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ORIGINAL PAPER

Reforming Occupational Pensions in the Netherlands: Contract and Intergenerational Aspects

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Abstract

In the summer of 2020 the Dutch government and social partners have agreed on a pension reform involving the transformation of occupational pensions from the current defined-benefit (DB) based contract into a new defined contribution (DC) contract with some additional collective features. This involves a unique operation as all current DB entitlements—also those already built up—are expected be converted into DC type capital accounts. With the transition to DC accounts the redistribution due to 'uniformity pricing' that was implicit in the DB contract will be abolished and solvency requirements adjusted. This paper analyses how the transformation affects different generations. Special attention will be given to the modelling of the collective add-on to the contract (in the form of a solidarity reserve) that aims to strengthen risk sharing among generations. The effects of the reform will be analyzed for three outcome measures: pension results (in terms of replacement rates), market valuation of pensions net of contributions ('net benefit'), and welfare measured in certainty equivalent consumption (measured through equivalent replacement rates). How the reform impacts different generations proves to be very sensitive to the measure used. There is little consensus neither in economic theory—nor in politics—on what is the best measure. It is sensitive to perspectives, and different traditions in economics focus on different measures. This paper will discuss how economic analysis can still be useful for actual policy making in such a sensitive domain as a pension reform. Finally, by investigating alternative parametrizations of the contract the paper aims to provide insight into the robustness of the results under alternative measures, and on how the new contract could be further improved.

Keywords Pension funds · Asset liability management · Occupational pensions · Policy · Netherlands

JEL Classification G23 · J32 · C54

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1 Introduction[1]

The Dutch pension system is top-ranked in the world, taking a first position in Mercer Global Pension Index (Mercer, 2020) thanks to its strong second pillar of capital funded pensions together with a solid pay-as-you-go (payg) universal basic pension in the first pillar. Total assets accumulated in occupational pension schemes amount to over 200 percent of GDP.[2] In an international perspective, Dutch pension wealth in terms of GDP is among the highest in the world (OECD, 2019), providing a strong buffer against population aging in the next decades to come. Yet, the system has been subject to a prolonged debate within the Netherlands due to falling funding ratios and persistent threats of pensions being cut. Due to falling interest rates most pension funds have been unable to live up to the expectations on indexation of pensions to (wage) inflation leading to great discontent of pensioners and other stakeholders.

In the summer of 2020, the Dutch government and social partners reached an agreement on a major reform of the pension system concerning the second pillar of occupational pensions in particular.[3] It was decided that by 2027 all pension funds should transform their DB (Defined Benefit) contracts into a DC contract in which capital accounts come in the place of pension rights that were common in the DB contracts. In order to maintain the collective character of pensions a new, special DC contract—the 'new pension contract' (NPC)—has been designed which features some extra collective elements such as a 'solidarity reserve'. The solidarity reserve is meant to strengthen intergenerational risk sharing by damping shocks in financial markets and longevity. Pension funds can also opt to transform their DB contract into a so-called 'improved DC contract', which is closer to a traditional DC contract. In this paper we focus on the NPC. The reform supposes that DB promises are no longer sustainable and accepting risk in pensions is inevitable. The pension reform is deemed necessary to make the system more robust to future developments, to restore trust in the pension system, and thus to pacify the ongoing debate between generations.

The new contract aims to be more transparent, fairer both actuarially and intergenerationally, and less distortive for the labor market. It also allows for better tailoring of risk profiles over the lifecycle, and the use of individual capital accounts makes it easier to introduce elements of choice. At the same time the collective character of occupational pensions is to be preserved. Investments remain collective and intergenerational risk sharing is retained by introduction of a solidarity reserve. This reserve allows for intergenerational risk sharing with future participants (Gollier, 2008; Teulings & De Vries, 2006) as well as for trading risks for

[1] The numerical results presented in this paper are largely based on work done for the Dutch Ministry of Social Affairs policy (see Metselaar et al., 2020a) and accompanying background documents).

[2] In 2019 the combined wealth of financial institutions that provide pensions amounted to about 1900 billion euro, which is more than twice Dutch GDP (own calculation using data from De Nederlandsche Bank and Dutch Association of Insurers).

[3] See the proposal for the pension reform by the Ministry of Social Affairs and Employment (2020).

which well developed markets are missing, like (wage) inflation, aggregate longevity risk and introducing a pay-as-you-go element. Furthermore, as the reserve is funded by a fixed proportion of pension contributions (to a maximum of 10 percent), this implies some sharing of wage risks too as pensions of the older generations—now and in the future—may become dependent on contributions by the younger, working generations.

Legislation on the policy reform is set to take effect from 2023 while the reform will likely be fully phased in by 2027. This reform implies a major overhaul of the system which features a large variety of pension arrangements; in total there are about 200 pension funds and collective pension contracts. Most of these pensions are average-pay DB contracts, but there is a significant share of collective DC contracts, mostly for individual companies. It has been decided that all old contracts should by default be converted into new capital accounts with uniform, age-independent contributions. As also entitlements accrued in the past are expected to be transformed in DC accounts[4] this means that all current pension entitlements have to be appreciated in terms of euros and converted into individual accounts in terms of capital. This direct conversion of DB accounts into DC accounts features a unique operation which is unprecedented in pension reforms around the world (Steenkamp & Van Popta, 2021)).[5] Usually, transition from DB to DC contracts would start with new accrual only, and leaves existing DB contracts untouched until they expire. The Netherlands has chosen for direct conversion to maintain the collective character of pensions, to avoid shrinking closed DB funds, and to keep risk sharing between older and younger participants intact. This choice has a price in that it requires all existing entitlements to be evaluated in euros, and total capital of pension funds to be distributed over the new DC accounts of participants.

This conversion to the new contract is a complex operation given the large variety of pension funds and pension contracts. With the transition to the DC contract also the implicit subsidy from younger to older workers that is intrinsic to 'uniformity pricing' will be abolished. In the current DB contracts both contributions and pension accrual rates are uniform across ages, thus neglecting that the price of entitlements varies with the duration. At the same time, the solvency requirements will be different—in general lower—for DC pensions which tends to mitigate the redistributive impact of abolishment of uniformity pricing. Each of these factors affects the distributional effects of the pension reform and may represent a potential source of conflict during the transition. These effects are not negligible given the large amount of pension wealth that is at stake amounting to some 1900 billion euros in 2019 equivalent to about 200.000 euros per participant in Dutch occupational pension schemes.

The transition to the new contract should be completed by 2027. Social partners agreed that this transition should be generationally fair, thus involving no significant

[4] Exceptions can apply, for example DB funds that are already closed to new entrants.

