Institutional disparities and asset allocation homologation in Italian defined contribution pension funds. How do they affect the guarantee commitment?

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Abstract

This paper analyzes the performance of the Italian defined contribution guaranteed pension funds during the period 2008-2012 through a panel analysis. This period has been very challenging for the guarantors, since it has been characterized by simultaneous systemic shocks to a wide range of asset classes. In such a scenario, we explore the determinants of cross-sectional differences in funds capacity to outperform the guarantees provided and to meet regulatory provisions. In particular, the paper is organized around three main research questions. The first one is focused on the probability of a guarantee payment in a given year. The second research question deals with the determinants of the gap between actual return and minimum guaranteed yield on a yearly basis. The third question explores the capability of the pension funds to meet the objective of a return in line with the level guaranteed by law on the termination indemnity's contributions.

The analysis tests a wide range of variables related to asset allocation, investment style, funds characteristics, markets return and volatility.

The outcomes show that the capability in meeting the guarantee commitment is affected by the nature of the fund and the type of investment manager, whereas the impact of asset allocation is less marked, due to high homologation of financial strategies.

Keywords

Defined contribution pension fund; Minimum return guarantee; Asset allocation; Money-weighted rate of return

JELCodes G23

This paper focuses on Italian defined contribution (DC) pension funds with a compulsory minimum return guarantee. Italian guarantees providers, which are private financial institutions[1], have to grant by law at least a capital guarantee (Legislative Decree 252/2005, COVIP (2006), COVIP (2007)), but they often provide higher minimum returns guarantees, either in nominal or real terms. Moreover, they must provide ongoing guarantees in a number of specified circumstances as well as at retirement.

The paper aims to assess whether investment managers are able to meet the guarantees they provide. To this end, focusing on the time frame 2008-2012, we carried out a panel analysis on a self-made data set, which covers more than 80 per cent of the Italian pension schemes with a minimum return guarantee. The time frame of the analysis has been a very challenging period for guarantors, since it has been characterized by simultaneous systemic shocks to a wide range of asset classes. In such a scenario, we explore the determinants of cross-sectional differences in funds capacity to outperform the guarantees provided. To this end, we consider a range of variables related to the asset allocation and the investment style of Italian guaranteed schemes and we tests the relevance of a number of control variables related to funds characteristics, markets return and volatility.

Until now, the functioning and the sustainability of DC guaranteed schemes have not been adequately explored, since previous analysis on this topic are basically theoretical. In particular, a number of research works analyze the risk related to guaranteed pension funds

[1] In several OECD countries, the guarantees were set in order to make the conversion from a DB to a DC system more attractive. Furthermore, in many case, a public pension sponsor provides the mandatory guarantees (Pennacchi (1999), Antolìn et al. (2011), OECD (2013)).

(Broeders et al. (2013) and Broeders and Chen (2013)) or estimate the theoretical cost of different type of guarantees (Pennacchi (1998), Pennacchi (1999), Biggs et al (2009), Munnell et al. (2009), Grande e Visco (2010) and Antolìn et al (2011)). Another branch of the literature on guaranteed schemes focuses on the theoretical modelling of optimal asset allocation strategies (Di Giacinto et al. (2011), Huang (2010), Federico (2008), Deelstra et al. (2003), Boulier et al. (2001)). In addition, the contributions by Turner and Rajnes (2002), which provide insight into the functioning of DC guaranteed schemes in different countries, only compare the funds characteristics on a qualitative basis.

Therefore, as far as we know, the present analysis is the first work which provides empirical evidence on the functioning of DC guaranteed schemes.

The paper is organized as follows: firstly, we explain the regulatory framework of the Italian complementary pension system, secondly we describe the main characteristics of Italian DC guaranteed schemes and the data set applied for the analysis, then we explain the research hypothesis and discuss the main results, finally we conclude.

1. The regulatory framework

Pension funds were introduced in Italy in 1993 and became the so-called second and third complementary pillars of our pension system. Both pillars are private, voluntary funded schemes, aimed to filling the gap between the final salary and the public pension provided by the compulsory public pillar (that is the first pillar). The key difference between pillar two and three is that the former is collective, while the latter is individual. More in details, there are three types of pension schemes[2]: occupational or closed, open, and "pre-existing" pension funds.

[2] In this context we consider only pension funds, leaving out individual pension plans, as they are not the objective of our analysis.

Closed funds are established on the basis of collective agreements between workers and employers and they are closed because the access is restricted to specific types of workers at industry level, e.g. all workers in the chemical sector, or at company level or at regional/territorial level. All of them set by law the contribution amount that both the employer and the employee must invest in the fund and entrust the contributions management to financial firms or insurance companies under a medium-term (usually 5 years) mandate.

On the other end, open funds are set up by financial intermediaries that directly manage the collected resources and allow any kind of worker to join in. If the membership is collective, based on a bargaining agreement within a company, the pension fund belongs to the second pillar. On the contrary, if the membership is individual, the fund belongs to the third pillar and cannot oblige the employer to participate to the contribution plan.

"Pre-existing" pension funds are those created before the 1993 legislation, mainly in the banking and the insurance sector. They are still submitted to partially different rules, so they are not allowed to accept new adherents.

Since private pension schemes, during the first decade from their introduction, experienced a very limited growth, the system was radically changed in 2005 by the Legislative Decree n. 252 that came into force in 2007 (Law 296/2006, COVIP deliberations 28/06/2006 and 21/03/2007). The main innovation introduced from January 1st, 2007 is that employees have to decide whether to transfer their termination indemnity (TFR) contribution into a pension scheme or to keep it in the firm. If transferred, the decision is irreversible; otherwise, employees always have the option to divert their severance indemnity to a pension scheme. In case of silence, the so-called tacit consent, the TFR contribution is automatically allocated into a collective fund and addressed, by law, to a guaranteed scheme. This must provide a minimum capital guarantee and pursue the aim of providing returns aligned, in the

medium-long term, to the TFR revaluation set by law equal to 1.5% plus 75% of the inflation rate. The aim of the regulator is clear: to protect retirement income from financial markets volatility. Nevertheless the Legislative Decree n. 252/2005 gives pension funds managers the opportunity to define their guarantee commitment. The compulsory minimum, and also cheapest, guarantee is a protection of the nominal amount of contributions (a capital guarantee), while a more challenging and costly task consists in promising a self-selected positive return, in nominal or real terms, even though the legislator suggests to be aligned with the TFR revaluation. Thus, the TFR revaluation should become a formal or informal benchmark for all the guaranteed pension schemes that host the silent TFR, also because it is one of the most important pieces of information that workers consider when they need to decide where to allocate their severance indemnity. In practice, the supervisor Commission specifies that the return guarantee commitment consists in assuring the capital reimbursement, out of all costs, and the minimum positive return, if there, within a predetermined period of time and/or at the occurrence of specified events. The events that trigger benefit payments are set by law: retirement, death, permanent disability and unemployment for more than 48 months are mandatory, while healthcare costs, loss of participation rights, transfer to other pension scheme and unspecified needs of the adherent are optional, at the pension fund discretion.

