

Pension Funds' Performance in Strongly Regulated Industries in Central Europe: Evidence from Poland and Hungary

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Abstract

This paper presents an analysis of pension funds' performance in Poland and Hungary, as Central European countries characterized by strong regulation of their private pension fund industries. The paper contributes to the existing literature in the following ways. First, it is among the first papers to provide empirical evidence on the performance of pension funds in the two Central European countries. Second, it complements the available evidence on performance of pension funds operating in lax regulatory environments and guided by "prudent man" laws by analyzing the performance of pension funds acting under much stricter regulations. Third, since the details of the regulations differ across the countries', the paper will provide valuable evidence on the effect of the regulations on pension funds' portfolio composition in these countries. Fourth, we believe that the paper's findings will have important implications for policy makers and pension fund managers in the Central European countries.

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1. Introduction

Following the proposal of the World Bank (1994), in the end of the 1990s pay-as-you-go pension systems in Central European (CE) countries have been complemented by a capital-market-based element in the form of privately managed pension funds. The pension reform aimed to facilitate accumulation of future pensions and reduce the fiscal burden resulting from excessive pension liabilities.

Since investment in private pension funds in these countries is mandatory, investment limits and performance regulations on pension funds' activities were imposed to avoid losses of contributed money and guarantee future pension payments. In addition, regulation was expected to facilitate trust and acceptance of the new pension system, as well as to contribute to the development of capital markets of the respective countries. Presence of such strict investment regulations constitutes a peculiar feature of the environment, in which Central European pension funds operate, distinguishing it from the environment of many developed financial markets where often only the so-called "prudent man" rule applies. Poland and Hungary – two diverse Central European countries in terms of their economic conditions and their degree and manner of the regulatory framework – are chosen to provide a basis for the present study.

The paper contributes to the existing literature in the following ways. First, it provides empirical evidence on the performance of pension funds in two Central European countries. Second, it complements the available evidence on performance of pension funds operating in lax regulatory environments and guided by "prudent man" laws by analyzing the performance of pension funds acting under much stricter regulations. Third, since in Poland regulations are stricter than in Hungary, the paper will provide valuable evidence on the effect of the regulations on pension funds' portfolio composition in these countries. Fourth, we believe that the paper's findings will have important implications for policy makers and pension fund managers in Central European countries.

We use monthly data on pension fund portfolio returns, returns on local stock and bond market indexes and local Treasury bills. The data allows us to decompose the assets under management into different asset classes. Established performance measures, such as Sharpe ratio, Treynor ratio and Jensen's alpha are used to evaluate funds' performance. To calculate Jensen's alpha, several asset pricing models were estimated: single-factor CAPM, two-factor CAPM (stock and bond market factors), and Henriksson-Merton (1981) and Treynor and Mazuy (1966) timing models. In order to account for varying performance in bull and bear periods we also estimated the time-varying beta model developed by Fabozzi and Francis (1979). All models were estimated using pooled OLS estimator with Newey and West (1987) standard errors.

Firstly, we find that investment limits and performance regulations influence the investment decisions of pension funds. The exact effect depends on the type of the performance evaluation benchmark used. In Poland it leads to similar portfolio compositions of the funds across asset classes, while in Hungary it leads to an excessive investment into government securities. Secondly, we do not find a conclusive evidence of selectivity ability by Polish pension fund managers. Although the estimation results of the basic CAPM show evidence for a selectivity ability of pension fund managers in Poland, the results can not be confirmed once we apply models accounting for timing

ability. In case of Hungarian pension funds we find a strong evidence of underperformance. Finally, we place our findings in a broader context by comparing our results with the results on pension fund performance in selected developed markets. The present results provide further evidence on the development of the pension reforms in the Central European countries and are important for policy makers, fund managers and general public in these countries, as well as for the academics studying pension systems.

2. Pension Fund Industry and Regulatory Framework in Poland and Hungary

As pointed out by Chan-Lau (2005), the main determinants of pension funds' investment performance may be grouped into three categories: investment regulations, investment practices and the ability to diversify the portfolios abroad. Below we review those factors in the context of mandatory pension funds acting on the Polish and Hungarian markets.

