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Investment performance of US and European pension funds. A comparative analysis

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Abstract

Pension funds are growing rapidly in importance in developed countries as their retiring demographic population is growing faster than the contributing work force. Therefore, essential transformations of the pension systems are being introduced in many OECD countries to make pension systems more financially sustainable. The main ideas behind the changes to retirement systems consist of raising the retirement age and introducing funded rather than Pay-As-You-Go systems. The growth of the pension fund market has been more pronounced in the US and the UK than in other countries. Emerging markets in post-communist economies are also growing in importance both as a destination for pension funds investment and as a growing market in terms of their own domestic investors. The aim of this research is to compare the performance of pension funds in the US with those in selected European countries for the period 2002-2013, since both US and European pension funds are operating in sophisticated financial markets.

Keywords:

US pension funds, European pension funds, Performance and efficiency.

JEL classification:

G11, G15, G23.

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El rendimiento de los fondos de pensiones europeos y estado-unidenses. **Un análisis comparativo**

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Resumen

Los fondos de pensiones están teniendo una importancia cada vez mayor en los países desarrollados, en la medida en la que su población retirada está creciendo a un ritmo superior al de la población activa. En consecuencia, en los sistemas de pensiones de muchos de los países de la OCDE se están introduciendo transformaciones que resultan esenciales para su sostenibilidad. Dichas modificaciones consisten, básicamente, en el aumento de la edad de jubilación y la introducción de sistemas de capitalización en vez de sistemas de reparto. El crecimiento del mercado de fondos de pensiones ha sido más pronunciado en Estados Unidos y en el Reino Unido que en otros países. Los mercados emergentes de las economías postcomunistas también están experimentando un auge creciente tanto como destino inversor de los fondos de pensiones como mercado para los inversores domésticos. El objetivo de esta investigación es comparar el rendimiento de los fondos de pensiones que operan en Estados Unidos con el aquellos que operan en una selección de países europeos, donde los mercados financieros son ciertamente sofisticados; y ello para el periodo 2002-2013.

Palabras clave:

Fondos de pensiones estado-unidenses, fondos de pensiones europeos, rendimiento y eficiencia.

1. Introduction

Pension funds are important retirement investment savings vehicles for workers as the demographic bulge of baby boomers are expected to retire *en masse* with profound economic consequences. Technology is also making retirement investments easier and more accessible. Moreover, the choices of pension funds available are not limited to domestic funds but are also open to sector funds with domestic, global or social choice alternatives. The pension fund market is also an important source of financing for investment, especially in countries undergoing economic transformation and development.

The characteristics and focus of US pension funds may be different from European pension funds, leading to differences in efficiency and returns. Unless pension funds are efficient and provide sufficient funds to the generation of baby boomers whose life expectancy is increasing, a heavy economic burden will fall on future generations, the government, and society. The latest US Census Bureau data indicates that Americans aged 65 and older as a share of the total population is forecasted to increase from 14.5% in 2014 to 20.9% in 2050. For Japan and Germany, it is expected to increase from 25.8% to 40.1% and 21.1% to 31.1%, respectively. For France, the UK and Poland, the expected increase is from 18.3% to 25.8%, 15% to 17.5% and 23.6% to 31.7%, respectively.

The growth of the pension funds and the diversity of sector funds offered domestically and globally contribute to a positive outlook, depending on pension fund performance. In 2012, of the US$78.2 trillion under institutional investment management in OECD countries, pension funds comprised US$21.8 trillion (OECD, 2013). Given its prominence as the third largest source of institutional investment funds, after mutual funds (US$30 trillion) and insurance funds (US$24.5 trillion), pension fund performance is crucial to alleviating the looming economic threat, since for many retirees these funds are their sole source of income after retirement. There is a global trend moving away from the defined benefits towards the defined contributions pension systems backed by assets. This is important (especially following the substantial decline in retirement asset value in the aftermath of the 2008 financial crisis) because it ties the amount of terminal benefits investors will receive on retirement to the performance of the pension assets.

According to an OECD report (OECD, 2009, p. 33), real investment returns in 2008 declined by 38% in Ireland, 27% in Australia and 26% in the US. The aggregate loss for 23 OECD countries as a whole, where pension fund assets are significant, equalled 23% as a weighted average and 17.4% as an unweighted average. In Belgium, Canada, Hungary, Iceland and Japan real investments fell by more than 20%. The smallest decline was observed in Mexico and the Czech Republic—less than 7.5%—and in Germany, Slovakia, Spain and Norway—less than 12.5%. On the other hand, pension funds in Poland, the UK, the Netherlands Sweden, Denmark, Austria, Portugal and Switzerland recorded

losses smaller than 17.5%. These differences are relatively easy to explain since pension fund performance is closely tied to portfolio construction. The majority of the countries with the smallest losses in 2008, i.e. Germany, Slovakia, Mexico and the Czech Republic, had bond dominated portfolios with an equity share of between 6 and 12%. However, equities (although risker than bonds) have delivered larger returns over the long term.

Pension funds differ in the type of retirement plan they support (defined benefit, defined contribution or hybrid-mixed) and hence on the nature of their liabilities. Substantial differences can be observed between OECD countries when comparing the relative shares of defined contribution and defined benefit pension fund assets. According to an OECD report (OECD, 2014b, p. 24-25), in Chile, Estonia, France, Greece, Hungary, Poland, Slovakia, Slovenia and Czech Republic, defined contribution made up 100% of total pension fund assets. Germany, Finland and Switzerland lie at the other end of the scale: 100% of total pension fund assets comes from defined benefit and hybrid-mixed plans. The US has a combination of about 45% defined benefit systems and 55% defined contribution systems (OECD, 2014a, p. 15).

Pension fund asset allocation decisions are affected by different factors such as investment opportunities and funded status. Also, the governments of many countries stipulate restrictions concerning pension fund portfolios in order to protect retirees from losses which may occur in turbulent financial markets, as was the case in the last financial crisis, and from unduly risky investments suggested by fund managers.

