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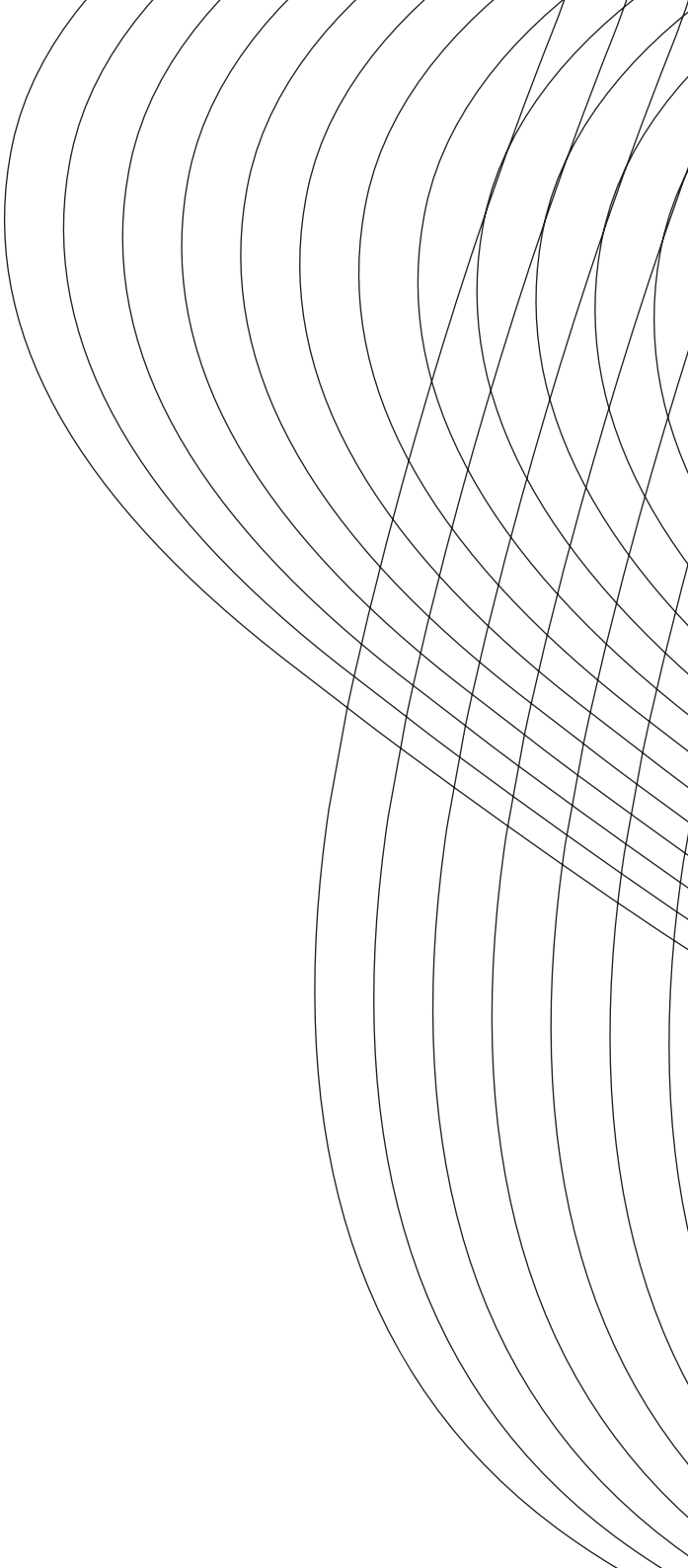
Collective pension schemes and individual choice



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PREFACE

Netspar seeks to stimulate debate on the effects of aging on the behavior of men and women, (such as what and how they save), on the sustainability of their pensions, and on government policy. The baby boom generation is approaching retirement age, so the number of people aged 65 and over will grow fast in the coming decades. People generally lead healthier lives and grow older, families have fewer children. Aging is often viewed in a bad light since the number of people over 65 years old may well double compared to the population between 20 and 65. Will the working population still be able to earn what is needed to accommodate a growing number of retirees? Must people make more hours during their working career and retire at a later age? Or should pensions be cut or premiums increased in order to keep retirement benefits affordable? Should people be encouraged to take personal initiative to ensure an adequate pension? And what is the role of employers' and workers' organizations in arranging a collective pension? Are people able to and prepared to personally invest for their retirement money, or do they rather leave that to pension funds? Who do pension fund assets actually belong to? And how can a level playing field for pension funds and insurers be defined? How can the solidarity principle and individual wishes be reconciled? But most of all, how can the benefits of longer and healthier lives be used to ensure a happier and affluent society? For many reasons there is need for a debate on the consequences of aging. We do not always know the exact consequences of aging. And the consequences that are nonetheless clear deserve

to be made known to a larger public. More important of course is that many of the choices that must be made have a political dimension, and that calls for a serious debate. After all, in the public spectrum these are very relevant and topical subjects that young and old people are literally confronted with.
For these reasons Netspar has initiated Design Papers. What a Netspar Design Paper does is to analyze an element or aspect of a pension product or pension system. That may include investment policy, the shaping of the payment process, dealing with the uncertainties of life expectancy, use of the personal home for one's retirement provision, communication with pension scheme members, the options menu for members, governance models, supervision models, the balance between capital funding and pay-as-you-go, a flexible job market for older workers, and the pension needs of a heterogeneous population. A Netspar Design Paper analyzes the purpose of a product or an aspect of the pension system, and it investigates possibilities of improving the way they function. Netspar Design Papers focus in particular on specialists in the sector who are responsible for the design of the component.