The first transfer of money to Polish pension funds took place on May 19, 1999. Due to organizational, as well as financial problems, the majority of Polish pension funds started their activity on the market in June 1999. As of October 1999, the number of active funds rose from 15 to 21. Since 2004, due to acquisitions and a merger, it has been reduced to 15 again. The Polish pension fund market is highly concentrated. In terms of market share, as measured by net assets, the market can be divided into three groups: very large funds (market share higher than 20%), large funds (market share between 5% and 20%) and small funds (market share below 5%). In August 2007, the funds Commercial Union (27%) and ING (23%), representing the group of largest funds, jointly held 50% of the market share. Approximately a further quarter was held by the group of large funds that included PZU (14%) and AIG (8%). The remaining quarter of the market was distributed between 11 small funds with market share below 5%. In August 2007 Polish pension funds held about 49 billion US-\$ of net assets, amounting to 12% of the Polish GDP in 2007 (www.knf.gov.pl).

In addition to the prudent man rules, Polish pension fund managers have to follow quantitative investment limits regulated in the Law on Organisation and Operation of Pension Funds from August 28, 1997. Here we focus on quantitative limits imposed on investment in particular types of assets and do not review the regulations restricting the concentration of holding securities of the same issuer. The overall investment in bonds and bills issued by Treasury and National Bank of Poland is not subject to constraints. A maximum of 40% of the accumulated assets under management may be invested in shares of domestic listed companies, in addition, no more than 25% in investment funds. The investment in bank deposits and foreign assets is limited to a maximum of 20% and 5%, respectively. According to Polish law, investments into derivatives may only be permitted by the Council of Ministers in exceptional cases. During the present sample period pension funds were banned from investing in such assets. Investing into real estate is prohibited (OECD (2006)).

Table 1 provides data on the quantitative limits faced by the Polish pension funds and their actual portfolio composition for the period between April 2002 and August 2007. We provide the average of all pension funds' portfolio shares. The quantitative regulations are deemed responsible for the distribution of shares versus

bonds in the funds' portfolios of about 31% to 64%. The remaining marginal fraction of the portfolios is dispersed across other asset categories. Table 1 reveals that Polish pension funds diversify less than they are allowed by the quantitative investment limits. In particular, the fraction of investment in foreign assets is substantially lower than the legal limit of 5% (www.knf.gov.pl). Diverse reasons might lead to this outcome. An analysis of the underlying portfolios of individual funds shows, that only the four largest funds invest in foreign assets. Smaller funds might refrain from investing abroad due to lack of experience and high information costs associated with such investments.

Table 1. Portfolio Limits on Pension Fund Investment in Selected Asset Categories

Asset Category	Poland		Hungary	
	Investment Limits	Actual Portfolio Share	Investment Limits	Actual Portfolio Share
Equity	40.00	31.57	50.00	9.68
Real estate	0.00	0.00	5.00 directly, 10.00 together with real estate investment funds	
Government bonds	No Limit	63.79	No Limit	75.20
Investment Funds	25.00	0.32	50.00	6.43
Loans	Equal to the investment in the shares of the borrower	0.13	0.00	0.00
Bank Deposits	20.00	3.03	No Limit	0.00
Foreign Assets	5.00	0.57	30.00	N.A.

Note: The table shows the quantitative investment limits and actual shares of assets in the portfolio for Polish and Hungarian pension funds, indicated as % of the pension funds' investment portfolios. The quantitative investment restrictions refer to 2006 for Polish mandatory (open) pension funds and to 2004 for Hungarian mandatory pension funds (OECD (2006)). The actual shares of assets in the portfolios of Polish pension funds are calculated using data provided by www.knf.gov.pl. The shares of assets in Hungarian pension funds portfolios are calculated using the arithmetic average for all pension funds for the period of 1998 to 2004 given in the dataset provided by the PSZAF. Data on investments in foreign assets by Hungarian pension funds is not available.

To guarantee future pension payments, the pension funds' performances are observed, evaluated and compared with the industry's average return on a regular basis

by the Insurance and Pension Funds Supervisory Commission (KNF). Pension funds are required to guarantee a minimum rate of return on their investments. The Polish law defines this mandatory minimum as "the rate of return lower by 50% than the weighted average rate of all funds established for a given period, or the rate of return four percentage points lower than the aforesaid average, whichever is lower". The measure is calculated and announced on a quarterly basis for the previous 36-month period. A rate below the required threshold should be made up from pension funds' reserve account¹. If these assets will not suffice to cover the deficit, it has to be financed by the so-called Guarantee Fund, which was introduced to secure future pension payments² (www.knf.gov.pl).