[5] Denmark introduced market valuation of current liabilities taking them as nominal guarantees. The transition was much more straightforward and hardly influenced solvability. Denmark's pension system did not include a strongly redistributive element like uniformity pricing.

redistribution between generations. More specifically, labor unions summoned that nobody should be worse off after the transition to the new contract. This raises a number of questions. The first, and most important one, is by what measure should be evaluated whether somebody is better or worse off under the new contract. We distinguish three alternative measures: the pension outcome as measured by—the distribution of—replacement rates, the market value of these pension results net of contributions paid, the so-called 'net benefit' of pensions, and finally the welfare derived from the pension as measured by equivalent consumption, here expressed through an equivalent replacement rate.[6] Each of these measures is taken over the full remaining lifecycle of generations, assuming that participants keep building up pension and paying contributions until retirement. The second question is how to compare the impact of the old contract to the new contract. Typically, the pension contract is largely explicit and put down in rules, but not completely. There is a margin for discretion, for example with regard to future contribution rates, but also to policies in extreme scenarios, both positive and negative. Third, it is to be decided how the intergenerational effects of the transition are going to be determined, at what date in time, with which data and what model (in particular for constructing both a suitable projection and risk-neutral scenario set), and which party will ultimately be responsible for assessing the intergenerational fairness of the transition. Fourth, one should take account of possible compensation measures when certain groups are threatened to be significantly worse off due to the reform.

This paper analyzes the transition from the current DB contract to the new DC contract focusing on the intergenerational impact using a stochastic generational accounting framework. Several alternative specifications and parametrizations of reform will be investigated to gain insight into the best way to shape reform and its transition; several of these variants have been used by the Dutch government and social partners in the underpinnings of the pension reform.[7]

The paper contributes to the literature on pension reforms using a stochastic generational accounting framework (for a survey see Fehr (2009, 2016)), here applied to the transition from collective DB contracts to DC type of contracts. Special attention is given to by what indicator to assess the distributional impact of the reform; we consider three alternative measures—pension results, market value and welfare –corresponding to three different perspectives on the evaluation of redistributive effects. We find that these indicators may give diverging, and sometimes even contradictory results for the generational impact of the reform. It occurs for example that a cohort is better off by the transition in one measure and worse off in another measure. This is a remarkable and also uncomforting result. We will analyze the relevance of alternative measures for evaluating policy reforms, both from a theoretical

[6] According to the draft for the new legislation the key measure will be the market value of the expected pensions net of contributions paid, the so-called 'net benefit' of pensions, but other measures may be considered too.

[7] See Ministry of Social Affairs and Employment (2020). During this process the results of the present analysis were discussed in a counselling group consisting of representatives from the two largest Dutch pension funds (ABP and PGGM), De Nederlandsche Bank, Ministry of Social Affairs and Employment, The Federation of Dutch Pension Funds (Pensioenfederatie), and Tilburg University.

point of view and a policy perspective. In doing so, we aim to contribute to a framework for policy evaluation taking account of alternative indicators, and the way they can be used by policy makers in a comprehensive assessment of the generational impact of these type of policy reforms. Unfortunately, there is little unanimity on what is the best perspective for measuring distributional effects, both in literature and in actual policy-making. Different approaches can be distinguished depending on the perspective taken.

In general, *market value* is central in finance oriented studies (see for example the papers by Muns and Werker (2021) and Van Bilsen et al. (2021)). A similar market value approach is chosen in studies on valuation of pensions and adequacy of pension funding (Blake, 1998; De Jong, 2008) as well as generation accounting studies when calculating the net benefit of pensions and social security, see Bettendorf et al. (2011) and the recent update in CPB (2019) on the sustainability of social security in the Netherlands, and a similar analysis by the European Commission (2015) for the EU. In contrast to this approach most studies in the domain of—neoclassical—economics usually take *welfare* as the focus point, for example as the studies on intergenerational risk sharing (Aase, 2002; Balter et al., 2021; D'Amato & Gallasso, 2010; Gollier, 2008; Teulings & De Vries, 2006).Finally, behavioral economics—following Kahneman (2011)—generally focuses on the realizations of pensions (relative to expectations, or other reference points) and their impact on well-being (Disney & Emmerson, 2005). Also, the rich empirical work on income distribution focuses on actual realizations of pensions, usually taking the—expected—replacement rate as key indicator (see e.g. De Bresser & Knoef, 2015; OECD, 2013).

In addition, by analyzing the transition in the contract for alternative policy variants and parametrizations the paper may provide some insight into the optimal design of pension contracts, and the scope of intergenerational risk sharing in a realistic policy environment.

The paper is structured as follows. Section 2 provides background on the Dutch pension system and the planned reform and discusses the transition to the new pension contract. Section 3 describes the data, the model, and the set-up of the simulations. The results are presented and discussed in Sect. 4, and Sect. 5 concludes.

2 Background on Dutch Pensions and the Proposed Reform

2.1 Dutch Three Pillar System

The Dutch pension system can be characterized as a three-pillar model. The first pillar provides a universal basic pension ('AOW') to all citizens. Benefits are income-independent and not means-tested, only depending on the number of years of residence in the Netherlands. The second pillar concerns (quasi-)mandatory occupational pensions organized by social partners on sectoral or company level, covering about 75 percent of all workers; notable exceptions are the self-employed, flex-workers and employees in newer sectors as ICT and media. The number of self-employed has increased from 8 percent in 2003 to 13 percent of the working population in 2020 (CBS, 2021). From the salary workers about 13 percent do not participate in a

pension contract, and there is a tendency to increase; employers in the 'new' industries such as media and ICT have become more reluctant to offer pension arrangements to its workers (Stichting van de Arbeid, 2020).

There is large diversity in pension arrangements with over 200 different pension funds and collective contracts. The largest funds are industry-wide pension funds; the two biggest funds—for civil servants and workers in the care sector—hold about 40 percent of total pension assets. Next to the sectoral funds there are company pension funds, and some specific funds for professional groups such as doctors. Most sectoral pension funds offer average pay DB type contracts with yearly accrual in terms of pension entitlements. Company pensions—usually managed by dedicated pension premium institutes or insurance companies—tend to be rather diverse, with a majority nowadays featuring DC type contracts.

The size of the second pillar is substantial by international standards, comparable in size to the first pillar of basic pensions. For the average elderly about half of his or her pension income is derived from second pillar pensions while the other half stems from the first pillar basic pension. The role of the third pillar is relatively modest.[8] In total, pension benefits are generous by international standards yielding replacement rates for modal workers of 70 to 75 percent (OECD, 2019). In comparison, the replacement rate in the OECD area averages 50 percent. Together with third pillar pension income and income derived from home equity, Knoef et al. (2016) estimate that the replacement rate for about a quarter of pensioners exceeds 100 percent. All pensions in the Netherlands provide a lifelong income, fully insuring individual longevity risk. Since 2012, the pension age (to be eligible for AOW) has been gradually increased from 65 to 66 years and four months, and will increase further to 67 years in 2024; for the future it is automatically linked to changes in life-expectancy (in a 2 to 3 fashion).