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COLLECTIVE PENSION SCHEMES AND INDIVIDUAL CHOICE

Abstract

Collective pension schemes are the dominant form of saving for retirement in the Netherlands. We investigate the introduction of individual choices into a collective pension system without affecting the generally accepted advantages of a collective agreement. Increasing the range of individual choices can be beneficial, as it prevents pension plans from making decisions for the average plan participant that may not be optimal for individual participants. We argue for a system in which individuals choose from a set of low-cost balanced index funds, together with a level of intergenerational guarantees that are exchange-traded. This system maintains the two primary advantages of collective agreements (risk sharing and low implementation costs), while facilitating different risk-taking behavior at the individual level.

To facilitate individual choices within collective pension schemes, it is important to enhance the transparency associated with intergenerational guarantees to all participants in the scheme, both in terms of their price and quantity. We argue that the current system (in which long-term guarantees are given by the young to the old within a specific fund but not across pension funds) is not transparent and that it may be suboptimal. We propose a system of *Pension Guarantee Exchanges* (PGEs) that increase transparency and allow pension funds with different age distributions to trade with each other. Knowing the price of such guarantees facilitates the introduction of individual portfolio choices within collective pension schemes.

1. Introduction

At present, many defined benefit pension plans around the world are underfunded. The poor performance of global stock markets, aging populations, staggering economic growth, and low interest rates have all contributed to shortages in assets relative to liabilities. As a consequence, the question of who should absorb these shocks is once again at the forefront of the policy and academic debate. Risk solidarity is often understood to imply that the elderly are protected against a sudden loss of pension capital (Teulings and de Vries (2006)). The young, by contrast, are able to absorb more risk, as they can adjust savings and labor supply decisions going forward (Bodie, Merton, and Samuelson (1992)), and in return pay a lower average pension premium.[1]

However, several pension plans are currently reducing (or plan to reduce) the level of pension benefits, suggesting that the elderly absorb part of the recent negative shocks after all. At the same time some other plans have increased their premiums and have chosen to leave the level of pension payments relatively unaffected. To illustrate this point, Figure 1 displays the current funding ratio alongside the planned reduction in pension benefits.[2] Despite the negative relationship between the funding ratio and the planned reduction, there is significant heterogeneity across pension plans. This suggests that there may be differences across pension funds in the ex ante amount of risk taking and the ex post amount of risk sharing that is applied.

1 Benzoni, Collin-Dufresne, and Goldstein (2007) show that if labor income and stock prices are co-integrated, it is optimal for young households to hold a *smaller* fraction of their wealth in stocks, in contrast with the optimal solution of Bodie, Merton, and Samuelson (1992).

2 Note that, with a few exceptions, the reduction in benefits is capped at 7 percent.

In 2007, many pension plans were holding close to a 60-40 mix in stocks and bonds, leading to the underfunded status of many plans in 2012.[3] As retirees are generally advised to reduce their holdings in risky investments, these older plan participants would probably not have chosen such a risky portfolio themselves. The question is therefore why they should absorb (part of) the negative shocks, and perhaps more importantly, whether it was known ex ante that this was the risk sharing across generations that would be applied ex post.

This naturally puts pressure on collective pension plans, as participants call for more freedom to choose the amount of risk they would like to take. This paper explores the possibility of introducing individual portfolio choice within collective pension schemes. We first analyze the main advantages of collective pension schemes. We then explore how choice elements can be introduced in such a way that the benefits of collective pension schemes are preserved.

Our proposal takes seriously the lessons from behavioral economics, where there is abundant evidence that households may not be sufficiently literate to take optimal decisions with regards to savings (Beshears, Choi, Laibson, Madrian, and Sakong (2011)), investment (Calvet, Campbell, and Sodini (2007)), and insurance (Koijen, Van Nieuwerburgh, and Yogo (2012)) when given too much freedom to choose. Complexity and choice-overload might therefore render participants unable, and perhaps even unwilling, to actively choose. Therefore, we intend to introduce limited choice

3 Defined benefit pension plans typically run a mismatch between assets and liabilities on their balance sheet. Note that investing in equities relative to bond-like liabilities does not in itself create value for a pension fund, but makes for a different risk profile for the stakeholders. The expected higher return is attended by a higher probability of indexation, but also by a higher probability of future increases in contributions or reductions in benefits.

along the dimensions that we deem important. We distinguish three types of decisions: the *savings* decision, the *investment* decision, and the *risk-sharing* decision.

First, we take mandatory participation in pension schemes as given, and therefore propose limiting the choices in the *savings* decision that household face. One could surely argue in favor of more flexible savings rates, within reasonable limits, or allowing the pension contributions to adjust in response to temporary idiosyncratic shocks. Motivated by the permanent income hypothesis, most economists would argue in favor of such flexibility.