Mandatory pension funds in Hungary were introduced in January 1998 as a second tier within the new three-tier pension system (World Bank (2007)). Four funds started their activity on the market during the first quarter of 1998. Since 2001 18 mandatory private pension funds have been active on the market. By the end of 2007 they managed 11.5 billion US-\$ of assets (at market prices), which accounted for 7.8 % of Hungarian GDP. The funds had 2.8 bn of members (www.pszaf.hu). The concentration of the Hungarian pension fund market is similar to the one in Poland. At the end of 2005 one very large and four large Hungarian pension funds, holding about 80% of assets, dominated the market, whilst the very large fund held 25% on its own. The remaining 20% of the market was held by 13 small funds. The oligopolistic structure of the Polish and Hungarian pension fund markets is similar to the one in the UK, where 50% of voluntary pension fund assets were held by five managing houses in 2002 (Blake and Timmermann (2002)).

Investment limits in Hungary are somewhat less strict than those in Poland. Holdings in government bonds and bank deposits are not limited. Investment in domestic stocks and investment funds is limited to 50% each, investment in foreign assets is limited to 30% and investment in real estate may reach a maximum of 10%. It is prohibited for pension fund managers to invest in loans (OECD (2006)). Despite the less restrictive limits Hungarian pension fund managers diversify their portfolios even less, which becomes apparent from the data provided in Table 1. More than 75% of assets are invested in government bonds, while only 10% of assets are held in stocks. The large proportion of government bonds in the pension funds' portfolios is likely to be caused by the performance regulation being linked to the performance of Hungarian government bonds. Pension fund managers, striving to meet the performance

¹ Pension funds shall transfer funds to a reserve account amounting up to 0.005% of the value of the managed net assets of the fund. If the fund fails to serve the reserve account they are charged a fine by the supervision authority.

² Such performance regulations in combination with the high concentration of the pension fund industry in Poland can be seen as reasons for herding behavior by Polish pension funds and to similar composition of the funds' portfolios. Voronkova and Bohl (2005) investigate this typical feature of the Polish pension fund market in detail.

requirements, avoid investing in equities, which are associated with more risk. As is the case of Polish pension funds, only minor fractions of the overall portfolios are invested in foreign assets.

In order to ensure the security of future pensions the Hungarian Financial Supervisory Authority (HFSA) monitors the pension funds' performance. Funds are expected to achieve a minimum rate of return, which is defined as 85% of the return on long-term government bonds. Funds failing to achieve the performance target for three consecutive years may be subject to a government enquiry. However, in contrast to Poland, the Hungarian pension fund managers cannot be held liable for not delivering a minimum rate of return since their assets are not kept segregated from the participants' assets. Unlike in Poland, pension funds in Hungary are subject to long-term performance regulations: the pensions that they disburse should be at least at the level of 25% of a comparable public pension benefit on the retirement at the statutory pension age. In particular, after 15 years of participation in a pension fund, the total pension from the first and the second pillar should reach 92% of a corresponding old-style pension.

It should be pointed out that Hungarian pension funds suffer from a lack of sufficiently operate in a relatively small and illiquid stock market. The number of stocks listed on Budapest Stock Exchange fluctuated between 49 and 66 during the sample period. However, the five most traded shares accounted for over 80% of the stock market capitalization and around 90% of its turnover (Budapest Stock Exchange (2006)). This, in combination with the present investment and performance regulations, has resulted in a very high fraction of domestic bonds in the Hungarian pension fund portfolios, which amounted to about 70% during our sample period (Hungarian Financial Supervisory Authority (2005)). Thus the circumstances of the Hungarian stock market, along with the investment regulation, effectively negate the opportunity to invest up to 50% of the portfolio into equities.

Analysis of the portfolio compositions of the pension funds in the two countries shows that pension fund managers heavily invest in government bonds. Pension funds in both countries underutilize limited opportunity to invest in stocks and their investments in other allowed financial instruments are minor, particularly so in Hungary.

3. Performance Measures

To provide a first insight into the investment performance of the pension funds and their ranking Sharpe (1966) and Treynor (1965) ratios are calculated. While the Sharpe ratio considers the total risk of a portfolio, the Treynor ratio takes the systematic risk into account. A well diversified portfolio features a total risk equal to the systematic risk. Thus, through a comparison of the two ratios, a rough estimate of the diversification capability of the managers is possible. An identical ranking of the performance measures indicates a high diversification capability.

