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Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

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Signature

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Abstract

The purpose of this thesis is to analyze mutual fund performance in the Central and Eastern Europe - CEE region. The author chose two countries from this geographic region, the Czech Republic and Poland. Using the econometric model that is based on CAPM (Capital Asset Pricing Model) the author compares past performance of equity and bond oriented mutual funds. This thesis also examine the theory which states that most of mutual funds are not able to outperform the benchmarks in real terms as they charge relatively high fees.

Keywords	Mutual funds, Emerging market mutual funds, CEE region, Performance evaluation
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Abstrakt

Tato práce se zabývá analýzou výkonnosti podílových fondů v regionu střední a východní Evropy - regionu CEE. Autor pro analýzu v této práci zvolil dvě země z této geografické oblasti, a to Českou republiku a Polsko. Pomocí ekonometrického modelu, jenž vychází z tzv. CAPM (Capital Asset Pricing Model), autor porovnává historickou výkonnost akciových a dluhopisových podílových fondů. Tato bakalářská práce také zkoumá teorii, která říká, že většina podílových fondů není schopna v konečném součtu překonat benchmark, jelikož si účtují relativně vysoké poplatky.

Klíčová slova	Podílové fondy, Podílové fondy v rozvojových zemích, Region CEE, Hodnocení výkonnosti
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TEZE BAKALÁŘSKÉ PRÁCE

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Garant studijního programu Vám dle zákona č. 111/1998 Sb. o vysokých školách a Studijního a zkušebního řádu UK v Praze určuje následující bakalářskou práci.

Předpokládaný název BP:

Collective investment in the CEE region: risk and return comparison

Předběžná náplň práce

Recent surveys show that demand for investment products grows at a steady rate. Collective investment funds are getting more popular as people in the emerging world adopt habits of the developed countries. In this bachelor thesis we are going to analyze and describe how these funds work, what kind of (if any) added value they bring to investors and last but not least we will make a comparison (considering the region of CEE) of stock/equity and bond funds. The outcome of the thesis will be also empirical analysis assessing performance of selected funds from the CEE region using various performance measures.

Seznam základních pramenů a odborné literatury:

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Jan Šmejkal   PhDr. Pavel Streblov, MSc

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Chapter 1

Introduction

Recent years have been substantially affected by the global economic crisis that started in 2007-2008. Capital markets were hit dramatically as it experienced long periods of downturns. The mutual fund industry was influenced in the same manner, especially the year 2008 was really painful for investment companies which had to face the extensive outflow of financial means from mutual funds they operate. On the other hand, mutual funds are also getting more popular as people in the emerging world adopt habits of households in developed countries.

We will look at the CEE[1] region and then two specific emerging markets - the Czech Republic and Poland - where the collective investment is still relatively young industry.

The objective of this thesis is to provide the reader with brief overview of the CEE (especially Czech and Polish) collective investment environment. Then we will focus a little bit more on the two mentioned neighboring countries. The aim is to find out if mutual funds' managers in these countries are able to outperform the benchmark (market) and thus to earn investors an excess return.

The thesis is structured as follows: Chapter 2 serves as intruduction to collective investment terminology and concepts. Chapter 3 reveals some facts and statistics regarding the CEE region. Chapter 4 and Chapter 5 discuss the mutual fund industry in the Czech Republic and Poland respectively. Chap-

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[1]Central and Eastern Europe.

ter 6 discusses the studied literature from which the concepts are applied to our analysis. Chapter 7 and Chapter 8 deal with data description and methodology. In the Chapter 9 we summarize and comment on the results. The last Chapter 10 covers conclusion and suggestions for futher analysis.

Chapter 2

Fundamental concepts of collective investment scheme

2.1 Collective investment

The principle of collective investment is very easy. Basically, it is about collecting or gathering funds from small, individual investors by financial institutions (*investment companies*) that invest this money in the variety of financial instruments - for instance stocks, government/corporate bonds, properties, all together etc. depending on what kind of a fund one has chosen - through financial markets.

Formal definition of collective investment[1]: *"Collective investment is a kind of business whose object consists in collecting financial means through the subscription of shares of an investment fund or issue of unit certificates of a mutual fund[2], investment according to the principle of risk diversification, and further management of these assets."*

Another idea of the collective investment is that the investment companies or funds dispose of the large amount of assets that they invest into the financial instruments and projects (as mentioned) in the extent which an individual could hardly afford. This means that one can participate in the variety of (lucrative) investments even with "negligible" contribution.

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[1]Definition edited by author, based on 189/2004 Coll. ACT.
[2]Also referred to as *unit trust.*

This form of investment is suitable also for individuals/investors that do not have enough time or appropriate skills to manage their portfolios on their own, so, they instead entrust their money to investment companies and their fund managers. This service is not for free, there is actually couple of fees one has to take into account when either considering confiding money to an investment company or comparing different companies and funds. The fee structure will be discussed later on.

There is one more fact the author would like to point out in this section - **diversification**. For any investment company which administrates a big amount of assets it is much easier to diversify its portfolio, it has much more options than an individual.

2.2   Investment company

Investment companies are joint stock companies that deal with collective investment in the following manners. They:

1. *Establish and manage mutual funds.*

2. *Manage investment funds on the basis of management contract.*

In general, their role is to manage, sell and market funds to the public.

Investment companies usually offer investors a variety of funds and related investment services such as:

- Portfolio management

- Account keeping

- Legal services

- Tax management

- Recordkeeping

- Custodial services[3]

- Valuation of assets and liabilities of the collective investment fund

- Determination of the current value of a participation/unit certificate or share of the fund

License from the Czech National bank is required for activities of an *investment company*.

2.3 Types of funds

There are many kinds of the funds. Both short definition and the formal description (stated in inverted commas and italics) in reference to Czech legislation[4] will be provided.

1. **Mutual funds** - pool the capital of many individual investors and invest it in a set portfolio. Investors get for their money so called mutual fund units (or participation/unit certificates). Mutual funds are not legal entities, i.e. only investment company may establish mutual fund based on the license from the Czech National Bank.

    "A mutual fund shall be the aggregate of assets belonging to all holders of unit certificates of the mutual fund, pro rata according to the number of unit certificates held by each. A mutual fund is not a legal entity, which means that license from the Czech National Bank shall be required for establishment of a mutual fund. The license to set up a mutual fund shall be applied for by an investment company. Mutual fund may be either open-ended or closed-ended."

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[3]In addition to holding securities for safekeeping, custodial services embody for instance account administration, transaction settlements, collection of dividends and interest payments, tax support and foreign exchange.

[4]Please note that formal description based on the 189/2004 Coll. ACT does not have to be complete. In most cases contains only the (edited) information the author of the thesis considered essential.

(a) **Open-end funds** (majority) - there are no restrictions on the amount of participation/unit certificates the fund can issue. The fund also buys back the shares when an investor wants to sell.

"The number of unit certificates issued by an open-end mutual fund is not limited. The holder of a unit of an open-end mutual fund shall also have the right to have this unit repurchased by the investment company at his request. A unit certificate of an open-end mutual fund need not have a nominal value. The name of this kind of fund shall contain the business name of the investment company that manages the fund and designation - open-end mutual fund."

(a) **Closed-end funds** - the amount of the units is set in advance. Once this volume is reached the fund is closed to other investors. One can get the invested money back at the maturity date only.

"An investment company shall not repurchase unit certificates of a closed-end unit trust from the unit-holders with the use of the assets of the closed-end mutual fund unless the Act stipulates otherwise. An investment company shall issue a unit certificate of a closed-end mutual fund for an amount equal to its current value announced on the decisive date. This amount may be increased by the surcharge specified in the statute. The statute shall stipulate which date shall be considered to the decisive date in purchase of a unit certificate.

A closed-end mutual fund shall be established for a fixed term. After expiry of this term, the fund shall enter into liquidation or be transformed into an open-end unit trust. The term for which the closed-end mutual fund is established must be specified in the statute, including information as to whether, upon expiry of this term, the fund will enter into liquidation or be transformed into an open-end mutual fund.

The name of a closed-end mutual fund shall contain the business name of the investment company that manages the mutual fund and the designation - closed-end mutual fund."

2. **Investment funds** - these funds are legal entities (they are autonomous) that pool money of individual investors by issuing shares. Investment funds may only issue shares of the same nominal value. Nowadays, these funds almost do not exist in the Czech Republic.

   > "An investment fund is a legal entity whose business consists in collective investment and that has a license of the Czech National Bank for activities of an investment fund. Only the founders of a joint stock company that is yet to be incorporated may apply for a license to perform activities of an investment fund. The company must not be established on the basis of an initial public offering.

   > The business name of an investment fund shall include the designation - closed-end investment fund. An investment fund other than a qualified investor fund may be established for a fixed term only, not exceeding 10 years, which must be specified in the statute."

3. **Qualified investors funds** - as the name suggests, these funds are designed for qualified investors that are able to assess the risk of the funds' investments only. There are also other specifications such as minimum investment (1 000 000 CZK or a currency equivalent) and number of participants (2 - 100). These funds are not so accessible (they are not retail funds) due to both relatively high initial investment (limited number of investors) and the fact that potential investors have to proof their experience. These funds also invest in, apart from usual instruments and assets (see the next page), specialized projects (such as private equity projects). Qualified investors funds are very attractive also from a taxable point of view. This topic is going to be discussed in the following chapter. Qualified investors funds may exist in a form of either investment fund or mutual fund.

   > "A special qualified investors fund may have no more than 100 shareholders or unit-holders; the Czech National Bank may permit an exemption from this limit. Securities issued by a special qualified investors fund may not be publicly offered or promoted. However, a promotional spot may be published upon establishment of the fund. A special qualified investor fund may accept or provide a loan or credit if so stipulated in its statute.

   > The statute of a special qualified investor fund determines:
   >   - *Scope of investors for whom the fund is intended*
   >   - *Limits for the risk diversification*

> - *Types of assets in wich a special qualified investor fund invests*
> - *Rules for disposal of the funds' assets*
> - *Rules for provision and acceptance of credit and loans*
>
> *The statute also stipulates that, in the event of passage of the ownership of a security issued by the fund, the acquirer must inform the fund of the change in the owner without undue delay."*

2.3.1 Classification by type of investment

- **Equity funds** - these funds invest the collected capital in the companies/firms by purchasing their stocks on the capital markets. Historically, these funds exhibit the highest returns, but the volatility (fluctuation of a stock price) is greater as well.

- **Bond funds** - these funds allocate the investors' money to securities - especially bonds (government or corporate) - with longer maturity.

- **Blend funds** - portfolio of these funds consists predominantly of less volatile stocks and more risky bonds (for instance emerging markets government bonds). The portion of the stocks is generally larger.

- **Money market funds** - the money market funds focus on debt securities with short maturity such as treasury bills, short-term bonds issued by multinational institutions, etc. These funds are synonym for almost zero risk connected with low returns.

- **Secured funds** - these funds promise recovery and the minimal appreciation of the investment (in case that one holds the investment till maturity).

- **Real estate funds** - managers of the real estate fund use the pooled capital for investments in immovable property (storehouses, apartments, offices, etc.) and also securities and projects linked to it.

- **Funds of funds** -funds that basically invest in other funds. Distinct advantage is higher degree of diversification.

