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Can auctions help reduce the pension funds' fees – the case of Poland

Abstract: The companies which manage the mandatory pension funds are frequently accused of excessive fees taking. The international analyses identify that in the countries with legal caps usually the commissions stick to these caps, hence, the market competition does not function. Surprisingly, there are not many international cases, where the local regulators would implement any mechanism to facilitate the competition. One of the few exceptions come from Chile and Peru, where the authorities decided to organize the reverse auction. The observed market outcomes imply that this could be an efficient solution, however, the variety of auction mechanisms bring us ask the question about the optimal solution for this particular purpose. Therefore, in this study, we present the evidence on fees-reduction potential of reverse auctions which is based on the controlled regulatory experiment. Trying to mimic the conditions of Polish market, we look for the set of auction rules resulting in the deepest commissions' cut. We find out, that in the case of Poland a different system of rewards (compared to Latin America countries) should be established. We identify that a variant of an *all-pay* auction, which is a mechanism still unexplored in practice, may result in the most favourable outcomes. Moreover, as under this mechanism we have observed the narrowest gap between the average and the minimum collected fee, we argue that it has a potential to improve the existing Latin America solutions.

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1. Introduction

There are no doubts that cost efficiency of the pension system is one of the factors affecting pension adequacy. Especially, the mandatory system should provide cost competitive solutions to keep the democratic support for its existence. It is not surprising that in Poland the fees charged by the firms (MF) managing the mandatory pension funds (MPF), focused the attention of politicians and economists. MF have been frequently accused of excessive fees taking (Wieteska, 2011) and this argument is even used to support the idea of liquidation of the 2nd pension pillar (Oręziak, 2014). However, before employing this radical solution, we should think about the potential policy tools lowering the MF commissions first.

This paper provides the policy recommendation to introduce the reverse auction mechanism facilitating the fees' competition between MF. This idea is based on the promising experiences of Chilean and Peruvian pension system. Our research contributes to the existing literature by providing a different type of evidence, which comes from the controlled laboratory experiment. Moreover, we propose different auction rules to maximize its efficiency in Polish conditions.

The remainder of the paper is organized as follows: Section 2 provides a brief description of the Polish pension system and MF market. Section 3. surveys the literature on the existing policy options of fees reduction. Section 4 presents the model and hypotheses tested. Section 5. contains a detailed description of the laboratory experiment used in this study. Section 6. reports the empirical outcomes. Section 7. concludes the study.

2. The Polish pension system and MF market

Poland was one of the first countries in Central and Eastern Europe that implemented pension reform (1999) challenging the society's ageing problem. The main policy shift was the transition from the defined benefit (DB) to the defined contribution (DC) rule. Under the DC rule the individual accounts are set up for the participants, where the fixed contributions are transferred by employers and employees. The pension is calculated individually for each participant and depends solely on the value of accumulated receivables and the return on accumulated assets. The Polish system has been based on three pillars. In the 1st pillar the receivables have a non-financial character (NDC), while in the two others the financial securities are collected (FDC). As opposed to the 3rd pillar, the 1st and 2nd pillars are mandatory. The overall mandatory pension contribution was established at the 19.52% level of the gross salary, being divided to 12.22% and 7.3% between the 1st and 2nd respectively.

Until the 2011, the reform did not experience any regulatory changes. That year, probably due to the worsening budgetary outlook, the contribution to the 2nd pillar was cut by 5 percentage points and the contribution to the 1st pillar increased by the same amount. Then, in 2014 the government introduced the default option of transferring the further pension contribution solely (*i.e.* 19,52%) to the 1st while leaving the collected financial securities in the 2nd pillar. However, the remaining in the 2nd pillar T-bonds issued by Polish government have been 'nationalized' *i.e.* the financial securities have been converted to the records on individual accounts in the 1st pillar.

The two main (in terms of revenues collected) kinds of fees charged by Polish MF are:
a) Upfront fee on contribution with the maximal level set by the regulator at 1.75%;
b) Management fee on assets which is based on a regressive algorithm meaning that the fee will fall with the growth of the pension assets. Similarly to the upfront free, the cap on marginal rates is also established here;
c) Premium account fee - which is charged for the superior performance relative to the other funds' investment results.

As it can be seen, besides the fee caps, Polish regulators have not designed any mechanism directly intended to put pressure on the funds to lower their fees, probably assuming that they would do so anyway, in order to beat their competitors. This assumption seems to be plausible, once we take into account the high number of competing funds. When the system was started, the number of MF equalled 15. Assuming an equal market share of each firm, that meant that the Hirschman Herfindahl Index (HHI) – which is a popular measure to assess the concentration level in the markets(Belleflamme & Peitz, 2002) – would equal 0,0667, indicating a market of a low concentration. The actual HHI value for the Polish market[1], with 12 MF left at the moment, equals 0,1118, when measured by the number of members, and 0,1467 when measured by the net assets, both of which mean a medium concentration level.

But, contrary to the regulator's expectations, a decrease in the level of commission charged by the funds, has not been observed. Currently only two MF cut their upfront fees – to 1.7% and 0,75%.[2] while the others still keep the allowed maximum. Previously when the cap was set at the level of 3.5% only two funds decided to offer the marginal discount, *i.e.*

[1] Market shares based on http://www.knf.gov.pl/Images/Kwartalnik_OFE_2015_IV_kw_(20160218)_tcm75-45989.xls.
[2] In fact, 0,75% of contribution is charged by government agencies, *i.e.* 0.4% by Social Security Office, 0.3% by Guarantee Fund and the rest by Polish Financial Supervision Authority. Consequently, lowering the fee to this level results in zero profit from this revenue source.

0.05 and 0.1 percentage point. It has to be underlined though, that a cut in the contribution fee does not lead to a severe reduction in funds' revenues, as their main source is the management fee. The data provided by Polish Financial Supervision Authority (KNF)[3] demonstrates that in 2015 the MF revenues coming from the contribution fee equalled 48 million PLN, whereas the revenues from the management fee were as high as 741 mln PLN.

3. Literature review

To find the rationale for using reverse auction mechanism for fees' reduction we need to answer a few fundamental question before. First of all, how do we know that fees charged are too high? Secondly, in case of lowering the fees what kind of trade-offs do we face? Last not least, why should we presume that other cost-reduction solutions may not be enough to achieve the aforementioned objective?

Numerous research works have underlined the problem of excessive fees charged in various countries, *e.g.* (Queisser, 1998) and (Kritzer, Kay, & Sinha, 2011) in case of Latin America states, (Aguila, Hurd, & Rohwedder, 2008) in case of Mexico and (Ayres & Curtis, 2014) in case United States - 401k plans. These findings are usually based on various cost comparisons, *e.g.* pension funds vs. Pay-As-You-Go[4] (PAYG), pension funds *vs.* mutual funds, mandatory *vs.* voluntary pension funds or cross-country comparison of pension funds of the same type. It is difficult to say which type of comparison is the most accurate because in every case it is possible to indicate some shortcomings. For PAYG it may be hard to measure precisely the pension-related costs, as PAYG systems are usually a part of public social insurance system. On the other hand the comparison between different type of funds may be affected by different type of fiduciary and reporting requirements they face. In case of cross-country comparison it is also quite unlikely to expect that pension funds from emerging economies can experience the same level of transaction costs as pension funds from mature economies investing domestically. Moreover, the eventual comparison can be difficult also due to various systems of fees employed in different countries (Ionescu & Robles, 2014). The pension system maturity may also matter as pension funds usually experience high sunk cost (Tapia & Yermo, 2008). Therefore, by employing the proposed laboratory experiment we can additionally verify if there exists any potential of fees' reduction.

[3] http://www.knf.gov.pl/Images/Kwartalnik_OFE_2015_IVkw_k_tcm75-45989.xls

[4] Pay-As-You-Go is used here as a synonym of the 1st pillar pensions, based on defined contribution (NDC) or defined benefit (NDB) rule.