2. Description of the sample

In order to perform our analysis we composed a sample of guaranteed pension schemes, starting from the complete list of pension funds available at the website of the Commission supervising the sector (Commissione di Vigilanza sui Fondi Pensione – COVIP). From this list – containing both closed and open funds – we extracted all guaranteed schemes where the silent TFR contributions are addressed. Afterwards, we selected a sub-set of schemes having

a single value of the quota, since – otherwise – the calculation of yearly return may give rise to different results depending on the type of participant considered. At this stage, we had a sample of 31 closed funds and 39 open funds. Then we started to build the dataset, trying to find a complete series of financial statements and informative notes for the period 2008-2012 i.e. the first five years of the new regulatory framework described in the previous paragraph. This was not an easy task as far as the open funds are concerned, since the documents are normally available on the website just for the latest year and are cancelled when the new ones are uploaded. To solve the problem we had to use different formal and informal channels. Despite all efforts, however, for some funds the documents remained missing or incomplete. Consequently, we had to restrict the sample of open funds from 39 to 26 guaranteed schemes. Nevertheless, the data summarized in Table 1 show that our sample coverage of the universe in analysis is more than satisfactory. In particular, the sample represents over 82 percent of total net asset value (NAV) of guaranteed schemes and 77 percent of the participants at the end of 2012. For the above-explained reasons the coverage is wider for closed funds than for open funds, whose sample however represents more than 50 percent of the universe in terms of both NAV and participants[3].

Tables 2-7 provide some descriptive statistics on the pension schemes included in the sample. Table 2 shows that the majority of closed funds is managed by insurance companies, whereas

[3] We have analyzed the issue of a potential sampling bias. Based on a restricted set of information for the year 2012, we have compared the included with the excluded open funds along the following features: a) total net asset value; b) number of adherents; c) type of investment manager; c) amount of guaranteed return. The mean difference between our sample and the excluded funds is not significant under a statistical point of view. Thus, we concluded that the risk of a sampling bias is not relevant.

in the case of open funds the investment activity is most often performed by a securities house. Approximately half of the pension schemes analyzed provide a minimum return guarantee higher than the simple capital preservation. As detailed in table 3, the promised return is most often expressed in nominal terms, instead of real terms, and most often equals a fixed interest rate. This statistics is very stable throughout the five years analyzed. Table 4 restrict the sample to those funds offering a fixed guaranteed return and reveals that the average minimum yield promised by closed funds is higher that the level offered by open funds. The percentages do not practically change though time, both for closed and open funds.

Then, table 5 provides some descriptive statistics on the difference between the actual achieved return and the minimum guaranteed return for each pension fund, computed on an annual basis[4]. The t-stat indicates if the mean level of the variable is significantly different from zero. Both for the entire sample and the closed and open pension funds separately considered, there is a positive and significant gap between the actual and the minimum promised yield. The distance between the two subsamples of closed and open funds is thin under this point of view. The t-stat in the last column of the table indicates that the mean difference is not significantly different from zero.

Finally, tables 6 and 7 focus on the guarantee commitment, showing the distribution of the triggering events and the distribution of subsidies by type of payment, as reported in the balance sheet. Table 6 exhibits that quite a small percentage of the sample provides the guarantee for the optional events, with the exception of health benefits covered by one third

[4] This difference (DELTA_RET) will be the dependent variable for the second research question. More details on the method used for computing it will be provided in a subsequent paragraph.

of our pension funds, mainly the closed ones. On the other hand table 7 describes the payment of subsidies over the five years of our analysis, pointing out a sharp increase in the amounts that almost double during the period. In particular, this is the case for anticipations and lunp-sum capital payments.

Here Table 1

Here Table 2

Here Table 3

Here Table 4

Here Table 5

Here Table 6

Here Table 7

3. **Research questions and methodology**

The paper is organized around three research questions. Firstly, we explore the factors affecting the probability for a pension fund manager to be obliged to a guarantee payment in a particular year. The dependent variable, in this case, has an accounting nature and coincides with the matching amounts shown in the balance sheet of the pension funds among the assets and the liabilities under the label 'Guarantees acquired on single participants' positions' (Item 30 in the compulsory balance sheet scheme). The second research question analyses which factors affect the return gaps generated in a particular year, measured as the difference between the actual return and the minimum promised yield. The third research question focuses on the factors affecting the weight of administrative and management costs and their relationship with the fund dimension.

In the analysis of the three research questions we use a broadly common set of independent variables, to which we add a few specific factors that may be relevant only for one of the issues explored. In general, the expected sign of the variables in the first research question will be opposite that of the second. In fact, a factor increasing the potential performance is, at the same time, decreasing the probability of having to make a guarantee payment. However, the payment is not only affected by a lack of performance, but is also triggered by the occurrence of an event covered by the guarantee commitment. For this reason, some extra-variables are included in the analysis of the first research question. We will comment the expected signs of the independent variables for the first and the second research questions in parallel, whereas we will devote a more specific analysis to the third question – which draws from a different logical framework – at the end of the section.

Going into more details of the first two research questions, the independent variables can be subdivided into three main groups. First, we consider some structural features of the pension fund and of the guarantee provided. The FUND_TYPE dummy distinguishes between closed and open pension funds. We expect the former to perform better, due to their lower costs and their stronger monitoring on the fund manager's behavior (Bribi and Giorgiantonio, 2010). Thus, the expected sign of the coefficient is negative for the first research question, since the probability of having to make guarantee payments is lower for closed pension funds, and positive for the second questions given the potential for a higher yield. We then consider the type of fund manager which can be either an asset management or an insurance company. We expect the latter to perform better because of the similarities between the return guarantee offered by pension funds and the features of common savings products sold by insurance companies, that they manage adopting liability-driven investment (LDI) strategies. On the contrary asset management firms does not usually promise a minimum yield of return. On the

basis of this difference in expertise, we expect insurance companies to be able to better cope with the asset allocation strategies needed to face the guarantee commitment. The expected coefficient is positive in the first research question and negative in the second, since a pension fund managed by an asset management firm would have a higher probability of incurring a guarantee payment and would have a lower return, both in the short and medium term. With the variable N_MANAGER and DELEGATED_MANAGER we test if the number of investment managers running the asset allocation of the fund and the delegation of asset management to sub-contractors have an impact on performance.

Going to the features of the guarantee, the main variable is RET_GAR, that is the minimum return guaranteed by the pension fund. As suggested by the literature, those financial managers which provide a principal guarantee should be less exposed to the performance risk, while their exposure increases offering a minimum return guarantee above the zero nominal rate (Antolìn et al. (2011)). Therefore, the expected sign for *RET_GAR* is positive for the first research question, increasing the probability of a guarantee payment, and negative for second question, since the space for over-performing a higher minimum return is thinner.

For the fund characteristics, we also consider the size of the guaranteed schemes and the annual amount of net contribution. We evaluate the influence of the fund size by using the natural logarithm of funds' *NAV*. Based on the evidence from Chen et al. (2004) we believe that the size affects the funds' capability to meet the provided guarantees by means of their performance. In fact, the paper puts forward that, although larger scale brings costs advantages, liquidity limitations seem to allow only smaller funds to outperform their benchmarks. Moreover, the larger a fund, the older it is and the more likely is that factors such as retirement, death and inability to work trigger the guarantee. A larger fund is also likely to have more heterogeneous participants, thus showing a higher likelihood of triggering

events, such as, for instance, prolonged unemployment. Therefore, we expect that, as the fund size increases, the probability of underperforming the guaranteed return also increases. In this case, the expected sign for the variable *NAV* will be positive for the first question and negative for the second. For the first research question, we also compute the *NETCONTRIBUTION* variable as the ratio between the net annual contribution and the net asset value at the end of the year. Since a greater annual contribution positively affects the performance of a pension fund, it is likely that, as the annual net contribution increases, the probability that the guarantee provider has to pay a subsidy declines.

A second important set of variables concerns the features of the pension fund's asset allocation. We expect higher liquidity and lower duration of the bond portfolio to be related to lower performance and thus higher probability to be obliged to a guarantee payment, due to the prudent risk profile of the asset allocation. We also expect that a higher exposure to financial shocks, resulting from a higher weight of equity investment, to be associated to lower performance in the short/medium-term. Thus, the coefficient sign should be positive in the first research question and negative in the second.