2.2 Why is Pension Reform Necessary?

In our analysis we will focus on the typical average-pay DB scheme which is by far the most important contract, holding a market share of 88.4 percent (De Nederlandsche Bank, 2021a) in terms of number of participants and much more in terms of wealth. This DB pension is conditional in the sense that there is no hard pension promise; pension funds in general aim to index the nominal entitlements to (wage or price) inflation but this is no hard promise; it is conditional on the financial position of the fund. In extreme circumstances pension benefits may even be cut in nominal terms. Therefore, this pension contract can be designated as a 'conditional DB pension'. Alternatively, it is sometimes labelled as a 'Collective Defined Contribution'

[8] In 2019, first-pillar benefits amounted to 39.5 billion euro, whereas second-pillar benefits were about 10 per cent higher: 43.1 billion euros (CBS (2021); own calculations). The role of the first pillar is thus somewhat smaller than in a number of other countries (OECD (2019)). No detailed information is available about third-pillar wealth. Combining data from CBS, De Nederlandsche Bank and the Dutch Association of Insurers learns that third-pillar wealth amounts to a few per cent of total pension wealth at most. Second pillar pension benefits are very heterogeneously distributed among the Dutch elderly: about 20% receive no second or third pillar pension.

(CDC) contract (e.g. Franzen, 2010). In the context of our analysis it is, however, essential that it is a contract in terms of accrued pension entitlements, and not capital.

Each year participants can build up a pension entitlement equivalent to 1.875 percent of the salary—above the franchise—from 68 years onwards; the franchise reflects the size of the basic pension in the first pillar. The benchmark of age 68 is a fiscal concept that regulates the maximum accrual per year. With increasing life expectancy this age is likely to increase as well.

Both the accrual and the contribution rate are based on the salary as far as it exceeds this franchise. The entitlement accrued stands for the equivalent of a guaranteed nominal pension from the pension age to death. Over a working life of 40 years a pension can be accrued of 75 percent of average wage earned over the lifecycle. This can thus be seen as a minimum promise which pension funds might index to price or wage inflation if returns on investments are sufficiently high.

Solvency rules introduced in 2007 as part of the supervisory regime ('Financieel ToetsingsKader', FTK) were further tightened in 2015 in the new FTK ('nFTK') regime. Pension funds are required to hold reserves of up to about 30 percent of total liabilities, where liabilities are defined as the total value of all entitlements as discounted by the term structure of interest rates. The ratio of total assets over liabilities is the funding ratio, which is taken as the key parameter for the financial soundness of the fund. Pension funds are allowed to index pensions fully when the funding ratio is 130 percent or higher. No indexation is allowed when funding ratios drop below 110 percent, and pensions may have to be cut when funding ratios are lower than 104.6 percent for a prolonged period.

Figure 1 shows the evolution of average funding ratios of Dutch pension funds since 1988, showing a declining trend that accelerated after the year 2000 when interest rates started to fall.[9] Since 2010 it is hovering around 100 percent necessitating some funds to cut their pensions, and leading to a continuous threat of cuts for other funds, including the two large funds for civil servants and workers in the care sector. This caused an intense debate among stakeholders, and increasing pressure on the Dutch government to relax the solvency regime, which it frequently also did.

In 2019 the Social Economic Council (2019) advised towards a structural reform of the pension system, intending to make it more robust both towards risks in financial markets and better fitted with the increasing mobility in labor markets. Pensions were to become more personal, more transparent, and more actuarially fair entailing less—unintentional—redistribution between generations. More personal, to allow for better tailoring to individual needs of participants. This opens up possibilities to for instance introduce the option to withdraw a—limited—lump sum at retirement age,[10] and—for homeowners—an option to exchange pension for investing in

[9] The average returns on investments for the average Dutch pension fund were positive amounting to 4.8 per cent annually in real terms in last 15 years. Hence, a real cumulative return of over 100% in the 2004–2019 period (OECD (2020)). This was not sufficient to keep up with rising liabilities due to the falling interest rates. Note that the pension entitlements are in nominal terms which are valued using the term structure of interest rates.

[10] This has been made possible in the old pension contract as well.

home-equity, as well as opening up the possibility to temporarily pay lower contributions to fund a home deposit. More transparent, by making the pension contract simpler and clearer about costs and returns. And finally, more actuarially fair, by abolishing the distortive 'uniformity pricing' system, i.e. the mandatory combination of a uniform contribution rate and a uniform accrual rate for all participants within a pension fund. This system implied a substantial ex-ante subsidy from younger to older workers as—due to discounting—entitlements for older workers are worth more than for younger workers. This is illustrated in Fig. 2 showing the actuarially fair contribution rate for each age group—for a 1.875 percent accrual rate—and the actual uniform rate which was determined for a pension fund as a whole. Due to this system the young pay about one-fifth too much and the older workers one-fifth too little.[11] This systematic transfer from the young to the old represents was deemed undesirable in a modern, more flexible labor market, where people move between careers more frequently. The implicit subsidy from younger to older generations leads to a pay-as-you-go element in the pension system. It was advised to abolish the uniformity pricing, and more specifically to make accrual rates age dependent and actuarially fair while maintaining age-independent, uniform contribution rates within each pension contract.

2.3 The New Pension Contract

A key element of the pension reform is the design of a new capital based, collective pension contract as an alternative to the old 'nFTK' contract. In the so-called 'New Pension Contract' (NPC) participants build up pensions in terms of capital that is converted into a pension at retirement age. The capital accrued by each individual is referred to as capital intended for future benefit payments. The sum of individuals' capital adds up to the total collective capital of the fund (save a collective buffer). Next, by distributing the financial risks in an age dependent fashion risk profiles effectively feature a lifecycle pattern with risk exposure being reduced as people get older. Interest rate risk is treated separately by assigning a compensation for the interest rate to all accounts first before distributing the remaining 'excess' returns. In principle, according to the proposed legislation no interest rate risks are being shared between generations in the NPC. This is to repair a serious problem in the old 'nFTK' contract where elderly used to be over-exposed to the interest rate risk emanating from the liabilities of the younger generations.