2.3.2 Classification by strategy

- **Territorial** - for instance Global, European, American, Asian, etc. These funds focus on specific regions or countries.

- **Sectorial** (or Sector funds) - funds that invest in a particular sector such as luxury goods, banking (and financial institutions), automotive, telecommunication, energy, pharmaceutical sector, etc.

- **Blue chips funds** - their portfolio is composed of the established companies (brands) such as Apple, Coca-Cola, McDonalds, Microsoft, General Electric, Hewlett-Packard, etc.

- **Emerging markets funds** - these funds invest usually in the countries and regions that offer high potential of the future growth for example the BRICS (referring to Brazil, Russia, India, China and South Africa).

- **Dividend funds** - the strategy is to buy and hold the stocks of the companies that are financially sound and pay out (on a regular basis) a portion of their profits as a dividend to their stockholders.

2.3.3 Classification by the way of management

- **Actively managed funds** - the strategy of the fund changes according to situation on the markets. As the manager can restructure the portfolio several times within the year, the management costs are usually higher.

- **Passively managed funds** - the strategy is set beforehand. The fund manager uses the principle buy & hold. Changes of portfolio are negligible which can result in huge slump of the stock prices (and the portfolio as such).

- **Life-cycle funds** - funds that are managed (the portfolio is adapted) according to in what period of the life cycle the investor currently is. In other words, fund managers of these funds compose the aggressive portfolio at the beginning and then, as the retirement of the investor or maturity of the fund approaches they reallocate the capital into conservative securities (such as bonds and money market instruments).

One could definitely find much more types of mutual funds. All the investment companies continuously offer new, complex products (funds) as they strive to attract new investors (especially their money). However, these other funds and products are out of the scope of this thesis.

2.4 Fee structure

Before execution of the investment in a specific collective investment fund one should, at first, pay attention to fee structure of that fund as the excessive charges may substantially affect the final returns of the investment portfolio. In the list below one can find the most common fees to be encountered when dealing with collective investment funds. More information will be given in practical part of the thesis.

- **Entrance/Purchase fee**[5] - this is one of the transaction fees in this list. Some funds charge the investors this fee when they buy shares or participation/unit certificates of the fund. Basically, this term refers to any charge for admission.

- **Redemption fee**[6] - second transaction fee listed in this enumeration. Funds charge this fee to discourage investors to exit the fund. A fee or charge imposed on an investor for selling the shares (or participation/unit certificates) prior to a formerly agreed date.

- **Management fee** - this fee belongs to a category of so called periodic fees. Management fee represents the costs connected with managing (salaries of portfolio managers, administration costs, etc.) the investment portfolio in professional way. These charges differ from fund to fund but they are typically calculated as a percentage of assets under administration.

- **Total expense ratio (TER)** - ratio that measures total costs associated with managing and operating a collective investment fund (management fees constitute the biggest portion of the expenses, but there are also other costs such as maintenance fees, trading fees, legal fees, auditor fees and other operational expenses).

As mentioned before fees and charges are very important aspects of collective investment process - every (potential) investor should keep this in mind. In general, fees vary according to following "rules":

- Equity funds (riskier investments) tend to have higher expenses (=charges) than bond and money market funds (less risky investments).

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[5]Also referred to as *Front load.*

[6]Also referred to as *Exit fee.*

- Similarly, actively managed funds (they execute more transactions) versus those managed passively.

- It depends also upon the country the fund is domiciled in. Funds in United States for instance tend to charge lower fees than those in emerging markets.

Statistical evidence to prove practices stated above may be found in the study of Khorana *et al.* (2009).

At this moment, one should understand the basic facts about collective investment and its tools. Let's now have a closer look at the collective investment in the CEE region.

Chapter 3

Collective investment in the CEE region

This part was elaborated based on the study[1] *Potential to Invest, Generali PPF Asset Management (2013).*

At the beginning, it is useful to define CEE (Central and Eastern Europe) region. Within this section (thesis) CEE region represents Czech Republic, Slovakia, Poland, Hungary, and Slovenia.

3.1 Development of mutual fund investments in the CEE region

"Household[2] investments into mutual funds are highly correlated with the economic development of each country; quite simply, the richer the country, the higher the value of household investments into mutual funds."

According to data Generali PPF Asset Management analyzed over the last eight years it is clear that the highest mutual fund investments among CEE region countries are in Slovenia. Capital invested this way reaches 1150 Euro per capita at the end of the first half of the year 2012. Despite the fact that the Czech Republic and Slovakia are notably wealthier than Hungary, it surpasses these two countries and ranks second with 769 Euro. Imaginary bronze medal

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[1]Text in inverted commas (within sections 3.1 to 3.5) represents quotations from the study.

[2]Household investors are defined as individual retail investors, not institutional investors.

goes to the Czech Republic with 591 Euro. TOP 3 is followed by Slovakia and Poland with relatively comparable mutual fund investment of 472 Euro and 469 Euro respectively.

All the data are shown in the following table:

Table 3.1: Households' Mutual Fund Investments at the end of Q2 2012

Rank	Country	€ per capita
1	Slovenia	1150
2	Hungary	769
3	Czech Republic	591
4	Slovakia	472
5	Poland	469

Source: GPPF AM

When one takes a look at the data for four quarters (ending mid 2012) he will see the downfall of the investment figures in all observed countries; Slovenia 7.5%, Hungary 13%, the Czech Republic 4.7% Slovakia 12.2%, and Poland 9%.

This drop was caused by a combination of the following factors:

- Declining stock markets (15% to 20% in all countries)

- Currency depreciation

- Difficult economic conditions (ability of households to invest is limited)

There are three key factors affecting the development of collective investment in the CEE region:

1. **The European economic and financial environment**

   Taking this fact into account, it can be concluded that current economic situation has influenced household investments in the CEE region negatively. Recession in the Czech Republic and Hungary serves as an example. Similarly, albeit the Slovak economy expanded by 2.6% year-on-year

in Q2 2012, level of consumer demand for mutual fund investments is stagnant.

2. **Maturity of pension system in given country**

   This statement is backed by data. "Countries with strong funded second and third pillars such as Poland have relatively lower mutual fund investments compared to countries with no such an option like Slovenia" (more capital in financial asset structure; Slovenia ranks first in the comparison of all observed countries).

   This is quite logical as pension funds (second and third pillar) are perceived as a good substitute of mutual funds especially by conservative investors.

   It will be fairly interesting watching the effects on collective investment in the Czech Republic at the end of the year 2013 after the pension system reform will take place and changes will become evident, if at all. The reform could influence the level of mutual fund investments in the Czech Republic in the same or similar way as in Slovakia and Poland.

   "Czechs who participate in the second funded pillar will send an extra 2% of their wages to the fund and could discourage willingness or ability to invest more money into mutual funds."

3. **Exchange rate fluctuations**

   "As household investments in mutual funds are stated in Euro, it is clear that a relatively volatile currency in some countries (e.g. Poland) might lead to substantial changes in Euro value of mutual fund investments, especially compared to EMU[3] members like Slovakia and Slovenia."

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[3]European Monetary Union - author's note.

3.2 International Comparison

CEE countries still belong to the poorest in Europe in per capita point of view. It is no surprise that against more developed Western European countries (nearly 4000 Euro per capita) the mutual fund investments in the CEE region remain relatively low.

However, since 2004 the CEE's potential to invest has experienced pretty clear increase, see table below. This increase was induced primarily by rising wealth in the CEE countries (expressed as GDP growth).

Table 3.2: Development of household mutual fund investments per capita since 2004

Rank	Country	Percentage change
1	Hungary	+230%
2	Poland	+160%
3	Slovenia	+100%
4	Czech Republic	+65%
5	Slovakia	+25%

Source: GPPF AM

3.3 Financial assets structure

The structure of household investment portfolios in the CEE region is different in important perspectives from what observed within more developed countries of the EMU. We can conclude that investments into mutual funds represent a relatively small share of CEE[4] household's financial assets, approximately 5%; the exception is Hungary where these investments reach the level of 8%.

Structure of financial assets says a lot about the nature of investors (households) in given country. This brings us to a sort of predictable finding.

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[4]For the information, average of the EMU is 7%.

"CEE households demonstrate their conservative nature by keeping the largest portion of financial assets in bank deposits and currency assets with the most conservative households in Slovakia, Slovenia and the Czech Republic, with currency assets and bank deposits representing more than half of all households' financial assets, followed by Poland (46%), and Hungary (39%). These figures are significantly higher than the 36% average in the EMU."

As mentioned before, mutual fund investments unfold from the quality and position of pension system in monitored country as well. Although Slovakia and Poland can be found at the bottom of the following table, one must keep in mind that both countries dispose of funded pension systems which as serve as an alternative to mutual funds, which implies/explains lower level of these investments.

Slovak government is about to cut down support of contributions to pension funds. It will be interesting to see the impact of this decision, if any occur at all.

Households in EMU have more than 30% of their financial assets allocated in pension funds and life insurance products in comparison with 17% on average in the CEE region (Poland 27%, Slovakia 21%, Czech Republic 14%, Slovenia 12%, and Hungary 11%).

3.4 Outlook for mutual fund investments

"Despite a sharp rise over the last 8 years, further substantial growth of household investments in the CEE is expected over the course of the next five years. The forecast is based on basic assumptions; with the economy expected to recover (especially in Poland, Slovakia and Czech Republic), every 1 Euro increase of GDP should increase mutual fund investments by 11 cents. We don't assume sharp boom of equity markets, neither sharp appreciation of regional currencies. Lastly, it is not expected that CEE households will change their current conservative investment tendencies."

Households' capital invested in mutual funds is anticipated to be more than twice as large in Poland. Slovakia and the Czech Republic should experience an increase of 70-80%. Hungary and Slovenia will probably undergo the lowest

Table 3.3: Structure of Households' Financial Assets

	CZ	HU	PL	SL	SK
Currency and deposits	55.10%	38.60%	46.40%	53.20%	64.20%
Unquoted share and other equity	18.80%	29.60%	15.30%	17.30%	0.30%
Quoted shares	1.50%	1.20%	2.80%	3.20%	0.00%
Mutual funds shares	4.00%	8.00%	5.90%	6.40%	5.30%
Life insurance reserves	8.00%	6.90%	7.40%	8.60%	8.30%
Pension funds	6.00%	4.00%	19.30%	3.20%	13.10%
Other	6.60%	11.80%	2.80%	8.20%	8.80%

Source: GPPF AM; Data from the end of Q2 2012

gains of around 50% and 40% respectively. This difference is given by two elements that hold for both Hungary and Slovenia.