It is also necessary to think about the potential trade-offs associated with cost reduction. The intuition suggests, that lower fees, which would result in lower MF revenues can translate to worse quality of services provided and lower returns. However, the existing literature does not support this view. There exist the bunch of studies supportive for the passive management in pension funds industry *e.g.* (Dobronogov & Murthi, 2005), (Okseniuk & Tymoczko, 2013). This approach has its roots in the efficient market hypothesis, which concludes that it is impossible to beat the market in the long run. Consequently, under passive framework fund managers should only track market index and the fees become the only factor that determine the net returns. The other kind of evidence comes from the study of (Alda & Ferruz, 2012). They compared the gross and net returns of Spanish bonds and equity pension funds and found the negative relationship between gross returns and fees charged. The same result has been obtained also for mutual funds operating on US market (Gil-Bazo & Ruiz-Verdu, 2007). Additionally, (Alda & Ferruz, 2012) found that after-fee performance is worse than market performance which is again supportive for passive management framework.

Finally, the regulators being aware of excessive fees have implemented various tools to challenge this problem. One of the popular solutions was establishing the fee caps. (Skypala, 2015) provides a meaningful example that since discarding the caps in 1980 in UK the fees charged have gone up. It means that the economy of scale, which has been confirmed by many studies in pension fund industry (Dobronogov & Murthi, 2005), (James, 2005), (Sy & Liu, 2010) did not translate into more favourable conditions for clients but only to bigger companies' gains (Rudolph & Rocha, 2007). Actually, in many countries with legal caps, the market average coincided with the legal maximum fees, especially in the mandatory systems (Ionescu & Robles, 2014). Consequently, caps should not be viewed as the perfect tools. Additionally, the doubts about the 'right' level for caps will always be present (Whitehouse, 2000).

Of course one could argue that instead of the complex tools like the reverse auction advocated for in this paper, the regulator could simply lower the fee caps, which would force all MF to lower the level of fees. One argument against that is simple: due the asymmetry of information the regulator does not have a perfect knowledge how deep it can cut the maximum fee, without endangering the financial stability of MF, and the efficient functioning of the market. Any non-market intervention of that type is risky, as it might cause more problems than it solves. The second argument comes from the auction theory. As (Bulow & Klemperer, 1996)demonstrate, the auction is more efficient than the introduction of reserve prices (in this case: fee caps).

Nevertheless it is intriguing why the market competition did not work. The Bertrand competition model demonstrates that even with just two firms in the market one can expect a price war to start. One reason for the non-existent price competition in pension fund industry could then simply be that it doesn't meet the assumptions of this competition model. In case of Poland it actually fails at three of them: it's neither homogeneous, nor perfectly transparent, plus there exist the exit barriers for the members[5] – all of which make the reduction of commission not that profitable for the fund. The cross country experience reveals that clients did not pay a lot of attention to the commission levels. Instead, they were mainly driven by marketing activities (advertising, promotional gifts) in their choices (Queisser, 1998),(Chybalski, 2011), which have frequently constituted a significant part of MF expenditures (Impavido & Rocha, 2006). Moreover, the complexity of fees charged and presumably low financial literacy of many clients may additionally weaken the impact of information about the commission cut, thus additionally lowering the expected gains from this decision for MF.

But even with the homogeneous, and transparent market with no entry/exit barriers the price competition is not necessarily inevitable. The Sweezy's kinked demand model of oligopoly predicts that firms would be reluctant to lower the prices, as they would fear that it would be matched by the similar cut in prices on the side of their competitors. Thus a reluctance to lower the commissions might be looked upon as a consequence of a tacit agreement between the MF. Simply, all MF understand that cutting the commission could be just a spark that would start the price war, and they want to avoid. If the deteriorating market situation or regulatory shifts do not force them to make any change, they can all stick to the initial prices for the longer period of time.

This latter model may suggests that some additional tool should be implemented to induce the market competition. One of potential solutions may be the reverse auction mechanism.

In fact some of the countries have already used this idea in their pension systems. Bolivia run an international competitive bidding process to choose MF allowed to operate in this market (von Gersdorff, 1997). The similar action was later repeated in Kosovo and this step is recognized as the main determinant of much lower fees experienced by both countries comparing to other economies in their regions (James, 2005).

[5] In the past some MF have established a reduced contribution fees for their long term members. Additionally, a small one-time fee was paid by the shifting individual. Nowadays, the exit costs are limited to filling in the appropriate documents, which can be submitted every two year during the four months "transfer windows" which will be announced every two years.

The other evidence, being the inspiration for our study, comes from Chile and Peru. In 2008 the Chilean government introduced the reverse auction, designed to force the operating MF to lower the fees' level. In the auction that is held every second year the MF ask the level of fees they are going to charge from new contributions. The winner, being the MF that asked the lowest price, is rewarded with the right to acquire the contributions of all new participants that are joining the pension system for the period of two years (when the next auction would be arranged). Moreover the benefits of the lower fees are experienced by all the members of MPF, which is managed by the winning company, as the price discrimination is not allowed, and the MF must charge all its clients with the same fee. Apart from the benefit, being an acquisition of new clients, the winning MF gains a public attention, and can count on additional clients, who come over from the MFs with higher fee level. Figure 1 demonstrates that the years after the auction brought a continuing decrease in the values of fee level charged, but this change concerned mainly the minimal fee, and to a lesser extent the average fee level charged.

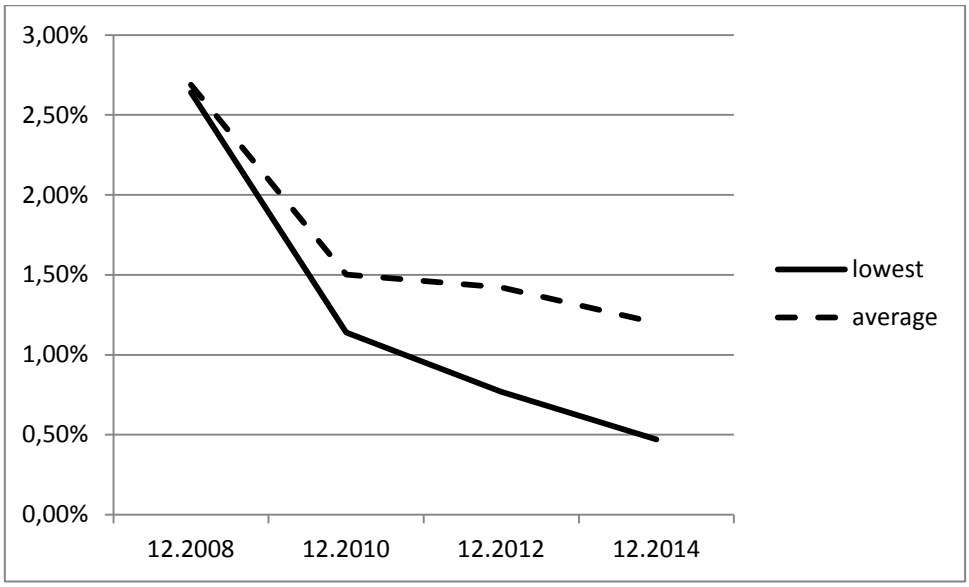

Figure 1. Changes in fee levels charged by Chilean pension funds, after the introduction of the auction mechanism
Source: calculations on basis of statistical data from Centro de Estadisticas de Superintedencia de Pensiones, www.safp.cl. All data for the 31.12 of the respective years. Average values weighted by the number of funds' members. The average fee level for 2014 taken as estimation from (Ionescu & Robles, 2014).

The 2012 Peruvian pension reform introduced an auction system very similar to the one that has been successfully applied in Chile, with the same reward system, being an acquisition of the new clients for the period of 2 years. The reform in Peru changed the system of fees, converting from the fees based on salaries to the system based on account

balances. As all new clients will pay fees based on account balances, the existing clients will be charged a mixed commission partly based on new contributions and partly on account balances. The transition period will last till 2023, when the contribution fee is going to disappear.

The experience from Chile and Peru tends to assume that the introduction of the auctions might be an efficient tool in bringing down the fees charged by MF. Nevertheless, before implementing a similar concept on Polish market, there is a number of issues that need to be addressed. An efficient auction design depends on the properties of the given market and the specific goals of the auctioneer. In this study we hope to provide the laboratory evidence, which would fill in this gap.