Detailed information about the portfolio structure of the individual funds is available for a limited period due to the access to general public information only. Therefore, the analysis is constrained to established unconditional performance measures based on the CAPM. Jensen's (1968) regression:

$$(1) \quad r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \varepsilon_{it}$$

r_{it} is the return of pension fund i at time t , r_{ft} the risk-free rate and r_{mt} the return of the market portfolio. The coefficient α_i indicates Jensen's α of fund i , the coefficient β_i denotes its beta. While a positive and significant α indicates a superior risk-adjusted performance of a fund, a negative value reports an inferior performance assuming that the fund manager potentially does not show stock selection ability, but timing ability (Cesari and Panetta (2002)). Stock selection ability refers to the allocation of funds' assets within different investment instruments, whereas market timing concerns changes of the funds' asset allocation across those instruments.

As was pointed out above, in addition to stocks pension funds' portfolios in both countries contain significant fraction of bonds. To account for the presence of bonds in the pension fund portfolios, we estimate a two-index model that includes both stock and bond returns:

$$(2) \quad r_{it} - r_{ft} = \alpha_i + \beta_{1i}(r_{mt} - r_{ft}) + \beta_{2i}(r_{bt} - r_{ft}) + \varepsilon_{it}$$

The structure of the two-index model can be justified using two different considerations. If a fund is composed out of three portfolios (stocks, bonds and risk-free assets), its return is the weighted average of the returns given by the previously defined portfolios. β_{1i} (β_{2i}) indicates the sensitivity of fund i excess return to a change of the excess return of the stock index (bond index). Given the two beta coefficients the return of a fund is interpreted as its excess return compared to the combination of the stock and bond excess returns. α_i indicates the additive value achieved through active management compared to a passive investment strategy, subject to the same risk (Elton et al. (1993)). Yet, the model may also be seen as a two-factor equilibrium model, with the stock benchmark and the bond benchmark being the factors. In both models (1) and (2), Jensen's α is affected by the information available to the manager. Exclusive availability of security-specific information leaves the measure unbiased. However, if the management resorts to timing information, its value is generally biased downwards (Cesari and Panetta (2002)). In order to capture possible market timing ability of fund managers we apply the approaches by Treynor and Mazuy (1966) and Henriksson and Merton (1981). The Treynor-Mazuy approach is based on the idea that managers are able to predict the market trend and the extent of future excess returns. Thus, a fund manager adapts the beta of the fund continuously to his forecasted market trend. The fraction of the market portfolio held by the managers increases (decreases) when they expect the general stock market to rise (fall). In order to capture the timing ability, Treynor and Mazuy (1966) add the squared excess return of the market portfolio to the basic Jensen regression:

$$(3) \quad r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \gamma_i(r_{mt} - r_{ft})^2 + \varepsilon_{it}$$

$\gamma_i=0$ indicates no timing ability, and $\gamma_i>0$ that the manager has access to and successfully uses timing information, while α_i measures the share of the fund's performance achieved through selectivity. The contribution to the performance of a fund achieved by timing ability corresponds to the product of the γ coefficient and the variance of the excess market return σ_{erm}^2 . The sum of the selection contribution and the timing contribution is equal to the total performance. The Treynor-Mazuy approach may only detect timing ability, when the structure of the estimated model complies with the managers' timing ability. Using a multi-beta-strategy or the three-factor model by Fama and French (1993) may solve this shortcoming (Prather and Middleton (2006)).

The Henriksson-Merton approach (1981) is based on the idea that managers use forecasts of excess market return for the following period, and adjust the beta accordingly. The product of the excess market return and a dummy variable is added to the basic Jensen regression:

$$(4) r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \gamma_i(r_{mt} - r_{ft})D_t + \varepsilon_{it}$$

The dummy variable D_t takes the value 0 if $r_{mt}-r_{ft}>0$ and -1 if $r_{mt}-r_{ft}\leq 0$. A positive value of γ_i indicates that the manager has timing ability. The Henriksson-Merton approach regards time-varying beta-factors of the Jensen model as evidence for timing activity. However, instability of this risk-measure is not necessarily due to timing activities. Another critical assumption of the approach is that managers only take the forecasted trend of the market return into account and not the absolute level of the excess return in order to determine the beta. The performance achieved by timing and selectivity may be biased, if their behavior does not correspond to the assumptions of the model.

Since we are interested in the performance of the whole sector, rather than in the individual performance of the pension funds, we report the results of the models estimated using pooled ordinary least squares (OLS). Results for the individual funds are available upon request. Given the small samples, pooling information across funds has the potential advantage of gaining power compared to estimates based on a fund-by-fund analysis (Chevalier and Ellison (1999)). We correct the standard errors by using the method proposed by Newey and West (1987) with a lag length of three in order to account for possible heteroscedasticity and serial correlation. The statistical inference is strengthened by calculating bootstrapped standard errors, based on a resample of the residuals with 10,000 replications.