The average portfolio for the pension funds surveyed shows that, as of December 2013, 52.1% of total assets were invested in fixed income and cash, 31.5% in equity, 1.6% in unlisted infrastructure, and 14.8% in alternative/other investments. Bonds and cash represented the majority of assets for funds based in Italy, Spain and Russia. Pension funds based in Australia, South Africa, the UK and the US had the largest proportion of allocations to listed equities. (OECD, 2014b, p. 14)

The key question is whether pension funds are efficient at providing the terminal wealth necessary for beneficiaries to retire. Also of interest is whether there is a difference in performance between US and European pension funds, in countries facing an inverted demographic pyramid with an aging population.

2. Literature review

Pension fund performance will have significant economic impact on the aging and retiring population to fund their retirement. The prevailing literature on pension fund studies (for example, Elton *et al.*, 2006 and Angus *et al.*, 2007) argues that the inad-

equate and restricted investment choices in defined contribution pension funds are the reason why pension funds perform worse than a market portfolio in providing terminal wealth for their beneficiaries in the long run. Angus *et al*. (2007) argue that an expanded menu choice and even the "naïve diversification strategy of the 1/*n* rule" outperforms a restricted portfolio. On the other hand, a later study by Tang and Mitchell (2008) argues that it is the types and particular set of efficient investment funds offered rather than the total number of choices of funds available that determines the performance of defined contribution pension funds compared to eight conventional benchmark indexes. Most pension funds predominantly offer mutual funds that are already diversified. The argument against offering an expanded investment menu is the higher cost associated with actively managed equity funds versus lower cost equity indexed funds, a cost which negatively affects the fund performance and terminal benefits for retirees (Brown *et al*., 2007).

Other studies find that having too many investment choices reduces active investment participation by investors. Iyengar *et al*. (2003) call this "choice overload" and Agnew and Szykman (2005) refer to it as "information overload". Tang and Mitchell (2008) find an extensive range of choices on offer in their analysis of more than 1500 pension plans: 98.9% offer money market funds, 97.4% offer bond funds, 96.5% offer balanced funds while 93.2% offer international funds. Almost all plans offer equity funds, this being the dominant option (56%) with 10% of the plans offering more than 12 options. Brown *et al*. (2007) claim that the increase in more new funds offerings tends to be high-cost actively managed funds. The higher number of options lowered the number of low-cost equity indexed funds available, and this negatively affects fund performance.

Some behavioural finance studies (Benartzi and Thaler, 2001) find evidence of investors practising the "naïve 1/*n* investment rule" whereby they invest an equal proportion in each of the *n* investment choices offered, while other studies (Ameriks and Zeldes, 2004) find that investors tend to rebalance their portfolios infrequently. A corroborating study by Choi *et al*. (2001) finds that investors tend to passively invest in the offered default fund despite being able to opt out. Karlson *et al*. (2006) find that investors tend to be attracted to funds that offer a greater number of categories in terms of the investment menu offerings ("menu exposure"). Whether it is due to information overload, choice overload, menu exposure or investors' passivity in not rebalancing their portfolios to incorporate potentially higher performing funds, the literature suggest that investors may select funds based on factors other than their performance, which is detrimental to their terminal wealth on retirement.

In the aftermath of the 2008 financial crisis and the subsequent wealth reduction, along with baby boomers having to work longer or retirees having to return to work, the dependence on efficient pension funds to either supply or top up terminal wealth is more

crucial than ever. A study by Antolin and Stewart (2009) provides an insight into the impact of the crisis on the global private pension industry and the industry's response. Such repercussions include a reduction in the value of private pension assets (more than 30% in Ireland and US), shifting allocation trends favouring more conservative asset investments with poorer outcomes (Norway, Slovakia, Spain, Turkey, Bulgaria), and declining contributions to pension funds. Their study also supports Bauer *et al*. (2008), showing that pension fund equity performance after subtraction of benchmarks, although close to zero, performed better than mutual funds. This may be explained by the ability of pension funds to reduce agency and hidden costs.

Another global private pension trend is the shift from defined benefit to defined contribution plans, placing a greater onus on plan members to make knowledgeable and appropriate investment choices in order to achieve better outcomes with respect to their retirement wealth. Rinaldi and Giacomel (2008) enumerate some key risk factors facing investors in their allocation choices: the complexity of investment choices and lack of financial literacy; the difficulty of conveying to members the value, risk and expectations of long-term benefits; information asymmetry; and the mismatch of expectations between plan members and providers. In particular, the study suggests that, as well as providing ex-ante information, providing correct ex-post information on investment outcomes would help to alleviate excessive risk aversion by plan members by empowering them as informed investors who can make appropriate decisions affecting their future terminal wealth. The authors do acknowledge that better information is not a panacea due to the complexity of decision making and so suggest that a well-designed default option should be on offer. The risk of making suboptimal decisions due to investor passivity, information overload, choice overload, menu exposure, excessive risk aversion and decision avoidance ultimately results in investors receiving inadequate retirement benefits.

3. Characteristics of selected country global pension funds

In absolute amounts, the US pension fund is still the largest by far with total assets of US$18.879 trillion (113% of GDP) in 2013, followed by the UK (US$3.263 trillion or 131% of GDP-US$), and Japan (US$3.236 trillion or 65% of GDP-US$), and global pension assets have been growing at a compound annual growth rate of about 6.6%, 10.0%, and 1.1%, respectively for the three above-mentioned countries in the period 2003-2013 (Towers Watson, 2014). Table 1 shows total pension fund investments for 2002-2012. It is noteworthy that in 2008, at the height of the financial crisis, most of the developed countries (the Netherlands, Switzerland, the UK and Ireland) registered a significant reduction in investment, but by 2012 most had recovered and were above the pre-crisis levels (the US remained slightly below). Exceptions were Hungary

and Portugal, where a change in funding regulations for the state retirement system led to a sharp drop in pension fund assets. Since Central and Eastern European countries such as Poland, Estonia, Slovakia and the Czech Republic are transition countries, they are relatively new to pension investment and are slowly catching up with smaller asset-to-GDP ratios: 17.2%, 9.5%, 8.7% and 7.1%, respectively, in 2012. However, only 7 (of 22) countries register a value for this ratio greater than that of Poland: Denmark, Finland, Ireland, the Netherlands, Switzerland, the UK and the US. The smallest values for the asset-to-GDP ratios are observed for Greece (0%), France (0.3%), Luxemburg (2.0%), Hungary (3.3%), Slovenia (3.7%) and Belgium (4.6%).