Second, we consider it to be advantageous that households are allowed flexibility in their *investment* decision, and particularly with regard to the level of investment risk they prefer to take. We do argue that this decision should only be introduced within reasonable bounds set by the regulator. We propose that households can choose from a set of diversified balanced index funds, with different weights in stocks and bonds.

Third, and related to the previous point, households should have some choice in their *risk-sharing* decision, that is, the amount of long-term guarantees they purchase. One of the main benefits of collective pension schemes is that they offer intergenerational contracts (i.e., guarantees) that are currently not offered (or not offered at competitive prices) in financial markets. We provide examples of such (long-term) guarantees below. However, the flip-side of this argument is that other (younger) participants should be willing to write those guarantees. As a first step, we argue that it needs to be transparent what the guarantees are that each generation buys or sells to one another. Since the market for guarantees has to clear within the collective pension scheme, we can determine the price of the guarantees. We show

in this paper that, in the current system, the price of guarantees is determined within each fund, and therefore crucially depends on, for instance, the age composition of each fund. This means that by making it transparent what the guarantees are that are purchased and sold within different collective pension schemes, we will observe a wide variety of prices for the same contract. This will naturally lead to a debate about why different pension plans offer the same guarantee at different prices. The opaqueness of the current system masks those differences in prices. Since prices are required to allow households to decide how much of a guarantee they want, we need to resolve this issue.

Our suggestion is to clear the market for standardized guarantees across pension funds at a national exchange (for instance, a national clearing market for 30-year inflation-indexed annuities). Such an exchange achieves two things. First, there is a single price for the same guarantee across different pension plans. Second, as we show theoretically in this paper, such exchanges are welfare-improving and hence provide the maximum benefit offered by collective pension schemes.

Once a national exchange is present, the next question that arises is why it is not possible to allow investors other than the younger plan participants to offer those guarantees to the older plan participants. For instance, these other investors might be other countries that are ageing less rapidly or that want to obtain exposure to Dutch inflation for the purpose of diversification. They may be able to offer the guarantees at even lower prices than can be offered by the young. This would provide even cheaper guarantees for older households. We discuss the pros and cons of this new system and provide a model example to illustrate the potential welfare benefits of the *Pension Guarantee Exchanges* (PGEs).

One important advantage worth highlighting is that the risk-sharing agreement we propose is between different, existing generations participating in the pension scheme. This differs from the current risk-sharing agreement in which the younger plan participants provide guarantees to older participants in return for the (implicit) promise that these guarantees will be offered to them as well, by future generations. We argue that such an implicit agreement may be unattractive for several reasons. First, it is non-trivial to make the guarantees transparent and to compute their fair value. In particular, the implicit guarantee with future generations is a challenge, as future generations do not participate in the negotiations. Our risk-sharing agreement between participating generations avoids this problem. Second, guarantees with future generations rely on (implicit) assumptions about population growth, industry dynamics, and labor market conditions over planning periods as long as several decades. Our proposal avoids this uncertainty and only depends on the current distribution of young versus old generations.

The paper proceeds as follows. Section II discusses the important trade-offs between defined benefit (DB) and defined contribution (DC) plans that have been discussed in the literature, and concludes that the main advantages of DB plans are (1) low implementation costs and (2) intergenerational risk sharing. We argue that it is possible to introduce individual portfolio choice to participants by having them choose from a set of balanced index funds (i.e. more flexibility in their *investment* decision) together with a quantity of long-term guarantees (i.e. more flexibility in their *risk-sharing* decision). To achieve this flexibility, we propose a market for intergenerational risk sharing, which we discuss in section III. We provide a theoretical illustration of the upsides of PGEs in section V and conclude in section IV.

2. Collective pension agreements and individual choice

To assess the benefits of collective pension agreements, we start with an individual defined contribution (DC) plan in which every agent saves for his or her own retirement. We assess the advantages or disadvantages of such a plan relative to a collective DB pension plan.

Within a DC plan, the optimal savings and investment behavior of each agent is dependent on his or her age, income process, and risk preferences. An individual entering into a collective pension agreement loses the flexibility to invest based on these individual parameters. Further, collective DB pension schemes can induce agency problems that naturally arise within large institutional investors and that may distort optimal diversification (see for instance Sharpe (1981), Binsbergen and Brandt (2007) and Binsbergen, Brandt, and Koijen (2007)). Hence, a natural question to ask is why not move to a DC system?

The biggest downside of DC plans is that agents may save too little, withdraw too much from their savings account too early, and make portfolio choices that are undiversified. We argue that these are serious concerns. However, even with a DC scheme, we can impose a minimal savings rate, a maximum withdrawal rate, and a restricted set of investment options that only includes globally diversified portfolios. Hence, a "constrained DC" can address all of the main concerns that are often brought up in this discussion. Such a constrained DC can easily allow for age and income differentiation and, to a certain degree, differentiation by risk aversion.