4. Model and hypotheses

In Poland there compete 12 MF at the moment. If one wanted to simulate experimentally this market structure, a huge number of participants would be needed. To avoid this, it has been decided to cut that number by half, by assuming that there are only 6 MF competing in the market. In order to make the market structure at least partly similar to the Polish one, we tried to minimize the difference between the real market and modeled market HHI, and normalized HHI values, where the latter is calculated according to the following formula:

$$nHHI = \frac{HHI - \frac{1}{n}}{1 - \frac{1}{n}} (1),$$

i.e normalized for the number of firms. This lead us to the market structure, with the following market shares: 29%, 26%, 20%, 10%, and 5%. Obviously that increases the concentration level compared to the real one, but hopefully is close enough to mirror the real market competition level[6].

It has been assumed that costs of the MF have the following linear form:

$$TC(A) = \alpha A + \beta \ (2),$$

where: TC is the total cost, A is the value of net assets, and α, b are parameters.

The linear form of the total cost function and the assumption that parameter α, and β have the same values for all MF is a simplification that is much needed for the experimental purposes, but it actually turns out to fit the data astoundingly well, proving that there are grounds to believe that the variable cost depends linearly on the value of assets. The

[6] The real HHI (measured by net assets at the end of 2015) is 0.147, and the one resulting from the model is 0.214, and for the normalized HHI these values equal 0,0691, and 0,0574, respectively

parameters of equation (2) were estimated using the linear regression and the data from Polish OPFs market by the end of 2015[7], resulting with the values $\alpha = 6.01$ PLN for each 1000 PLN of net assets, and $\beta = 10.86$ mln PLN[8].

The MF take decisions concerning 4 variables: contribution fee (f_C), management fee (f_m), and investment in 2 risky assets (r_1, r_2). The contribution and management fees cannot exceed the current caps, which are 1.75%, and 0.54% (annually), respectively.

The investment decision is made as simple as possible. The participants decide only about the fraction of money invested in two types of risky assets, r_1 being an amount of money invested in the medium risk assets, and r_2 being the amount invested in the high risk assets. The rest is invested in the risk free bonds. Participants know the distribution of returns from both types of investments, which are modeled to have the independent normal distributions.

According to the aforementioned default option of automatic enrollment to the 1st pillar introduced in 2014, only about 15% of the MPF members[9] decided to continue transferring part of their pension contribution to the 2nd pillar. From now on we will call these members as *active* ones, while the rest majority as *inactive* (their accumulated funds are still managed by the MF, but no new contributions are made). The share of active members number will be decreasing with years, as a very small percentage (around 1%) of new people[10] entering the system decide to become a member of MPF now. The total number of the MPF members will be denoted by X, and the share of the active members by ω.

The MPF members are modeled as homogeneous. At the beginning of the experiment their accrued assets are set to be equal (a), and each round the active members make new contributions to the fund at the fixed value, that equals c.

The MF' revenues result from 3 sources:

- upfront fee from new contributions (only active members),
- management fee, based on the accumulated assets (all members),

[7] http://www.knf.gov.pl/Images/Kwartalnik_OFE_2015_IVkw_k_tcm75-45989.xls

[8] The coefficient of determination equals 0.97. The value of b (fixed cost) is statistically insignificant (p=0.051), which was actually expected, but the crucial information is that the value of a is statistically significant (p=3.4E-09), moreover quite stable over the years, as the estimated data from three other years studied equaled 5.09 (2011), 4.45 (2012), and 5.17 (2013). In case of all those years, the value of the α parameter turned out to be statistically significant, and the value of parameter β (the fixed cost) was statistically insignificant. This demonstrates, that there are reasonable grounds to believe, that the variable costs do actually depend linearly on the value of net assets, and this relationship is similar in case of various funds.

[9] http://mu.rf.gov.pl/58/art-6.html

[10] http://www.polskieradio.pl/42/273/Artykul/1267682,OFE-czy-ZUS-Mlodzi-Polacy-wybieraja-ZUS

- premium management fee, f_p, which depends on the funds' investment results in the previous period, and equals maximally 0.06% (annually) of the acquired assets.

Summing up, the MF's profit each year is calculated in the following way:

$$TP(A, C, f_m, f_p, f_c) = f_m \cdot A + f_p \cdot A + (f_c - 0.75\%) \cdot C - \alpha A - \beta \text{ (3)},$$

or:

$$TP(A, C, f_m, f_p, f_c) = (f_m + f_p - \alpha) \cdot A + (f_c - 0.75\%) \cdot C - \beta, \text{ (4)}$$

or:

$$TP(X, f_m, f_p, f_c) = (f_m + f_p - \alpha) \cdot aX + (f_c - 0.75\%) \cdot c\omega X - \beta, \text{ (5)}$$

where: TP is total profit, A is the total value of net assets, and C is the total value of new contributions.

Two variables controlled by the participants (f_m, f_c) affect their profits in a direct way, whereas the last one (r) affects it indirectly, as it is responsible for the rate of return, reached by the fund, which in exchange influences f_p. Values of those variables are also (to some extent) taken into consideration by the existing and potential funds' members, and so affect the values of assets and contributions in the next rounds.

Let us use (5) to analyze the role of the fee levels for the total profit reached, by calculating the partial derivatives from the TP function:

$$\frac{\partial TP}{\partial f_m} = aX + (f_m + f_p - \alpha) \cdot \frac{a \cdot \partial X}{\partial f_m} + (f_c - 0.75\%) \cdot \frac{c \cdot \partial(\omega X)}{\partial f_m},$$

and so:

$$\frac{\partial TP}{\partial f_m} = aX + [a \cdot (f_m + f_p - \alpha) + c \cdot (f_c - 0.75\%)] \cdot \frac{\partial X}{\partial f_m}; \text{ (6)}$$

and

$$\frac{\partial TP}{\partial f_C} = (f_m + f_p - \alpha) \cdot \frac{a \cdot \partial X}{\partial f_C} + c\omega X + (f_c - 0.75\%) \cdot \frac{c \cdot \partial(\omega X)}{\partial f_C},$$

and so:

$$\frac{\partial TP}{\partial f_C} = c\omega X + [a \cdot (f_m + f_p - \alpha) + c \cdot (f_c - 0.75\%)] \cdot \frac{\partial X}{\partial f_C}. \text{ (7)}$$

Using those derivatives, one can calculate how many new members would MF have to acquire to compensate for the lower value of the fees charged. Equaling (6) to 0, we get:

$$\frac{\partial X}{\partial f_m} = -\frac{aX}{[a \cdot (f_m + f_p - \alpha) + c \cdot (f_c - 0.75\%)]}, \text{ (8)}$$

where $\frac{\partial X}{\partial f_m}$ shows the change in the number of fund's members due to a change in value of the management fee. Taking the real (average) values from the Polish market[11], and applying them to (8), we get that lowering the management fee by 0.01%, would be profitable if and only if it resulted in acquiring the additional 590 thousand members. We can also check, how this value changes with the level of the average variable cost. As an illustration, if α was down to 3 PLN/th. assets, then this threshold value would decrease to 79.3 thousand, which can be interpreted as some demonstration of the law of supply[12].

The profitability of the decrease of the management fee depends on the market share of the MF. For the smallest MF in the simulated market structure these numbers equal 177 thousand (for α = 6 PLN/th.), and 23.8 (for α = 3 PLN/th.), whereas for the largest one these are: 1.03 million, and 138 th., respectively. In both cases the number of new members that would have to be acquired is much higher, than what can be expected in the real market.

By analogy, let us now take a closer look at (7). Making it equal to 0 we get:

$$\frac{\partial X}{\partial f_C} = -\frac{c\omega X}{[a\cdot(f_m+f_p-\alpha)+c\cdot(f_c-0.75\%)]}, \quad (9)$$

where $\frac{\partial X}{\partial f_C}$ shows the change in the number of fund's members due to a change in value of the contribution fee. Substituting again the values from the Polish market, we get that lowering the contribution fee by 0.01%, would be profitable if and only if it resulted in acquiring the additional 11.3 thousand members (and in case of $\alpha = 3$ PLN/th. assets 1.5 thousand additional member would be sufficient). Again, looking at the data for the smallest and largest MF in the simulation, we get that those numbers equal 3.4 th., and 0.46 th. for the smallest MF, and 19.6 th., and 2.6 th. for the MF with the biggest market share.