Finally, we place a set of control variables in order to test if the financial turmoil has affected the capability of maintaining the guarantee commitment. To this end, since the great majority of the portfolio under management is invested in Treasury bonds, we add two variables related to the return and volatility of such a portfolio *(RET_BONDBENCH)* and *VOL_BONDBENCH)*.

Moreover, in consideration of the incidence of the portfolio of Italian Treasury bonds we also include the variable *SPREAD_BTP_BUND,* which is computed as the difference between the return of the 10-year BTP and that of the 10-year Bund. This variable is aimed at representing the specific volatility of the Italian bond market during the sovereign debt crisis. As such, the

control factor has the same expected sign as the VOL_BONDBENCH variable: i.e. positive in the first research question and negative in the second. However, especially in the second research question, we will need to explore how the specific episode of volatility shock may have affected the asset allocation choices of fund managers in the short term, given the strong orientation towards the Italian bond market.

As anticipated above, specifically in the analysis of the first research question, we consider a few extra variables. In particular, we assess the influence of the different events which generate guarantee claims, by decomposing the benefits payable to the members in three parts: those related to the members that voluntarily leave the fund (*TRANSFER_OUT),* those due in occurrence of the death, the unemployment and the inability of fund's members *(BENEFITS_PAYABLE),* and those related to the retirement of fund's members (*PENSION_PAYABLE*)[5]. In general, we expect a positive relationship between the amount of benefits paid and the dependent variable.

Moving to the third research question, we use a set of variables, partially in common with the first two research questions, partially specific for this analysis. In particular, the focus of the analysis is on the impact of the dimension of the fund, in terms of net asset value and number of adherents, on the weight of different type of costs. For what concerns the dimension, since a non-linear relation is probable, a quadratic term is included in the specifications.

On the management cost side, we expect lower costs in closed funds than in open funds, due to the competitive mechanism of assignment of the investment mandate. Therefore, the sign of the variable FUND_TYPE should be negative. We also expect a negative relation with the fund dimension, represented by the NAV, but a positive sign with the squared dimension,

[5] Which are influenced by the composition by age of the members. No guaranteed schemes provide any information on this aspect.

since the relation between the two variables should be nonlinear and we expect decreasing marginal economies of scale. Moreover, the level of costs is expected to be positively related to the level of guaranteed return, since the achievement of a higher yield requires more effort and professionalism in the management of financial resources. Finally, the number of fund managers and delegated managers are expected to affect the level of investment costs. In particular, the delegation of asset management to sub-contractors, DELEGATED_MANAGER, should have a positive sign, meaning an increase of management costs, while the number of fund managers, N_MANAGER, is less clear. It could display a positive sign, since the number of investment management firms to pay is bigger, but it could also have a negative sign, if the fund managers are selected with a price-based competing procedure.

Moving to the administration costs, we analyze the weight of costs per adherent. The expected sign of the variable ADHERENTS is negative, while that of ADHERENTS_SQUARED positive. The reason is again related to decreasing marginal economies of scale. We consider the number of adherents because this is the usual cost driver used to allocate some shared costs among the different investment lines of pension funds. We then consider the acquisition costs for the external services, expecting a negative sign of the variable OUTSOURCING, given that it should allow funds to save on administration costs. Finally, we test the other dimension variable, computing the net asset value per adherent, NAV / ADHERENTS, that should display a negative sign. In fact, a fund manager administrating a larger portfolio could have better bargaining power and be able to reduce the weight of administration costs per adherent.

Table 8 summarizes the independent variables and the control factors used in the following analysis, specifying the calculation method and the expected sign in the three research questions.

Here Table 8

4. First research question: the dependent variable and the methodology

This analysis aims to assess the determinants of Italian investment managers' capability to meet the guarantees they provide with the return on investments generated on every individual retirement account.

Financial managers compute the return on investments related to each individual account plan every month. Whenever the return on investments on a retirement account is lower than the minimum guaranteed return, the guarantor runs into a contingent liability. Such contingent liability can turn into an actual liability in specific circumstances, which are the participant's retirement, death and inability to work, a period of unemployment longer than 48 months and, for closed funds only, the mandate termination of the investment manager. Under these circumstances, the guarantee provider has to compensate a participant for an inadequate return on investment on his/her retirement account, by paying a subsidy. The total amount of the subsidies to be paid by a guarantor at the end of each year is published in the balance sheet of the pension scheme and coincides with the matching amounts shown among the assets and the liabilities under the label 'Guarantees acquired on single participants' positions' (Item 30 in the compulsory balance sheet scheme). This amount is zero when no fund participant benefits from any guarantee activation during the year.

Based on balance sheet data related to 57 Italian guaranteed pension schemes, over the 2008-2012 period, we run an empirical analysis with the aim to assess the determinants of the

probability for a pension fund manager to be obliged to a guarantee payment and the factors affecting the size of a guarantee payment.

We firstly run a logistic analysis using as dependent variable the dummy *SUBSIDY,* which assumes value one for the years in which a guarantee provider was required to pay a subsidy and zero for the remaining years. Equation (1) is based on a strong balanced panel of data:

$$Pr(SUBSIDY) = F(RET\_GAR_{it}, NAV_{it}, NETCONTRIBUTION_{it}, LIQ_{it}, EQUITY_{it}, FUND\_TYPE_{it} MANAGER\_TYPE_{it}, N\_MANAGER_{it}, DELEGATED\_MANAGER_{it,} RET\_BONDBENCH_{it}, VOL\_BONDBENCH_{it}, SPREAD\_BTP\_BUND_{it}) + e_{it} \quad (1)$$

With equation (2), we analyze the influence of other variables related to the asset allocation of the guaranteed scheme and the composition of the benefits payable:

$$Pr(SUBSIDY) = F(RET\_GAR_{it}, NAV_{it}, TRANSFER\_OUT_{it}, BENEFITS\ PAYABLE_{it}, PENSIONS\ PAYABLE_{it}, LIQ_{it}, EQUITY_{it}, IT\_SOV\_BOND_{it}, DURATION_{it}, MAX\_EQUITY_{it}, INV\_AREA_{it,} RET\_BONDBENCH_{it}, VOL\_BONDBENCH_{it}, SPREAD\_BTP\_BUND_{it}) + e_{it} \quad (2)$$

The second analysis we carry out aims to assess the factors affecting the size of the guarantee payments due by the guarantee provider every year. To this purpose, we apply the Tobit equation, running a regression with left-censored data on the dependent variable.

The item 30 of the financial statement provides information on the difference between the guarantee claims and the NAV of the fund, only if it generates a guarantee payment. Whenever the NAV of the fund is higher than the claims arising from the guarantee obligation, item 30 is equal to zero. Thus, information on the return gaps generated by the financial management of the fund is not available. Then the item 30 can be interpreted as a

variable consisting of censored and uncensored observations, where the zero guarantee payments represent the left-censored observations.

Since the variable *ITEM30* is very non-normal, we transform it as lognormal following Cameron and Trivedi (2010). It means that our dependent variable is ln*ITEM30*. We then run a pooled Tobit regression model using the same independent variable and the same hypothesis applied in equation (1):

$$lnITEM30 = F(RET\_GAR_{it}, NAV_{it}, NETCONTRIBUTION_{it}, LIQ_{it}, EQUITY_{it}, FUND\_TYPE_{it} MANAGER\_TYPE_{it}, N\_MANAGER_{it}, DELEGATED\_MANAGER_{it,} RET\_BONDBENCH_{it}, VOL\_BONDBENCH_{it}, SPREAD\_BTP\_BUND_{it}) + e_{it} \quad (3)$$

5. **First research question: the results of the analysis**

We first estimate equation (1) running a balanced panel logistic regression with random effect, as it results from the Hausman test.