1. Underperforming in terms of economic

2. Relatively high investment base

3.5   Other interesting tables and figures

Table 3.4: Mutual funds: Structure of net assets by segment

	CZK	PLN	HUN	SLK	SLO	Euro area
Bonds	45%	50%	55%	47%	19%	48%
Shares	25%	31%	11%	19%	81%	38%
Other	30%	19%	34%	34%	0%	14%
Total	100%	100%	100%	100%	100%	100%

Source: GPPF AM

Table 3.5: Structure of Households' Financial Assets (EUR per capita)

	CZ	HU	PL	SL	SK
Currency and deposits	8,123	3,737	3,711	9,623	5,673
Unquoted share and other equity	2,766	2,868	1,225	3,128	27
Quoted shares	227	115	228	576	1
Mutual funds shares	591	769	469	1,150	472
Life insurance reserves	1,184	663	591	1,556	733
Pension funds	890	382	1,544	572	1,157
Other	969	1,143	224	1,488	780
Total Financial Assets	14,750	9,677	7,992	18,093	8,843

Source: GPPF AM; Data from the end of Q2 2012

Table 3.6: Structure of Households' Financial Assets (EURmn)

	CZ	HU	PL	SL	SK
Currency and deposits	85,925	37,125	141,990	19,776	30,924
Unquoted share and other equity	29,259	28,494	46,882	6,429	146
Quoted shares	2,402	1,141	8,705	1,184	7
Mutual funds shares	6,250	7,648	17,936	2,364	2,574
Life insurance reserves	12,525	6,592	22,606	3,197	3,993
Pension funds	9,419	3,798	59,066	1,175	6,306
Other	10,246	11,361	8,575	3,058	4,252
Total Financial Assets	156,026	96,159	305,760	37,183	48,202

Source: GPPF AM; Data from the end of Q2 2012

Chapter 4

Mutual fund industry in the Czech Republic

This chapter will be dedicated to some statistics gathered for Czech market such as development of AUM[1] for the period 2006 - 2012. All the data are arranged in graphs and tables.

4.1 Asset management in the Czech Republic

Figures below represent assets allocated in individual portfolios (private cliets, institutions and corporations) and collective investment funds (domestic and foreing funds).

Table 4.1: AUM in the Czech Republic

Year	Value (CZK)	Percentage change
2006	630,281,266,175	-
2007	715,756,374,963	13.56%
2008	722,709,777,043	0.97%
2009	753,239,470,614	4.22%
2010	796,435,413,883	5.73%
2011	793,328,351,971	-0.39%
2012	885,258,548,936	11.59%

Source: AKAT ČR; `http://www.akatcr.cz/` and author's computations

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[1]Assets under management.

Figure 4.1: AUM in the Czech Republic
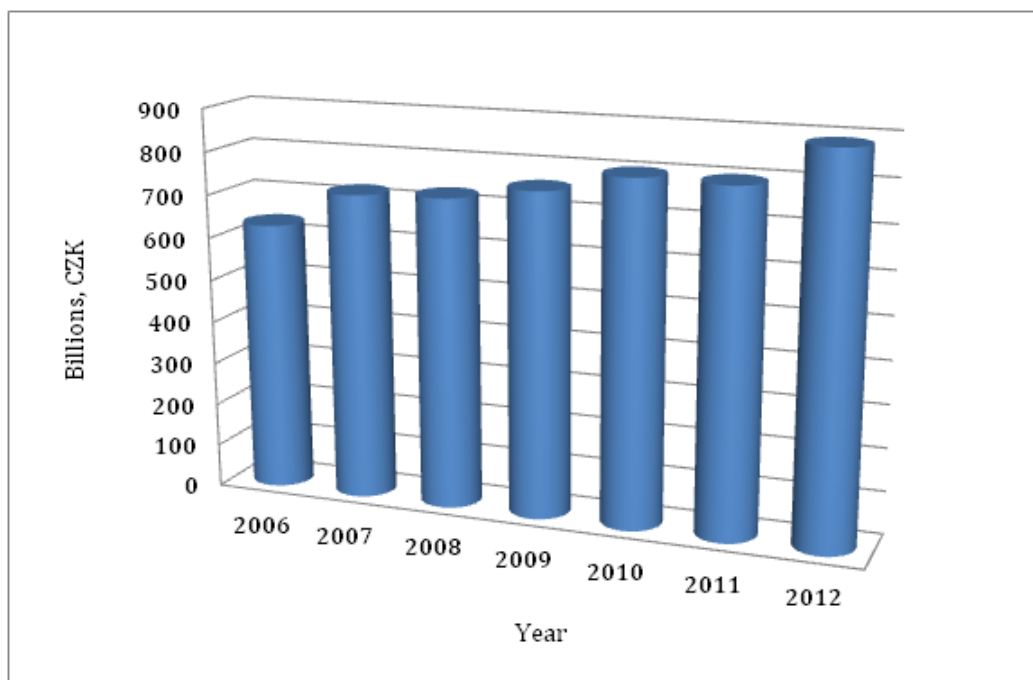
Source: AKAT ČR; `http://www.akatcr.cz/` and author's computations

Next graphics depicts TOP 3 asset administrators in the Czech Republic according to amount of pooled capital they managed in the 2011 and 2012. These administrators account for more than half[2] of all AUM.

Table 4.2: TOP 3 administrators

Company	Assets - 12/31/2011 (CZK)	Assets - 12/31/2012 (CZK)	Percentage change
Generali PPF AM a. s. / ČP Invest	201,344,455,826	221,444,991,753	9.98%
Česká spořitelna, a. s. (group)	148,775,378,905	163,836,851,370	10.12%
ČSOB (group)	137,175,943,204	145,193,569,981	5.84%

Source: AKAT ČR; `http://www.akatcr.cz/` and author's computations

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[2]*Source:* AKAT ČR; `http://www.akatcr.cz/` and author's computations.

Figure 4.2: TOP 3 administrators
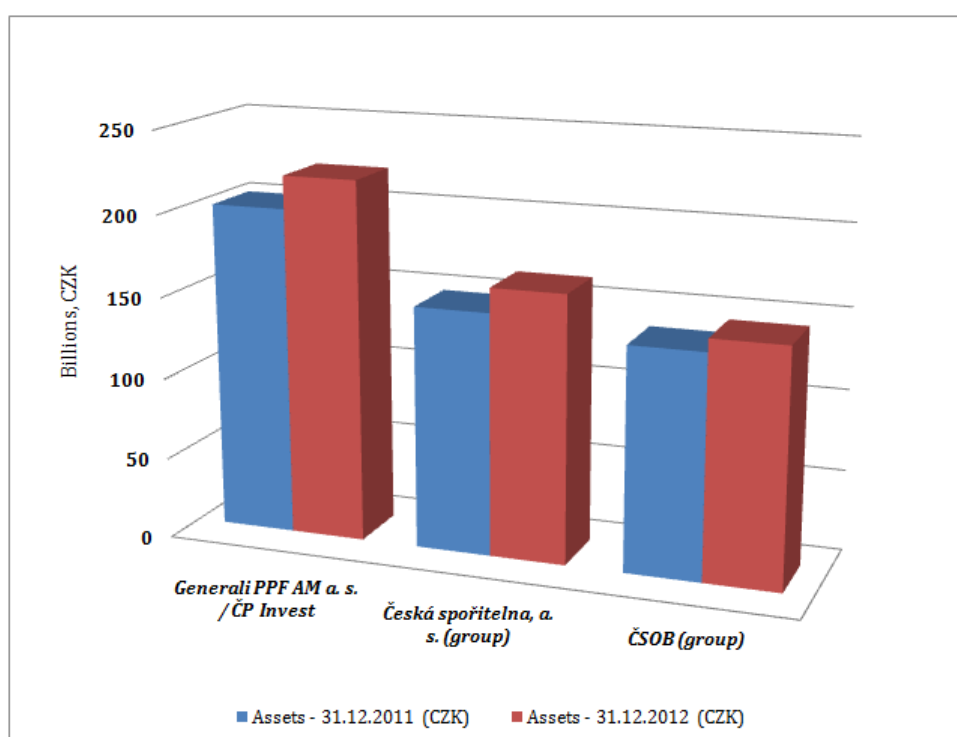
Source: AKAT ČR; `http://www.akatcr.cz/` and author's computations

4.2 Collective investment in the Czech Republic

Following table and chart show the development of the capital allocated in mutual and investment funds in the Czech Republic. Data are collected for the period of seven years (2006 - 2012). These data support the theory that mutual and investment funds investments are highly affected by economic situation on the markets. The biggest slump (-22.63%) in asset value appeared in 2008 when almost every country was hit by economic recession caused by bursting of the housing bubble in the USA and succesive bearish sentiment on global capital markets.

Table 4.3: Capital in Czech mutual funds

Year	Capital invested in mutual and investment funds (CZK)	Percentage change
2006	271,294,171,735	-
2007	315,227,731,623	16.19%
2008	**243,880,968,779**	**-22.63%**
2009	234,520,933,770	-3.84%
2010	247,467,676,744	5.52%
2011	224,064,892,664	-9.46%
2012	235,275,664,188	5.00%

Source: AKAT ČR; http://www.akatcr.cz/ and author's computations

Growth in mutual fund investments is expected in the near future (horizon of five years) as economies will recover and GDP will surely rise. These investments should increase by 70-80% in the Czech Republic[3].

Last set of tables and pie charts (starting from Table 4.4) includes statistics for distribution (allocation) of the funds' capital, domestic and foreign respectively.

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[3]Potential to Invest, Generali PPF Asset Management (2013).

Figure 4.3: Capital in Czech mutual funds
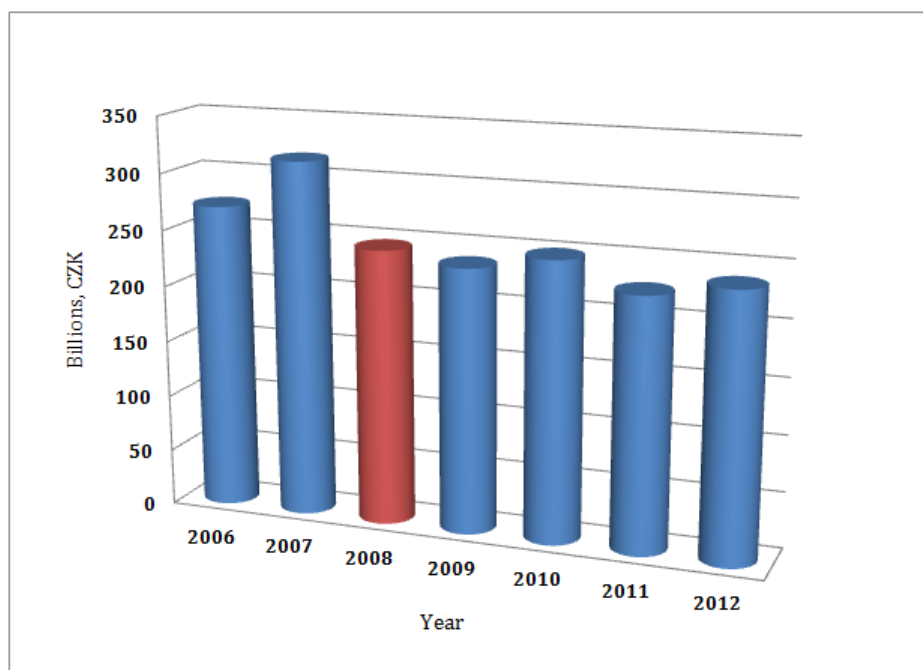
Table 4.4: Distribution of domestic funds, end of the year 2012

Type of funds	Assets 2012 (CZK)
Equity Funds	16,735,637,966
Bond Funds	51,290,841,807
Funds Of Funds	16,594,861,416
Real Estate Funds	2,124,863,251
Money Market Funds	2,955,596,296
Blend Funds	19,162,074,998
Secured Funds	1,542,406,518
Total	**110,406,282,254**