4. Data

Our empirical investigation is based on two samples containing panel data of Polish and Hungarian private pension funds. The sample covering portfolio returns of Polish pension funds runs from June 1999, the time the majority of funds entered the market, to August 2007. The data for the 52-week local t-bill yield, which proxies the risk-free-rate in Poland, is available up to April 2007. The estimations are adjusted accordingly if necessary. The 21 Polish pension funds can be classified into survived and discontinued funds. The group of survivors, containing 15 pension funds, includes those funds active on the market during the whole sample period. The group of discontinued funds

contains those six funds entering the market late and quitting it before the end of the sample period. The classification of the pension funds allows us to identify the influence of discontinued pension funds on the aggregate results. In addition, we may draw conclusions on the behavior of pension funds with respect to mergers and acquisitions.

The returns of the pension funds, provided by Analizy Online under www.analizy.pl, are measured as the monthly change in pension funds' unit value. The end-of-month data of the Polish total return index WIG and the price index WIG20 are used as proxies for the Polish stock market portfolio. The choice of the benchmark is decisive, as it is difficult to distinguish between benchmark inefficiency and abnormal returns due to the interdependence between performance evaluation and the choice of the benchmark (Lehmann and Modest (1987), Grinblatt and Titman (1994), Blake et al. (2002)). The use of different benchmarks provides a possibility to check the robustness of the estimations. Additionally, we use the WIG20 along with the WIG, since Polish pension fund managers are known to invest heavily in blue chips due the existing investment constraints and performance regulation. Monthly Morgan Stanley Capital International index (MSCI) for Poland, a total return index, is used as a benchmark for the returns on bonds held by the funds. The risk-free rate, as well as the benchmark indices, is obtained from Thomson Financial Datastream.

The data on returns of Hungarian private pension funds are provided by the Hungarian Financial Supervisory Authority (HFSA). The dataset contains quarterly annualized net rates of returns of 18 mandatory private pension funds from the first quarter of 1998 until the last quarter of 2004. Due to the fact that some pension funds only started their activity on the market after the first quarter of 1998 and due to additional missing values, the set of data is fragmentary. The names of the pension funds are not provided by the HFSA. Instead, pension funds are identified by numbers. As a proxy for the local risk-free-rate, we use the Hungarian one-year t-bill rate. The market portfolio benchmark is proxied by the Budapest stock index (BUX). In order to incorporate a benchmark for the returns on bonds held by the funds, the total return index MSCI for Hungary is used. The Hungarian t-bill-rate is obtained from Global Financial Data (www.globalfindata.com). The BUX and the MSCI indices are obtained from Thomson Financial Datastream. For the purpose of the empirical analysis continuously compounded rates of return are used.

5. Empirical Findings and Comparison with Existing Literature

Sharpe and Treynor ratios for the Polish pension funds are presented in Table 2. As the returns of the pension funds are similar to the level of the t-bill rates, the absolute values of the performance ratios are small. The ratios are mainly positive and have similar rankings. Indeed, they differ in some cases, but those minor differences may be neglected since the correlation between the ranking values is high. This result suggests diversification ability of fund managers. By comparing the survived and the discontinued funds it becomes apparent that all discontinued funds performed worse than the survived funds. The Treynor ratios based on the WIG and the WIG20 are highly correlated indicating robust results.

Table 2. Sharpe- and Treynor-Ratios of Polish Pension Funds

Survived Pension Funds	Market Share in %	Sharpe Ratio		Treynor Ratio			
		Value	Rank	WIG20	Rank	WIG	Rank
Commercial Union	26.65	0.1628	6	0.165	9	0.1413	8
ING NNP	23.44	0.1675	5	0.1669	7	0.1454	5
PZU	13.73	0.1709	3	0.1809	3	0.1489	3
AIG	8.29	0.1425	12	0.1444	12	0.1238	12
AXA	4.3	0.158	10	0.1588	11	0.1377	11
Generali	3.68	0.1684	4	0.1685	5	0.1429	6
Nordea	3.52	0.175	2	0.1896	2	0.1586	2
Bankowy	3.09	0.1027	15	0.1101	15	0.0976	15
Skarbiec Emerytura	2.52	0.1272	13	0.1302	13	0.1146	13
Allianz Polska	2.46	0.1531	11	0.1619	10	0.1418	7
AEGON	2.19	0.1592	7	0.166	8	0.1411	10
Pocztylion	2.02	0.125	14	0.1256	14	0.1082	14
Pekao	1.62	0.1582	9	0.1711	4	0.1455	4
DOM	1.53	0.1592	8	0.1684	6	0.1413	9
Polsat	0.96	0.2278	1	0.2381	1	0.2	1
Average		0.1572		0.163		0.1392	