The results of equation (1) are summarized in Table 9 column 2, while those related to the unbalanced panel models are displayed in columns from 3 to 7. The probability of paying a subsidy increases as the minimum guaranteed returns, the fund size and the share of liquid assets increase. Moreover, the variables related to the returns and volatility of the Treasury bond portfolio significantly affect the dependent variable and appear with the expected signs. The negative sign of the dummy *FUND_TYPE* indicates a higher ability of closed funds to meet the guaranteed return provided with the performance of the fund. This evidence is particularly interesting if we consider that closed funds typically have more challenging guarantee obligations to meet than open funds.

The major outcomes from the unbalanced models are related to the variables *PENSION_PAYABLE* and *DURATION*. *PENSION_PAYABLE* is significant in all the model specification and appears with a negative sign. This evidence suggests that the funds with a

greater proportion of ageing members, which are approaching retirement, are more capable in matching their obligations with their assets, maybe because guarantors know when retirement will occur and include these expected payments in the financial decisions related to the asset management of the fund.

DURATION is significant in the model specifications reported in column 5 and appears with a positive sign. This evidence suggests that the Sovereign debt crisis has greatly affected those funds with a higher portfolio duration by means of the evaluation of the bond portfolio at market value. By adding the interaction term between *DURATION* and *FUND_TYPE,* we find a significant relationship and a negative sign. It means that, as the portfolio duration increases, the probability of incurring in a guarantee payment increases as well, but at a lower intensity for closed funds than for the open ones. Open funds, in fact, show a considerably higher portfolio duration than the closed ones.

Table 10 shows the results of the Tobit equation (3) with the lognormal transformation of the variable *ITEM 30*. This pooled model confirms the same relationships resulting in the previous analysis. In particular, the guarantee payment increases as the minimum guaranteed return, the size of the fund and the share of liquid asset increase. Moreover, it is higher for open funds than for closed ones (column 3) and increases if the investment manager of the fund is an asset management firm. Finally, in consideration of the high incidence of the portfolio of treasury bonds, the return and the volatility of this financial market and the "shocks" which can occur on it have a relevant incidence on the amount of the guarantee payment due to funds' members.

Here Table 9

Here Table 10

6. Second research question: the dependent variable and the methodology

The second analysis focuses on the determinants of the gap between the annual return actually generated by the fund management and the minimum guaranteed return promised to the adherents. In particular, we want to test if this gap is affected by the nature of the fund, the kind of asset allocation and the type of fund manager.

First of all, we had to devise a suitable dependent variable, taking into consideration that: a) the minimum level of return is guaranteed on a compound basis over the calculation period for each participant; b) the total funds under management in the pension fund vary each year as an effect of the new contributions and the benefits paid by/to the adherents. In order to incorporate both aspects in our dependent variable, we had to devise an original approach by adapting the money-weighted rate of return used in the evaluation of asset management to the specific issues of pension funds. As a simplifying hypothesis, we assumed a single participant in the pension scheme contributing, each year, an amount equal to the net balance of cash flows received and paid by the fund. We then calculated the number of new fund quotas issued to this single participant each year as:

$$N.quotas_t = \frac{Net\ contribution_t}{P_{t-1}}\ N.quotas_t = \frac{Net\ contribution_t}{P_{t-1}} \qquad (4)$$

where:

P_{t-1} = unit value of the quota at the end of year t-1 i.e. the value of the quota at the beginning of year t.

$Net\ contribution_t$ = balance of new contributions received and benefits paid by the fund during the year t as detailed in the balance sheet.

The total value of the position held by the hypothetical single adherent at the end of each year is calculated as:

$$FV_t = P_t \times \sum_{t=1}^{n} N.quotas_t \; FV_t = P_t \times \sum_{t=1}^{n} N.quotas_t$$

(5)

The value of the guaranteed position is calculated by applying the minimum rate of return to the cumulative balance of yearly net contribution:

$$FV\_Gar_t = \sum_{t=1}^{n} Net\ contribution_t \times \prod_{t=1}^{n}(1 + i_{gar;t})$$

$$FV\_Gar_t = \sum_{t=1}^{n} Net\ contribution_t \times \prod_{t=1}^{n}(1 + i_{gar;t}) \quad (6)$$

where:

$i_{gar;t}$ = minimum rate of return contractually guaranteed by the fund manager. It is equal to zero if the fund just provides a guarantee of principal reimbursement.

In order to consider exclusively the component of FV_t variation due to financial management and not to the net contribution flow, the actual return generated on an annual basis is computed as a money-weighted rate of return (MWRR) (Tippet (1994), Geltner (2003), Kahila (2005)),

$$MWRR_t = \frac{FV_t - FV_{t-1} - Net\ contribution_t}{Average\ (FV_t; FV_{t-1})} \; MWRR_t = \frac{FV_t - FV_{t-1} - Net\ contribution_t}{Average\ (FV_t; FV_{t-1})}$$

(7)

Similarly, the minimum guaranteed return for our hypothetical single adherent is computed as a money weighted guaranteed rate (MWGR):

$$MWGR_t = \frac{FV_{Gar_t} - FV_{Gar_{t-1}} - Net\ contribution_t}{Average\ (FV\_Gar_t; FV\_Gar_{t-1})} \; MWGR_t = \frac{FV_{Gar_t} - FV_{Gar_{t-1}} - Net\ contribution_t}{Average\ (FV\_Gar_t; FV\_Gar_{t-1})}$$

(8)

The difference between the actual return and the minimum guaranteed return is our dependent variable on an annual basis:

$$Delta\_Ret_t = MWRR_t - MWGR_t \; Delta\_Ret_t = MWRR_t - MWGR_t$$

(9)

To our knowledge the described approach has not been used in previous works on the topic. However, we are strongly convinced of its merits. In particular, this indicator is able to represent, in a reasonably precise way, the performance of a guaranteed pension funds, taking into appropriate consideration the compounding calculation made on each individual account in order to determine the minimum guaranteed value. In addition, as a robustness check, we have computed all the regressions using a time-weighted rate of return (TWRR), obtaining very similar results.

After having computed the DELTA_RET for all funds and all years in our panel, we test – through a series of univariate least square regressions – the relevance of a wide set of independent variables. The regressions used, in the balanced and unbalanced form, are detailed in formulas (10) and (11).

$$DELTA\_RET = F(FUND\_TYPE_i, RET\_GAR_i, NAV_i, LIQ_i, EQUITY_i, MANAGER\_TYPE_i, RET\_BONDBENCH_i, VOL\_BONDBENCH_i, SPREAD\_BTP\_BUND_i) + e_i \quad (10)$$

$$DELTA\_RET = F(FUND\_TYPE_i, RET\_GAR_i, NAV_i, LIQ_i, MAX\_EQUITY_i, DURATION_i, ITSOV\_BOND_i, MANAGER\_TYPE_i, RET\_BONDBENCH_i, VOL\_BONDBENCH_i, SPREAD\_BTP\_BUND_i) + e_i \quad (11)$$

7. Second research question: the results of the analysis

Table 11 summarizes the most interesting results concerning our second research question. The regressions are conducted with the ordinary least square method (OLS), since the

Breusch-Pagan text indicated that the usage of a panel structure was inappropriate. As a robustness check, we have performed the estimations also with a panel structure, obtaining very similar evidence.

The first three regressions are balanced and, thus, a subset of variables is included for which we have a complete dataset. The other regressions are unbalanced and, consequently, include a lower number of observations.