● Table 1. **Total pension fund investments for selected countries, 2002-2012 (as % of GDP)**

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Austria	3.8	4.2	4.4	4.8	4.9	4.8	4.4	5.1	5.3	4.9	5.3
Belgium	4.9	3.9	4.0	4.4	4.2	4.4	3.3	4.0	3.7	4.2	4.6
Czech Rep.	2.6	3.0	3.4	4.0	4.4	4.6	5.0	5.7	6.1	6.5	7.1
Denmark	26.0	28.5	30.8	33.8	32.6	32.4	47.0	43.1	49.3	49.6	50.1
Estonia	0.2	0.8	1.8	2.7	3.6	4.4	4.5	6.9	7.5	7.1	8.7
Finland	49.3	54.0	61.9	68.6	71.9	70.6	60.7	77.2	82.8	76.1	79.3
France	n.a	n.a	n.a	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.3
Germany	3.5	3.7	3.8	4.1	4.2	4.6	4.8	5.3	5.4	5.7	6.3
Greece	n.a	n.a	n.a	n.a	n.a	0.0	0.0	0.0	0.0	0.0	0.0
Hungary	4.5	5.3	6.9	8.5	9.8	11.1	9.7	13.3	14.9	3.8	3.3
Ireland	34.2	39.4	41.5	47.5	49.4	45.9	35.5	44.8	48.2	45.5	49.2
Italy	2.3	2.4	2.5	2.8	3.0	3.2	3.4	4.1	4.6	4.9	5.6
Luxembourg	n.a	n.a	0.3	1.1	1.0	1.0	1.0	2.3	2.0	2.0	2.0
Netherlands	85.5	101.2	108.1	120.7	124.4	135.1	112.7	118.6	129.5	136.2	160.2
Poland	3.8	5.3	6.8	8.7	11.1	12.0	10.9	13.5	15.7	15.0	17.2
Portugal	11.1	11.3	10.2	12.3	13.2	13.2	11.8	13.0	11.4	7.7	8.8
Slovakia	n.a	0.0	n.a	0.5	2.4	3.7	4.7	6.3	7.4	8.4	9.5
Slovenia	n.a	0.5	0.9	1.3	1.6	1.8	1.9	2.6	3.1	3.3	3.7
Spain	5.7	6.2	6.6	7.2	7.5	8.2	7.2	8.1	8.0	8.0	8.4
Sweden	7.4	7.4	7.3	9.0	9.1	8.5	7.3	8.2	9.5	9.2	10.5
Switzerland	93.2	99.9	104.0	113.3	114.8	112.0	94.8	108.0	108.5	106.9	113.6
UK	58.1	63.3	66.7	76.8	81.6	77.4	64.4	80.2	87.9	95.3	95.7
US	62.2	71.4	73.0	74.1	76.4	76.8	58.7	69.2	73.8	72.3	74.5

SOURCE: OECD GLOBAL PENSION STATISTICS.

Table 2 shows that negative real average returns from the pension funds were observed for the majority of countries in the following years:

2007 (for 11 of 19 countries for which data were available),
2008 (all except Denmark, Germany and Greece), and
2011 (for 16 of 21 countries for which data were available).

Table 2. Real average net annual rate of returns in selected countries, 2002-2013 (in percent)

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Austria	-6.9	5.7	3.6	9.0	3.8	-1.8	-14.4	7.3	3.7	-6.0	5.5	2.9
Belgium	-11.6	6.0	6.0	10.3	10.3	7.7	-22.3	13.4	4.4	-4.6	9.3	5.8
Czech Rep	3.2	2.2	0.7	2.7	1.3	-2.1	-1.5	-0.6	0.7	0.5	0.2	0.2
Denmark	-6.7	6.3	11.5	14.8	1.3	-3.3	5.1	1.2	7.1	12.1	5.4	-4.6
Estonia	n.a	2.9	3.7	7.2	2.2	-5.4	-32.4	14.8	2.1	-8.0	5.2	0.9
Finland	-2.1	0.4	7.4	12.1	6.2	2.4	-19.7	14.0	7.1	-5.2	6.6	6.0
Germany	1.6	3.5	2.6	3.6	3.3	1.1	0.5	3.9	3.4	1.0	3.3	2.8
Greece	n.a	n.a	n.a	n.a	n.a	n.a	2.3	0.3	-7.8	-5.6	5.0	7.4
Hungary	1.4	-2.6	9.5	7.6	1.2	-3.9	-21.7	12.8	4.2	-0.5	6.8	7.0
Ireland	n.a	n.a	n.a	n.a	n.a	-7.4	-35.7	n.a	n.a	n.a	n.a	n.a
Italy	-1.6	2.5	3.7	6.1	2.1	0.3	-5.3	5.3	1.2	-2.8	4.0	3.9
Luxembourg	n.a	n.a	n.a	29.0	4.9	-2.5	-11.3	6.5	0.7	-2.3	5.0	1.7
Netherlands	-10.6	8.7	8.4	10.9	6.8	0.6	-17.3	11.5	8.8	4.3	13.5	3.2
Poland	11.8	8.8	8.6	12.9	13.4	1.5	-17.3	8.9	7.2	-9.1	1.6	2.7
Portugal	-6.7	7.3	6.6	7.0	7.2	5.5	-13.2	11.6	-3.0	-7.3	5.8	4.9
Slovakia	n.a	n.a	n.a	n.a	n.a	-0.1	-8.9	1.0	0.0	-3.8	0.4	1.1
Slovenia	n.a	n.a	n.a	n.a	n.a	-1.0	-5.4	4.2	1.8	-1.8	4.5	2.5
Spain	n.a	n.a	n.a	n.a	n.a	n.a	-9.9	6.9	-2.2	-2.3	3.6	7.9
Sweden	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	-1.0	7.9	6.7
Switzerland	-7.2	4.9	2.8	9.2	5.3	0.2	-13.8	9.9	2.8	0.6	7.5	5.9
UK	0.9	1.2	0.6	0.2	-0.9	-0.2	-0.9	-0.9	-2.1	-2.5	-1.2	n.a
US	-4.9	2.4	-1.4	-1.8	0.1	-2.7	-6.7	1.3	1.1	-2.7	n.a	11.7