Discontinued Pension Funds

Arka Invesco		-0.2884	20	-0.3797	20	-0.326	20
Epoka		-0.4007	21	-0.6869	21	-0.5865	21
Kredyt Banku		-0.0306	18	-0.0342	18	-0.0287	18
Rodzina		0.0363	16	0.0865	16	0.0604	16
ego		-0.0207	17	-0.0252	17	-0.0204	17
Pioneer		-0.0523	19	-0.1848	19	-0.1336	19
Average		-0.1261		-0.2041		-0.1724	

All Pension Funds

Average		0.0762		0.0581		0.0502	
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Note: The maximum length of the sample period is June 30 1999 until August 31 2007. Survivors are sorted according to their market share in August 31 2007.

All Sharpe ratios and a substantial number of Treynor ratios of Hungarian pension funds, presented in Table 3, are negative. Those Treynor ratios that are positive result from negative β -factors. A negative β -factor results from a negative covariance between the excess return of the pension fund and the excess return of the market portfolio. This

indicates a counter-cyclical investment strategy. The rankings of the Sharpe and Treynor ratios of all but one Hungarian pension fund differ substantially, suggesting a lack in managers' diversification ability. The considerable difference in Polish and Hungarian Sharpe and Treynor ratios indicates that Polish pension funds perform better than Hungarian ones, despite facing a relatively stricter regulatory framework.

Table 3. Sharpe- and Treynor-Ratios of Hungarian Pension Funds

Pension fund	Sharpe Ratio		Treynor Ratio	
	Value	Rank	BUX	Rank
1	-0.3349	1	0.5654	12
2	-0.9032	12	-4.095	14
3	-2.4869	18	94.8481	1
4	-0.6509	6	1.273	9
5	-0.7673	9	-9.4016	16
6	-0.7737	10	-1.9371	13
7	-0.5448	4	3.1133	3
8	-1.1744	13	1.7182	5
9	-0.6757	7	1.6192	6
10	-1.5921	15	-4.198	15
11	-0.8883	11	2.1686	4
12	-0.5967	5	1.5404	8
13	-0.3686	3	0.9318	10
14	-0.34	2	0.7472	11
15	-1.2894	14	-12.9053	18
16	-1.5941	16	1.5648	7
17	-0.7616	8	-9.4526	17
18	-1.9346	17	6.0912	2

*Note: The maximum length of the sample period is 1998q1 until 2004q4. All pension funds are considered. For the calculation of the Treynor ratio the BUX is used as market portfolio. The Treynor ratio of pension fund three is an outlier. This results from a covariance of the excess return of this funds and the corresponding excess return of the market portfolio being close to 0. * indicates the average of the Treynor ratios calculated excluding the ratio of fund three. Including this ratio leads to an average of 4.1218.*

The estimated performance measures for Polish pension funds based on the CAPM, presented in Table 4 in Panel (A). The estimated α coefficients of the Jensen model are positive and significant, indicating that the funds' management created an additional value compared to a passive investment strategy. According to the single-index model, the funds outperform the market by 3.71% and 2.11% per annum using the WIG20 and the WIG, respectively³. The coefficients of the two-index model largely support the above findings. As the WIG does account for dividends, while the WIG20 does not, the difference in the estimates is not only due to the included stocks.

The empirical results for the Treynor-Mazuy and Henriksson-Merton model in Panel (A) differ depending on the chosen benchmark. Results based on WIG20 suggest that Polish pension fund managers do not appear to possess any timing ability, while they maintain their selectivity as shown by the Jensen and two-index models. However, when WIG is used as a market benchmark, both models indicate no selectivity ability, although they suggest timing ability. Thus, pension fund managers show selectivity ability with respect to "blue chip" stocks and show basically no such ability concerning stocks of smaller companies. Managers tend to hold stocks of "blue chip" companies, while they trade those of small and medium size companies. Their intention is to profit by a long-term-investment in "blue chips" and by timing the rising and falling prices of the remaining stocks of small and medium size companies, simultaneously. These findings are in line with the fact that "blue chips" constitute a significant proportion of the funds' portfolios. Such portfolio structure is attributed to the existence of minimum required rate of return and the resulting security orientation of the managers (KNF (2007)).