A first and quite expected result is the strong negative correlation between the return gap and the minimum return guaranteed by the pension fund. In other words, the higher the promised yield, the lower the capacity to outperform it. This relation holds true in all versions of the regressions.

The nature of the pension fund – closed vs. open – is not significant in the first specification. The result is quite unexpected under a theoretical point of view. In fact, the closed funds could perform better probably due to their lower costs and to their stronger monitoring on the fund manager's behavior. To further explore the question, in the second specification, we added among the independent variables an interaction factor between the nature of the fund and the promised yield. This factor however is not significant. Thus, the closed funds do not display a higher return gap, even when considering the different yield they pledge to. A potential explanation to this counter-intuitive result will be proposed in the analysis of the third research question.

The nature of the investment manager is significant in all specifications. This is a dummy variable that is equal to 0 when the pension fund is managed by an insurance company instead of an asset management firm. The negative sign of the coefficient implies a higher return gap for the funds managed by insurance companies. When in the second specification we introduce among the independent variables the cross-product between the fund type and

the manager-type, the interaction factor is not significant and the comparative weakness of the funds managed by asset management firm is confirmed. This results is in contrast with what we found and commented in our first research question, where the institutional nature of the fund – closed vs. open – was affecting the probability of a subsidy payment, whereas the nature of the fund manager was not. In the second research question, where we focus the attention on the yearly return gap instead of the guarantee payment, the comparative performance is affected more by the skills of the investment manager than by the institutional features of the fund.

Another important potential driver of performance is the asset allocation. The regressions detailed in Table 11 include the variables that were found significant in a preliminary univariate analysis: the duration, the amount of liquidity and the weight of equity investments. Looking at the data, we can notice the low explicative power of all these factors. The share of portfolio held as liquidity (LIQ) is significant and has the expected sign in the balanced specifications, but not in the last one which includes the duration of the bond portfolio as an important descriptive parameter of the asset allocation. The weight of the equity component (EQUITY) in the asset allocation is never relevant. The most interesting variable is, by far, the duration of the bond portfolio, especially when interacted with the Eurobond market's standard deviation. A higher duration of the bond portfolio increases the return gap, unless the market is very volatile. In summary, the asset allocation displays a limited effect on the return gap generated. A potential explanation of this apparently counter-intuitive result lays in the "homologation" of the Italian guaranteed pension schemes as far as the financial portfolio management is concerned. Since the inter-temporal and cross-sectional differences are very small, their effect on performance is barely discernible.

The control variables accounting for the market conditions are always significant and strongly affect the return gap. The DELTA_RET is positively related to the Eurobond market return, whereas it is negatively affected by a stronger volatility. The BTP_BUND_SPREAD – being a proxy of the specific volatility of the Italian bond market – displays in the specifications from (1) to (4) a sign not in line with expectations. A reason could be related to the short term changes in asset allocation induced by the sovereign debt crisis. These changes would have a stronger impact on the results generated on an annual basis, whereas the cumulated results and thus the probability of a subsidy payment could be less affected. This could explain the non-relevance of the issue in our first research question. Thus, the crisis period had a positive impact on yearly return. The higher return of the newly bought bonds probably more than compensated the capital losses on the previous portfolio that – due to the limited average duration – where not so relevant.

In summary, the ability of pension funds to beat the guaranteed return is negatively affected by the generosity of the promise and is strongly dependent on the market conditions. The funds managed by insurance companies tend to perform better, probably due to their greater skills in LDI strategies. The institutional features of the fund and the asset allocation have a limited effect. The only important aspect of the investment portfolio is the duration that increases the performance of the pension fund, unless there is strong volatility.

Here Table 11

8. Third research question: the dependent variable and the methodology

The third research question aims to identify the factors affecting the operating expenses and tests the relation between costs and fund dimension.

First of all, it is necessary to split the operating expenses in two different categories: management costs and administration costs. The former are related to the investment activity

and consists of management fees, over performance fees, commissions paid to the depository bank and the cost of the guarantee. Their change in time is mainly due to the costs of financial services set by the fund manager, the type and complexity of the investment strategy and the size of the fund. For these reasons, in the estimation models we use as dependent variable the ratio between the management costs and the net asset value of the fund. We call the variable MANAGEMENT_COSTS_NAV.

The other category contains the administration costs, i.e. the cost of personnel, the fees paid to the external financial service, used by all closed pension funds, and the generic working costs such as utilities, advisory, auditing and advertising. These costs are mainly related to the size of the fund in terms of adherents. The personnel costs and the other fixed costs decrease with the increasing of fund participants, at least within certain thresholds. In general, the larger the number of adherents, the smaller the administration costs per head. We then decide to use as dependent variable the ratio between the administration costs and the number of adherents to the guaranteed scheme and call the variable ADMISTRATION_COSTS_ADHERENTS. In this case the analysis is necessarily restricted to closed funds, as open funds take advantage of the administrative services provided by the founder firm and do not record these costs in their accounts.

Looking first at the management costs, we run a multivariate least square regression, on the whole sample, as well as on the two closed and open funds subsamples, using those independent variables that were significant in the univariate OLS regressions. The analytic formula is detailed in equation (12):

$$MANAGEMENT\_COSTS\_NAV = F(FUND\_TYPE_i, RET\_GAR_i, NAV_i, SQUARED\_NAV_i, EQUITY_i, N\_MANAGER_i, DELEGATED\_MANAGER_i) + e_i \quad (12)$$

Moving to administrative costs, an important costs driver is the number of adherents that represents the basis for the allocation of some shares costs among the different investment lines of a pension. The equation is detailed as follows (13):

$$ADMINISTRATION\_COSTS\_ADHERENTS = F(ADHERENTS_i, SQUARED\_ADHERENTS_i, OUTSOURCING_i, NAV/ADHERENTS_i) + e_i \quad (13)$$

9. **Third research question: the results of the analysis**

Taking first into consideration the management costs, the main results of the analysis are summarized in table 12. Column (1) exhibits the regression outcomes on the whole sample, column (2) restricts the sample only to closed funds while column (3) to open funds.

The coefficient of the FUND_TYPE variable confirms that the costs are significantly lower in the closed pension funds, even when considering other potential explicative factors. The level of costs is strongly positively related to the level of guaranteed return, even if this evidence disappears in the closed funds subsample. On the contrary, the level of costs is negatively related to dimension, but positively to the squared dimension. This evidence is not significant when we consider closed and open funds together, but becomes strongly significant when we divide the two subsamples, showing an interesting difference between closed and open funds. With reference to closed funds, it tells us that the economies of scale can be effectively exploited up to a certain dimension above which the extra resources needed to manage the fund surpass the benefits. The explicative power of the regression model is quite high, above 60 per cent. Thus, the function describing the relationship between costs and dimension is U-shaped. However it has to be considered that the better potential for performance gained by larger and closed funds, due to the lower weight of costs, is used to increase the level of minimum guaranteed return instead of generating a higher return gap above the minimum. On the contrary, when we observe only the open funds subsample, the

relationship between costs and dimension is reversed, even if the R square of the model falls down to 16 per cent. Possible explanations could be found both in their less competitive in-house management process, that drives up management fees compared to closed funds, or in their small size, that necessarily imply bearing structural investment costs as their net asset values increase. Unfortunately, in-depth data on the nature and size of management costs are not available in our database, otherwise a further analysis on the relationship between costs and dimension could have bene done to clarify the potential efficiency of economies of scale.