Figure 4.4: Distribution of domestic funds, end of the year 2012
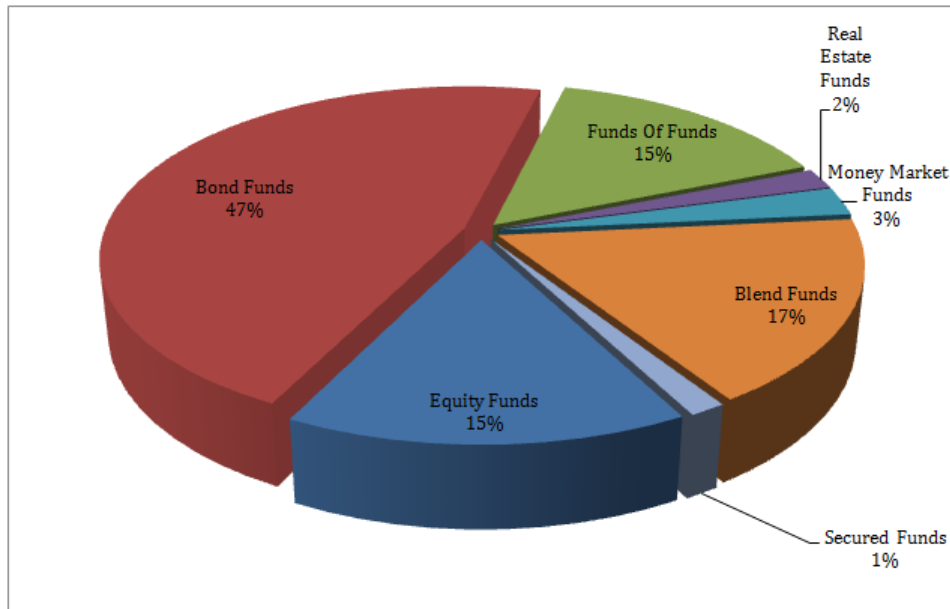
Table 4.5: Distribution of foreign funds, end of the year 2012

Type of funds	Assets 2012 (CZK)
Equity Funds	26,710,336,401
Bond Funds	30,895,231,942
Funds Of Funds	299,858,633
Real Estate Funds	425,056,394
Money Market Funds	12,222,464,901
Blend Funds	12,044,597,215
Secured Funds	37,254,366,337
Total	**119,851,911,822**

Figure 4.5: Distribution of foreign funds, end of the year 2012
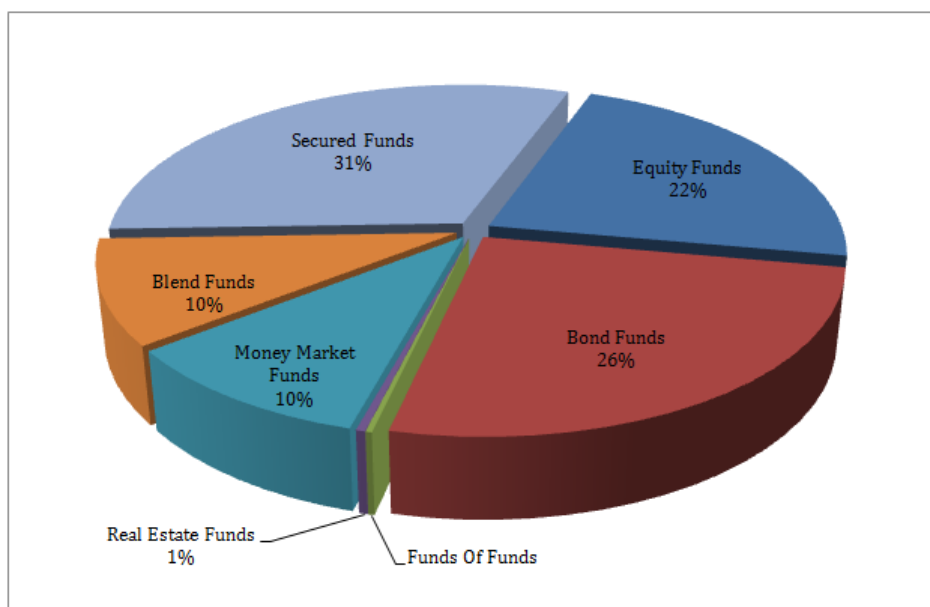
Chapter 5

Mutual fund industry in Poland

In this chapter, the brief introduction to Polish mutual fund industry will be given using some statistics similar to those that have been provided for the Czech Republic in previous chapter.

5.1 Asset management in Poland

Table and chart below reveal development of the Polish asset management in terms of means managed by investment companies. When PLN/CZK exchage rate from 6/30/2013[1] is used, one will see that the AUM in Poland are worth almost **1.02 billions of CZK**.

Table 5.1: AUM in Poland

Year	Value (PLN)	Percentage change
2005	61,287,959,801	-
2006	98,837,949,987	61.27%
2007	134,962,666,096	36.55%
2008	**74,214,419,906**	**-45.01%**
2009	93,530,311,069	26.03%
2010	116,139,180,675	24.17%
2011	114,367,465,186	-1.53%
2012	145,830,050,556	27.51%
2013	166,204,912,597	13.97%

Source: Poland IZFiA; `http://www.izfa.pl/`, `www.analizy.pl` and author's computations

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[1]Data for the year 2013 collected as of this date.

Figure 5.1: AUM in Poland
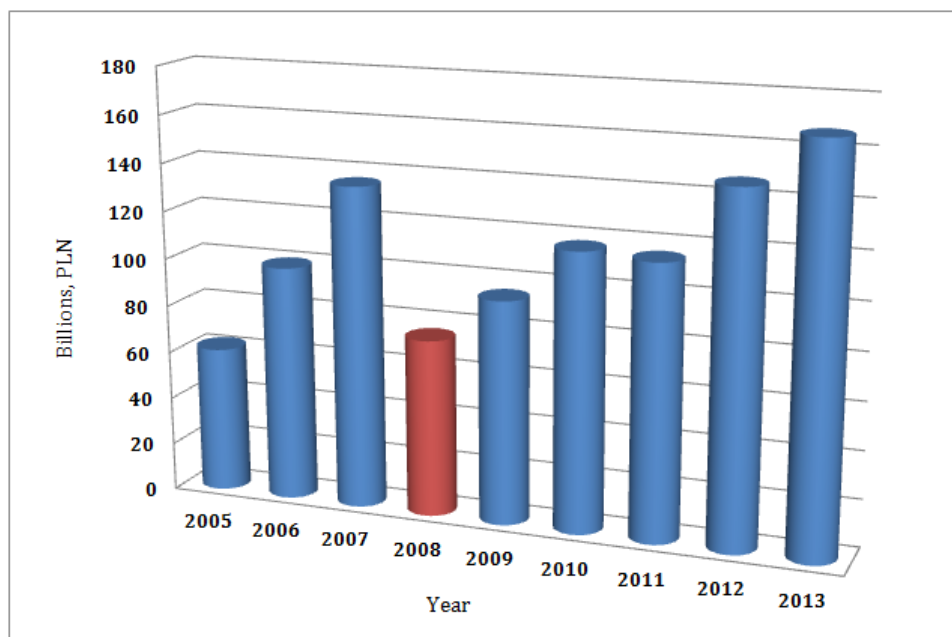
Source: Poland IZFiA; `http://www.izfa.pl/`, `www.analizy.pl` and author's
computations

TOP 3 investment companies according to AUM are **TFI PZU S.A.**, **Pi-oneer Pekao TFI S.A.** and **PKO TFI**, accounting for approximately 30%[2] of all AUM.

Table 5.2: TOP 3 administrators

Company	Assets - 6/30/2012 (PLN)	Assets - 6/30/2013 (PLN)	Percentage change
TFI PZU S.A.	6,953,784,434	20,867,919,847	200.09%
Pioneer Pekao TFI S.A.	14,132,737,251	16,008,900,678	13.28%
PKO TFI	8,365,304,502	11,860,684,535	41.78%

Source: Poland IZFiA; `http://www.izfa.pl/`, `www.analizy.pl` and author's
computations

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[2]*Source:* Poland IZFiA; `http://www.izfa.pl/` and author's computations.

Figure 5.2: TOP 3 administrators
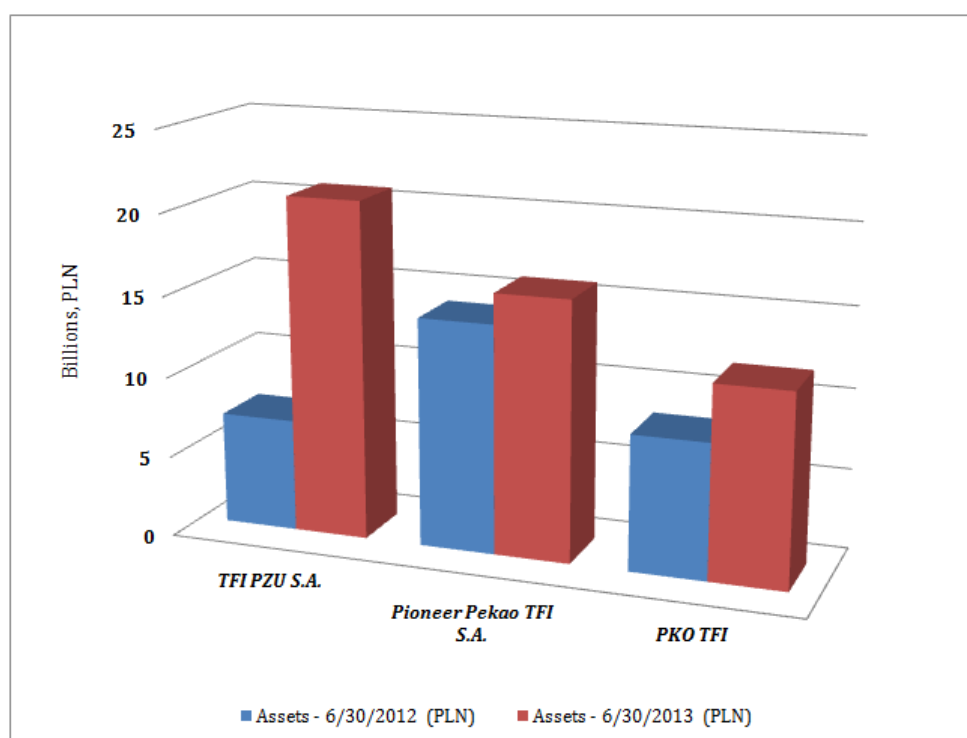
5.2 Collective investment in Poland

Collective investment in Poland is still developing (so is that of the Czech Republic), but accourding to study Local Insights: Poland, Transaction Services Citi (2013) capital in mutual funds is worth almost 81 billions[3] of PLN wich makes Poland's market larger than Croatia, the Czech Republic, Hungary and Russia combined. "Assets grew significantly from the mid-'90s, at almost 50% compound annual growth rate until 2007, but then in the crisis, AUM was cut in half." See Table 5.1.

Last graphics within this section show distribution (allocation) of the funds' capital. As one can see it embodies kind of similiar pattern like in case of the Czech Republic.