To allow for intergenerational risk sharing and sharing risks that are not traded in well-developed markets the NPC also includes a 'solidarity reserve'. All participants pay a set fraction of their pension contribution—up to a maximum of an equivalent 10 percent of pension contributions—to this reserve, that is distributed according to fixed rules. In addition, also excess returns may feed into the solidarity reserve. Many see intergenerational risk sharing as essential to the Dutch second pillar as providing the rational for the system of sector wide pension agreements that are mandatory for all

[11] The size of the subsidy from the young to the old workers depends on the interest rate and future returns; Fig. 2 is based on a long term nominal interest rate of 0.5 per cent.

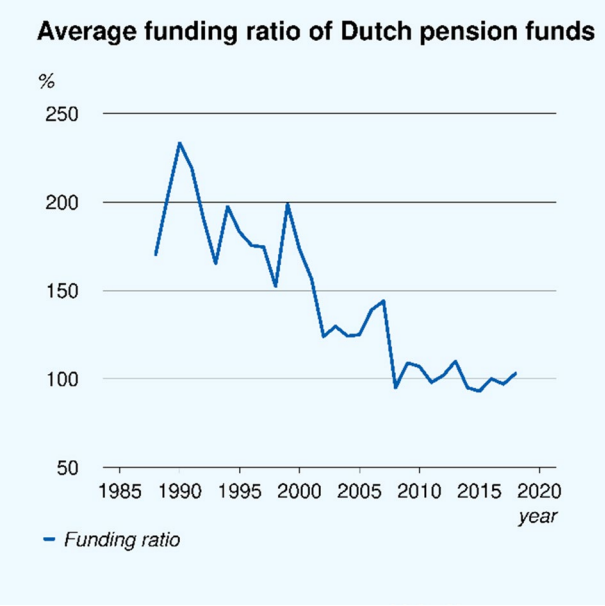

Fig. 1 Average funding ratio of Dutch pension funds, 1988–2019. *Source*: De Nederlandsche Bank.

workers in that sector. Moreover, intergenerational risk sharing can be welfare improving by allowing trade with future generations and sharing of risks that are not well traded in markets, such as aggregate longevity risk or wage risk. The solidarity reserve cannot become negative as intended by the Ministry of Social Affairs and Employment (2020).

As an alternative to the new NPC contract, funds can also opt for a transition towards existing DC contracts which were already used by many company pension funds. In order to make these contracts more attractive for the more traditional funds it will also be allowed to build in some additional collective elements, such as a solidarity reserve. Like the NPC contract the DC contract will have to use uniform, age independent contribution rates from 2016 onwards. This is a new requirement for existing DC contracts forcing them to transform their contract; currently, the typical DC contract features progressive contribution schemes with rates increasing with age.

An important difference between the NPC and a regular DC contract concerns the borrowing constraint: in regular DC contracts participants are not allowed to invest more than 100 percent of their individual capital in risky assets. In the NPC, an exposure of more than 100 percent to stocks is possible, thanks to its risk sharing mechanism. This could especially be relevant for the younger participants.

2.4 The 'Double' Transition

By 2027 at latest, all pension funds should have transformed current nFTK contracts into capital accounts, either the new pension contract (NPC) or another type of DC

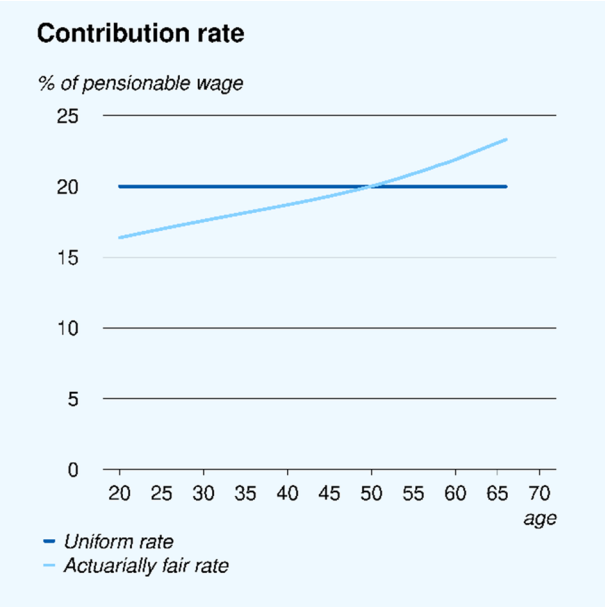

Fig. 2 The uniform rate in case of uniformity pricing and the actuarially fair contribution rate

arrangement. To preserve the collective character of pensions it is decided that by default all entitlements accrued in the past will be converted into the new contract as well. This avoids the pension fund to be split in a new fund for the new accrual and an old, closed fund for the old entitlements. This involves an operation at a nationwide scale that is unprecedented in pension reforms in the world. Usually, the transition from DB type contracts to DC contracts is done in a more gradual fashion by starting DC arrangements for the new accrual, and respecting existing DB contracts until they expire. The direct, collective transition to the new contract requires current entitlements to be converted into capital to be written on the new personal accounts.

This transition is further complicated because at the same time the implicit redistribution through uniformity pricing is abolished, and the solvency requirements will change going from DB contracts with a nominal guarantee towards capital accounts without any such guarantee. Both have a substantial impact on the intergenerational distribution. Given the mostly positive risk-free interest rates,[12] immediate abolishment of uniformity pricing removes the subsidy from the younger to the older workers. This hurts in particular workers that are half-way their career, since they have paid the subsidy in the past, while no longer getting subsidized during the rest of their working life. In addition, current generations will lose out when the

[12] The current one-year nominal interest rate (March 2021) is minus 0,5%. The 10-year interest rate is + 0,1% and the 50-year interest rate is + 0,8% (De Nederlandsche Bank, 2021b). Note that if the nominal interest rate term structure becomes negative the argumentation in this paragraph is reversed. In that situation, uniformity pricing implies a subsidy from the old to the young given legally prescribed present value calculations.

implicit pay-as-you-go-element due to uniformity pricing is abolished. Fortunately, this transfer is partly mitigated by the second element of the 'double transition', the relaxation of solvency requirements. As pension funds have to hold smaller buffers less wealth will be transferred to future generations. The lower solvency requirements may be partly offset by the introduction of the solidarity reserve which has to be built up from contributions of younger generations. This solidarity reserve may also contain a payg element (see also Van Bilsen et al. (2021)). As will be discussed in paragraph 4, the effect of the lower solvency requirements and the new solidarity reserve does or does not compensate for the opposite transfer due to the abolishment of uniformity pricing, which in addition also may depend on the chosen outcome indicator.