The estimation results for the groups of survived and discontinued Polish pension funds in Panel (B) and (C) of Table 4 support our findings by the Sharpe and the Treynor ratio evidencing a worse performance of discontinued pension funds. While the estimated performance measures for survived pension funds are similar to those of the whole market, the performance measures of the discontinued funds are different. According to the Jensen and the two-index model, discontinued funds underperform the market. In addition, the results of both timing models deny the managers of discontinued funds any timing ability.

The empirical findings on the performance of Polish pension funds are not clear cut. While we find evidence of selectivity ability when a simple Jensen model is estimated, the results do not hold when we account for their timing-ability. A comparison between the survived and discontinued funds, shows differences in their performances in that discontinued funds show a lower performance than survived pension funds.

³ The estimation of the Jensen model by single funds supports the findings, and indicates a low dispersion of the performance measures. We find that a high value of net assets does not guarantee the highest performance. The estimations for single funds are not reported but available upon request.

Although our sample period is larger, our estimation results for the Polish pension fund market are largely in line with the findings of Stanko (2003). Thus, our results seem to be robust with respect to the sample length.⁴

Table 5 shows estimation results for Hungarian pension funds. The estimations of the Jensen model demonstrate that Hungarian pension funds were not able to beat the market in the observed period. In fact, they underperform the market by 5% per annum. The estimations of the two-index model lead to a minor increase in the α estimates compared to the Jensen model, however, they still indicate that Hungarian pension funds were not able to outperform the market. The estimation results for the Treynor-Mazuy and the Henriksson-Merton model indicate no timing ability of Hungarian pension fund managers, as the values of γ -coefficients are close to zero and not significant.

⁴ To account for differences in the funds' performance during bull and bear periods, we estimated the time-varying beta model developed by Fabozzi and Francis (1979). To single out bull and bear periods, we used dummy variable definitions proposed by Bhardwaj and Brooks (1993) and by Kao et al. (1998). The results suggest that the Jensen's alpha estimates do not depend on bull and bear periods. Results are not reported but available upon request.

Table 4. Pooled Estimates for the CAPM-Based Models for Polish Pension Funds

		$\hat{\alpha}$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\gamma}$
(A) All Pension Funds					
WIG20	Jensen	0.0371***	0.2520***		
	Two-index, MSCI	0.0335***	0.2354***	0.3302***	
	Treynor-Mazuy	0.0369***	0.2520***		0.0002
	Henriksson-Merton	0.0404***	0.2475***		-0.0087
WIG	Jensen	0.0211***	0.2968***		
	Two-index, MSCI	0.0187***	0.2772***	0.3157***	
	Treynor-Mazuy	0.0070*	0.2984***		0.0206***
	Henriksson-Merton	0.0064	0.3195***		0.0444**
(B) Survived Pension Funds					
WIG20	Jensen	0.0393***	0.2621***		
	Two-index, MSCI	0.0350***	0.2449***	0.3387***	
	Treynor-Mazuy	0.0349***	0.2623***		0.005
	Henriksson-Merton	0.0368***	0.2656***		0.0067
WIG	Jensen	0.0211***	0.3059***		
	Two-index, MSCI	0.0180***	0.2856***	0.3336***	
	Treynor-Mazuy	0.0056	0.3069***		0.0234***
	Henriksson-Merton	0.0035	0.3329***		0.0539**
(C) Discontinued Pension Funds					
WIG20	Jensen	0.0091	0.1948***		
	Two-index, MSCI	0.0106	0.1835***	0.2587***	
	Treynor-Mazuy	0.0338**	0.1929***		-0.0201
	Henriksson-Merton	0.0495**	0.1463***		-0.0917
WIG	Jensen	0.0084	0.2409***		
	Two-index, MSCI	0.0093	0.2274***	0.2099***	
	Treynor-Mazuy	0.0108	0.2400***		-0.0032
	Henriksson-Merton	0.026	0.2130***		-0.0496

*Note: The table presents the pooled OLS estimates of the CAPM regressions based on the WIG20 and the WIG as benchmarks for each model and group. All models are estimated with Newey-West standard errors. The partitioning into groups is the following: In (A) all funds are included, in (B) only survived funds including late-starters are considered and in (C) only funds that started their activity later than June 1999 and quit the market prior to July 2005 are considered. *, **, *** represent estimates significant at 10%, 5%, 1 %, respectively.*

Table 5. Pooled Estimates for the CAPM-Based Models by Group of Hungarian Pension Funds