SOURCE: DATA FOR 2002-2012 FROM OECD (2013) AND DATA FOR 2013 FROM OECD (2014A).

Bauer *et al*. (2008) document that the net equity performance of US pension funds is better than that of mutual funds. The study compares the performance of size-matched US pension funds and mutual funds and finds that pension funds outperform mutual funds by about 2.5% per year through better control over agency costs and other hidden costs. Using risk-adjusted Sharpe ratios, Antolin (2008) compares aggregate investment performance of privately managed pension funds of 13 countries (Argentina, Australia, Canada, Chile, the Czech Republic, Hungary, Japan, Mexico, the Netherlands, Poland, Sweden, the UK and the US) and finds that pension funds in most of the countries tended to underperform relative to hypothetical benchmark portfolios, primarily due to the uncertainty of investment restrictions and regulations, and cautious asset allocation by managers.

The difficulty of finding common comparative measures of pension fund performance that will enable investors to make optimal decisions for their retirement benefits has prompted a lot of discussion in academia and the pension fund industry. Policy makers are also concerned as to the economic burden and threat when retirees face economic hardships at retirement due to the inadequacy of their expected funding and the un-

sustainability of the pension fund systems. Portfolio managers and policy makers must attempt to design a pension fund system that enables investors to make optimal allocation decisions and considers different parameters of life-time contribution rates, age, risk tolerance, density contributions, asset returns, and other sources of income. To address some of these issues where different investors have differing characteristics and preferences, Rudolph *et al*. (2010) suggest designing a life-cycle model of an investment portfolio that can adjust to age, preferences and circumstances, and developing benchmarks against which pension fund managers' performance can be measured. It is interesting that the Netherlands' defined benefits pension system has produced relatively consistent high returns and the highest in 2012 relative to other countries. In the Dutch system, asset allocations are regulated with respect to targeted, though not guaranteed, benefit streams. The Netherlands has quasi-mandatory occupational pension plans, usually determined by collective labour agreements, and employees are required to participate. Bagliano *et al*. (2009) support such a life-cycle approach to performance efficiency, whereas Spitzer and Singh (2011) disagree citing lower accumulation efficiency.

3. Performance measures

Pension funds operate like mutual funds, although investment portfolios with the former may be subject to certain (sometimes very strict) regulations, for instance concerning limitations on risk assets. However, pension funds are, to some extent, sensitive to the turbulences which appear in financial markets and in economies. Therefore, pension fund performance is crucial for people paying into them, especially since it is possible for retirement savings to be wiped out by financial crises. Pension funds have to work over the long-term thus their investment efficiency should also be evaluated over a longer time span. In order to measure the performance of the investment portfolio, different measures are used. For our study, we determined that the best efficiency measures are the Sharpe ratio, return information ratio, the Sortino ratio, and the so-called Sharpe alpha[1]. All these ratios are evaluated taking into account excess returns from the investments and the risk of the investment.

The excess return (risk premium) is measured by comparing the rates of return from the portfolio in question, R_e, to the returns from the:

- selected benchmarks - R_b,
- market portfolio - R_m,
- risk-free instrument - R_f, or
- the investor's return target or minimal acceptable return - R^*.

[1] These measures of portfolio performance are used to evaluate the efficiency of pension funds, for instance, Antolin (2008) applies the Sharpe index to evaluate the efficiency of private pension funds.

There are also several measures of risk which can be used in the investment efficiency ratios such as:

- standard deviations of the analysed portfolio, market and the benchmark - S_e , S_m, S_b, respectively,

- tracking error S_{eb} , which is the standard deviation of differential returns, defined as:

$$S_{eb} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(R_{et} - R_{bt} - (R_e - R_b))^2} \tag{1}$$

or

- semi-deviation of differential returns SS_e :

$$SS_e = \sqrt{\frac{1}{T}\sum_{t=1}^{T} d_t^2} \tag{2}$$

where

$$d_t = \begin{cases} R_{et} - R^* \;\; gdy \;\; R_{et} - R^* < 0 \\ 0 \;\; gdy \;\; R_{et} - R^* \geq 0 \end{cases} \tag{3}$$

The Sharpe (reward-to-variability) ratio (Sharpe, 1966) measures an investment's excess return per unit of risk and is defined as follows:

$$WS_e = \frac{R_e - R_f}{S_e} \tag{4}$$

This measure is compared to the reward-to-variability evaluated for the market or the benchmark.

The excess return information ratio or differential return information ratio (Sharpe, 1994) is defined as:

$$WGS_e = \frac{R_e - R_b}{S_{eb}} \tag{5}$$

The modern variation of the Sharpe ratio is the Sortino ratio (Sortino and Price, 1994), which is defined as:

$$WSP_e = \frac{R_e - R^*}{SS_e} \tag{6}$$

The performance of the investment portfolio is determined not only by the managers of the fund but by market conditions as well. Therefore, efficiency measures that take into account market trends and conditions are also considered. An example of such measures is the so-called Sharpe's alpha (Jamróz, 2013), defined as:

$$WSA_e^2 = (R_e - R_f) - (R_m - R_f) \cdot \frac{S_e}{S_m} \tag{7}$$

The evaluation of pension fund performance using the efficiency measures involves comparing the values obtained by the pension funds in each country to the performance of the benchmark. For mutual fund performance, particularly equity mutual funds, the market benchmark is often represented by the stock index. But pension fund investment portfolios tend to combine returns with relatively low risk. For this reason, diversified pension fund portfolios usually contain shares, bonds and bills, debt instruments, cash, and deposits. Hence, comparing their performance only to the equity market may not be the correct approach. A better solution seems to be to construct a benchmark that at least includes both equity instruments and bonds, which better represents the pension funds environment.