For the conversion of the old entitlements into capital two methods have been devised. The first is the 'standard method' (Werker et al. (2019)) that follows the by Dutch law prescribed valuation in the nFTK-contact of entitlements by the nominal risk free interest term structure. In addition, this method includes a proportional 10 year adjustment to distribute any excess or shortage in funding, that is, an initial funding rate different from 100%. The results of this conversion can be assessed, and compensating measures—if deemed necessary—can be taken.

Alternatively, it would be possible to distribute the fund's total capital directly in such a manner that all current participants receive a capital equal to or greater than the market value of their pensions under the current nFTK contract. This value concerns the 'net benefit' as it takes account of all future contributions and pension accrual too. This way each participant is meant to receive the value of their pension under the current contract, assuming lifelong participation. This method is called the 'Value Based Asset Liability Management' method, or briefly the VB-ALM or VBA method. This value concerns the risk-neutral market-consistent based value; note that not all elements of the pension contract are explicitly priced in financial markets. This method can be implemented as follows: in a first iteration the entitlements are converted into capital by the 'standard method'. By simulating the old nFTK-contract and the NPC the 'risk neutral value market valuation' is calculated similarly as actuaries and finance professionals perform market-consistent valuations of optionality in insurance liabilities and of financial contingent claims. To obtain a small as possible ('zero') effects, capital is adjusted for participants. The resulting capital for each participant is transferred to the new pension contract.

The standard method is attractive as it concurs with practice of valuation of entitlements and communication with participants. The VB-ALM method is attractive as it takes all effects together and ensures a generation neutral transition in terms of market values from the outset. For participants as well as pension fund boards (and policy makers) it is, however, more complex and tends to be seen as a black box. Moreover, there are uncertainties in estimating prices and financial-economic scenarios. Specifically, three uncertainties should be mentioned regarding the VB-ALM method:

- One has to estimate a pricing kernel and deal with the problem that the pension contract features factors that are not typically traded on a market like (wage) inflation risk and pay-as-you-go elements in the pension contract.

- There are technical uncertainties building a risk neutral scenario set.
- Market valuation may be very different according to the date of evaluation. Markets are volatile and so are market valuations. Market prices on December 31st 2019 (the date used in this paper) will likely be different from the market valuation in 2027, when the actual transition will take place.

In addition, there is uncertainty about the future interpretation of the current defined beneùùfit contract. This applies to each of the three alternative outcome measures. For comparison of the two contracts one has to assume that the current contract will continue indefinitely in the future. The same holds for the new pension contract. In practice, rules change over time, often also dependent on the state of the economy. For example, rules about cuts have not been strictly carried out in the past. Implementing this policy uncertainty in a formal analysis as in this paper is hard.

Finally, it should be mentioned that all the above concerns the transition of the old entitlement based contract towards the capital-based NPC contract. But other transitions are possible as well, for example from the nFTK contract to a pure DC contract. Furthermore, the existing DC contracts faces a transition problem too, as they have to switch from age dependent 'progressive' contribution rates to age-independent 'flat' contribution schemes, see Metselaar et al. (2020b) for more details. Again, this may cause an issue for workers half-way their career who have built up little pension in the past under the old regime, that is no longer compensated by higher accrual in the second phase of their career.

2.5 Intergenerational Effects: Three Alternative Measures

Finally, when designing the transition pension funds have to decide on how they appreciate the intergenerational effects. An important requirement agreed by social partners is that the transition should be largely intergenerationally neutral, involving no significant shifts in the distribution among generations. Less clear is, however, how this is going to be evaluated. Three alternative measures can be distinguished: expected pension results, net benefit of pensions, and welfare. Each of these concepts is forward looking[13]; they take account of pensions in the future only, and do not look at what has been paid and received in the past. These concepts can be specified as follows:

a. *Pension outcome* concerns the distribution of pensions to be expected; often it is expressed in inflation corrected replacement rates to ease the interpretation. To find this distribution a financial-economic scenario set has to be chosen a priori.
b. *Net benefit* is the market value of pensions; this measure requires a framework for risk neutral valuation.
c. *Welfare* measures the impact of the transition from the old to the new contract in term of equivalent variation based upon the full distribution of pension outcomes

[13] A fourth – more backward looking – criterion could be equal annual return on pension contributions. Since pension funds have not registered this information in the past, we have not made these calculations.

calculated in a. This measure requires information on the preferences, usually to be taken simply CRRA (constant relative risk aversion) preferences.

Each of the measures is taken over the full remaining lifecycle, so also including new accrual less contributions paid during the future working life. Also, these measures concern the second pillar of occupational pensions only. The first measure gives the full spectrum of possible pension results. Usually, information focuses on the median, and a low and high scenario for the replacement rate (in this paper P5 and P95). This measure has the advantage that it provides information that is familiar to participants, as pension funds already communicate with participants about scenario-dependent benefits in their yearly statements. However, for a comprehensive judgement one has to weigh the different moments of the distribution. The other two indicators provide a comprehensive result which makes judgement easier. On the other hand, these concepts may be regarded as being more abstract to participants (and policy makers). Moreover, they are conceptually different and may yield diverging results. Net benefit measures the pension outcome in terms of market value. Welfare takes account of individual preferences; it is usually expressed as certainty equivalent consumption in terms of the replacement rate.

Which of the two latter measures is most relevant depends on the constraints faced by the participants. If (i) all elements of the pension contract are traded in the market (complete markets), (ii) the pension contract is well defined in all possible states of the world and (iii) participants have full access to capital markets (including the possibility of short positions), net benefit is the appropriate measure. In that case, the risk features of the pension contract are irrelevant to participants since they can always take extra or less risk in their own investments, arriving at their optimal risk exposure.

However, these conditions are not generally fulfilled. Households have typically only limited access to capital markets. Moreover, markets are not perfect and complete in practice. For example, there are missing markets for among others aggregate longevity risk, wage risk and trade with future generations. Furthermore, the pension contract also concerns non traded elements such as future contributions and pension accrual. Therefore, we also evaluate the pension reform in terms of welfare assuming that households are fully constrained, so that actual income and consumption are governed by the pension contract. We consider this to be a more realistic assumption for Dutch households than the case of perfect access to capital markets.

Finally, it is important to take account of the direct results in terms of pension outcome too, the first measure. Both the market value and the welfare measure depend on specific assumptions on market prices and households' preferences, respectively, which are both uncertain. Therefore, to allow a balanced judgement by the stakeholders, we will in the subsequent analysis present the effects of the pension reform for each of these three measures, and pay attention to the sensitivity of the results too.

In addition to that it is important to note that the effect of the new pension contract in comparison with the old nFTK contract effects must be assessed for all generations. Limiting the evaluation to effects on future (or current) generations only, has the risk of losing sight on for example transition effects which reduce pension

outcomes of current (or future) generations only. This means that is not possible to separate the transition phase from the potential benefits of the new pension contract in our analysis.