(A) All Pension Funds				
	$\hat{\alpha}$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\gamma}$
BU				
X				
	-0.0503***	-0.0176**		
Two-index, MSCI	-0.0459***	-0.0340***	0.1501***	
Treynor-Mazuy	-0.0535***	-0.0093		0.0075
Henriksson- Merton	-0.0570***	0.002		0.0295

*Note: The table presents the pooled estimation results of the CAPM-models for the Hungarian pension funds with the BUX used as benchmark. All models are estimated with Newey-West standard errors. *, **, *** represent estimates significant at 10%, 5%, 1 %, respectively.*

A number of reasons may be cited to explain this evidence of underperformance by Hungarian pension funds. The relatively short sample period and the dynamics of the t-bill rate might lead to the negative and insignificant α -estimates. Unfavorable monetary and fiscal conditions over the sample period exerted pressure on the government securities markets and caused the Hungarian t-bill rate to be higher than in other Central European countries⁵. The usage of returns on government bonds as a benchmark in the Hungarian performance regulation further affects the portfolio diversification, as it keeps security oriented managers from investing into assets other than bonds. As a result, Hungarian pension fund members do not benefit from the profit opportunities offered by other assets (Hungarian Financial Supervisory Authority, 2007). Additionally, Hungarian pension fund managers face an illiquid and small stock market, which further limits their diversification opportunities. Finally, the legislative framework itself has been subject to numerous changes, providing additional uncertainties for managers and participants (World Bank, 2007). Therefore, restrictive performance regulations, with their potential adverse effects on the performance of the funds operating on the Hungarian market, were complemented by other unfavorable circumstances faced by the fund managers in this market.

⁵The macroeconomic situation in Hungary is discussed in IMF (2006) and Government Debt Management Agency (AKK) (2004).

It should be pointed out that the reported evidence on underperformance by Hungarian pension funds is not unique in the literature. Several studies of pension funds in developed markets find that pension funds may slightly underperform market benchmarks. For example, Blake et al. (2002) analyze the portfolio composition and performance of UK pension funds during 1986-1994 using the Jensen regression. As UK pension fund managers face no constraints in regard to their investment decisions they hold a larger fraction in equities and a smaller fractions in bonds than pension funds in Poland and Hungary. Blake et al. (2002) present a cross-sectional distribution of unconditional α -estimates, which ranges from -4.59% per annum to 4.68% per annum. Compared to the present estimates for Polish pension funds, the range of the values is smaller, regardless of the chosen market portfolio. Less than 50% of the observed UK pension funds achieve a positive α , whereas the ratio of positive α -parameters of Polish pension funds is higher than 85%. On average, UK pension funds have an α estimate of -0.047% per annum. This indicates that UK pension funds tend to underperform the market in general. Our findings on Polish pension funds also show that a large amount of net assets does not necessarily guarantee the highest performance, are in line with the results of Blake et al. (2002) and Lakonishok et al. (1992) for the UK and the US market, respectively.

Christopherson et al. (1998) studied performance of the US pension funds, which, like the UK pension funds, are also subject to the “prudent-man rule”. The study is based on 185 US pension fund managers over the period between 1979 and 1990. In addition to the basic CAPM with one explanatory variable, they also estimate time-varying conditional alphas and betas of Ferson and Schadt (1996). They find that pension funds pursuing value-oriented strategy show negative alphas of -0.033 when CRSP index is used as a benchmark. Growth-oriented pension funds show negative alphas of -0.010 in case Russel style index is used as a benchmark. Growth- and value-oriented fund groups each account for about 22% of their sample. The above-mentioned empirical results show that underperformance is found among pension funds in the UK and US. The extent of underperformance, however, is lower than in case of Hungarian pension funds. These findings call for further, more detailed enquiries into the effects that various types of regulations have on pension fund performance and into the optimal design of the financial regulation systems.

6. Concluding Remarks

The aim of this paper is to investigate the performance of mandatory defined-contribution pension funds on strictly regulated markets of Poland and Hungary and provide a comparison of pension funds' performance across these two countries. We apply established performance measures for a comparative analysis. We find no conclusive evidence of selectivity ability by Polish pension funds once we have accounted for their timing ability, and a strong evidence of underperformance by Hungarian pension funds. Investment limits and performance regulations seem to influence the investment decisions of pension funds. The impact on a fund's performance, however, depends on the type of the performance evaluation benchmark used by the regulator. In Poland it leads to similar portfolio compositions of the managers, while in Hungary it leads to an exceeding investment into government

securities. The low liquidity and small size of the Hungarian equity market, inferior skills of managers and the instability of the regulatory framework in Hungary are possible further factors resulting in the weak performance of Hungarian pension funds.

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