4. Empirical research

The aim of our research is to compare the performance of the pension funds operating in Europe and the US. Nonetheless, European countries determine their own policy individually, their economies operate in different conditions, and they have different laws in place to regulate the system. Therefore, there are two possible approaches to the empirical investigation. The first consists in selecting representative European countries. The second consists in constructing an aggregate representing Europe. We apply both approaches, however, we have to recognize and reflect on a number of limiting factors in our study, which are connected with:

1. lack of data for certain periods and countries,
2. geographical diversification of European pension systems, and the role of the pension funds in the countries under study.

In our research, we apply data available from the OECD (OECD, 2014a) containing the average rate of investment returns (IRR). But many observations on the pension fund returns, which are needed for the efficiency measures evaluations, are incomplete for many countries and years. In such cases, either the country missing a substantial amount of data is omitted from the rest of the study or, for countries missing a relatively small amount of date, we replace the missing data with substituted values. Accordingly, France, Ireland, Sweden, Iceland and Norway are deleted from the analysis because they are missing large amounts of data. Bulgaria, Croatia, Cyprus, Malta, Lithuania, Latvia and Romania do not belong to the OECD (i.e. there is no data in OECD sources), thus they are omitted from our study as well. Therefore, in our comparative analysis we consider only 19 European countries belonging to the OECD, and the US. The European countries in our study include 75% of the EU countries

and 52% of the European population. For the US pension fund returns in 2012 we use the five-year average provided by OECD data (OECD, 2014a, p. 17). The average data for Greece for 2002-2006, Luxemburg for 2002-2003 and for Slovenia for 2002 are averaged from the observed OECD data. For the UK, the pension funds data sample is shortened to end in 2012 since the observation from 2013 is missing.

It should be borne in mind that there is no common model for the pension system in Europe. In other words, each country creates its own pension system and applies national regulations concerning retirement savings. Therefore, the European pension fund market is highly diversified geographically, with many different countries having different structures and investment vehicles, even within the European Union. For example, the long-established pension fund system in a developed, sophisticated market like the UK is very different in structure and operations from a recently-established pension fund system in a transitional country like Poland, which is the most developed of all the transitional countries in the EU. The most developed pension fund markets in our comparison study are the US and, in Europe, the UK. The biggest European economy is Germany, however, it has a Pay-As-You-Go (PAYG), defined benefit system that results in an underdeveloped pension fund market. These factors make a comparison of pension fund performance challenging. Our study, therefore, focuses on four European representatives of pension fund markets—the UK, Germany, Poland and the aggregate "Europe"—and compares them to the US pension fund market. The aggregate "Europe" is constructed as a weighted average of the 19 European countries, with the weights based on the proportion of pension fund investment in US dollars from each country.

To calculate the performance measures (4)-(7) it is necessary to define the market indexes, risk-free instruments, the benchmarks, and the minimal return required by investors. The selection of benchmarks and risk-free instruments depends on the applied measure and the country.

The risk-free instruments are defined as the 10-year Treasury Bonds in Poland, Germany, the UK and the US. The risk-free instrument for the aggregate "Europe" is the simple average of UK, Polish and German Treasury Bonds[2]. The market index is represented by the equity indexes: WIG for Poland, FTSE 100 for the UK, DAX for Germany, S&P 500 for the US and Euro Stoxx 50 for Europe[3]. We assume that the minimal required return by investors (needed for the Sortino measure) is 3% annually, given that 30-year Treasury bonds yield a 3% return.

[2] Sources of data concerning the 10-year Treasury Bonds: for Poland – authors' calculation of annual real returns on the basis of bonds daily quotations; for Germany – https://research.stlouisfed.org/fred2/series/IRLTLT01DEM156N; for the UK – http://data.okfn.org/data/core/bond-yields-uk-10y; for the US – http://pages.stern.nyu.edu/~adamodar/New_ Home_Page/datafile/histretSP.html.

[3] Sources of data for WIG – http://www.gpw.pl/indeksy_gieldowe (authors' calculation of returns in real terms), for FTSE 100 – http://1stock1.com/1stock1_764.htm, for DAX – http://www.forecast-chart.com/historical-dax-germany.html, for Euro Stoxx 50 – http://1stock1.com/1stock1_1192.htm and for S&P 500 – http://pages.stern.nyu.edu/ ~adamodar/New_Home_Page/datafile/histretSP.html.

The benchmarks' returns, evaluated for the countries under study and the aggregates "Europe" and "global", are defined according to the composition of the average pension fund asset portfolio and relative allocation to the selected investment categories such as shares, treasury bills or bonds, debt instruments, etc. In the defined benchmarks portfolios, we focus on two investment instruments, shares and bonds, and calculate their proportions in the benchmark portfolio, taking into account the sum of both instruments in the pension fund portfolios as a total. The shares of equity and bond markets are as follows: Poland 45% in the equity market and 55% in the bond market; Germany 8% and 92%; the UK 44% and 56%; Europe 30% and 70%, respectively. For the US the proportion is 70% and 30%. A general benchmark for both Europe and the US pension funds is also constructed assuming 30% in the equity market, represented by the simple average of WIG, DAX, FTSE100, S&P 500 and Euro Stoxx 50, and 70% in the bond market, represented by the simple average of Treasury bonds issued in Poland, Germany, the UK, and the US.