Moving to the specific features of the investment management, only the weight of equity on financial assets and the number of managers involved in running the asset allocation of the fund significantly affect the level of costs. All these variables display the expected signs, confirming that costs increase when the portfolio is more diversified and its asset allocation is delegated to sub-contractors. In fact, EQUITY and DELEGATED_MANAGER have a positive sign. On the contrary costs decrease when the portfolio management is entrusted to several investment firms competing each other. The other features of asset allocation, the type of fund manager and the degree of activism were not significant and thus not included in our model. The total explicative power of the regressions is high both for the entire sample and the closed funds subsample, with R squared above respectively 70 per cent and 60 per cent. Instead it becomes quite narrow when the model concerns only open funds.

We then decide to run an in depth-analysis only on closed funds in order to identify the maximum dimension that allow to take advantage of the economies of scale. The results are detailed in table 12, column (4). By conducting a regression using only the variable dimension and its square, the coefficients of the independent variables suggest that the maximum efficient net asset value equals approximately 40 million Euros. Since the average NAV managed by closed funds in the guaranteed scheme is around 53 million Euro, the

median 20 million, and the standards deviation of NAVs is extremely high, we can conclude that in this sector there is room for improvement of efficiency.

Moving now to the administration costs, table 13 shows the main results of the analysis. The level of costs is negatively related to the size of the funds measured in terms of adherents and positively related to its square. The relation between costs and dimensions is confirmed, even if the estimation is conducted with different parameters. The level of administration costs is also negatively related to the outsourcing costs and the net asset value per participant, as expected. The in-depth analysis aimed to estimate the maximum efficient number of adherents is conducted as in the previous case running a regression on the dimension and the squared dimension. Results are exhibited in table 13, column (2) and tell us that above approximately 15.600 participants, the pension fund starts to lose efficiency. Since the average number of adherents in our sample equals 13.000, the median only 5600, and the standard deviation is around 21.000, we can deduce that, despite some exceptionally numerous funds, the guaranteed schemes of closed funds have room to potentially host new adherents and increase their efficiency.

Here Table 12
Here Table 13

10. **Conclusion**

The paper is focused on Italian defined-contribution pension schemes providing a minimum return guarantee. The analysis is based on a self-made panel of accounting data concerning 57 funds in the five-year period 2008-2012. The objective of the work is to understand the determinants of cross-sectional differences in the funds' ability to outperform the promised guarantees and to meet regulatory provisions.

The work is developed along three research questions that approach the problem from slightly different angles. The dependent variable is defined according to the peculiar perspective in each analysis, whereas the independent variables are broadly common and concern the features of the fund, the asset allocation and the exposure to potential conflicts of interest.

The first research question focuses on the probability that an investment manager is called for a guarantee payment in a certain year. The dependent variable has an accounting nature and it coincides with the amount shown by the item 30 of the compulsory balance sheet scheme with the label 'Guarantees acquired on single participants' positions'. The results show that the probably of paying a subsidy increases as the minimum guaranteed return, the fund size and the share of liquid assets increase. Finally, in consideration of the high incidence of the portfolio of treasury bonds, the return and the volatility of this financial market and the "shocks" which can occur on it have a relevant incidence on the amount of the guarantee payment due to funds' members.

The second research question explores the determinants of the gap between actual and minimum guaranteed return on an annual basis. The dependent variable is the difference between two money-weighted rates of return: one calculated on the actual performance and the other computed on the basis of the minimum promised yield. The analysis shows that the ability of pension funds to beat the guaranteed return is negatively affected by the generosity of the promise and is strongly dependent on the market conditions. The funds managed by insurance companies tend to perform better, probably due to their greater skills in LDI strategies. In contrast, the institutional features of the fund and the asset allocation have a limited effect. The only important aspect of the investment portfolio is the duration that increases the performance of the pension fund, unless there is strong volatility.

The third research question focus on management and administration costs, exploring the most explicative factors and inspecting the relation between costs and fund dimension. The analysis shows that closed funds are more efficient. The costs are also positively related to the level of guaranteed return and negatively linked to the dimension of the fund measured both by the net asset value and the number of adherents. More precisely, the relation between dimension and costs is U-shaped in the closed funds subsample meaning that economies of scale can be exploited only up to a certain point. On the contrary a little evidence of an inverted relationship seems to arise in the open funds subsample, likely because their fee structure is not sensitive to any pressure from competition among fund managers and because their dimension is still limited compared to closed funds. We conclude that the institutional features and the dimension significantly affect the level of administrative and management costs. However the better potential for performance gained by larger and closed funds, due to the lower weight of costs, is mainly used to increase the level of minimum guaranteed return instead of generating a higher return gap above the minimum.

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Table 1: Sample coverage. Source: Authors' calculations.

	Sample	**Total**	**Sample coverage**
N. of Pension Funds	57	79	72,15%
Closed funds	*31*	*35*	*88,57%*
Open funds	*26*	*44*	*59,09%*
Net asset value - 2012	4.649.122.790	5.629.656.000	82,58%
Closed funds	*3.866.302.364*	*4.162.356.000*	*92,89%*
Open funds	*782.820.426*	*1.467.300.000*	*53,35%*
N. of participants	477.841	617.615	77,37%
Closed funds	*393.897*	*453.093*	*86,94%*
Open funds	*83.944*	*164.522*	*51,02%*

Table 2: Sample description: minimum guaranteed return and nature of the asset manager. Source: Authors' calculations.

	N. of funds managed by an insurance company (2012)	N. of funds promising a minimum return > 0 (2012)
Total	32	35
Closed funds	24	11
Open funds	8	1
Total (in %)	56,14%	61,40%
Closed funds (in %)	77,42%	35,48%
Open funds	30,77%	3,85%

Table 3: Distribution of minimum guaranteed return. Source: Authors' calculations.

	2008	**2009**	**2010**	**2011**	**2012**
Minimum guaranteed return = 0	23	23	22	22	22
N. of closed funds	13	13	12	12	13
N. of open funds	10	10	10	10	9
N. of funds managed by insurance	11	13	7	7	6
Minimum guaranteed return >0	34	34	35	35	35
Fixed	20	20	20	20	20
Real (TFR and inflation rate)	11	11	11	11	11
Floating	3	3	4	4	4

Table 4: Average minimum guaranteed returns - fixed rate. Source: Authors' calculations.

	2008	**2009**	**2010**	**2011**	**2012**
Total	1,83%	1,83%	1,83%	1,83%	1,79%
Closed fund	2,10%	2,10%	2,10%	2,10%	2,00%
Open fund	1,74%	1,74%	1,74%	1,74%	1,74%

Table 5: Difference between the realized return and the minimum guaranteed return on an annual basis: descriptive statistics

	All sample	Closed funds (CPF)	Open funds (OPF)	Delta CPF-OPF
Mean	1,55	1,58	1,51	0,07
Median	1,59	1,61	1,46	0,15
Max	13,58	13,2	13,59	-0,39
Min	-11,16	-10,6	-11,16	0,56
Stand. Dev.	3,85	3,48	4,26	-0,78
N. obs.	285	155	130	25
T-stat	13,34***	10,54***	8,34***	0,30

* = significant at 10% level; ** = significant at 5% level; ***= significant at 1% level with a two-tailed test.

Table 6: Distribution of guaranteed events. Source: Authors' calculations.