Contrary to the management fee, one should expect higher willingness to lower the contribution fee on the MF side. This is due to the fact, that new contributions do not weigh much in the MF' revenue structure, and so obtaining the new members (with their accumulated assets) might be tempting. The aforementioned observations from the Polish market seem to confirm the conclusions reached from the marginal analysis – 3 MF decided to cut the contribution fee and none of the MF has ever decided to cut the management fee. Moreover, the real data does not incline us to believe that lowering the contribution fee results in greater profit, as the transfers between MPF were mainly driven by marketing activity. Before implementing the ban on acquisition in 2012 the quarterly number of members

[11] $X = 2750000$, $f_m = 0.54\%$, $f_p = 0.03\%$, $\alpha = 0.006$.

[12] The lower is the average variable cost, the more MF earns per fund member, and so, the more members it pays to acquire.

changing the MPF was fluctuating between 100 and 160 thousand members (2008-2011), while after this regulatory shift the highest quarterly value reached only 15 thousands (Nov. 2014). Taking the perspective of the single MPF, the highest recorded quarterly net inflow of members has never been greater than 30 thousand.[13]

As the profit analysis demonstrates, it is not in MF' interest to lower the management fee, which is why we argue for introducing the auction. Even though this research was inspired by the Chilean and Peruvian experiences, the Polish market differs so much from the South American ones, that it demands a completely different approach. First of all, Polish market used to be much less concentrated from the very start, and even now the number of existing MF is much bigger than in the South American countries. Secondly, the Chilean auctions concerned only the fee level on new contributions, as it was the main source of revenues for the pension funds. As a consequence the natural reward in the auction was an acquisition of the new members. This solution created incentives for the funds to lower the level of fee on new contributions, and benefited the new members, by allocating them to the lowest cost funds. In Poland there are two types of fees, and it is the management fee that weighs more for the members. Moreover, due to the recent changes in the market, the number of new members entering the system is very small, and so the Chilean reward system would most likely not pay its role in Poland.

Thus, we suggest a different reward mechanism - the winning MF would be rewarded with the acquisition of some of the assets of the already existing members. For that purpose the assets of the inactive members could be used.[14] The inactive members do not pay the fee on contributions (as their new contributions go to 1st pillar only), and so the level of fee on new contributions cannot be a criterion in the auction. Those members would only be interested in the management fee, and the rate of return on their assets, and so those two variables would be the criteria in the auction.

Thus it was decided to test experimentally a two-criteria scoring auction with the main criterion being the management fee, and the second criterion being the rate of return. The rate of return is not a variable decided upon by the auction members, its value is calculated as the actual rate of return reached by the fund in the periods following the previous auction. Each

[13] http://www.knf.gov.pl/opracowania/rynek_emerytalny/dane_o_rynku/rynek_ofe/Transfery/transfery.html

[14] For example it could be the assets of these members who had to be randomly drawn to the MPF before 2014 reform, as they did not submit any declaration regarding the selection of the MPF. In some of the periods (the draws were organized two times a year) the share of 'uninterested' new members reached even 50%. Hence, If they have not been interested in the selection of MPF they should not be dissatisfied if their assets would be managed by the lowest cost MF.
http://www.knf.gov.pl/opracowania/rynek_emerytalny/dane_o_rynku/rynek_ofe/Losowania_ZUS/losowania_zus.html

fund learns about those values, and points reached for this criterion prior to the auction, and so it knows, how well it stands compared to its competitors.

It is difficult to determine what should be the weights of the two criteria in the scoring auction. The rate of return might have a tremendous impact on the situation of the fund members: huge profits can double the value of the fund, whereas substantial losses can consume major part of it. The role of the management fee is less spectacular; the values it could take range between 0% (hypothetically) and 0.54% (maximum), so it would never dramatically affect the situation of the fund members.

But, on the other hand, the value of the management fee is stable. The clients of the winning MF are guaranteed that they would not be charged a fee higher than the declared commission for a period of two years to come. In case of the rate of return there is no guarantee of anything, hence, the persistence of MF has not been observed (Kominek, 2006).

Taking that into account it was decided to assign a much higher weight of 0.8 to the management fee, and only 0.2 to the rate of return. With the maximal score set to 1000 points, this means that MF can maximally reach 200 points for the rate return, and 800 points for the management fee. In case of the management fee a linear scoring rule is used, with the maximal value of 0.54% and the minimal value of 0.3%[15], *i.e.* the score is calculated using the following formula:

$$S(f_m) = 800 \cdot \frac{0.54\% - f_m}{0.24\%}, \quad (10)$$

In case of the rate of return a linear scoring rule would be difficult to introduce, as it is hard to predict, what range would the actual rates of returns take the values from, and we would like to avoid setting them arbitrarily in case of every new auction to come. For that reason it was decided to introduce a highest bid – lowest bid scoring rule (Dimitri, Piga, & Spagnolo, 2006)

$$S(r) = 200 \cdot \frac{r - r_{lowest}}{r_{highest} - r_{lowest}}, \quad (11)$$

where: r_{lowest}, $r_{highest}$ are, respectively, the lowest and the highest rates of return reached by all MF participating in the auction.

The main difference between the formulas (10) and (11) is that in case of the former the threshold values are predetermined, whereas in case of the latter they result from the bids. The consequence of that is, that the MF with the lowest rate of return will get 0 points for that criterion, and the MF with the highest rate of return will get 200 points. The maximal, 200

[15] This value cannot be too low, once we want the auction to differentiate the participating MF, but low enough so that the MF would have problems reaching it. The final value set results from the game parameters.

points differential in case of the rate of return corresponds with the 0.06% differential in case of the management fee, i.e. this is by how much the worst investing MF would have to cut down its management fee to catch up the lost points.

Of course, we could consider a different auction design, one in which MF declare the minimal guaranteed rate of return for the period of two years to come. In case of this auction protocol we could consider a much higher weight of the rate of return. But there are some risks when implementing a solution of this type. Will MF be willing to risk declaring any positive value in the auction like that? And if so, wouldn't it result with a much safer investment policy in the coming years, actually providing the members of the winning fund with the lowest rate of return in the market? Finally, there is an adverse selection risk. There is a danger that the MF in the worst financial condition would be the ones desperate enough to risk guaranteeing the positive rates of return, which could have fatal consequences in the future both for them, and for the financial security of their clients.

The decision to use a scoring auction doesn't predetermine the auction mechanism adapted. As a benchmark model it has been decided to apply the first-score auction. In case of this mechanism participants make sealed-bids of the management fees, with the winner being the MF that reaches the highest score from both criteria involved. After the auction the winning bidder applies the declared value of the management fee, which cannot be lowered for the period of two years to come.

But there is a certain flaw resulting from the application of this or any other standard auction rule. As the auction forces the winning MF to lower the management fee, it does not introduce any incentives for the losing MF to do the same. Of course this problem has also been observed in case of the South American auctions described in Section 3. - as Figure 1. demonstrates, the minimal fee level applied is much lower than the weighted average; the biggest MF did not necessarily cut their fees to such an extent. When planning the auction in Chile, the hope was that the other MF would be forced to lower their fees as well, as a consequence of the higher market pressure, and potential shifts of their members to the lowest fee fund. In Poland, due to the non-transparency of the market, and limited number of active members left, this problem might be even more serious.

Therefore it has been decided to test experimentally a non-standard auction mechanism, that is widely known in the auction literature, *i.e.* an all-pay auction (Krishna, 2002). This is a sealed-bid mechanism, just as the first-score auction, with one important exception – in case of this mechanism it is not just the winner that has to pay his or her bid, but this rule applies to every bid made in the auction. If the all-pay auction design was

introduced in case of the scoring auction under study, it would mean, that all participating MF would have to keep the management fees asked in the auction for the period of two years, even if they lose the auction. The Revenue Equivalence Principle predicts the same efficiency of the first-price sealed-bid auction, and the all-pay auction, which results from the fact, that the participants of the all-pay auction should be very careful with their bids. But in case of the risk-averse bidders, and the specific design of the scoring auction under study, this result in not necessarily expected.