Table 5.3: Distribution of mutual funds in Poland

Type of funds	Assets 6/30/2013 (PLNmn)
Equity Funds	256,500
Bond Funds	44,210
Real Estate Funds	2,900
Money Market Funds	20,990
Blend Funds	19,520
Secured Funds	1,710
Total	345,830

Source: Poland IZFiA; `http://www.izfa.pl/`, `www.analizy.pl` and author's computations

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[3]*Source:* Local Insights: Poland, Transaction Services Citi (2013) and author's computations.

Figure 5.3: Distribution of mutual funds in Poland
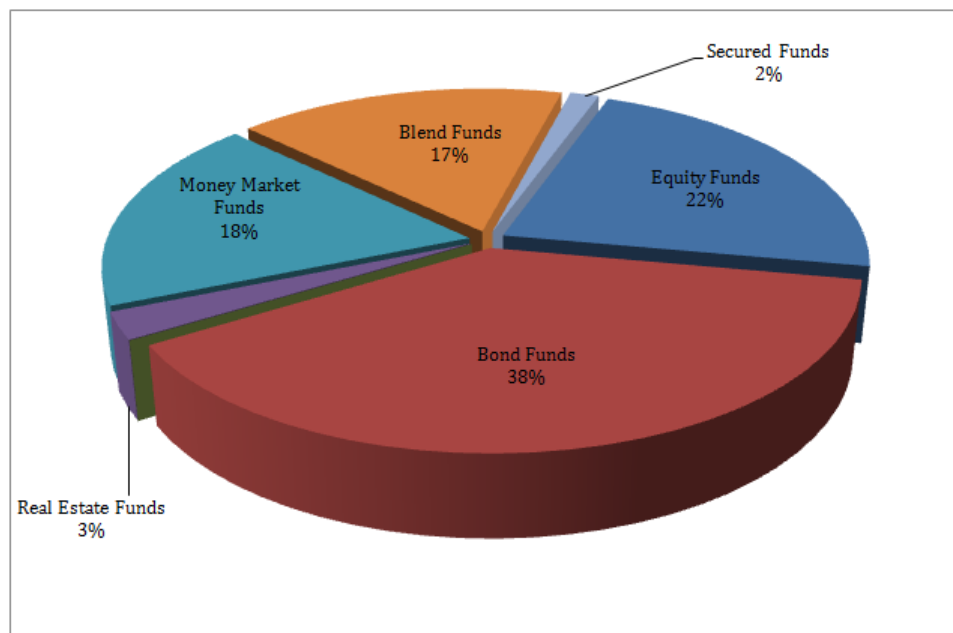
Chapter 6

Literature review

This chapter reviews the relevant literature that deals with mutual fund performance and that the author studied before writing this thesis.

One can find a lot of literature concerning this topic, but the truth is that the vast majority of these studies focuse on the US mutual fund industry, which is - on the other hand - not surprising as United States in terms of AUM and the level of development of capital market are far ahead of the rest of the world[1] (this difference is even greater in case of emerging markets and markets such as the Czech Republic and Poland).

The list of studies dealing with this issue starts with Treynor (1965), Sharpe (1966) and Jensen (1968), Jensen (1969). This is why Jensen, Sharpe and Treynor ratios are nowdays commoly used to describe performance of mutual funds (mutual funds' managers). All the studies mentioned and also those that are going to be covered later on are based on the Capital Asset Pricing Model.

"Does active management bring any value to investors?" This question has been a source of debate for decades. Empirical work brought researches to the strong consensus that actively managed portfolios (mutual funds) are not able to out-perform benchmarks (market indices), they actualy under-perform these idices on average. For instance Jensen (1968) and Sharpe (1966) claim that mutual funds lag behind the market by the amount of expenses they charge

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[1]For instance Dermine and Roller (1992) on French mutual funds, Ward and Saunders (1976), Shukla and van Imwegen (1995) and Blake & Timmermann (1998) on UK funds, Wittrock and Steiner (1995) and Saidov (2007) on German funds, Ter Horst, Nijman and De Roon (1998) on Dutch funds, Fernandez, Bermejo, Bilan (2008) on Spanish funds, Sorros (2001), Rompotis (2007) on Greek funds, and Dahlquist *et al.* (2000) on Swedish funds.

the investors. One can definitely find some examples of the opposite results, see Ippolito (1989). Consecutive authors, however, questioned the Ippolito's approach[2]. This led to the emergence of models that include other variables and thus can better explain the funds' performance.

6.1 Mutual fund performance models

In this section the author introduces some econometric models that are most frequently used in academic papers the author studied.

Jensen (1968) used the following model derived fromm CAPM[3]:

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \epsilon_{it}; \tag{6.1}$$

R_{it} stands for return of fund **i** in month **t**,
R_{ft} is the return of a risk-free asset in month **t**,
R_{mt} is the return of the given benchmark in month **t**,
α_i (intercept of this model) represents Jensen alpha, which is usually iterpeted as a measure of (out)under-performance relative to the used market proxy (benchmark).

Second model in this list is extended by two variables to capture effects of size (proposed by Elton *et al.* (1993)) and book-to-market (Fama & French (1992), Fama & French (1993), Fama & French (1996)) ratio[4].

$$R_{it} - R_{ft} = \alpha_i + \beta_{0i}(R_{mt} - R_{ft}) + \beta_{1i}SMB_t + \beta_{2i}HML_t + \epsilon_{it}; \tag{6.2}$$

SMB_t is the difference in return between a small capitalization funds and a large capitalization[5] funds at time **t**,
HML_t represents the difference in return between funds that hold a portfolio of high book-to-market securities and funds that hold a portfolio of low book-to-market securities at time **t**.

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[2]Results driven by non-S&P 500 holdings while comparing mutual funds' performace to Standard and Poor's 500 Index.
[3]Capital Asset Pricing Model.
[4]"The book-to-market ratio attempts to identify undervalued or overvalued securities by taking the book value and dividing it by market value" - `http://www.investopedia.com/`.
[5]Volume of AUM.

To capture the Jegadeesh & Titman (1993) momentum anomalyCarhart (1997) enlarges the previous model by another variable.

$$R_{it} - R_{ft} = \alpha_i + \beta_{0i}(R_{mt} - R_{ft}) + \beta_{1i}SMB_t + \beta_{2i}HML_t + \beta_{3i}PR1YR_t + \epsilon_{it}; \quad (6.3)$$

PR1YR$_t$[6] stands for the difference in return between a portfolio of past winners[7] and a portfolio of past losers[8] at time **t**.

For instance, Blake & Timmermann (1998) showed that there exists some evidence of persistence of performance. They found out that among more than 2300 mutual funds for the period 1972 - 1995 in the UK a portfolio composed of the historically best-performing quartile of mutual funds performed better, on average, in the consecutive period then a portfolio composed of the historically worst-performing quartile of funds.

Elton *et al.* (1993) and Elton *et al.* (1999) suggested improving the model by inclusion of a bond index in the mutual fund performance assessment. They claim that some of the funds' managers choose higher yielding and risky bonds, which is not captured by risk-free rate **R$_{ft}$**.

$$R_{it} - R_{ft} = \alpha_i + \beta_{0i}(R_{mt} - R_{ft}) + \beta_{1i}SMB_t + \beta_{2i}HML_t + \beta_{3i}PR1YR_t + \beta_{4i}(R_{bt} - R_{ft}) + \epsilon_{it};$$
$$(6.4)$$

R$_{bt}$ is the return of a government bond index at time **t**.

These were the models used in the most of studies. All of them fall to the category of so called unconditional models. One can also find articles concerning conditional models. They are definitely useful but out the scope of this text. Otten & Bams (2004) presented and described these models.

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[6]The period may vary.

[7]Mutual funds that did perform well during a given period of time (that out-performed the benchmark).

[8]Analogously.

6.2 Survivorship bias

Survivorship bias can be, among other things, caused by excluding mutual funds that perished (most probably due to their poor performance) during the observed period from the dataset.

Brown *et al.* (1992) pointed out that leaving out dead funds leads to an overestimation of average performance.

Many other empirical studies discussing and dealing with this kind of bias. See for instance Rohleder *et al.* (2011); Elton, Gruber, Blake (1996) and Blake & Timmermann (1998). The latter study estimated survivorship bias at level of 0.8% per year for the UK sample. They concluded that since the number is quite large it indicates the importance of having access to the complete set of funds, both surviving and non-surviving ones when assessing performance.

6.3 Literature on emerging market funds' performace

This kind of literature is sort of scarce. It is probably due to relatively short history of mutual fund investments (and collective investment as such) in these countries and also due to the fact that potencial dataset of funds is not comparable to countries such as US, UK and Germany for instance. But some studies that examine emerging markets in terms of mutual funds' performance exists.

Białkowski & Otten (2011) study Polish mutual fund industry. More precisely they observe performance and persistence in performance of sample of 140 mutual funds over the period 2000 - 2008 using multi-factor Carhart model. They also controlled for survivorship bias by including mutual funds that were closed at any point during the sample period. The findings are sumarized below.

 (i) Polish funds underperform their relevant benchmarks.

 (ii) Domestic funds outperform international funds.

 (iii) Both domestic and international funds have exposure outside their region

(= international funds exhibit a home bias and domestic funds also invest internationally).

(iv) Adding back management fees to excess returns leads to significantly positive alphas for domestic funds, international funds produce alphas that are indifferent from zero (this reveals the fact that domestic managers are able to beat the local market, but charge investors too much for that).

(v) Strong persistence in performance is present (the strategy of buying last year's top funds and selling last year's bottom funds yields a return in the range of 13.44 - 17.52% per year).

One can also find empirical paper focused on the Czech Republic. Filip (2011) examines Czech mutual fund industry by using survivorship bias free sample for the period 2004 - 2010. Number of funds ranges from 15 to 25 at the end of the observed period. Author of this paper runs two different regressions, one using the single-factor model and the other using four-factor Carhart model. Prague Stock Exchange Index (PX) was picked as an equity benchmark in this study. The author concluded:

(i) According to Jensen's alphas and Carhart measures, the funds had slightly better performance than the benchmark. However, the majority of results was statistically insignificant.

(ii) The momentum effect was insignificant with reference to fund performance. fund performance.

(iii) Low values of survivorship bias of equity funds in the Czech Republic could allow to exclude non-survived entities from the study.

(iv) Slight outperformance of some funds is caused rather by market factors than managerial skills.

Chapter 7

Data description

The data sample used in this thesis consists of data for selected Czech and Polish mutual funds that are further divided into four and three categories for the Czech Republic and Poland respectively. Total number of observed funds is 42[1].

We employ the following data for the analysis:

1. **Monthly NAV**[2] for time period from October 31, 2006 to July 5, 2013[3].

2. **Monthly rates of risk-free assets**

3. **Management fees**

4. **Entrance/Purchase fees**[4]

The NAVs are net of fees and in local currency.

Data for NAV of mutual funds was obtained from the *Morningstar.com* database in case of Czech mutual funds and from the *mojeFundusze.pl* database in case of Polish mutual funds.

NAVs for benchmarks[5] were taken from the *Morningstar.com* and the *Bloomberg Professional* database was used as a source of the risk-free assets' values.

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[1]25 of Czech and 17 of Polish mutual funds that existed over the whole time period.

[2]Net Asset Value at the end of the trading day.

[3]This period slightly differs for particular categories due to data (un)availability for some benchmark indices.