	Retirement	Death	Permanent disability	Unemployment	Loss of participation rights	Healthcare	Tranfer to other pension fund's accounts	Other
2008	57	57	57	57	9	18	3	13
2009	57	57	57	57	9	18	3	13
2010	57	57	57	57	9	18	3	13
2011	57	57	57	57	9	18	3	13
2012	57	57	57	57	9	18	3	13
average %	100%	100%	100%	100%	16%	32%	5%	23%
N. of closed funds	31	31	31	31	5	15	2	3
N. of open funds	26	26	26	26	4	3	1	10
N. of funds managed by insurance	24	24	24	24	3	4	1	10

	N. of funds	Total (in %)	N. of closed funds	N. of open funds	N. of funds managed by insurance
Retirement	57	100%	31	26	24
Death	57	100%	31	26	24
Permanent disability	57	100%	31	26	24
Unemployment	57	100%	31	26	24
Loss of participation rights	9	16%	5	4	3
Healthcare	18	32%	15	3	4

Tranfer to other pension fund accounts	3	5%	2	1	1
Other needs of the adherent	13	23%	3	10	10

Table 7: Distribution of subsides by trigger event (thousand of Euros). Source: Authors' calculations.

	2008	**2009**	**2010**	**2011**	**2012**
Anticipations	11.130	15.804	22.096	26.237	40.171
Lump sum payment	12.138	15.513	36.424	53.795	55.378
Redemption	38.740	51.581	96.745	96.770	118.238
Transfers to other pension fund account	23.003	22.743	41.123	50.478	55.715
Conversion into annuity	86	15	291	612	4.166
Premiums for additional coverages	59	576	2.149	280	294

Table 8: Independent variables used in the analysis

		First question	**Second question**	**Third question**
Explanatory variables	**Description+**	**Expected Sign**		
RET_GAR	Minimum guaranteed return expressed on an annual basis	+	-	+
NAV	Natural logarithm of the guaranteed schemes net asset value at the end of the year	+	-	-
SQUARED NAV	Squared natural logarithm of the guaranteed schemes net asset value at the end of the year			+
NETCONTRIBUTION	Ratio between the balance of new contributions and benefits paid by/to the participants during a year and the NAV of the guaranteed schemes at the end of the year	-		
TRANSFER_OUT	Ratio between the payments on account of the fund leavers and the NAV at the end of the year	+		
PENSIONS PAYABLE	Ratio between the capital payments on retirements of fund's members and the NAV at the end of the year	+		
BENEFITS PAYABLE	Ratio between the payments on death,	+		

	unemployment and inability of members and the NAV at the end of the year			
COSTS	Ratio between the management costs and the net asset available for benefits	+	-	
LIQ	In the first question: Moving average of the fund liquidity ratio, computed with the above formula: $(\sum_{t=1}^{n} \frac{LIQUIDITY_t}{FINANCIAL\ ASSETS_t})/i$ $(\sum_{t=1}^{n} \frac{LIQUIDITY_t}{FINANCIAL\ ASSETS_t})/i$,-.,--.„-.-,-.. ,-.„-.-,-.. In the second and third question: $\frac{LIQUIDITY}{FINANCIAL\ ASSETS}$	+	-	-
EQUITY	Moving average of the share of financial asset invested in equities, computed with the above formula*: $= (\sum_{t=1}^{n} \frac{EQUITIES_t}{FINANCIAL\ ASSE}$ In the second and third question: $\frac{EQUITY}{FINANCIAL\ ASSETS}$	+	-	+
MAX_EQUITY	The maximum amount of equity investment indicated by the pension fund' Statute	+	-	
INV_AREA	Dummy = 1 if portfolio diversification outside the European area is allowed	+/-	+/-	
ITSOV_BOND	Average share of asset invested in Italian Treasury bond	+	-	
DURATION	Average duration of the bond portfolio	-	+	

FUND_TYPE	Dummy =1 for closed funds and =0 for open funds	-	+	-
N_MANAGER	Dummy =1 for more than one fund managers and =0 for one fund manager	-	+	-
MANAGER_TYPE	Dummy = 1 if the main fund manager is an asset management firm and =0 if it is an insurance company	+	-	
DELEGATED_MANAGER	Dummy =1 in presence of delegation arrangements and =0 if the designated investment manager directly runs the asset management of the fund	-	+	+
RET_BONDBENCH	Annual return of the JPMorgan Euro Bond 1-5 years Index	-	+	
VOL_BONDBENCH	Annualized standard deviation of the JPMorgan Euro Bond 1-5 years index	+	-/+	
SPREAD_BTP_BUND	Spread between the return of the 10-year BTP and the 10-year Bund	+	+	
ADHERENTS	Natural logarithm of the number of adherents to the guaranteed pension scheme			-
SQUARED ADHERENTS	Squared natural logarithm of the number of adherents to the guaranteed pension scheme			+
OUTSOURCING COSTS	Ratio between the acquisition costs and the total administrative costs			-

* For the first research question, we apply this average measure instead of the share of asset invested in equity and liquidity every year, since the investment managers compute the performance related to each individual account plan over its specific accumulation period. It means that the probability of underperforming the guarantee depends on the asset allocation of both the current and the previous years. In absence of micro data

related to the contribution history of the fund participants, we adopt the streamline hypothesis that every participant started his/her contribution in concurrence with the establishment of the guaranteed scheme.

Table 9: Results of the Panel Logistic estimations. Source: Authors' calculations.

Estimations outcomes resulted using panel logistic regressions with random effects. The dependent variable is the dummy *SUBSIDY* = 1 for the years in which the fund manager of a guaranteed scheme was required to pay a subsidy to its participants. The independent variables are described in Table 8. The z-test is reported in brackets under each odds-ratio.

* = significant at 10% level; ** = significant at 5% level; ***= significant at 1% level

Independent variables	**Odds ratio (z test)**					
	(2)	(3)	(4)	(5)	(6)	(7)
	Equation (1)	**Equation (2)**				
RET_GAR	4.56*** (4.88)	4.628*** (4.89)	4.272*** (4.79)	3.821*** (4.51)	4.41*** (4.38)	6.080*** (3.91)
NAV	3.02*** (3.54)	2.727*** (3.33)	2.532** (3.30)	2.338*** (3.14)	2.802*** (3.31)	2.265** (2.38)
NETCONTRIBUTION	1.003 (0.18)	-	-	-	-	-
LIQ	1.311*** (3.38)	1.278*** (3.18)	1.300*** (3.42)	1.333*** (3.55)	1.423*** (3.66)	1.369*** (3.01)
EQUITY	1.032 (0.19)	1.081 (0.49)	1.069 (0.43)	-0.993 (-0.04)	1.081 (0.46)	1.218 (0.49)
MANAGER_TYPE	-0.169 (-1.44)	-0.157 (-1.51)	-0.331 (-0.90)	2.671 (0.69)	-0.799 (-0.14)	-0.598 (-0.25)
N_MANAGER	-0.198 (-1.11)	-	-	-	-	-
DELEGATED_MANAGER	2.345 (1.20)	-	-	-	-	-
FUND_TYPE	-0.005*** (-3.64)	-0.005*** (-3.66)	-0.331*** (-3.08)	1.108 (0.05)	-0.034** (-1.97)	-0.025* (-1.88)
RET_BONDBENCH	-0.551*** (-3.90)	-0.536*** (-4.48)	-0.533*** (-4.48)	-0.55*** (-4.25)	-0.549*** (-3.96)	-0.492*** (-3.69)
VOL_BONDBENCH	1.536* (1.84)	1.671** (2.13)	1.682** (2.15)	1.562* (1.79)	1.751** (2.07)	1.894* (1.99)
SPREAD_BTP_BUND	1.010*** (3.21)	1.010*** (4.01)	1.010*** (4.02)	1.001*** (3.82)	1.012*** (3.75)	1.013*** (3.46)
PENSIONS PAYABLE	-	-0.770**	-0.766**	-0.772**	-0.779*	-0.453**