The main hypothesis in the study is that the introduction of the auction will lead to the substantial decrease of the management fee, *i.e.* that the average level of management fee after the auction will be significantly lower than in the periods prior to it. Apart from the main hypothesis, there is a list of specific ones, that concern the individual decisions made by the auction participants, the efficiency of various auction mechanisms, or the role of collusion for the equilibrium reached. These hypotheses will be introduced in detail in the upcoming chapters.

5. The experimental design

The experiment was carried out as a multi-round experiment, with the unknown number of rounds, and a rule that one round corresponds with one year in the real economy. It was designed and implemented using the zTree environment (Fischbacher, 2007). Students of the Wroclaw University of Economics enrolled in the experiment voluntarily, through the Internet. The experiment was started with an instruction, that included the true or false questions, which checked the students comprehension of the game rules. After the instructions a one trial round was played, and all doubts concerning the rules were publicly cleared up, before starting the right experiment.

A significant part of the instructions and explanations was to ensure that all students understood the incentive system. As the model was asymmetrical, with students differing by the starting number of assets, and profits reached, it was decided that the participants' reward would be based on their relative performance, *i.e.* on the extent to which they were able to increase the MF's profit. Therefore, the final reward depended on the relationship between the average profit reached by a participant and the starting profit, resulting from the initial game parameters.

Students could keep a track of their rewards, as the information on the current level of their payoff was available on the computer screens throughout the game. It was underlined on

several occasions, that each participant's reward depends only on his or her profits, and does not depend on the profits reached by other MF.

As an incentive system it was decided to use the extra points for the classes, which affected students' final grades. There are reasons for which this type of an incentive was believed to work the best. First of all, when using the classroom points we avoid any income effects, which are known as a weak point of the financial rewards. All students were in exactly the same position: the experiments were carried out at the beginning of the semester, when none of the students had any points from the courses, and therefore reached similar utility from the classroom points. The maximal number of points that students could win during the experiment was 10% of the total number of points from the course, which is a significant reward for any student. Our experience from the previous years, concerning the auction experiments with classroom points, demonstrates that this is in fact a very strong incentive: the number of volunteers was spectacular, participants were highly motivated, and when asked in a post-experiment survey to valuate one classroom point, the median answer was 30 PLN. With the average payoff of 3.3 points that means that the average payoff was valuated at 100 PLN, or 25 EUR - a significant value in case of Polish students (Kuśmierczyk, 2013).. Therefore, we can say, that our experience proves a known fact, as pointed out by (Friedman i Sunder, 1994):"grades can elicit high levels of motivation and effort from subjects without spending money". Finally, the system of financial rewards would require some tax reporting duties from the participants, hence, this additional obstacle could discourage some of the potential volunteers.

After the instructions and the trial round, the right experiment was started. At first, students were not informed, that there would be an auction introduced in this market, as we needed to observe, how the competition works without them. After two rounds of competition, students were informed about the auction, and were provided with the instructions. Thereafter, the auction was started every second year.

Each decision round was followed by the results window, which provided all the necessary information:

- on the financial results of the individual MF, *i.e.*: revenues from all sources, costs, rate of return, profit, number of members, and the current payoff,
- on the current market situation, i.e.: fee levels, and fee level changes of all MF, rates of returns reached, shifts in the number of members, and profit changes.

All experiments were conducted, using the Wroclaw University of Economics' laboratory facilities. The average time of an experiment was 2 hours, which allowed as to simulate 9 years in the market.

5.1. Game parameters / Treatments

Summing up, the simulation of the pension funds' market was run with the following assumptions:

A. There are 6 MF competing in the market, with the following market shares: 29%, 26%, 20%, 10%, 10%, and 5%.
B. The total number of members is 2 750 000; 75% of them are inactive, and 25% are active. These numbers stay constant throughout the simulation: there are no new entrants, and no withdrawals from the system.
C. The members are homogeneous. As the total value of assets of all MF is 140 billion PLN, the value of assets per member equals 8485 PLN per member. All active members pay a new contribution every year, that equals 650 PLN.
D. All MF has costs functions given by (2), with $\alpha = 3$ PLN/th. of assets, $\beta = 1\,000\,000$ PLN[16].
E. The maximal values of the fees match the real ones, *i.e.* it is 0.54% annually in case of the management fee, and 1.75% in case of the distribution fee. In the game the players start with the values 0.50%, and 1.50%, so as not to suggest them, that the maximal fees are necessarily optimal.
F. Apart from the decisions concerning the fee values, the participants decide, about the share of all assets invested in 3 types of investments. The rate of return of the risky investment is drawn from a normal distribution: $N(7.58\%, 5{,}72\%)$, and in case of the moderately risky investment the following normal distribution is used: $N(4.29\%, 1{,}92\%)$. The rest of the assets is invested in the risk-free investment with the rate of return that equals 2%. The randomization process for the two risky investments is independent, and so are the draws in each subsequent period. But the draws for different members in the same decision period are not independent: in fact the returns from risky investments of various MF are very close to each other (they

[16] The value of the fixed cost was found to be insignificant, and so its value was set on the arbitrary level o 1 million PLN. The actual value of the average variable cost is about 5-6 PLN/th. assets. In the experiment this value was lowered, so as to provide the players with a wider range of possible choices, concerning the management fee. This does not affect the direction of the expected changes, or the relative efficiency of auction mechanisms, but does affect the final level of the management fee reached, which should be expected to be on a higher level in the real market.

differ by the random, marginal values, so as to differentiate the final rates of return, which affect the premium fees, and the auction results.

G. The shifts of the members between the funds were calculated using a simple algorithm. It was assumed that the members might decide to change the fund due to one of three criteria: the management fee, the distribution fee, and the last round rate of return. In case of all these criteria, independently, the maximum number of members changing the fund was set to 1% of all active members, and the potential switches of members were distributed proportionally, according to the parameter values. In the period right after the auction, the proportion of members considering a change of the MF was increased to 5%, in order to simulate the effect of the bigger awareness on the clients' side.

H. In case of the decisions periods, there are several information revealed, so as to facilitate the decision process: the expected rate of return, the expected shift in the number of members, the expected value of profit, which students could test for the various values of fee levels, and investments considered. The forecasts were made with the ceteris paribus assumption, i.e. assuming that none of the competitors changes any of his parameters.

I. In order to help the students make rational decisions concerning the bids in the auction periods, they were given information about the estimated break-even value of the management fee, calculated from the following relationship:

$$E[TP(f_m^0|"lose")] = E[TP(f_m^*|"win")], \quad (13)$$

where: f_m^* is the break-even value of the management fee, understood as the value of the management fee, that after winning the auction (and gaining additional members) gives a MF the same profit, as it would have, had it lost the auction, and lost 10% of the inactive members, but kept a higher (current) management fee (f_m^0). The students were exhaustively explained, how this value should be interpreted[17]. Naturally, the break-even management fee values depended on the fund's market share, as it was more profitable for the small funds to cut its value. The table presents the values of

[17] Students were explained, that this is the threshold value, and that this is just an estimation, that does not take into account the dynamics of the market, and all potential changes. In fact, it might be optimal to bid a lower value, if one has a strategic plan for a longer time span: win several auctions with low values of the management fee, and then increase it, realizing that the inactive members cannot quit your fund, as they don't take decisions of that sort. And, as a matter of fact, few students have been observed to use such a strategy.

f_m^* at the initial market shares, as well as the point advantage in the auction resulting from the scoring system used:

Table 1. The values of the break-even management fee levels at the initial market shares

MF	Market share	f_m^*	ΔS_m
F1	29%	0.449%	-
F2	26%	0.445%	13.33
F3	20%	0.436%	43.33
F4	10%	0.408%	136.67
F5	10%	0.408%	136.67
F6	5%	0.376%	243.33

Source: own study.