[4]Redemption fees are not included as mutual funds in the sample do not charge them.

[5]Data for Warsaw Stock Exchange WIG Index were obtained from *mojeFundusze.pl*.

Information about management and entrance/purchase fees was extracted from the funds' info lists available on the websites of corresponding investment companies or webpages such as *Analizy.pl*, *Fundusze.wp.pl*, *Mesec.cz*, *Penize.cz* and *Penizenavic.cz*.

Information about benchmark indices can be found on *Bank of America Merril Lynch*[6] and *MSCI*[7] websites.

7.1 Czech funds

7.1.1 Equity mutual funds - Geographic focus: Europe

ISČS Sporotrend
ČSOB akciový fond - Střední a Východní Evropa
Raiffeisen-Český akciový fond
ING International Český akciový fond
Conseq Invest Akciový
IKS Akciový PLUS
KB Akciový

Benchmark: MSCI EM Europe TR CZK
Risk-free asset: German 2-Year Government bond yields

7.1.2 Equity mutual funds - Geographic focus: Global

ISČS GLOBAL STOCKS FF
ISČS TOP STOCKS
ČSOB akciový mix
Fond globálních značek otevřený podílový fond ČP INVEST investiční společnost, a.s.
Pioneer - akciový fond

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[6]http://www.mlindex.ml.com
[7]http://www.msci.com/

Benchmark: MSCI ACWI TR CZK

Risk-free asset: US 2-Year Government bond yields

7.1.3 Bond mutual funds - Geographic focus: Czech Republic

ISČS Sporobond

ČSOB bond mix

Raiffeisen-Český dluhopisový fond

Raiffeisen-Český fond konzervativních investic

ING International Český fond obligací

Pioneer - obligační fond

KB Dluhopisový

Conseq Invest Dluhopisový

Benchmark: BofAML Czech Govt TR CZK

Risk-free assets: Czech 2-Year Government bond yields

7.1.4 Bond mutual funds - Geographic focus: Europe

ISČS Sporoinvest

ISČS Trendbond

IKS Dluhopisový PLUS

Conseq Invest Dluhopisů Nové Evropy

Benchmark: BofAML Em Europe Government TR CZK

Risk-free assets: German 2-Year Government bond yields

7.2 Polish funds

7.2.1 Equity mutual funds - Geographic focus: Europe

Pioneer Akcji Europejskich FIO

Arka BZ WBK Akcji Środkowej i Wschodniej Europy FIO

PKO Akcji Nowa Europa FIO

SKOK Parasol FIO subfundusz SKOK Akcji

Benchmark: MSCI EM Europe Index TR PLN
Risk-free assets: German 2-Year Government bond yields

7.2.2   Equity mutual funds - Geographic focus: Global

QUEAGRE PW Equity
Arka BZ WBK sub Akcji FIO
Idea Parasol FIO subfundusz Akcji
Allianz FIO subfundusz Akcji Plus

Benchmark: MSCI All Country World Index TR PLN, Warsaw Stock Exchange WIG Index
Risk-free assets: US 2-Year Government bond yields

7.2.3   Bond mutual funds - Geographic focus: Poland

KBC Portfel VIP subfundusz Obligacyjny SFIO
Arka BZ WBK Obligacji Skarbowych FIO
BPH FIO Parasolowy subfundusz Obligacji 1
ING SFIO Obligacji 2 A
KBC Parasol FIO subfundusz Papierów Dłużnych
SKOK Parasol FIO subfundusz SKOK Obligacji
Pioneer FIO subfundusz Pioneer Lokacyjny FIO
Skarbiec FIO subfundusz Instrumentów Dłuznych Skarbiec-Obligacja
UniFundusze FIO subfundusz UniKorona Obligacje

Benchmark: BoA ML Polish Government Bonds Index TR PLN
Risk-free asset: Polish 2-Year Government bond yields

Chapter 8

Methodology

Most mutual fund empirical papers mentioned in the literature the author studied prior to this analysis make use of a CAPM based four-factor Carhart model. This approach is really sophisticated and is able to produce more precise results as it addresses also effects of different investment styles. To be more accurate, it includes variables that allows the model to capture effects of funds' capitalization, book-to-market ratio and last but not least the Jegadeesh & Titman (1993) momentum anomaly.

Unfortunately, since we are limited by our dataset we apply the CAPM based single-factor(index) model:

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \epsilon_{it}; \tag{8.1}$$

This model assumes that a fund's investment behaviour can be approximated using only one single market index. The author is aware of the fact that this could sort of influence results of the entire analysis. On the other hand, this model should be sufficient for getting a notion about how Czech and Polish mutual funds stand compared to benchmark.

To make the analysis broader, we run three different regressions[1] using the statistical software STATA.

1. We regress monthly performance of given fund on monthly performance of appropriate benchmark[2]

2. We add back fees to see if managers are actually able to beat the market.

3. In the last regresion the Sharpe ratios[3] are used instead of performance measures

8.1 Capital Asset Pricing Model

The CAPM describes the relationship between risk and expected return and is used for pricing of risky securities. The CAPM was introduced by Treynor (1961, 1962), Sharpe (1964), Lintner (1965) and Mossin (1966) who built on the earlier work of Harry Markowitz on diversification and modern portfolio theory[4].

The CAPM can be expressed by the following equation:

$$E(r_i) = r_f + [E(r_m) - r_f]\beta_i; \tag{8.2}$$

$\mathbf{E(r_i)}$ is the expected return of the market,
$\mathbf{r_f}$ represents rate of risk-free asset,
$\mathbf{E(r_m)}$ is the expected return of the market,
$\mathbf{E(r_m)} - \mathbf{r_f}$ stands for so called *market premium*[5],
$\beta_\mathbf{i}$ is the systematic risk or *Beta*.

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[1]Ordinary least squares (OLS) regressions.
[2]Monthly performace is computed from the NAVs and is expressed as percentage change; Both variables are reduced by risk-free asset rate as it is stated in the model.
[3]To get risk-adjusted mutual fund's performance.
[4]*Source:* Wikipedia.org; Investopedia.com.
[5]The difference between the expected market rate of return and the risk-free rate of return.

Beta describes how a stock's return varies with the return of the market (sensitivity of the rate of return with regard to market moves), mathematically:

$$\beta_i = \frac{Cov(r_i, r_m)}{Var(r_m)};$$ (8.3)

$\mathbf{Cov(r_i, r_m)}$ is *covariance* between the return of the stock/fund and the return of the benchmark/market index,
$\mathbf{Var(r_i, r_m)}$ or $\sigma^2(\mathbf{r_m})$ is *variance* of benchmark/market index return.

$\beta < 0$: asset generally moves in the opposite direction as compared to the market index,
$\beta = 0$: movement of the asset is uncorrelated with the movement of the benchmark,
$0 < \beta < 1$: positive relation between change in rate of return of a security/fund and the market/benchmark (low sensitivity),
$\beta = 1$: security's/fund's rate of return moves together with the market/benchmark,
$\beta > 1$: positive relation between change in rate of return of a security/fund and the market/benchmark (high sensitivity).

8.1.1 Assumptions of CAPM

The CAPM model requires some assumptions to be held, they are listed below:

1. Investors aim to maximize economic utilities.

2. Investors are rational and risk-averse.

3. Investors are price takers[6].

4. Investors are broadly diversified across a range of investments.

5. All investors can lend or borrow for same risk free rate existing on the capital market.

---

[6]Investors cannot influence prices.

6. There are no transaction costs and taxes.

7. All the assets are infinitely divisible.

8. There is no inflation.

9. Capital market is efficient, information is freely and instantly available to all investors.

10. Investors have homogenous expectations (they have the same attitudes regard to the expected returns, standard deviations and covariances of securities).

8.2 Performace measures

Two performance measures are used within the analysis.

8.2.1 Jensen's alpha

As mentioned in the Chapter 6 in section Mutual fund performance models the intercept of the very first model α_i is called the Jensen's alpha.

Jensen's alpha is the measure that helps to determine if a fund/portfolio earns the proper return in regard to its level of risk. Positive Jensen's alpha means that the fund/portfolio earns excess return, in other words, positive Jensen's alpha indicates a fund manager was able to find stocks that outperformed the market/benchmark in a given period, it shows his or her investment skill. This ability is proven in case one can conclude that the intercept α_i is significantly above zero. If the intercept is equal to zero (or negative) a fund's/portfolio's rate of return did not reach the performance of given benchmark/market - this is not a good news for investors as they pay relatively high fees to investment companies.

8.2.2 Sharpe's ratio

Sharpe ratio aslo referred to as reward-to-variability ratio measures risk-adjusted performance of given and was first introduced by William Sharpe. The higher a fund's Sharpe ratio, the better its risk-adjusted performance has been. A negative Sharpe ratio indicates that a risk-less assets would perform better than the security being analyzed[7].

Sharpe ratio formula is (for given *mutual fund* and appropriate *benchmark* respectively):

$$SR_{fund} = \frac{R_{it} - R_{ft}}{\sigma_{R_{it}}}; \tag{8.4}$$

$\mathbf{R_{it}}$ stands for rate of return of a fund,
$\mathbf{R_{ft}}$ represents rate of risk-free asset,
$\sigma_{R_{it}}$ is standard deviation of the fund.

$$SR_{benchmark} = \frac{R_{mt} - R_{ft}}{\sigma_{R_{mt}}}; \tag{8.5}$$

$\mathbf{R_{mt}}$ is rate of return of a benhmark,
$\mathbf{R_{ft}}$ represents rate of risk-free asset,
$\sigma_{\mathbf{R_{mt}}}$ stands for standard deviation of the benchmark.

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[7]*Source:* Investopedia.com.

8.3   Total shareholder costs

We did not have access to information about mutual funds' TER[8] thus the author calculated so called *Total shareholder costs* (TSC) ratio in a following way (for *equity* and *bond* funds respectively):

$$TSC_{equity}{}^9 = Management fee + Entrance fee/5 + Redemption fee/5 \quad (8.6)$$

$$TSC_{bond}{}^{10} = Management fee + Entrance fee/3 + Redemption fee/3 \quad (8.7)$$

The average monthly fees for particular benchmarks used in the analysis where derived from the empirical study Khorana, Servaes, Tufano (2008) *Mutual fund fees around the world.* Fees for Czech and Polish government bond fund categories where further multiplied by coeficient of 2/3 since the author assumess that costs of buying (investing in) government bonds are minimal.

All fees were then divided by 12 to get mothly data.

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[8]Total expense ratio, see Fee structure.

[9]The denominator is equal to 5 as recommended investment horizon is 5+ years for equity mutual funds.

[10]The denominator is equal to 3 as recommended investment horizon is 3+ years for bond mutual funds.

Chapter 9

Empirical results

This chapter reports results of the three regressions carried out for each group of mutual funds and described in the previous chapter. Analysis was executed using statistical software STATA and that is why the results are presented in a form of the STATA output with a commentary.

9.1 Summary statistics

9.1.1 Czech mutual funds

First of all, let's start with basic summary statistics of particular categories:

Table 9.1: Summary statistics: Equity Global - CZ

Variable	Obs	Mean	Std. Dev.	Min	Max
EquityGL	405	-.0124399	.0609856	-.3484409	.2136778
Benchmark	405	-.0119167	.0486098	-.1620615	.0859411

Czech mutual funds investing mostly in Global equity securities.