3 Description of Calculations

3.1 Model and Data

We apply an overlapping generations stochastic simulation model, or 'Asset Liability Management (ALM) model' to analyze the effects of policy changes regarding the Dutch second pillar pensions system. The model has been described in detail in Michielsen (2015). The model requires demographic, financial-economic and fund policy inputs. We use demographic data from Statistics Netherlands from 2017, slightly adapted due to migration and birth rates to arrive at a steady population size around 2060. As we focus on intergenerational distribution—rather than intragenerational aspects—we assume identical individuals within each year-cohort. They also follow the same career trajectory, with a set participation and salary profile (subject to wage inflation) as shown in Fig. 3. Participants do not change their labor supply based on the fund's performance or other economic developments. The pension fund has perfect foresight: it knows life expectancies for each cohort exactly, and values its liabilities accordingly.

The stochastic set of financial-economic scenarios, including stock returns, price- and wage inflation, bond returns and the real and nominal interest rate term structure is based on market information and taken from Vlaar (2020).[14] Since the choice of the stochastic set may impact the results, we will present the sensitivity with respect to an alternative scenario set too.

Using this framework, we evaluate the reform of the current nFTK contract into the new pension contract (NPC), and consider the intergenerational consequences. Below we specify both contracts in detail. Pension contributions and the investment mix are assumed to be given and equal in the two contracts. The investment mix consists of 50% stocks, and 50% bonds that match the maturity of the (implied) liabilities.[15] Hence, the investment portfolios in all comparisons are identical and differences between two contracts (or different options within the NPC) are only due to differences in benefit schemes for generations.

[14] The scenario set has an interest rate on short term bonds of -0,1% on average (the median is -0,5%) and the ten year interest rate is 0,4% on average (the median is 0,1%). The average yearly cumulative price inflation is 1,1% (the median is 1,1%). The average yearly cumulative wage inflation is 1,5% (the median is 1,4%). The average yearly cumulative stock return is 5,6% (the median is 5,7%). We include 2500 scenarios in our calculations.

[15] This is largely comparable to the asset mix Dutch pension funds hold in reality. Between different pension contracts the (implied) liabilities can vary, leading to small differences in the maturity of the held bonds. This does not influence the results presented.

3.2 The nFTK Contract

In the current nFTK contract participants accrue rights on future pension benefits. The accrual rate is the same for all participants, independent of age, meaning it is not actuarially fair. This uniform accrual rate is taken as the actuarially fair rate on the level of the pension fund as a whole; it thus varies with the nominal interest rate term structure. Every year the pension fund determines the funding ratio: total assets over total liabilities. The total liabilities again depend on the nominal interest rate term structure. The funding ratio is the crucial parameter for the fund's indexation policies. Full indexation to (wage) inflation requires a funding ratio of about 130 percent or higher. For funding ratios between 110 and 130 percent partial indexation is allowed (in a linear fashion). For funding ratios above 130 percent many pension funds apply a 'satisfaction' rule ('enough is enough') implying that indexation is not further raised beyond 100 percent of the inflation. This cap, however, is not plausible in extremely good states of the world; we therefore assume that extra indexation will be given at funding ratios higher than 150 percent amounting to $1/5^{th}$ of the excess in funding (above this 150 percent). This prevents the funding ratio from growing exponentially in good scenarios.[16]

In the circumstances that the funding ratio falls below 104.6 percent for more than five consecutive years, pension funds are required to cut pensions. Also when the funding ratio is below 104.6 percent and cannot be shown to recover to 130 percent within 10 years,[17] pension funds are obliged to cut pensions. Cuts to pensions of retirees may be spread over the full recovery period of ten years.

3.3 New Pension Contract (NPC)

The new pension contract features individual capital accounts that will be converted into a lifelong pension at retirement. To strengthen solidarity, all active participants have to contribute up to a maximum 10 percent of the pension premium to a solidarity reserve that can be used to smooth shocks over current and future generations.[18] The solidarity reserve can also be used to share risks that cannot be traded on financial markets (Muns and Werker (2021)). Assets, including the solidarity reserve, are invested collectively and returns are distributed according to fixed rules, through a two-step approach.[19] First, every participant receives a so-called 'hedging return' to cover the interest rate risk; and secondly, the excess return of the fund is distributed over all participants according to their age, effectively yielding a lifecycle pattern in

[16] Also, the contribution rate could be decreased to mitigate high funding ratios. We leave this alternative out of consideration in the present analysis.

[17] Pension funds have to hand in a recovery plan based on a prescribed maximum for expected returns on investments.

[18] According to concept legislation, at most 10% of the pension premiums can go to the solidarity reserve. Additionally, at most 10% of the excess returns can also be added to the solidarity reserve.

[19] At this moment there is still some debate on the precise mechanism; in the subsequent we have made some practical choices based on the information currently available from the Ministry of Social Affairs and Employment. See Muns and Werker (2021) for more details about the risk-sharing mechanism.

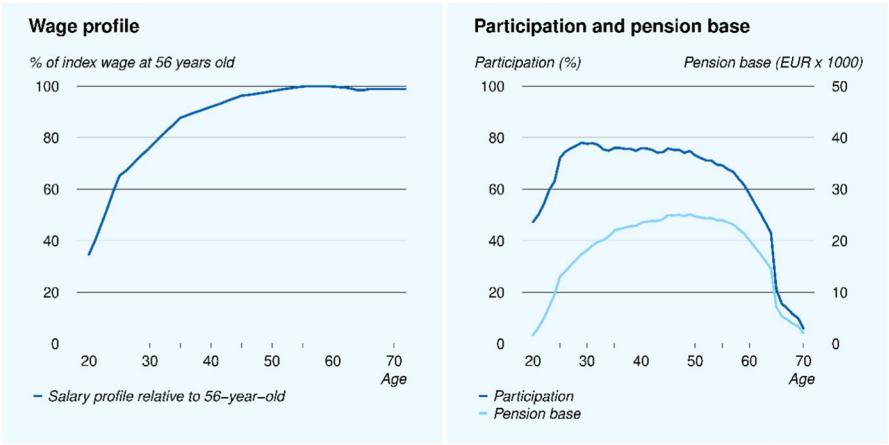

Fig. 3 Wage profile (left hand panel, index wage at 56 years = 100%) and participation and pension basis (right hand panel)

risk exposures. In our model we assume that each participant gets assigned a hedging return R_i^H corresponding to its duration, here modeled by the underlying portfolio for that particular cohort:

$$R_i^H = x_i R_i^B + \left(1 - x_i\right) R^C$$

Here x_i determines the exposure to returns on long and short fixed-income securities ('bonds' and 'cash') with returns of R_i^B and R^C, respectively. After this first step the 'excess return' of the pension fund Z is determined as the difference between the total return of the pension fund and the sum of the allocated hedging returns. This excess return can be both negative and positive. Each participant is assigned a fraction y_i to determine the distribution of the excess return according to age; y_i is a relative exposure and can be scaled to find the actual exposure. The excess return R_i^Z that participant i with assets V_i receives:

$$R_i^Z = \frac{y_i}{\sum_i \frac{V_i y_i}{V}} \left(\frac{Z}{V}\right) \text{ with } \sum_i V_i = V$$

The parameter values for x_i and y_i used in this paper are given in Table 1. Pension funds will have to decide upon their own parameter values based on the risk preferences of their participants.