Another often-heard argument against introducing choice in terms of risk taking (and DC plans) is that households are not

holding stocks, despite their high average returns.[4] We argue that pension plans can confront households with a trade-off between expected benefits and the riskiness of the investment portfolios. After all, the main reason why collective pension schemes take large positions in equities is to increase the average return, which in turn lowers the expected pension premium or increases the expected pension benefit. Hence, we think that households can be given a restricted choice set of risk taking alongside the implications for pension benefits and premiums. The investment options for households can then be limited to, for instance, three options for a 30-year-old household: 90%, 75% or 50% in the global index fund and the remainder in bonds or other less risky assets. For a 60-year-old household, the choice set may then be limited to 30%, 20%, and 10% in stocks. As mentioned before, alongside each of these investment choices, the pension fund indicates the premium and the expected pension benefits in order to ensure that the household realizes that a reduction in investment risk comes with an increase in the expected pension premium ora reduction in expected pension benefits.

Another concern with respect to individual risk choice (and DC) is that households start timing the market in ways that may not be optimal. For instance, in response to the stock market decline in 2008, households may have a tendency to shift to the safest option offered to them. This may be sub-optimal given the recent insights of the empirical asset pricing literature that show that risk premia vary over time (Campbell and Shiller (1988), Cochrane (1991), and Binsbergen and Koijen (2010)). During bad

4 There exists a large literature on the so-called participation puzzle, which states that many households are not participating in the stock market despite a high equity risk premium. See Mankiw and Zeldes (1991) and Vissing-Jorgensen (1997).

economic times, expected returns tend to rise and the investment opportunities for long-horizon investors may in fact improve (Campbell and Viceira (1999)). If households move out of risky investments in those episodes, then this "wrong" timing behavior may have a negative impact on their long-term performance and may in extreme cases even contribute to the volatility of asset markets. For instance, following the stock market decline in 2008, households would have lost out on the recovery in global asset markets in 2009. To mitigate the impact of such unwanted timing behavior, we suggest that households can be allowed to move their money only once a year and the only one step up or down. For instance, if the choice set is 90%, 75%, and 50% and the household currently invests 90% in the global index fund, the household can only reallocate to 75% equities.[5]

Arguably the most important upside of a collective DB pension fund is that it can enhance risk sharing in incomplete markets. The four important risk categories that participants face are inflation risk, income risk, asset market risk, and longevity risk. Within pension funds, these risks are traded between generations. This paper argues that the way risks are currently traded within pension plans is not always transparent. Also, it is not obvious why it would be optimal to share these risks only with the participants within a single pension fund, as opposed to the participants from other funds. If two pension funds have a drastically different age distribution, then the amount and price of the guarantees that are exchanged between generations are likely to be very different. Setting up a market that trades guarantees makes this explicit. Our Pension Guarantee Exchange allows pension funds to share these risks with each other.

5 One potential disadvantage of choice may be that employees will note that some will receive a more attractive pension deal than others.

3. Advantages of PGEs

An individual DC system allows for high individual flexibility, but does not offer intergenerational guarantees. Currently, collective DB systems offer guarantees but in a rather in transparent fashion. Introducing a market for guarantees overcomes these issues and has the following advantages.

1. PGEs allow participants to share risk not just with the participants in their own plan, but also with participants of other plans. This enhanced risk sharing across all pension plans (and potentially even with other (international) parties) is welfare improving, as it offers more instruments to accomplish consumption smoothing over the life cycle.
2. PGEs enhance the transparency of the pension system because a PGE reveals the market price of intergenerational risk sharing. Opaque systems with frequent policy changes introduce regulatory uncertainty. This causes uncertainty-averse agents to want to exit the pension system.
3. PGEs can help accommodate different risk-sharing preferences of individual plan participants. Several important long-term risks for retirees are not easily traded on financial markets. Participants can currently only share these risks through their pension plans. However, because pension plans make choices for the average participant, the amount of risk sharing the plan implements may not be optimal for individual participants.

4. Other considerations regarding PGEs

In the previous section we mentioned several advantages of PGEs. This section presents some additional considerations regarding PGEs. We discuss successively the positive externalities of PGEs, the institutional aspects of organizing a PGE publicly or privately and the consequences of a shortage in supply or demand for guarantees.

A. Positive Externalities of PGEs

A potentially less obvious, but important additional advantage of PGEs is that the widely-recognized benefits of collective pension schemes can be easily extended to self-employed households. Such positive externalities are not offered by collective pension schemes, which consequently discourages people from becoming self-employed.

Along the same lines, we can allow self-employed households to allocate capital to the global index fund, thereby offering the benefits of diversification to a larger group of households. Leveling the pension playing field encourages entrepreneurship and may therefore spur growth and innovation in the Netherlands.

B. Public or Private PGEs

Introducing a market for PGEs may be controversial to some. After the financial crisis, there may be concerns about the functioning of a potentially illiquid financial market. There may also be serious political economy problems if, e.g., legislators or lobbying organizations would try to influence pricing on these markets. That said, a key observation to make in this context is that these markets (with all their political problems) already exist and that

it happens to be the case that they are segmented and opaque across pension funds.