As Table 1. demonstrates, the auction was in fact asymmetrical with an *a priori* advantage of the smallest MF. The additional factor that introduces asymmetry in this market were the points reached for the accumulated rate of return, which were revealed to the action participants prior to the auction.

Apart from the multi-criteria auctions, being the main point of our interest, we have decided to run additional experiments, that would test the efficiency of a one-criterion auction, *i.e.* the auction in which the management fee is the only criterion, by which the winner is established. The elimination of the accumulated rate of return from the criteria list has two important consequences from the auction theory standpoint.

First of all, it makes the auction less asymmetrical. Still the smallest funds have an advantage as they have a lower value of the break-even fee, but as the points for the rate of return are no longer added, no MF can be *a priori* sure to win the auction.

Secondly, in a one-criterion auction we no longer need the scoring function, as the winner is simply the MF, that asks the lowest management fee. That means, that the minimal value of the management fee (in case of two-criteria auctions being 0.30%) is no longer needed. It is hard to predict the consequences of its elimination, though: on one hand, the MF are free to ask lower fees in the auction; on the other hand, there is no natural anchor value in the game, hence the firms might ask higher values.

The main factor changed in the subsequent treatments of the experiment was the auction mechanism. Table 2. presents the information on all treatments used in the experiment.

Table 2. The experimental treatments.

Treatment	Auction	No. of participants	No. of groups
A	Two-criteria first score auction	72	12
B	Two-criteria all-pay auction	54	9
C	One-criterion all-pay auction	54	9

Source: own study.

6. Empirical findings

In this part we start by looking at the main hypotheses, *i.e.* whether the auctions play their role in bringing down the management fee level, which is the main reason for its potential implementation. Additionally we will compare the efficiency of the auction mechanisms under study. In the last subsection we will look into the individual strategies of the participants, and try to characterize the emerging competition.

6.1 The auctions efficiency

Table 3 presents the main statistics concerning the fee levels.

Table 3. Fee levels prior and after the auction (in % values)

Treatment	Management fee		Distribution fee	
	weighted average	lowest	weighted average	Lowest
no auction	0.5148 (0.0161)	0.4846 (0.0366)	1.5014 (0.0806)	1.234 (0.2182)
A	0.4769 (0.0232)	0.3646 (0.0442)	1.5691 (0.082)	1.2116 (0.2936)
B	0.4272 (0.0333)	0.3506 (0.04608)	1.5394 (0.1175)	1.2771 (0.2348)
C	0.4580 (0.0271)	0.3792 (0.0417)	1.5507 (0.1224)	1.2576 (0.3114)

Source: own study.
Note: the "no auction" treatment aggregates the results of the first two decision periods from all the experimental groups. In case of treatments A-C, the values coming from the first two non-auction periods are omitted. Weighted averages are the fee average levels weighted by the market share. The values in brackets show the standard deviation.

The first observation on the basis of this data is the confirmation of the prediction, that with no auction, it is hard to expect the decrease of the management fee. The simulations were started with the value 0.5%, so that the participants had to decide, what is more profitable: to decrease or increase its value. The average value of the management fee in the first two periods (*i.e.* prior to the auction) is 0.5148%, demonstrating a shift up, closer to the maximal value of 0.54%. In case of the distribution fee the shifts of value were observed in both directions, and the average value is very close to the starting one.

Auctions did generally play its role in bringing down the management fee. In all cases under study both the average and minimal values of this fee are significantly lower than prior to auction. But one of the auction mechanisms turned out to be much more efficient than the others – the two-criteria all-pay auction forced the participants to cut their fees the deepest.

One of the reasons could be, that the minimal value of 0.3% served as an anchor. The management fee that low has been observed on several occasions in case of treatment B, but no one cut his or her fee that low in case of treatment C. More insight into the potential differences in auctions' efficiencies might be reached, once we look more closely to individual strategies applied in auctions, which is left for part 6.2.

6.2 Competition strategies

Let us now look deeper into the participants' strategies. The simulation was always started with the initial values of the contribution and management fees that equalled 1.5% and 0.5%, respectively. By not starting the experiment with the maximal values, the participants were allowed to judge by themselves whether the upright or the downright movements of those fees were more profitable. As has already been explained, due to the non-transparency of the market, it was never beneficial to lower the management fee, and in fact such moves were observed rarely. In their first decisions 69.4% of all participants decided to increase the management fee, and just 13.3% lowered it. In the second round of the experiment 73.3% of participants kept the management fee on the level higher than 0.50%. The willingness to lower the distribution fee was higher. In the first year 42.8% of all participants increased the distribution fee, but an almost equal number of 41.1% students decreased it. The numbers in the second round were similar. There are two arguments that can be used to explain the difference between the participants' strategies concerning the management and the distribution fees. First, as was demonstrated by the theoretical analyses in Section 4., there is a huge difference between the marginal benefits of lowering these fees: the 0.01% decrease of fee level would be profitable if it was followed by the 79.2 th. increment in number of members in case of the management fee, but in case of the distribution fee only 1.5 th. would be enough. As reaching the first number was impossible under the experimental regime, the second one was easily achievable. Secondly, the revenues coming from fees charged on new contributions formed a small share in MF total revenue, therefore it was more difficult for the participants to determine its optimal level.

After the two initial periods an auction was announced, the rules of which differed in the subsequent treatments. In treatment A students participated in the two-criteria first-score auction; treatment B tested the efficiency of the two-criteria all-pay auction, and treatment C simulated the one-criterion all-pay auction. Table 4. shows the main statistics concerning the value of the management fee bid in the auctions under study.

Table 4: Main auction statistics by treatments

Statistics	Treatment A	Treatment B	Treatment C
Average bid	0.4298%	0.4434%	0.4726%
Percentage of bids equalling 0.3%	2.1%	3.7%	0.5%
Percentage of bids ≥ 0.5%	12.2%	29.2%	48.61%
Average distance between bid and f_m^*	-0.0012%	0.0423%	0.0527%
Efficiency	31%	56%	44%

Source: own study.

As we can see, the participants showed the highest willingness to cut the management fee in case of treatment A, *i.e.* in case of the first-score auction. This is demonstrated by a number of variables: the lowest value of the average bid (0.4298%), the lowest percentage of bids at the level of 0.5% or higher (12.2%), and the average distance between participants' bids and the break-even value. This last statistic is even negative, which means that bidders asked fees lower than the hypothetical break-even point; nevertheless the distance is close to zero. All of those results were anticipated; in case of the first-score auction, the losing bidders did not have to keep the management fee on the level bid in auction, and so their willingness to cut it was higher.

The participants were much more reluctant to lower the fees in case of the all-pay auctions (treatments B and C), where the fee bid had to be maintained for the two years to come: they bid significantly above the value of the break-even point, and many of them have decided to offer fees close to maximum. By doing that they lowered their chances of winning the auction, but at least were able to keep high levels of the management fees in the post-auction periods. As we can see, in case of treatment C (one-criterion auction) as many as 48.61% of participants decided to bid 0.5% or higher.

All of the auctions under study have a relatively low efficiency, measured as a percentage of auctions won by the strongest bidder (the one that would get the highest number of points by bidding the f_m^* value), which is due to the complex nature of the auctions under study. Interestingly though, the efficiency of the all-pay auctions is higher than that of the standard first-score auction. Most likely this is due to the fact, that in case of all pay auctions the weaker bidders decided to withdraw from the auction competition (by bidding values close to 0.54%), which increased the chances of winning the auction by the strongest bidders.

Let us now take a closer look at the participants' strategies in the subsequent auctions, starting with the **two-criteria first-score auction**. Figure 2. shows the average and the minimal level of management fee, including the first two non-auction periods.