Table 9.2: Summary statistics: Equity Europe - CZ

Variable	Obs	Mean	Std. Dev.	Min	Max
EquityEurope	406	-.0066025	.0744011	-.3637439	.2421885
Benchmark	406	-.0020185	.0791803	-.3177242	.1940299

Czech mutual funds investing mostly in European equity securities.

Table 9.3: Summary statistics: Czech Bonds - CZ

Variable	Obs	Mean	Std. Dev.	Min	Max
CZBonds	464	-.0128894	.0155663	-.0817963	.0300503
Benchmark	464	-.0106771	.0178172	-.0498822	.0353753

Czech mutual funds investing mostly in Czech debt securities.

Table 9.4: Summary statistics: European Bonds - CZ

Variable	Obs	Mean	Std. Dev.	Min	Max
EUBonds	232	-.0054342	.0226188	-.1733841	.0557398
Benchmark	232	-.0038109	.0260667	-.0952945	.048537

Czech mutual funds investing mostly in European debt securities.

9.1.2 Polish mutual funds

Table 9.5: Summary statistics: Equity Global - PL

Variable	Obs	Mean	Std. Dev.	Min	Max
EquityGL	252	-.0087491	.0698588	-.2979971	.23121
BenchmWRL	252	.0017668	.0379513	-.1270282	.0644241
BenchmWIG	252	-.047033	.0714748	-.3103865	.1514722

Polish mutual funds investing mostly in Global equity securities.

Table 9.6: Summary statistics: Equity Europe - PL

Variable	Obs	Mean	Std. Dev.	Min	Max
EquityEU	284	-.0163716	.0658702	-.3528111	.1999521
Benchmark	284	-.014046	.0754509	-.2777298	.1760305

Polish mutual funds investing mostly in European equity securities.

Table 9.7: Summary statistics: Polish Bonds - PL

Variable	Obs	Mean	Std. Dev.	Min	Max
PLBonds	405	-.0394289	.0111411	-.0716423	.012003
Benchmark	405	-.0384218	.0121649	-.0601063	.0039882

Polish mutual funds investing mostly in Polish debt securities.

In the prior paragraphs, one had chance to see fairly expected figures. The least volatile are rates of return of mutual funds investing in bonds and on the other hand, mutual funds investing in equity/stocks exhibit greater rate of return fluctuations and thus are considered to be riskier securities. This relatively high volatility is mostly caused and influenced by current economic situation and the sentiment present on capital markets.

9.2 STATA outputs

Almost for all groups of mutual funds, we ran regressions with *heteroskedasticity robust standard errors* as given data exhibited heteroskedasticity[1]. We tested heteroskedasticity using command **hettest** in STATA. How to decide whether the heteroskedasticity is present or not is pretty straightforward, see next examples.

In the following outputs *cons_* represents **Jensen's alpha** for first two regression types see Chapter 8 and **Sharpe ratio coefficient** in case of the third regression type.

---

[1]Since most of the data exhibited heteroskedastcity we will make a remark only in case of non-heteroskedasticity robust standard errors regression.

Figure 9.1: Heteroskedastic standard errors

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
        Ho: Constant variance
        Variables: fitted values of PLBonds

        chi2(1)      =     25.71
        Prob > chi2  =    0.0000 ***
```

*** Indicates heteroskedasticity is present at 1% significance level.

Figure 9.2: Non-heteroskedastic standard errors

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
        Ho: Constant variance
        Variables: fitted values of EquityGL

        chi2(1)      =      0.75
        Prob > chi2  =    0.3880 *
```

* Indicates heteroskedasticity is not present even if we consider 10% significance level.

9.2.1   Czech mutual funds

Table 9.8: (a) Global Equity - CZ

```
                                         Number of obs =      405
                                         F(  1,   403) =   325.21
                                         Prob > F      =   0.0000
                                         R-squared     =   0.6035
                                         Root MSE      =   .03845
```

		Robust			
EquityGL	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
Benchmark	.974636	.054046	18.03	0.000	.8683886 1.080883
_cons	-.0008254	.0019146	-0.43	0.667 *	-.0045892 .0029384

First type of regression, see Chapter 8; * Indicates alpha is statistically insignificant. It can be assumed that the performance of the mutual funds is not considerably different as compared to benchmark.

Table 9.9: (b) Global Equity - CZ

```
                                         Number of obs =      405
                                         F(  1,   403) =   325.21
                                         Prob > F      =   0.0000
                                         R-squared     =   0.6035
                                         Root MSE      =   .03845
```

		Robust			
EquityGLFees	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
BenchmFees	.974636	.054046	18.03	0.000	.8683886 1.080883
_cons	-.0007874	.0019021	-0.41	0.679 *	-.0045267 .0029519

Second type of regression, see Chapter 8; * Indicates alpha is statistically insignificant. It can be assumed that the performance (including fees) of the mutual funds is not considerably different as compared to benchmark.

Table 9.10: (c) Global Equity - CZ, Sharpe ratio

```
                                          Number of obs =       405
                                          F(  1,   403) =    325.21
                                          Prob > F      =    0.0000
                                          R-squared     =    0.6035
                                          Root MSE      =    .63046
```

FundSR	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]
BenchmarkSR	.776853	.0430785	18.03	0.000	.6921664	.8615396
_cons	-.0135347	.0313938	-0.43	0.667 *	-.0752508	.0481815

Third type of regression, see Chapter 8; * Indicates Sharpe ratio coefficient is statistically insignificant. It can be assumed that the risk-adjusted performance of the mutual funds is not considerably different as compared to benchmark.

Table 9.11: (a) European Equity - CZ

```
                                          Number of obs =       406
                                          F(  1,   404) =    484.25
                                          Prob > F      =    0.0000
                                          R-squared     =    0.7149
                                          Root MSE      =    .03978
```

EquityEurope	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]
Benchmark	.7944684	.0361029	22.01	0.000	.7234955	.8654413
_cons	-.0049989	.001957	-2.55	0.011 ***	-.0088461	-.0011517

First type of regression, see Chapter 8; *** Indicates alpa is statistically significant at 2.5% significance level. Alpha is slightly negative. It can be concluded that the performance of the mutual funds is (slightly) worse as compared to benchmark.

Table 9.12: (b) European Equity - CZ

```
                                    Number of obs =      406
                                    F( 1,   404) =   484.33
                                    Prob > F      =   0.0000
                                    R-squared     =   0.7149
                                    Root MSE      =   .03978
```

EquityEUFees	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmFees	.7944684	.0360997	22.01	0.000	.7235016	.8654352
_cons	-.004109	.0019714	-2.08	0.038 **	-.0079846	-.0002334

Second type of regression, see Chapter 8; ** Indicates alpa is statistically significant at 5% significance level. Alpha is again slightly negative. It can be concluded that the performance (when we added back the monthly fees) of the mutual funds is **still**l (slightly) worse as compared to benchmark.

Table 9.13: (c) European Equity - CZ, Sharpe ratio

```
                                    Number of obs =      406
                                    F( 1,   404) =   484.25
                                    Prob > F      =   0.0000
                                    R-squared     =   0.7149
                                    Root MSE      =   .53463
```

FundSR	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmarkSR	.8455016	.038422	22.01	0.000	.7699697	.9210335
_cons	-.0671882	.0263035	-2.55	0.011 ***	-.118897	-.0154794

Third type of regression, see Chapter 8; *** Indicates Sharpe ratio coefficient is statistically significant at 2.5% significance level. Since the Sharpe ratio coefficient is negative, it can be concluded that the risk-adjusted performance of the mutual funds is worse as compared to benchmark.

Table 9.14: (a) Czech Bonds - CZ

```
                                    Number of obs =      464
                                    F(  1,    462) = 1054.85
                                    Prob > F       =  0.0000
                                    R-squared      =  0.7891
                                    Root MSE       =  .00716
```

CZBonds	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Benchmark	.7761031	.023896	32.48	0.000	.7291448	.8230613
_cons	-.0046029	.0003924	-11.73	0.000 ***	-.0053739	-.0038318

First type of regression, see Chapter 8; *** Indicates alpha is statistically significant at 1% significance level. Alpha is also slightly negative meaning the performance of the mutual funds is (slightly) worse as compared to benchmark.

Table 9.15: (b) Czech Bonds - CZ

```
                                    Number of obs =      464
                                    F(  1,    462) = 1047.03
                                    Prob > F       =  0.0000
                                    R-squared      =  0.7873
                                    Root MSE       =  .00719
```

CZBondsFees	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmFees	.7761031	.023985	32.36	0.000	.7289699	.8232363
_cons	-.0038733	.0003916	-9.89	0.000 ***	-.0046428	-.0031037

Second type of regression, see Chapter 8; *** Indicates alpha is statistically significant at 1% significance level. Alpha is also slightly negative meaning the performance of the mutual funds is (slightly) worse as compared to benchmark. The mutual funds' performace registered small improvement but **still** lags behind the benchmark.

Table 9.16: (c) Czech Bonds - CZ, Sharpe ratio

```
                                         Number of obs =       464
                                         F(  1,   462) = 1054.85
                                         Prob > F       =  0.0000
                                         R-squared      =  0.7891
                                         Root MSE       =    .4597
```

FundSR	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmarkSR	.8883293	.0273514	32.48	0.000	.8345808	.9420778
_cons	−.2956943	.0252061	−11.73	0.000 ***	−.345227	−.2461615

Third type of regression, see Chapter 8; *** Indicates Share ratio coefficient is statistically significant at 1% significance level. Sharpe ratio coefficient is strongly negative indicating that the risk-adjusted performance of the mutual funds is far below the risk-adjusted performance of selected benchmark.

Table 9.17: (a) European Bonds - CZ

```
                                         Number of obs =       232
                                         F(  1,   230) =   60.60
                                         Prob > F       =  0.0000
                                         R-squared      =  0.5287
                                         Root MSE       =   .01556
```

EUBonds	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Benchmark	.6309271	.0810511	7.78	0.000	.4712296	.7906246
_cons	−.0030298	.0009308	−3.25	0.001 ***	−.0048639	−.0011958

First type of regression, see Chapter 8; *** Indicates alpha is statistically significant at 1% significance level. Alpha is also slightly negative meaning the performance of the mutual funds is (slightly) worse as compared to benchmark.

Table 9.18: (b) European Bonds - CZ

```
                                        Number of obs =      232
                                        F(  1,   230) =    60.82
                                        Prob > F      =   0.0000
                                        R-squared     =   0.5278
                                        Root MSE      =   .01559
```

EUBondsFees	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmFees	.6309271	.0809047	7.80	0.000	.471518	.7903362
_cons	-.002392	.0009508	-2.52	0.013 ***	-.0042654	-.0005186

Second type of regression, see Chapter 8; *** Indicates alpha is statistically significant at 2.5% significance level. Alpha is also slightly negative meaning the performance of the mutual funds is (slightly) worse as compared to benchmark. The mutual funds' performace registered small improvement but **still** lags behind the benchmark.