One important concern is the way that prices at PGEs are determined and whether to allow other parties, such as insurance companies, hedge funds, and foreign pension funds, should be allowed to participate on PGEs. Let us first spell out the main objectives. First, the prices on PGEs should reflect the current or recent demand and supply curves of participants. Second, as it is too complicated to ask for full demand and supply schedules, the mechanism needs to be simple and transparent. Third, we believe that the market should be well-regulated to prevent price manipulation. The government can only regulate the rules of the game, but should not take positions in this market itself. This is to prevent prices from being distorted by politically motivated interventions.

A final concern with bringing in other market participants is that they may default on the guarantees they offer. There are various ways to mitigate such concerns. First, as with many financial contracts, one can require that the guarantor posts margins on a frequent basis so that the losses are minimized.[6] The regulator can impose restrictions on the types of institutions that can offer guarantees or the fraction of guarantees that have to be cleared internally versus the fraction that can be sold to parties outside of the Dutch pension schemes.

C. Lack of Demand or Supply

What if there is no demand or no supply of guarantees at what is believed to be a "reasonable" price? For example, what if the

6 E.g., central clearing of derivatives reduces counterparty risk and strengthens overall market integrity. Such central clearing of, e.g., over-the-counter contracts will be introduced in the foreseeable future.

young also want to buy guarantees and are unwilling to sell them? Could this lead to unreasonable prices? In many ways, posing this question reveals the main motivation for this paper. If young people are unwilling to offer guarantees, then why are pension funds offering these guarantees on behalf of the young participants to old participants at an unknown price, in an unknown quantity? Similarly, old people currently believe they own guarantees (hence the term "defined" benefits), but how hard these guarantees are in terms of their price and quantity is unknown.

One potential mechanism is the following. We randomly divide the population in 52 groups (corresponding to 52 trading weeks), which can be done on birthdays (scaled for seasonal effects). Each household trades once a year, and depending on age, has a default supply or demand for guarantees. This is similar for the minimum pension contribution or the maximum level of investment risk a household can take. At a higher (lower) price, the household can buy (supply) additional guarantees. Households then decide the amount of additional guarantees they would like to buy or supply. We clear the market as far as possible. Any mismatch in demand and supply is offered to third parties, such as insurance companies. If they want to hold the excess demand or supply of guarantees, the market clears. If not, the excess demand or supply is canceled and all positions of households that asked (or offered) the additional guarantees are canceled. As we observe the demand and supply at the different prices, we can update our best estimate of the demand and supply curves, which form the input for the trade the next week (recall that there are 52 groups). In this way, prices always reflect the recent demand curves, and third parties are only allowed to absorb excess demand or supply, which prevents them from squeezing the market.

Alternatively, we can impose the same level of paternalism as is currently in place; the young may well be forced to offer guarantees to the old participants. The main motivation for such a policy may be that households are unable to take such complicated decisions themselves, implying that the design of defaults is important. However, it is optimal from a welfare perspective to offer such guarantees all at the same price across funds in order to optimally share the risk across participants.

5. The welfare gains of PGEs: an illustration

This section provides a few simple examples to illustrate the potential benefits of PGEs. In Appendix B we develop a formal model, but we describe the main economic insights here with a series of graphs.

Collective pension schemes offer a variety of guarantees associated with asset market risk, inflation risk, and longevity risk. For instance, in collective DB plans, the pension plan implicitly offers long-term put options such that in case of market downturns, the retirement benefit is not as much affected. Another guarantee is that pension benefits may be indexed with inflation, thereby offering a valuable long-term risk-free asset that is otherwise not available to households (Campbell and Viceira (2001)).

In our example, we focus on the benefit of introducing a risk-free asset.[7] Old households have a demand for risk-free assets to finance their consumption during retirement. Young households, in contrast, receive labor income that allows them to finance consumption. As such, they can adjust their consumption-savings behavior in the future more easily and they can even adjust their labor supply decision if necessary. This naturally generates a market for risk-free assets within collective pension schemes; young participants write guarantees to old households.

In our model, we first determine the demand and supply of risk-free assets given a certain price. We then clear the market within a pension fund to arrive at the equilibrium price of risk-free assets within each pension fund. This is the most

7 The risk-free asset can be interpreted as a real annuity.

favorable interpretation of a collective pension fund: The risk sharing within the pension fund is optimal prior to the introductions of PGEs.

We consider two pension funds. The pension funds may differ in the age distribution of their participants. The age distribution across industries and firms may differ widely, as illustrated for instance in Table I. The table presents the fraction of participants older than 50 for Fortune 500 companies, implying that they are all large corporations in the United States. The heterogeneity in terms of the age distribution is quite remarkable. The companies with the oldest labor force have about 35–40% of their participants that are older than 50. For the companies with the youngest labor force, this is only 6–14%.

Our main point is that if we share risk within the pension funds of these companies, or across industries in the Netherlands, the risk sharing may be sub-optimal. For instance, in case of Google, with only 12.9% of workers older than age 50, a large group of young people can offer the guarantees and the price will be low as a result. As the interest rate is the inverse of the price of a risk-free asset, the interest rate that the older people earn on their guarantees is high. By contrast, American Airlines, with 39.2% of their participants older than 50, has fewer young people to offer the same guarantees. The price they will ask in equilibrium is higher, and hence the interest earned by the old plan participants of American Airlines is lower. Such differences in prices across funds driven by heterogeneity in the age distribution is sub-optimal.