The analysis covers two time spans: 2002-2013, which includes periods with missing data; and 2008-2013, a period in which all the data are available and reliable[4]. These two periods may also be representative of the financial market conditions in the US and Europe as the financial crisis occurred during this time.

The benchmarks in our study are constructed to represent the general market conditions for pension funds in each particular country or in the aggregate "Europe". Pension funds in each analysed country face different conditions and occupy different positions in the economy they operate in, some details of which are worth mentioning below:

1. Importance of pension funds relative to the size of economy. In 2013, pension fund assets in the Netherlands represented 166.3% of GDP, 148.7% in Switzerland, 100.7% in the UK, 83% in the US, 18.6% in Poland, 6.2% in Germany, and 0.1% in Greece (OECD, 2014a, p. 11).
2. Geographical distribution of pension fund assets. In 2013, the geographical distribution of total pension fund assets owned in OECD countries is highly concentrated in the US with 56.3%, the UK 10.8%, and the Netherlands 5.6% (OECD, 2014a, p. 12).
3. Different types of pension plans. For example, the US, Germany and the UK have 100% occupational pension plans, whereas in Poland there are mostly personal pension plans (OECD, 2014a, p. 14).
4. Allocation of pension funds in the type of assets. In the US, the allocation is 59.5% in shares and 20.8% in bonds, in Poland 41.5% and 51.8%, in the UK 24.5% and 30.7%, and in Germany 4.4% and 51.8%, respectively (OECD, 2014a, p. 21).

[4] The 2012 data for the US is calculated on the basis of the same data source, which is the geometric mean, and for the UK the sample was shortened to 2012.

The pension funds operate under different conditions and employ different strategies, and so their performance measures and benchmark construction must take into account these disparities.

Table 3 shows the differences in performance results of the pension funds over the two time spans, which reflect the impact of the 2008-2009 financial crisis. Poland (9.18%) and the US (7.24%) have the highest average benchmark returns for the years 2002-2013. In terms of pension fund performance, Poland has the highest average returns (4.25%), followed by Germany (2.55%). The only pension funds generating losses are in the UK (–0.53%). The risk is positively correlated with the returns. The highest risks are observed for Poland and the US, while the smallest risks are observed for the UK and German pension funds.

For the years 2008-2013, the results are reversed. The highest average returns, for both the pension funds (3.87%) and the benchmark (7.71%), are observed for the US, while the Polish (–1.00%) and UK (–1.52%) pension funds generated losses. The risk is the highest for the Polish pension funds and benchmarks, while the smallest risks are observed for the British and German pension funds.

Table 3. **Average real returns (R%) and standard deviation (S) for pension funds**

	Poland		Germany		UK		Europe		US	
	Fund	Benchmark	Fund	Benchmark	Fund	Benchmark	Fund	Benchmark	Fund	Benchmark
Years 2002-2013										
R	4.25	9.18	2.55	3.68	-0.53	3.77	1.32	3.94	1.24	7.24
S	8.87	12.22	1.13	2.38	1.13	6.74	3.71	6.32	6.82	11.21
Years 2008-2013										
R	-1.00	3.37	2.48	2.70	-1.52	2.86	0.73	2.62	3.87	7.71
S	9.28	13.75	1.27	1.89	0.66	7.35	4.44	6.19	8.61	2.83

SOURCE: OWN ELABORATION.

Table 4 shows that the highest returns for the equity markets for the 2002-2013 period are observed for WIG, DAX and S&P500. For the years 2008-2013, the highest returns are observed for S&P500 and DAX, while Euro Stoxx 50 experienced losses. The bond markets generate the highest returns in the US and Poland for both time spans. However, the risk for US Treasury Bonds is very high, which may reflect the high US debt burden, and is not comparable to the risk for European Treasury Bonds, particularly German bonds, which offer lower risk and lower returns. The "general" benchmark is a pattern benchmark for all the analysed countries and the aggregate "Europe". Hence, it describes the conditions in the equity and bond markets in all the analysed countries, and the aggregated equity market in the Eurozone.

● Table 4. **Average real returns (R%) and standard deviation (S) for the main stock indexes, 10-year Treasury Bonds and the general benchmark**

	Poland		Germany		UK		Euro Stoxx 50	US		General Benchmark
	WIG	Bond	DAX	Bond	FTSE100	Bond		S&P 500	Bond	
Years 2002-2013										
R	14.50	4.83	9.84	3.14	3.53	3.96	1.18	8.12	5.20	5.23
S	27.29	1.39	28.40	0.97	15.61	0.98	21.70	19.21	9.08	4.91
Years 2008-2013										
R	2.51	4.08	6.72	2.36	2.41	3.22	-2.39	9.06	4.56	3.59
S	31.12	0.71	25.26	0.71	17.26	0.87	23.16	22.46	11.72	4.94

SOURCE: OWN ELABORATION.

Performance measures (4) - (7) evaluate the investment efficiency by accounting for the return and risk. In our analysis, we evaluate these measures for both time spans using either the stock indexes or the constructed benchmarks as the market representative. The performance measures evaluated for the period 2002-2013 are presented in Tables 5a, 5b and for the period 2008-2013 in Tables 6a, 6b.

● Table 5a. **Performance measures evaluated for the 2002-2013 period**

Country	Sharpe ratio (Eq. 4)			Information ratio (Eq. 5)	
	Pension Fund	Equity market	Country Benchmarks	Benchmarks	
				"Country"	"Global"
Poland	-0.0650	0.3546	0.3564	-0.7674	-0.1423
Germany	-0.5246	0.2359	0.2252	-0.6080	-0.6318
UK	-3.9555	-0.0276	-0.0281	-0.6109	-1.1437
Europe	-0.6010	-0.1095	0.0616	-0.7227	-1.7854
US	-0.5802	0.1519	0.1823	-0.6450	-0.5802
Global			**0.1923**		

SOURCE: OWN ELABORATION.

● Table 5b.