Table 9.19: (c) European Bonds - CZ, Sharpe ratio

```
                                        Number of obs =      232
                                        F(  1,   230) =    60.60
                                        Prob > F      =   0.0000
                                        R-squared     =   0.5287
                                        Root MSE      =   .68802
```

FundSR	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmarkSR	.7271026	.0934061	7.78	0.000	.5430616	.9111435
_cons	-.1339514	.0411535	-3.25	0.001 ***	-.2150374	-.0528654

Third type of regression, see Chapter 8; *** Indicates Share ratio coefficient is statistically significant at 1% significance level. Sharpe ratio coefficient is negative meaning the risk-adjusted performance of the mutual funds is worse than the risk-adjusted performance of selected benchmark.

9.2.2 Polish mutual funds

Table 9.20: (a) Global Equity - PL, World benchmark

Source	SS	df	MS			
Model	.176171233	1	.176171233			
Residual	1.04877231	250	.004195089			
Total	1.22494354	251	.004880253			

				Number of obs =	252
				F(1, 250) =	41.99
				Prob > F =	0.0000
				R-squared =	0.1438
				Adj R-squared =	0.1404
				Root MSE =	.06477

EquityGL	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmWRL	.6980784	.1077227	6.48	0.000	.4859187	.9102381
_cons	-.0099825	.0040845	-2.44	0.015 ***	-.018027	-.001938

First type of regression[2], see Chapter 8; *** Indicates alpha is statistically significant at 2.5% significance level. Alpha is slightly negative which indicates the same interpretation as before (the performance of the mutual funds is worse as compared to benchmark), but what is important here is the value of **R-squared** which is fairly low. The author assumes it is because the WORLD benchmark is not suitable for this regression as Polish Global Equity mutual funds invest most of the pooled capital in stocks quoted on the Warsaw Stock Exchange. In the regression below the WIG market index was used instead.

Table 9.21: (a) Global Equity - PL, WIG benchmark

				Number of obs =	252
				F(1, 250) =	405.76
				Prob > F =	0.0000
				R-squared =	0.7517
				Root MSE =	.03488

EquityGL	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmWIG	.8474233	.0420694	20.14	0.000	.7645677	.9302788
_cons	.0311077	.0031197	9.97	0.000 ***	.0249634	.037252

First type of regression, see Chapter 8; *** Indicates alpha is statistically significant at 1% significance level. Now, one can see the big difference. Firstly, **R-squared** embodies reasonable value. Secondly, Polish Global Equity mutual funds (that invest predominantly in Poland) outperformed the benchmark! Alpha is significant and strongly positive.

---

[2]No heteroskedasticity is present.

Table 9.22: (b) Global Equity - PL, World benchmark

```
      Source |       SS           df       MS              Number of obs =     252
-------------+----------------------------------           F(  1,   250) =   41.99
       Model |  .176171233         1  .176171233           Prob > F      =  0.0000
    Residual |  1.04876496       250   .00419506           R-squared     =  0.1438
-------------+----------------------------------           Adj R-squared =  0.1404
       Total |  1.22493619       251  .004880224           Root MSE      =  .06477
```

```
  EquityGLFees |      Coef.   Std. Err.       t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
     BenWLDFees |   .6980784   .1077223      6.48   0.000     .4859194    .9102374
          _cons |  -.0073505   .0040952     -1.79   0.074 *   -.015416    .0007151
```

Second type of regression[3], see Chapter 8; * Indicates alpha is statistically significant at 10% significance level. The results are pretty much the same as in the *(a) Global Equity - PL, World benchmark case.*

Table 9.23: (b) Global Equity - PL, WIG benchmark

```
                                                          Number of obs =     252
                                                          F(  1,   250) =  407.35
                                                          Prob > F      =  0.0000
                                                          R-squared     =  0.7517
                                                          Root MSE      =  .03488
```

```
               |               Robust
  EquityGLFees |      Coef.   Std. Err.       t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
     BenWIGFees |   .8474233   .0419871     20.18   0.000     .7647297    .9301168
          _cons |   .0333335   .0030698     10.86   0.000 *** .0272875    .0393795
```

Second type of regression, see Chapter 8; *** Indicates alpha is statistically significant at 1% significance level. The results are again pretty much the same as in the *(a) Global Equity - PL, WIG benchmark case.* The outperformace is even stronger, as expected.

---

[3]No heteroskedasticity is present.

Table 9.24: (c) Global Equity - PL, World benchmark, Sharpe ratio

Source	SS	df	MS		
Model	36.0987898	1	36.0987898		
Residual	214.90121	250	.859604841		
Total	251	251	1		

				Number of obs =	252
				F(1, 250) =	41.99
				Prob > F =	0.0000
				R-squared =	0.1438
				Adj R-squared =	0.1404
				Root MSE =	.92715

FundSR	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
BenWLDSR	.3792359	.0585211	6.48	0.000	.2639787 .4944932
_cons	-.1428957	.0584684	-2.44	0.015 ***	-.2580491 -.0277423

Third type of regression[4], see Chapter 8; *** Indicates Share ratio coefficient is statistically significant at 2.5% significance level. Sharpe ratio coefficient is negative meaning the risk-adjusted performance of the mutual funds is worse than risk-adjusted performance of selected benchmark. **R-squared** is relatively low again.

Table 9.25: (c) Global Equity - PL, WIG benchmark, Sharpe ratio

				Number of obs =	252
				F(1, 250) =	416.93
				Prob > F =	0.0000
				R-squared =	0.7599
				Root MSE =	.491

FundSR	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]
BenWIGSR	.9048245	.0443132	20.42	0.000	.8175498 .9920993
_cons	-.1415436	.0308556	-4.59	0.000 ***	-.2023136 -.0807736

Third type of regression, see Chapter 8; *** Indicates Share ratio coefficient is statistically significant at 1% significance level. Sharpe ratio coefficient is negative meaning the risk-adjusted performance of the mutual funds is worse than risk-adjusted performance of selected benchmark. **R-squared** has been corrected by using WIG as benchmark.

---

[4]No heteroskedasticity is present.

The inference of the following regressions is analogous to prior examples. If any extraordinary situation occurs the broader explanation will be provided.

Table 9.26: (a) European Equity - PL

```
                                              Number of obs =      284
                                              F(  1,   282) =   171.53
                                              Prob > F      =   0.0000
                                              R-squared     =   0.5746
                                              Root MSE      =   .04304
```

EquityEU	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Benchmark	.661796	.0505299	13.10	0.000	.5623323	.7612597
_cons	-.007076	.0025363	-2.79	0.006 ***	-.0120686	-.0020835

First type of regression, see Chapter 8; *** Indicates alpha is statistically significant at 1% significance level.

Table 9.27: (b) European Equity - PL

```
                                              Number of obs =      284
                                              F(  1,   282) =   171.43
                                              Prob > F      =   0.0000
                                              R-squared     =   0.5748
                                              Root MSE      =   .04302
```

EquityEUFees	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmFees	.661796	.0505452	13.09	0.000	.5623022	.7612897
_cons	-.0043235	.0025271	-1.71	0.088 *	-.009298	.0006509

Second type of regression, see Chapter 8; * Indicates alpha is statistically significant at 10% significance level.

Table 9.28: (c) European Equity - PL, Sharpe ratio

```
                                      Number of obs =      284
                                      F(  1,   282) =   171.53
                                      Prob > F       =   0.0000
                                      R-squared      =   0.5746
                                      Root MSE       =   .65335
```

FundSR	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
BenchmarkSR	.7580524	.0578794	13.10	0.000	.644122	.8719828
_cons	-.1074238	.0385049	-2.79	0.006 *** -.1832173	-.0316303

Third type of regression, see Chapter 8; *** Indicates Share ratio coefficient is statistically significant at 1% significance level.

Table 9.29: (a) Polish Bonds - PL

```
                                      Number of obs =      405
                                      F(  1,   403) =   581.88
                                      Prob > F       =   0.0000
                                      R-squared      =   0.7772
                                      Root MSE       =   .00526
```

PLBonds	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Benchmark	.8074091	.0334716	24.12	0.000	.7416084	.8732099
_cons	-.0084067	.0013699	-6.14	0.000 *** -.0110998	-.0057137

First type of regression, see Chapter 8; *** Indicates alpha is statistically significant at 1% significance level.

Table 9.30: (b) Polish Bonds - PL

```
                                        Number of obs =       405
                                        F(  1,   403) =    591.22
                                        Prob > F       =    0.0000
                                        R-squared      =    0.7770
                                        Root MSE       =    .00527
```

PLBondsFees	Coef.	Robust Std. Err.	t	P>|t|		[95% Conf. Interval]	
BenchmFees	.8074091	.0332063	24.31	0.000		.74213	.8726882
_cons	-.0071164	.0013359	-5.33	0.000	***	-.0097425	-.0044902

Second type of regression, see Chapter 8; * Indicates alpha is statistically significant at 1% significance level.

Table 9.31: (c) Polish Bonds - PL, Sharpe ratio

```
                                        Number of obs =       405
                                        F(  1,   403) =    581.88
                                        Prob > F       =    0.0000
                                        R-squared      =    0.7772
                                        Root MSE       =    .47257
```

FundSR	Coef.	Robust Std. Err.	t	P>|t|		[95% Conf. Interval]	
BenchmarkSR	.8816067	.0365475	24.12	0.000		.8097592	.9534543
_cons	-.7545722	.1229588	-6.14	0.000	***	-.9962929	-.5128515

Third type of regression, see Chapter 8; *** Indicates Share ratio coefficient is statistically significant at 1% significance level. Sharpe ratio coefficient is strongly negative indicating that the risk-adjusted performance of the mutual funds is far below the risk-adjusted performance of selected benchmark.

Chapter 10

Conclusion

In this study we describe and analyze Collective investment in the CEE region.

In general, devepoled world is far ahead the emerging markets in terms of development of the mutual fund industry and the CEE region is not an exemption. It will take some time and definitely some regulation changes to get abreast of lets say United Kingdom, Germany or United States.

We have chosen the Czech Republic and Poland for the comparison.

The economic crisis affected this industry markedly (especially in our countries) as people/investors tend to keep their investment capital on bank accounts instead of investing it into mutual funds. Anyway, recently we have been witnesses of growth in households' investements into mutual funds (within the CEE region). For the accurate statistics see Chapter 3. These investments are predicted to grow even more when consequences of economic recession disappears and GDP increases.

The results of our empirical analysis are not surprising except for finding that Polish mutual funds investing in a global equity/stocks were able to beat a market proxy (benchmark) at a substantial rate of **0.0311** and **0.0333** (with statistical significance at 1% significance level) net and gross of monthly fees respectively. All the other mutual fund categories observed laged behind the benchmark (considering all measures - Jensen's alpha net of monthly fees, Jensen's alpha gross of monthly fees and Sharpe ratio) during examined period.

When we compare the results to those of studies discussed in Section 6.3 we will see only partial consistency (rather inconsistency):

(i) Polish funds underperform their relevant benchmarks (except for **Polish global equity funds investing predominantly in Poland**).

(ii) Adding back monthly fees to excess returns does NOT lead to positive alphas.

(iii) Analysis of Czech mutual funds brings mostly statistically significant results.

(iv) Czech funds (managers) were not able to beat the benchmarks (neither net nor gross of monthly fees).

Although the results are statistically significant the author thinks the study could be further improved by employing more sophisticated models as mentioned in Chapter 6 and by collecting more data that would be survivorship bias free. The master thesis is suitable for more comprehensive analysis of the topic/issue.

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