Pension benefits are derived from the capital in the individual account taking a nominal annuity using the nominal interest rate term structure and taking account of the survival probabilities. Each year the benefits are updated depending on the

returns on the individual account including the hedging return, and possible contributions from the solidarity reserve. Changes are spread over a ten year period.

In case the pension fund's fixed-income portfolio exactly matches the sum of the individual hedging returns, interest rate risks are not shared between participants. In that situation, the procedure above is mathematically identical[20] to a standard DC-contract in which each participant i has an investment portfolio with share x_i bonds, y_i stocks (or other direct business investments) and c_i cash, with $x_i + y_i + c_i = 1$. The new pension contract, however, allows for the assigned hedging returns not matching the bond portfolio of the pension fund, either in value or in maturity. In that case interest risk is shared between participants. Risk sharing through the pension fund also allows for example for investment in illiquid assets (e.g. wind parks, infrastructure), and allows for lifting the borrowing constraint for young participants (i.e. more than 100 percent exposure to risky assets).

The pension fund is initialized in correspondence with the average actual situation of Dutch pension funds in 2020. The initial funding ratio is 100% in the nFTK contract. Participants can envisage a replacement rate of 73%, based on a current accrual of entitlements of 1.875% per working year, but with a 15% indexation backlog. The solidarity reserve is initially empty, and will gradually be filled with ten percent of the contributions in every year. The return on this buffer is equal to the return of the investment mix of the funds as a whole, i.e. a 50/50 mix of stocks and bonds in our default calculations. The default option for the solidarity reserve is to pay out $1/15^{th}$ of the total buffer every year. Active participants and pensioners all get their share, relative to the size of their personal account. We will also investigate alternative rules for the solidarity reserve.

3.4 Transition

For the conversion of the entitlements into capital accounts we take account of both the standard method and the Value Based-ALM method. In the standard method any excess or shortage in funding ratio is assumed to be resolved through extra indexation or cuts over a period of ten years. The resulting liabilities are converted into individual accounts using the nominal interest rate term structure. We have modelled the VB-ALM method in such a way that the difference in (risk neutral) market valuation of pension benefits under the old and new contract are minimized for current participants in an ongoing, 'open' fund. In this calculation we have to make assumptions about future participation of current participants and future participants. The minimization is subject to a boundary condition that the new individual account can never be smaller than the market value of the benefits based on those entitlements accrued at the moment of the transition. Participants that have already been pensioned at the time of the transition will therefore never get less than the market value they would have received under the old pension contract.

In our results we assume that the transition takes place on January 1^{st} 2020, consistent with the date of the risk neutral scenario set. If the transition would occur for

[20] By using formula manipulations, equality of both approaches can be shown mathematically.

Table 1 Parameter values for the exposure in the new pension contract (x_i and y_i)

Age	Exposure to excess return (y_i)	Exposure to hedging return (x_i)
Years	%	%
20	150	25
71	35	50
100	35	50

example on January 1st 2027, all effects on cohort have to be shifted by seven years. Hence, if the transition takes place in 2027 instead of 2020, the presented effect for a cohort born in 1980 will then hold for a cohort born in 1987: a seven year shift.

4 Results

The effects of the pension reform are determined for each cohorts of participants for each of the three possible outcome measures: actual pension outcome, market value, and welfare.[21] We express welfare in terms of certainty equivalent replacement rates based on constant relative risk aversion preferences in terms of the replacement rate $(v) = \frac{v^{1-\gamma}}{1-\gamma}$, with risk aversion parameter $\gamma = 2.5$ and replacement rate v.,[22][23]

Figure 4 displays the impact of pension reform for each cohort (by year of birth) from the current nFTK contract to the new pension contract for each of the three alternative outcome measures: pension results (distribution in replacement rates), the market value (net benefit), and welfare (expressed as certainty equivalent in replacement rate). For each measure the results are given for both conversion methods (standard method and VB-ALM method). The figure shows separately the impact of abolishing the uniformity pricing system.

Panel a shows the results for pension outcome in all different states of the world. This figure features the conventional increasing spread in pension results towards the future. Comparing the current and the new pension contract, it can be seen that the new contract produces higher median replacement rates for all current generations, which corresponds to the larger upward potential, at least for the current older generations. This is obviously due to the lower required buildup of solvency buffers under the new contract. In contrast, future generations tend to end up with lower

[21] Another possible outcome measure could be the instantaneous change in benefit received by the participant at the time of the transition. You could design the new contract in such a way, using the tilt of the path of pension payments, to make sure that there is no income shock at the moment of the transition. Due to the fact that the new pension contract is a defined contribution plan, this only means that participants are shifting their own capital through time. This does not affect the redistribution question at heart of the pension reform.

[22] This somewhat specific modelling of preferences is to focus on the second pillar of occupational pensions, looking only at the pensions above the basic level of first pillar pensions. In Metselaar et al. (2020b) it is shown that the results are largely similar for more general CRRA preferences.

[23] See Metselaar et al. (2020b) Annex C for more extensive information on the model.

median replacement rates; this can be explained by the fact that they do not longer benefit from the larger buffers they 'inherit' from current generations in the nFTK contract.