This effect is illustrated in Figure 2. The solid line illustrates the equilibrium interest rate in the isolated pension fund if we vary the fraction of young employees between 10–90%. We also consider the combined pension fund. In case of the combined

pension fund, we introduce the PGE that sets a single price for the guarantees. The second pension fund with which the first pension fund can share risk has a 50–50% distribution of young and old workers. We assume that both pension funds have the same funding positions, in order to highlight the main economic forces at work. As risk sharing is more optimal in this case, the slope of the interest rate curve is flatter.

In Figure 3 we illustrate the value, as measured by the certainty equivalent, of the first pension fund in isolation as we vary the age distribution of the pension fund. The certainty equivalent of the old participants is increasing in the fraction of young plan participants (and vice versa for the certainty equivalent of the old plan participants). The intuition is that the old plan participants can trade with many young plan participants if the share of young plan participants is high. As a result, the price of guarantees is lower and the rate of return of the old is higher. The opposite is true for the young plan participants. For that reason, the benefits of varying the age distribution move in opposite directions for young and old plan participants. Furthermore, unless the age distribution of the first pension fund is 50–50% as well, the prices of the very same guarantee differ across funds. Such differences are obviously hard to explain to plan participants, and in fact result in welfare losses as well, as we show below.

We now introduce the PGE to facilitate for risk sharing across pension funds. The certainty equivalents are compared in Figure 4. If the fraction of young plan participants is low in the first pension fund, it is better for the old plan participants to merge with the second pension fund and for the young to stay in isolation. The intuition is the same as before.

This result begs the question whether PGEs are in fact welfare-improving. We show that they are. The welfare gains

are presented in Figure 5 from merging both pension funds. Only if the first fund also has a 50–50% distribution are there no gains from PGEs. This is obvious, as the prices in both funds for the same guarantee are identical. However, imagine again that the fraction of young plan participants are low in the first fund. We show in Figure 4 that the young would prefer to stay in isolation, while the old benefit from PGEs. As the fraction of young plan participants is low, it is welfare enhancing to share risk across both pension funds. The welfare gains are larger the more heterogeneity there is in terms of the age distributions: for instance, if the plan participants of Google in our earlier example were to share risk with the plan participants of American Airlines.

6. Conclusion

This proposal discusses how to introduce individual risk choices in collective pension schemes. Collective pension schemes, as has been argued in earlier work as well, offer scale advantages to diversify investments and may create markets that are otherwise non-existent. To facilitate individual choice, we argue in favor of pension guarantee exchanges (PGE), where intergenerational guarantees are traded.

PGEs improve risk-sharing across pension funds, offer transparent pricing of guarantees, and thereby make it possible to introduce the freedom to choose individually the level of guarantees depending on an individual's age, income, and risk preferences. The welfare-enhancing characteristics of PGEs are typically present, as the age compensation of pension funds is diverse. The welfare gains are larger the more heterogeneity there is in terms of the age distributions.

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Appendix A. Table and figures

Fortune 500 Companies with the Most Older Workers in 2011	
Company	percentage of plan participants are age 50 and older
1. American Airlines	39.157
2. Eastman Kodak	38.420
3. TravelCenters of America	38.387
4. Delta Air Lines	37.688
5. United Airlines	37.648
6. Weyerhaeuser	36.877
7. Edison International	36.225
8. Northeast Utilities	36.127
9. Smithfield Foods	35.948
10. United Services Automobile Association	35.459
Fortune 500 Companies with the Least Older Workers in 2011	
Company	percentage of plan participants are age 50 and older
1. AECOM Technology	6.041
2. Auto-Owners Insurance	9.802
3. Goldman Sachs Group	11.331
4. C.H. Robinson Worldwide	12.042
5. Google	12.855
6. Electronic Arts	13.620
7. Freeport-McMoRan Copper & Gold	14.216
8. Chesapeake Energy	14.269
9. Nordstrom	14.269
10. Consol Energy	14.278

Table I. Fraction of plan participants older than 50 for Fortune 500 companies

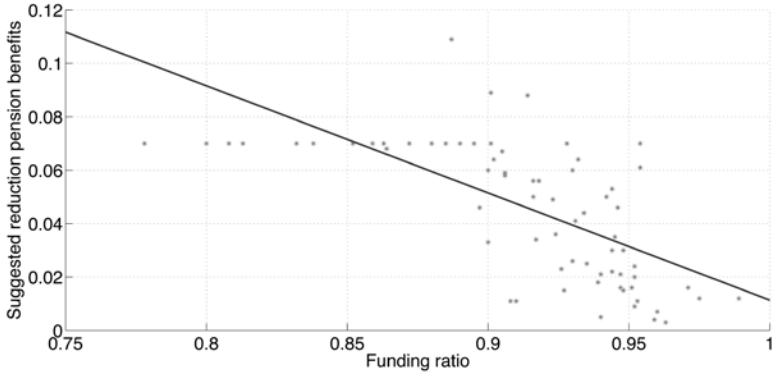

Figure 1. Funding ratios and planned reduction in pension benefits

Source: http://www.pensioenfederatie.nl/Document/Pers/Lijst\%20Pensioenfederatie\%2021-02-12.pdf