Country	Sortino ratio (Eq. 6)		Sharpe's alpha (Eq. 7)		
	Benchmarks		Equity market	Benchmarks	
	"Country"	"Global"		"Country"	"Global"
Poland	0.1565	0.2389	-3.3342	-3.5822	-1.7653
Germany	-0.2102	-0.0993	-0.2904	-1.5677	-0.6162
UK	-0.4876	-0.4648	-0.2950	-0.7237	-1.3286
Europe	-0.3915	-0.3624	0.0250	-1.5369	-2.9474
US	-0.1726	-0.2518	-2.4406	-3.6501	-5.5301

SOURCE: OWN ELABORATION.

Table 6a. **Performance measures evaluated on the basis of 2008-2013 data**

Country	Sharpe ratio (Eq. 4)			Information ratio (Eq. 5)	
	Pension Fund	Equity market	Country Benchmarks	Benchmarks	
				"Country"	"Global"
Poland	-0.5473	-0.0506	-0.0515	-0.9314	-1.2252
Germany	0.1007	-0.0932	0.1848	-0.2668	-0.3656
UK	-7.1958	-0.0468	-0.0484	-0.8178	-1.3640
Europe	-0.4622	-0.2236	-0.0263	-0.9584	-2.7412
USA	-0.0804	0.2004	0.2456	-0.5138	0.0484
Global			**0.0065**		

SOURCE: OWN ELABORATION.

Table 6b.

Country	Sortino ratio (Eq. 6)		Sharpe's alpha (Eq. 7)		
	Benchmarks		Equity market	Benchmarks	
	"Country"	"Global"		"Country"	"Global"
Poland	-0.7139	-0.8184	-1.0462	-2.9511	-8.6115
Germany	-1.2210	-0.2500	-0.2136	-0.1489	-0.2842
UK	-0.8491	-0.9261	-0.1499	-0.3928	-0.6802
Europe	-0.0281	-0.0600	0.5996	-1.3587	-2.5655
US	0.1328	0.3038	-1.9896	-2.5779	0.4901

SOURCE: OWN ELABORATION.

Analysing the Sharpe ratios (4), we note that the pension funds perform worse than the equity markets, the "country" and global markets in all the analysed countries and the aggregate "Europe". The lowest value is obtained for the UK but we cannot make direct comparisons among the countries, except with the "global benchmark". However, the British funds show the greatest distance from the "global" benchmark[5].

Applying the information ratio (5), it is noted that all the values are negative. This means that all the pension funds performed worse than the benchmarks. However, the values obtained for the "country" benchmarks are very similar for all analysed countries and the aggregate Europe, whereas the value of this ratio evaluated for the global benchmark, shows that the UK and "Europe" have the worst performance. The Sortino ratio is positive only for Poland, where the average real returns of pension funds exceed 3% annually. Using Sharpe's alpha (7), we note that only pension funds in the aggregate "Europe" perform better than the equity market represented by Euro Stoxx 50, but it should be borne in mind that this stock index was characterized by the smallest returns in both periods and high risk (Table 4).

[5] The results for UK funds may be biased by the fact that the sample was cut short at 2012.

Pension fund performance seems to be better in 2008-2013 than in the longer time period, 2002-2013 (Tables 6a,6b), notably for the US, Germany and "Europe". However, pension savings are long-term investments and it is more important to have consistently good performance over the longer periods than in shorter periods.

The direct comparison is possible only for the "global" benchmark, as shown in Table 7, where the positive values of the measure are shaded. It is clear that US pension funds improved their position in the second analysed period, as measured by the information ratio, Sortino ratio, and the Sharpe alpha. Poland is ranked first according to the information ratio in the first period under study, but comes last when the Sortino ratio is used for the years 2008-2013. Germany only tops the ranking once, but is in second position three times, and in third place twice. The UK is ranked last twice—when the information and Sortino ratios are applied.

Table 7. **Ranking of countries for different periods and efficiency measures evaluated for the global benchmark**

Position in ranking	Information ratio		Sortino ratio		Sharpe's alpha	
	2002-2013	2008-2013	2002-2013	2008-2013	2002-2013	2008-2013
1.	Poland	US	Poland	US	Germany	US
2.	US	Germany	Germany	Europe	UK	Germany
3.	Germany	Poland	US	Germany	Poland	UK
4.	UK	UK	Europe	Poland	Europe	Europe
5.	Europe	Europe	UK	UK	US	Poland

SOURCE: OWN ELABORATION.

5. Conclusion

Our paper compares the performance of pension funds in the US and selected European countries. To this end, efficiency measures such as the Sharpe, information and Sortino ratios together with Sharpe's alpha were applied. These ratios were evaluated for pension funds in two different time spans using selected risk-free instruments, market indexes and benchmarks. By applying different representatives of the market index, i.e. stock indexes, and constructed "country" and "global" benchmarks, we were able to compare 70 efficiency measures evaluated for the pension funds operating in Germany, the UK, Poland, the US and aggregate "Europe" for both of the periods under study.

According to the obtained results, Poland and the US achieved the highest average returns for the constructed benchmarks in the period 2002-2013, while the pension funds in Poland and Germany achieved the highest average returns. However, al-

though Poland registers the highest average returns, it also has the highest risk. For the shorter period, 2008-2013, the US had the highest return for both pension funds and the benchmarks, while Poland and the UK experienced losses. On the other hand, the smallest risks are observed for British and German pension funds.

Our analysis shows that the highest stock market returns are observed for Poland, Germany, and the US for the longer period, and for the US and German stock indexes for the shorter investment period, while the European stock index (Euro Stoxx 50) experienced negative returns. The better performance of the market benchmarks relative to the country pension funds indicates that the pension fund managers did not construct effective investment portfolios in all the countries and in both periods. However, in Germany, the UK and "Europe", pension fund risk is significantly smaller than with the "country" benchmarks and the stock indexes. On the other hand, Polish and US pension funds are characterized by relatively high risk, which to some extent is due to the portfolio compositions, since the US and Poland show the greatest share of equity instruments.