		(-2.01)	(-2.05)	(-2.07)	(-1.81)	(-2.47)
DURATION	-	-	1.417 (1.56)	1.843** (2.15)	1.643 (1.42)	1.011 (0.03)
TRANSFER_OUT	-	-	-	1.102 (1.40)	1.079 (1.06)	1.108 (1.33)
BENEFITS PAYABLE	-	-	-		1.161 (1.21)	1.04 (0.74)
ITSOV_BOND	-	-	-	-	-	-1.998 (-0.08)
MAX_EQUITY	-	-	-	-	-	-0.942 (1.08)
INV_AREA	-	-	-	-	-	1.515 (0.47)
FUND_TYPE MANAGER_TYPE*	356.50*** (3.24)	234.88*** (3.12)	94.334*** (2.7)	7.494 (1.11)	38.612* (1.83)	49.69 (1.47)
DURATION FUND_TYPE*	-	-	-	-0.324* (-1.90)	-	-
Wald chi2	39.63	39.00	39.15	37.47	32.79	22.84
Prob > chi2	0.000	0.000	0.000	0.001	0.003	0.154
Log Likelihood	-103.614	-102.575	-99.396	-91.618	-89.456	-70.622
Rho	0.517	0.524	0.534	0.429	0.512	0.541
test of rho=0 - Prob >=chibar2	0.000	0.000	0.000	0.001	0.000	0.001
N. observations	285	285	273	244	241	192

Table 10: Results of the Tobit model. Source: Authors' calculations.
Estimations outcomes resulted using Tobit equation with pooled data. The dependent variable is the lognormal variable *ITEM30,* it results from the balance sheet of the guaranteed schemes and it is transformed following Cameron Trivedi (2010). The independent variables are described in Table 8. The t-stat is reported in brackets under each coefficient.
* = significant at 10% level; ** = significant at 5% level; ***= significant at 1% level

Independent variables		
	(2)	(3)
	Equation (3)	
RET_GAR	1.203*** (8.07)	1.358*** (8.34)
NAV	0.476*** (3.14)	0.582*** (3.69)
NETCONTRIBUTION	0.004 (0.40)	0.001 (0.12)

LIQ	0.184*** (4.21)	0.194*** (4.40)
EQUITY	-0.128 (-1.50)	-0.105 (-1.23)
MANAGER_TYPE	0.442 (0.99)	-0.513 (-0.95)
N_MANAGER	2.133*** (2.96)	2.361*** (3.26)
DELEGATED_MANAGER	-0.111 (-0.31)	0.097 (0.27)
FUND_TYPE	-1.785*** (-3.91)	-2.935*** (-4.84)
RET_EU_T_BOND	-0.456*** (-4.96)	-0.436*** (-4.75)
VOL_EU_T_BOND	0.573*** (3.18)	0.588*** (3.02)
SPREAD_BTP_BUND	0.063*** (3.56)	0.005*** (3.02)
FUND_TYPE MANAGER_TYPE*	-	2.790*** (3.01)
Cons	-11.826*** (-4.29)	-13.133*** (-4.65)
Pseudo R2	0.2110	0.2232
Prob > chi2	0.000	0.000
Log Likelihood	-296.325	-291.738
N. observations	285	285

Table 11: Impact of the pension fund's nature on the return gap on a yearly basis. Source: Authors' calculations.

The regressions are all conducted with the ordinary least square method (OLS),using White heteroskedasticity-consistent standard errors and covariances. The dependent variable is DELTA_REND as defined in paragraph in paragraph 6. The independent variables are described in Table 8. The t-stat are reported in brackets under each coefficient.

* = significant at 10% level; ** = significant at 5% level; ***= significant at 1% level with a two-tailed test.

Independent variables	(1)	(2)	(3)	(4)

FUND_TYPE	-0,14 (-0,31)	-0,67 (-1,16)	-0,36 (-0,52)	
RET_GAR	-1,23*** (-10,44)	-1,56*** (*5,84)	-1,22*** (-10,22)	-1,15*** (-9,48)
NAV	0,05 (0,41)	-0,08 (0,61)	0,07 (0,53)	
LIQ	-0,04** (-2,17)	-0,04** (-2,19)	-0,04** (-2,15)	-0,03 (-1,64)
EQUITY	-0,01 (-0,09)	-0,01 (-0,16)	-0,003 (-0,05)	-0,03 (-0,47)
DURATION				1,28*** (4,09)
MANAGER_TYPE	-1,05** (-2,42)	-0,97** (-2,26)	-1,26* (-1,83)	-0,74* (-2,13)
FUND_TYPE*RET_GAR		0,45 (1,50)		
FUND_TYPE*MANAGER_TYPE			0,47 (0,55)	
DUR*_RETBENCH				-0,41*** (-3,34)
RET_BONDBENCH	0,81*** (11,43)	0,81*** (11,48)	0,81*** (11,35)	0,77*** (10,67)
VOL_BONDBENCH	-1,53*** (-10,53)	-1,54*** (-10,54)	-1,53*** (-10,50)	-0,73*** (-2,83)
SPREAD_BTPBUND	0,01*** (3,39)	0,01*** (3,32)	0,01*** (3,38)	0,005** (3,92)
SPREAD_BTPBUND*ITSOV_BOND				
N. observations	285	285	285	264
R squared	0,5703	0,5744	0,5708	0,618
Adjusted R squared	0,5562	0,5589	0,552	0,604

Table 12: Analysis of the weight of management costs. Source: Authors' calculations.

The regressions are all conducted with the ordinary least square method (OLS), using White heteroskedasticity-consistent standard errors and covariances. The dependent variable is MANAGEMENT_COSTS_NAV as defined in paragraph 8. The independent variables are described in Table 8. The t-stat are reported in brackets under each coefficient.

* = significant at 10% level; ** = significant at 5% level; ***= significant at 1% level with a two-tailed test.

Independent variables	(1)	(2)	(3)	(4)

	Whole sample	Closed fund sub sample	Open fund sub sample	Closed fund sub sample
FUND_TYPE	-0,62*** (-19,98)			
RET_GAR	0,04*** (4,73)	0,05*** (8,99)	-0,03 (-1,31)	
NAV	-0,30 (-1,15)	-0,63** (-2,59)	0,66** (2,43)	-0,56** (-2,38)
SQUARED NAV	0,01 (1,12)	0,02** (2,55)	-0,02** (-2,50)	0,02** (2,34)
EQUITY	0,01** (2,21)	0,01*** (3,56)	0,02*** (2,70)	
N_MANAGER	-0,17** (2,56)	-0,20*** (3,00)	-0,37*** (3,53)	
DELEGATED_MANAGER	0,05** (2,05)	0,05*** (3,30)	0,08 (1,49)	
R^2	0,72	0,61	0,16	0,37
N. observations	285	155	130	155

Table 13: Analysis of the weight of administration costs. Source: Authors' calculations.

The regressions are all conducted with the ordinary least square method (OLS), using White heteroskedasticity-consistent standard errors and covariances. The dependent variable is ADMINISTRATION_COSTS_ADHERENTS as defined in paragraph 8. The independent variables are described in Table 8. The t-stat are reported in brackets under each coefficient.

* = significant at 10% level; ** = significant at 5% level; ***= significant at 1% level with a two-tailed test.

Independent variables	(1)	(2)
	Closed fund sub sample	Closed fund sub sample
ADHERENTS	-7018,55 (-3,20)***	-6812,14 (-2,94)***
SQUARED-ADHERENTS	366,38 (3,12)***	352,69 (2,84)***
NAV/ADHERENTS	-10,16** (-3,40)	
OUTSOURCING COSTS	-18,46*** (-3,24)	
R^2	0,52	0,46
N. observations	140	140