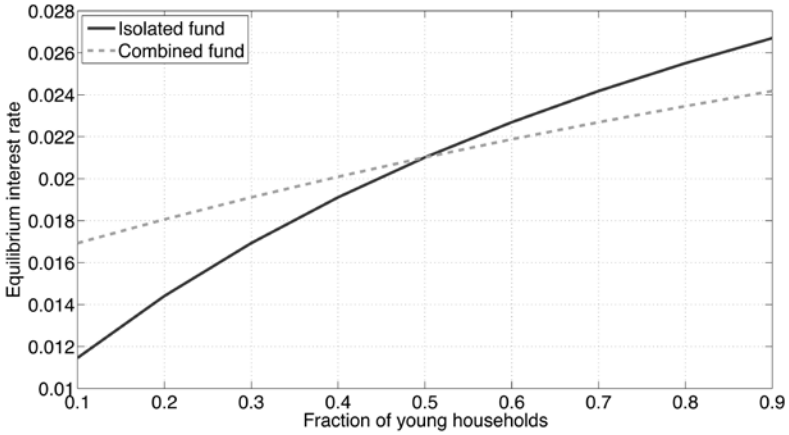

Figure 2. The interest on guarantees for a fund in isolation and in the presence of a PGE

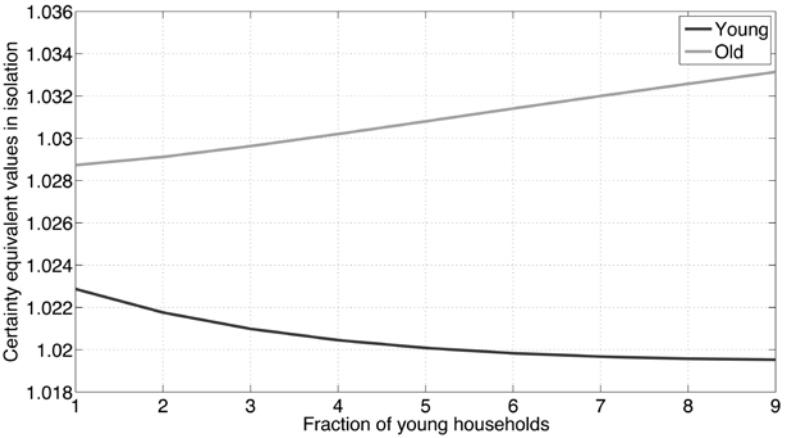

Figure 3. The certainty equivalents of a fund in isolation

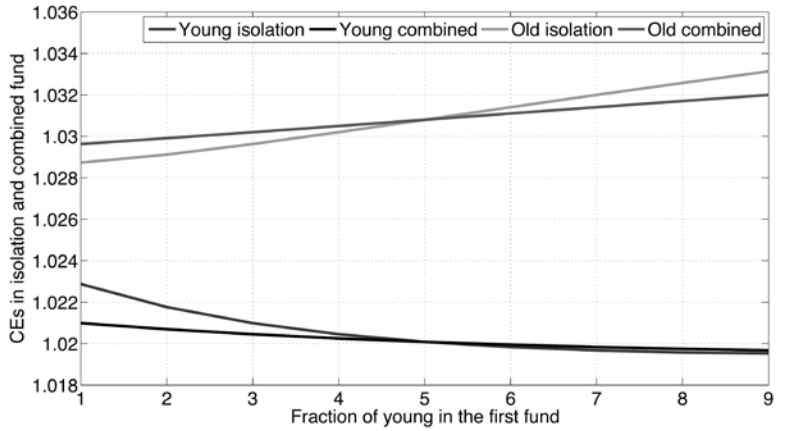

Figure 4. The certainty equivalents of a fund in isolation and in the presence of a PGE

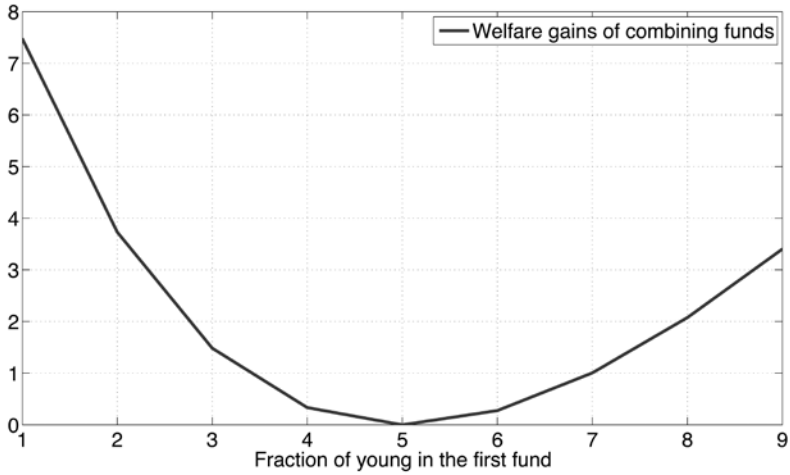

Figure 5. Welfare benefits of a PGE

Appendix B. Motivating theory

We consider a simple model where there are two groups of agents per pension fund. The first group, "young agents," have preferences of the form:

$$E\left[\frac{(C_Y+Y)^{1-\gamma}}{1-\gamma}\right]$$

Young agents receive labor income . The second group, "old agents," have preferences of the form:

$$E\left[\frac{C_O^{1-\gamma}}{1-\gamma}\right]$$

Young agents own W_Y and old agents W_O. There is a single risky asset with a return $R \in \{R_L, R_H\}$, where $P(R=R_L)=\pi$.[8] Initially, this return is given exogenously. Without further contracts, the market is incomplete, as there are two states of the world and only one asset.