It is worth mentioning that the application of different efficiency measures, which combine returns and risk, assigns different rankings to countries and produces a different efficiency evaluation of the pension funds in comparison to the benchmarks. However, in the majority of cases these measures are negative. In other words, the excess return associated with the selection of benchmarks is negative. Therefore, the assumptions made concerning the selection of risk-free instruments and the market index are crucial to the efficiency performance evaluation.

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References

- Agnew, J. and Szykman, L.R. (2005). Asset Allocation and Information Overload: The Influence of Information Display. Asset Choice and Investor Experience, *Journal of Behavioral Finance*, **6**(2), pp. 57-70.
- Ameriks, J. and Zeldes, S. (2004). How Do Household Portfolio Shares Vary with Age? Working Paper. Available at: https://www0.gsb.columbia.edu/mygsb/faculty/research/pubfiles/16/Ameriks_Zeldes_age_Sept_2004d.pdf
- Angus. J., Brown, W.O., Smith, J.K. and Smith, R.L. (2007). What's in Your 403(b)? Academic Retirement Plans and the Costs of Under Diversification, *Financial Management*, **36**, pp. 87-124.

- Antolin, P. (2008). Pension Fund Performance. OECD Working Papers on Insurance and Private Pensions, No. 20. Available at: http://www.oecd.org/finance/private-pensions/41218144.pdf
- Antolin, P. and Stewart, F. (2009). Private Pensions and Policy Responses to the Financial and Economic Crisis, Working Paper No. 9. International Organization of Pension Supervisors. April.
- Bagliano, F.C., Fugazza, C. and Nicodano, G. (2009). *Pension Funds. Life-Cycle Asset Allocation and Performance Evaluation*, OECD, March. Available at: http://www.oecd.org/finance/private-pensions/43779973.pdf
- Bauer, R., Frehen, R., Lum, H. and Otten, R. (2008). *The Performance of US Pension Funds*, International Centre for Pension Management Research Paper, University of Toronto. November. Available at: https://wpweb2.tepper.cmu.edu/wfa/wfasecure/upload2009/2009_7.583868E+07_PA_WFAtext.pdf
- Benartzi, S. and Thaler, R.H. (2001). Naïve Diversification Strategies in Retirement Saving Plans, *American Economic Review,* **91**(1), pp. 79-98.
- Brown, J.R., Liang, N. and Weisbenner, S. (2007). Individual Account Investment Options and Portfolio Choice: Behavioral Lessons from 401(K) Plans, NBER Working Paper No. 13169. June.
- Choi, J.J., Laibson, D., Madrian, B. and Metrick, A. (2001). For Better or for Worse: Default Effects and 401(K) Savings Behavior, NBER Working Paper No. 8651, December.
- Elton, E.J., Gruber, M. and Blake, C.R. (2006). The Adequacy of Investment Choices Offered in 401K Plans, *Journal of Public Economics*, **90**(6-7), pp. 1299-1314.
- Iyengar, S.S., Huberman, G. and Jiang, W. (2003). How Much Choice Is Too Much? Contribu-tions to 401(K) Retirement Plans, Pension Research Council Working Paper, PRC WP 2003-10.
- Jamróz, P. (2013). Efficiency of Selected Equity Mutual Open-end Funds in the Years 2003 - 2011, *Rynek Kapitałowy. Skuteczne Inwestowanie*, Zeszyty Naukowe Uniwersytetu Szczecińskiego Nr. 768, Finanse, Rynki Finansowe, Ubezpieczenia Nr. 63, Wydawnictwo Uniwersytetu Szczecińskiego, Szczecin, pp. 193-206 (in Polish).
- Karlsson, A., Massa, M. and Simonov, A. (2006). Portfolio Choice and Menu Exposure. Available at: http://faculty.insead.edu/massa/Research/menu7.pdf
- OECD (2009). *Pension at a Glance: Retirement-Income Systems in OECD Countries*, OECD, Paris.
- OECD (2013). Pension Markets in Focus. Available at: http://www.oecd.org/finance/PensionMarketsInFocus 2013.pdf
- OECD (2014a), Pension Market in Focus. Available at: http://www.oecd.org/daf/fin/private-pensions/Pension-Markets-in-Focus-2014.pdf
- OECD (2014b). Annual Survey of Large Pension Funds and Public Pension Reserve Funds, Report on Pension Funds' Long-term Investments. Available at: https://www.oecd.org/ pensions/private-pensions/2014_Large_Pension_Funds_Survey.pdf
- Rinaldi, A.I. and Giacomel, E. (2008). Information to Members of DC Pension Plans: Conceptual Framework and International Trends, Working Paper No. 5, International Organization of Pension Supervisors, September.
- Rudolph, H.P., Hinz, R., Antolin, P. and Yermo, J. (2010). Evaluating the Financial Performance of Pension Funds, in: Hinz, R., Rudolph, H.P., Antolin, P. and Yermo, J. (eds.) *Direction in Development, Finance*, The World Bank, Washington DC.

- Sharpe, W.F. (1966). Mutual Fund Performance, *Journal of Business*, **39**(1), pp. 119-138.
- Sharpe, W.F. (1994). The Sharpe Ratio, *Journal of Portfolio Management*, **21**(1), pp. 49-58.
- Sortino, F. and Price, L. (1994). Performance Measurement in a Downside Risk Framework, *Journal of Investing*, **3**(3), pp. 59-65.
- Spitzer, J.J. and Singh, S. (2011). Assessing the Effectiveness of Lifecycle (Target-Date) Funds During the Accumulation Phase, *Financial Services Review,* **20**(4), pp. 36-64.
- Tang, N. and Mitchell, O. (2008). The Efficiency of Pension Plan Investment Menus: Investment Choices in Defined Contribution Pension Funds, Michigan Retirement Research Center. Working Paper WP2008-176, June.
- Towers Watson Global Pension Assets Study (2014). January. Available at: http://www.towerswatson.com/en-US/Insights/IC-Types/Survey-Research-Results/2014/02/ Global-Pensions-Asset-Study-2014