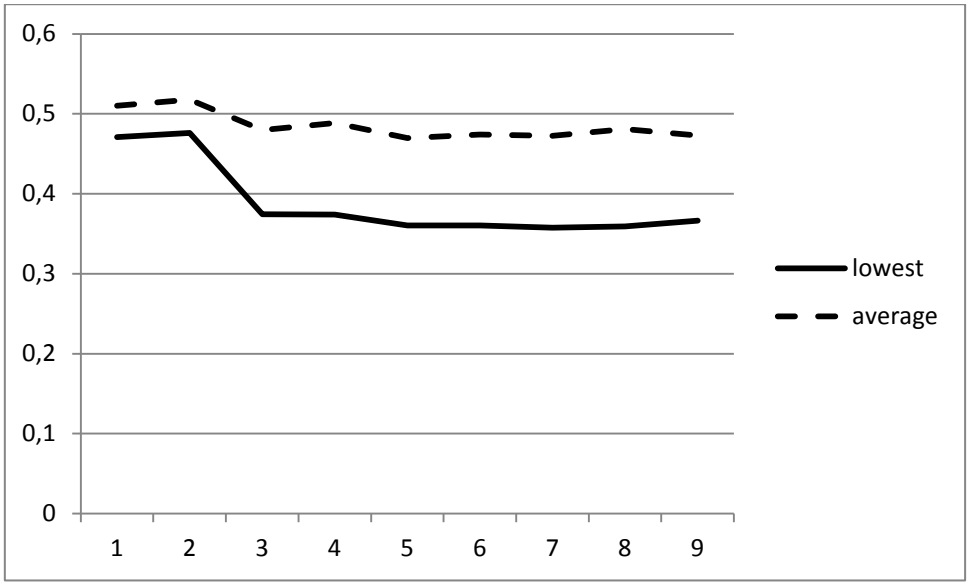

Figure 2. The average and the minimal level of management fee in treatment A.
Source: own study.

As we can see, there is a clear cut in the management fee level after the first two non-auction periods, but unfortunately it concerns mainly the lowest fee levels. These come from the auction winners, who were obliged to keep the management fee on the low level, but unfortunately was not matched by the fee reductions from the other MF. The bidders who lost the auction were rationally returning to their fee levels from the pre-auction periods.

Let us now take a closer look to the price strategies in auction. In the first-score auction used in treatment A, there were two parameters that affected the final score: the rate of return and the management fee. As the rate of return had already been determined, and the resulting points had been revealed prior to the auction, the participants decided only about the management fee levels. The participants were provided with the information on their break-even management fee levels, which can be treated as the zero profit levels. The participants should have bid above their levels, unless they had a more complex long-term strategy[18].

The auction theory generally has little to say about the optimal strategies in the asymmetrical auctions, but luckily in this case, with the points from rate of return and the break-even management fee levels of all participants publicly announced, it is actually possible to say a bit more about the optimal bidding strategies. Notice that the bidder, who reached the maximal number of points for the rate of return, knew precisely, what value of management fee he or she should bid in order to win. The optimal strategy was then the

[18] See discussion in footnote 17.

higher of two numbers: the aforementioned threshold bid and his break-even management fee. Knowing that, the next bidder in line could determine her optimal strategy, and so on. Let us demonstrate it, using an example.

Let us say that the numbers under study were given by Table 5.

Table 5. The optimal strategy in the first-score auction.

MF	S_r	f_m^*	ΔS_m	S
F1	69	0.449%	0	69
F2	163	0.445%	13.33	176.33
F3	25	0.436%	43.33	68.33
F4	200	0.408%	136.67	336.67
F5	0	0.408%	136.67	136.67
F6	121	0.376%	243.33	364.33

Source: own study.

Firm F6 is the strongest in the auction, with the advantage over F4 which equals 27.66 points (364.33-336.67). Its optimal strategy is to bid the value of f_m that solves the following equation:

$$S(f_m) = S(0.376\%) - 27.66, \quad (14)$$

Using formula (11) we get, that it equals 0.3843%. The rest of the MF have nothing to lose, and so they should bid the f_m^* values. Therefore, if students bid optimally, most of them should bid the f_m^* values, and only the strongest ones should bid slightly above it.

The average distance between participants bid and f_m^* (-0.0012%), seems to suggest that bidders did actually offer fees close to the optimal strategies. But a closer look at the data shows that the situation was more complicated, and bidders used various strategies. In fact 30.2% of all bids made in treatment A were close to f_m^* (differed by not more than 0.01%), 38.2% of them were higher, and 31.6% were lower. The low efficiency of the auction is one more evidence that bidders' strategies were actually far from the theoretical optimum.

The introduction of the two-criteria auction has one more potential long-term consequence. As it pays to have as many points as possible in the auction, the implementation of the auction might incline the participants in the coming periods to become less risk-averse, or even risk-seeking, by investing more in the most risky investments.

Let us now move to the analysis of the **two-criteria all-pay auction**. The only difference between this auction mechanism and the first-score auction was that it enforced all bidders to keep the management fees bid in the auction. Of course that was a fundamental

difference, which should have made all participants bid more carefully. Figure 3 shows the average and the minimal level of management fee, including the first two non-auction periods.

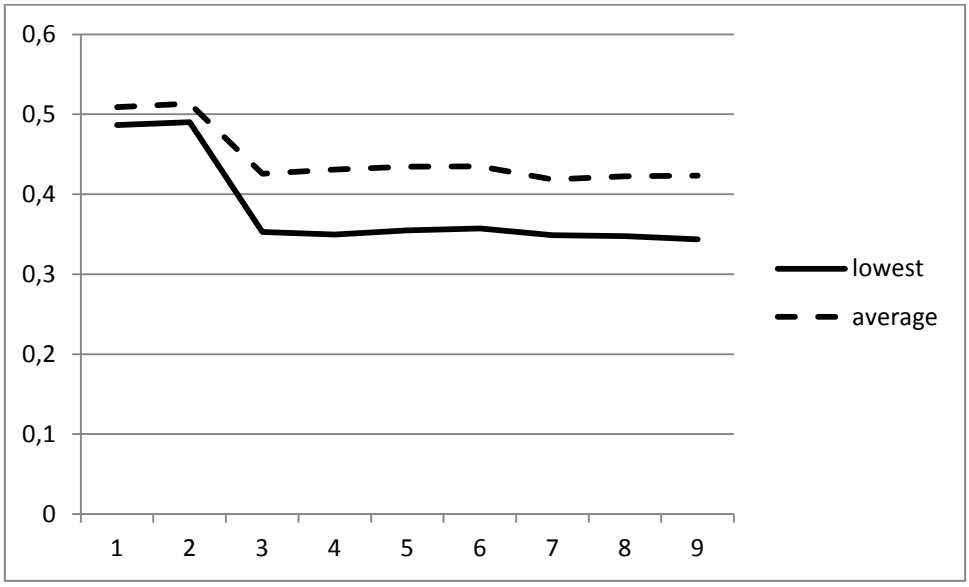

Figure 3. The average and the minimal level of management fee in treatment B.
Source: own study.

In this case, the auction lowered not just the lowest fee levels charged, but also had a tremendous impact on the average levels. One could say that this a natural consequence of the auction rules, but in fact it is not that trivial; the rational bidders, knowing that their chances of winning the auction are very low, should have bid higher management fee values - they would lose the auction, but at least they would not have to keep the low management fee in the two years to come.

In case of the first-score auction it was actually possible to determine the optimal bidding strategies, unfortunately it is more complicated in case of the all-pay auction. Certainly we should have observed higher bids, than in case of the first-score auction, and Table 4. shows that it did happen. The only statistics which shows a higher willingness to bid low is the percentage of bids at the minimal value of 0.3%. This might be due to a high risk related to an all-pay auction; losing this auction with a low value of the management fee might be very painful from the financial perspective, and so some bidders, bid the minimal value to guarantee a winning. Nevertheless most of the participants competing in treatment B bid above the break-even value: as many as 66.7% of bidders bid at least 0.01% above f_m^*. Moreover this number is underestimated, as there were some learning effects observed. Due to the fact that the rules of the all-pay auction were a bit counterintuitive, students had to learn the optimal strategies. In the first auction started just 46.3% of participants bid significantly

above f_m^*, but this number grew with time to stabilize at the value of 76% in the last two auction played. By analogy in the first auction played 31.5% of students bid below f_m^*, and in the last auctions this number was just 8%.

Finally, in treatment C it was decided to test experimentally the efficiency of the **one-criterion all-pay auction**. It was interesting to see, what was the actual role of the rate of return as an auction criterion. Did the additional asymmetry brought into the auction by this criterion have a positive or negative consequence for the auction efficiency? Figure 4. shows the average and the minimal level of management fee, including the first two non-auction periods.