Without pension plans, there is no risk-free asset that would facilitate a guaranteed fixed pension. The role of pension plans is to complete this market. The payoff of the contract equals 1. The price of the contract is determined in equilibrium and equals B.

There are two pension funds, indexed by $j=1,2$. Funds differ by the age distribution of their workers. The fraction of young workers equals λ_j. The main role of the pension fund is to facilitate binding risk-sharing agreements across generations.

8 We think of the single risky asset as a low-cost index fund.

We introduce a stochastic discount factor of the form:

$$\left[\frac{1}{B}\right]=\left[\begin{array}{cc}\pi R_L & (1-\pi)R_H \\ \pi & 1-\pi\end{array}\right]\left[\begin{array}{c}M_L \\ M_H\end{array}\right].$$

The Lagrangian of the young agents is given by:

$$\frac{(C_Y+Y)^{1-\gamma}}{1-\gamma}-\Lambda_Y(MC_Y-W_Y),$$

which we optimize over C_Y. This leads to the FOC:

$$C_Y=(\Lambda_Y M)^{-\frac{1}{\gamma}}-Y.$$

For the old, we have:

$$C_O=(\Lambda_O M)^{-\frac{1}{\gamma}}.$$

The LMPs satisfy:

$$\Lambda_Y=\left[\frac{W_Y+BY}{\pi M_L^{1-\frac{1}{\gamma}}+(1-\pi)M_H^{1-\frac{1}{\gamma}}}\right]^{-\gamma},$$

$$\Lambda_O=\left[\frac{W_O}{\pi M_L^{1-\frac{1}{\gamma}}+(1-\pi)M_H^{1-\frac{1}{\gamma}}}\right]^{-\gamma}.$$

This implies:

$$\Lambda_O=\frac{W_O^{\gamma}}{(W_Y+BY)^{\gamma}}\Lambda_Y.$$

The demand for bonds follows from:

$$(W_Y-N_YB)R+N_Y=W_YR+(1-BR)N_Y=C_Y,$$
$$(W_O-N_OB)R+N_O=W_OR+(1-BR)N_O=C_O.$$

The equilibrium condition for bonds is:

$$\lambda_j N_Y + (1-\lambda_j) N_O = 0 .$$

Using the budget constraints, we can write this as:

$$\lambda_j \frac{C_Y - W_Y R}{1-BR} + (1-\lambda_j) \frac{C_O - W_O R}{1-BR} = 0 .$$

That is:

$$\lambda_j \left((\Lambda_Y M)^{-\frac{1}{\gamma}} - Y - W_Y R \right) + (1-\lambda_j) \left((\Lambda_O M)^{-\frac{1}{\gamma}} - W_O R \right) = 0 ,$$

which we solve for B. In case of two pension funds, we have:

$$\lambda_1 N_Y + (1-\lambda_1) N_O + \lambda_2 N_Y + (1-\lambda_2) N_O = 0 ,$$

where we assume that the wealth of the young and the old are identical across both funds. This condition simplifies to:

$$(\lambda_1 + \lambda_2) \left((\Lambda_Y M)^{-\frac{1}{\gamma}} - Y - W_Y R \right) + (2 - \lambda_1 - \lambda_2) \left((\Lambda_O M)^{-\frac{1}{\gamma}} - W_O R \right) = 0 .$$

With an equilibrium bond price in hand, we can compute the certainty equivalents:

$$W_{Y,j}^{CE} = E\left[(C_{Y,j} + Y)^{1-\gamma} \right]^{\frac{1}{1-\gamma}} ,$$

$$W_{O,j}^{CE} = E\left[(C_{O,j})^{1-\gamma} \right]^{\frac{1}{1-\gamma}} .$$

which we can aggregate

$$CE^{Total} = \lambda_1 W_{Y,1}^{CE} + \lambda_2 W_{Y,2}^{CE} + (1-\lambda_1) W_{O,1}^{CE} + (1-\lambda_2) W_{O,2}^{CE}$$

A fully dynamic, OLG version of this model is in progress, so stay tuned.

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Netspar

Collective pension schemes and individual choice

Collective pension schemes are the dominant form of saving for retirement in the Netherlands. To facilitate individual choices within collective pension schemes, it is important to enhance the transparency associated with intergenerational guarantees to all participants in the scheme, both in terms of their price and quantity. Jules van Binsbergen (Stanford), Dirk Broeders (DNB), Myrthe de Jong (MinFin) and Ralph Koijen (Chicago) investigate in this paper the introduction of individual choices into a collective pension system without affecting the generally accepted advantages of a collective agreement.