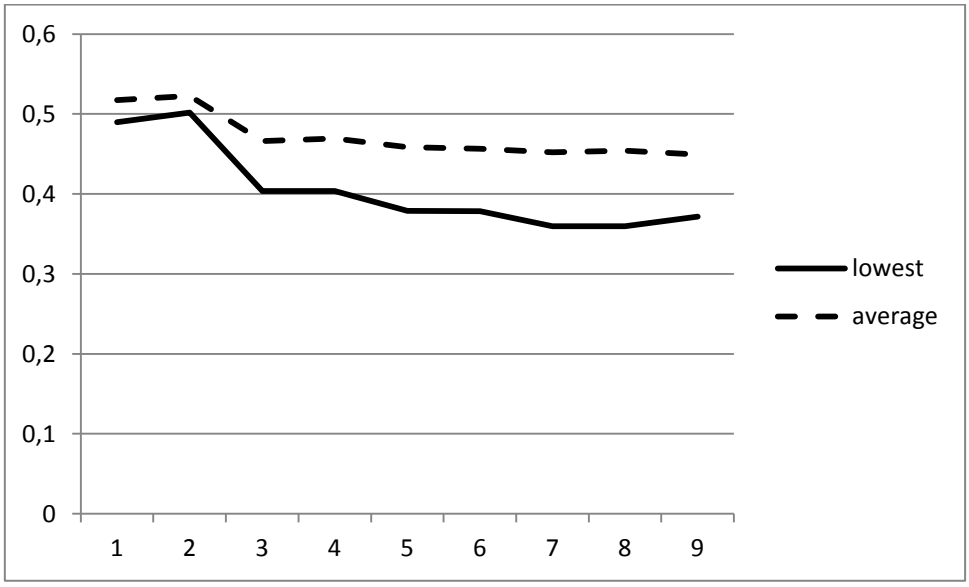

Figure 4. The average and the minimal level of management fee in treatment C.
Source: own study.

In case of one criterion all-pay auction we can also observe a significant cut in the average level of management fee, even though its magnitude is smaller than in case of multi-criteria all-pay auction. As it is still a strongly asymmetrical auction it is hard to determine the optimal bidding strategies, nevertheless they should not differ much from those in case of two-criteria auction. Notice that the marginal profitability of the fee's cut is similar in treatments B and C, as the past rate of return is irrelevant in this case.

But it turned out that one minor element played a significant role in players' strategies, and might have been instrumental in how deep they cut the fees. The rules of the scoring auction demanded establishing the minimal fee level, which was necessary to calculate the points from this criterion. This minimal value was fixed at 0.3%. In case of the one-criterion

auction no points were calculated, as the winner was simply the bidder with the lowest management fee asked. In this case no minimal value of f_m was used. It might seem that in case of the mechanism with a bottom constraint (treatment B) the fee levels bid by participants should be higher than in case of the mechanism with no such constraint (treatment C), but actually a reversed situation was observed. We believe that the minimal fee of 0.3% served as an anchor in case of the two-criteria all-pay auction, and that is why, paradoxically, the lower values of management fee were observed in this case. Simply speaking, when participants were not given the information on the lowest value, their bids were significantly higher than that, but when it was introduced, they seemed to stick to it more often.

Looking at the statistics presented in Table 4., we can see that in case of treatment C only 0.5% of bids were made at the value of 0.3% (compared to 3.7% in treatment B), higher is the average margin over the break-even value (0.0527% vs. 0.0423%), and as a consequence higher is the value of the average bid made (0.4726% vs. 0.4434%). A similar pattern is observed once we look deeper into the individual bidding strategies in treatment C. The average number of bids significantly higher than f_m^* turns out to be 73.6% (compared to 66.7% in treatment B), and lower is the percentage of bids below the break-even point (11.6% vs. 14.4%)[19].

Figure 5. compares the average levels of the management fees in all treatments, showing that the highest efficiency of the multi-criteria all-pay auction is not the effect of the shock resulting from the introduction of the new, non-standard auction rule, but is observed in all periods of the experiment.

[19] The differences between those values are insignificant in the last two auctions, *i.e.* are mostly the consequence of decisions taken in the first two auctions.

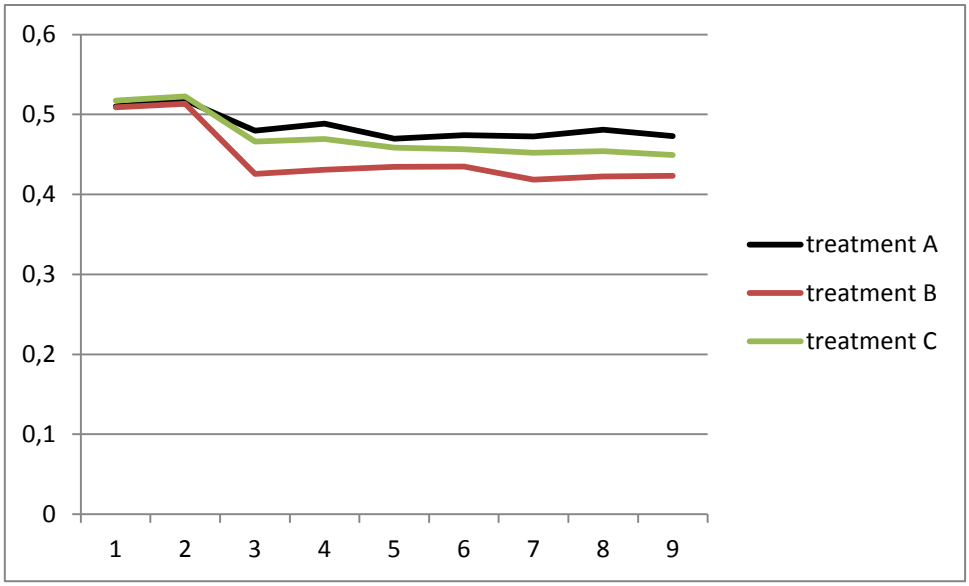

Figure 5. The average level of management fee by rounds
Source: own study.

7. Conclusions

The Polish market of MF has been notorious for maintaining a high level of management fees, which was one of the sources for its public criticism and a reason why many people decided to move with their funds to the 1st pillar. The international experience shows, that this is a universal phenomenon: given a low transparency of the market, and reluctance of MF to start the price wars, it is generally observed that the MF stick to the maximal, legal fee caps.

The paper discusses a potential role of auctions in enforcing the lower levels of management fees. Starting with the Chilean and Peruvian experiences, we demonstrate, that the Polish pension system faces a completely different system of challenges, and demands a different auction system. We propose to implement a two-criteria scoring auction, where the MF compete by the rate of returns and the management fees, fighting over a chance to win part of the inactive members' assets, managed by the competition. The experiments have demonstrated that the most efficient solution might be an implementation of the variant of the all-pay auction, which enforces all MF (and not just the winning one) to keep the management fee on the lower level.

This result is interesting for the number of reasons. Firstly, it is one of the rare applications of the all-pay auction - a mechanism, known in the auction literature, but not studied much. The analyses provided in the paper might give some insight into its properties

and applicability. Secondly, it shows an alternative to the current Polish regulations, that might be successful in lowering the MF costs from the members perspective. Thirdly, our results suggest that the all-pay auction (or its variant) might be a useful mechanism in all countries, considering a similar problem. The standard auction mechanisms are not as efficient as needed, as they (directly) affect only the winning bidder. Figure 1., depicting the post-auction fee levels in Chile, demonstrated that there is always a gap between the lowest fee level, and the average one. The all-pay auction might be instrumental in bringing down that gap.

Our study did not answer all the problems, and it definitely has to be continued. Among the unsolved problems is the role of the tacit agreement in the pension market. In order to give the participants of our experiments a chance to form some type of cartel, they were given an opportunity to use the chat. Unfortunately, this tool was used only occasionally, and never became crucial for the functioning of this market. Therefore, we are thinking of introducing some changes to the communication system, that will make the participants feel more comfortable with using it.

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