As also the spread in pensions changes it is difficult to draw unambiguous conclusions on the net effect for each generation. Therefore, one should also consider the two comprehensive measures, net benefit and welfare which are presented in panels b and c. These two graphs show remarkable divergences between the two concepts, however, which deserve closer attention. It is useful here to consider the impact of abolishment of uniformity pricing separately, first. How this affects generations can best be seen for the net benefit (panel b). Abolishment of uniformity pricing is modeled by making accrual rates actuarially fair at given, uniform pension contributions (see light blue 'nFTK (no uniformity pricing)'). With positive interest rates this implies accrual rates that decrease with age. As a result mid aged cohorts born around 1980 tend to be worse off as they no longer receive the implicit subsidy from younger to older workers present in uniformity pricing. Pensioners are unaffected as uniformity pricing only affects working cohorts.[24]

The second major factor influencing the intergenerational distribution follows from the difference in solvency requirements for the old and the new contracts. Given the initial funding ratios of 100 percent pension funds under the current nFTK must build up solvency buffers first before they can start raising pensions. This affects current pensioners in particular: with positive inflation their purchasing power (in real terms) is likely to decrease. This group is better off under the new contract which is subject to less stringent solvency requirements. With funding ratios equal to 100 percent and initial benefits equal to the nominal entitlements in the nFTK contract any positive investment return in subsequent years will immediately lead to higher pension benefits; at the same time younger generations contribute to the solidarity reserve, of which the benefits partly go to retirees too. On average, current participants benefit from the lower required solvency buffers, and future generations lose out. This redistribution in favor of current generations depends also on the—to be chosen—design of the solidarity reserve.

The lower solvency requirements—net of the solidarity reserve—thus mitigate the impact of the abolishment of uniformity pricing. These two contrary forces (termed the 'double transition') help to ease the transition to the new contract. As can be seen in panel b it does not take away all intergenerational effects among current participants: in terms of net benefit, current pensioners tend to profit while participants aged 50 and younger tend to be worse off. The size of these remaining effects is—with the current interest rates and initial state of the funds—limited, and generally deemed to be manageable from a policy point of view (Social Economic Council, 2019). Moreover, in terms of replacement rates and welfare this group of participants turns out to profit from the pension reform (see below).

Panel b also shows the net benefit for the VB-ALM conversion method; as this method explicitly aims at intergenerational neutrality there is a negligible effect of

[24] Future generations lose out in the calculations when the payg element due to uniformity pricing is abolished, because in the applied scenario set the risk free rate is lower than the average wage increase.

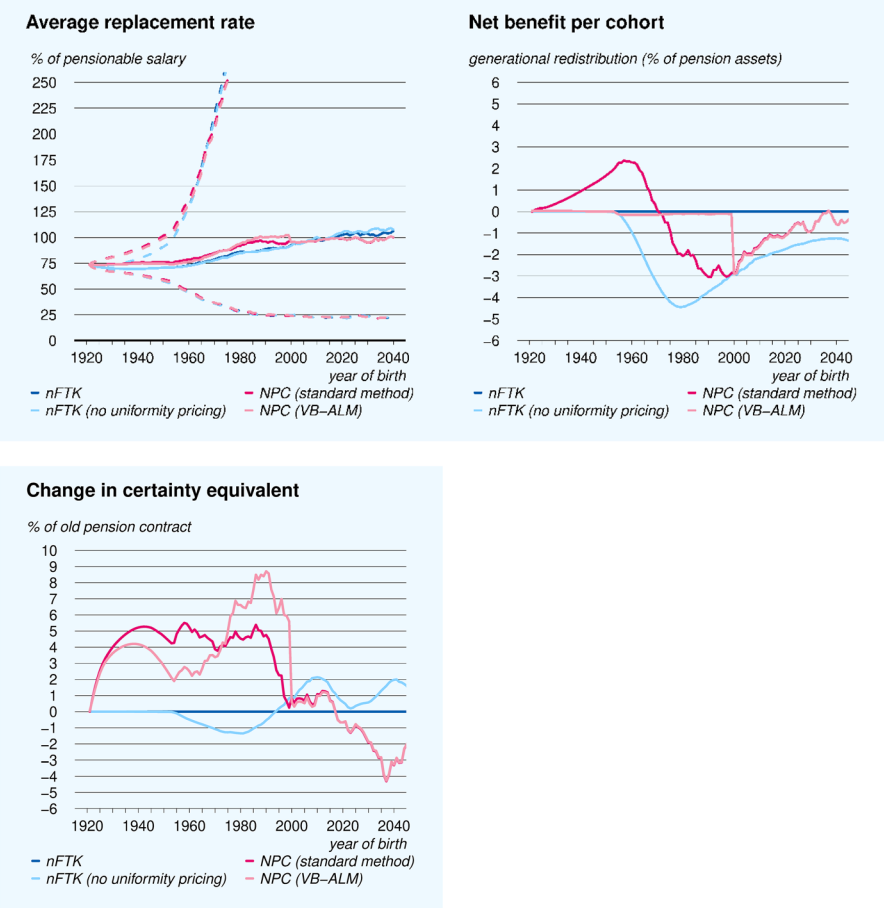

Fig. 4 Transition effect in average replacements rates (panel a), net benefit (panel b) and certainty equivalent (panel c). Explanation: As net benefit is zero-sum the net benefit of generations in the distant future—not shown in the graph—is given by the residual of all previous generations.

the reform for all cohorts up to birth year 2000, that is all current participants. Intergenerational neutrality must be understood as relative to the old pension contract; it is a strong assumption indeed to put forward the old pension contract as our measure of 'fair'. The old pension contract does include redistributive elements, such as the build-up of a buffer and uniformity pricing. In our modelling we do not include an explicit target for future generations so that there may be some variation between generations in the near and more distant future. The overall result over all current and future generations is zero sum in terms of net benefit.

Finally, panel c gives effects of the reform in terms of welfare, expressed as certainty equivalent replacement rates. Again, for the standard conversion method in particular pensioners appear to benefit from the pension reform as it enhances the

upward potential of pensions in the near future.[25] In case of the VB-ALM conversion method the gains are more concentrated at younger workers: the VB-ALM method directly transfers capital from older to younger generations, and thus compensates the younger generations for residual effects of the abolishment of uniformity pricing and the change in solvability requirements measured in net benefit.

Important is that for both conversion methods all current generations are better off under the new contract than under the current contract measured in replacement rates and welfare. This is interesting as pensions in terms of market value (net benefit) do not increase in case of the VB-ALM method. The difference is due to the fact that—by definition—the expected excess return of stocks plays no role in net benefit (or market value): the market value of recently bought stocks is identical to the market value of recently bought bonds. However, the excess return does have a direct effect on replacement rates and welfare (both via solvency requirements and directly). Hence, the abolishment of uniformity pricing (the first element of the double transition) dominates the double transition measured in net benefit. The reduced solvency requirement (the second element) dominates the double transition measured in replacement rates and welfare.

When comparing the results for the three alternative indicators (replacement rates, net benefit and welfare) there is a remarkable divergence in the results in market value and welfare. In terms of welfare (and replacement rates) all current generations are better off under the new contract, while in terms of market value birth cohorts born in 1965 and later appear to lose out under the new contract (in case of the standard conversion method). The decrease in net benefit is—also politically—important. According to draft legislation all transitions to the new contract must in the first place be judged in terms of net benefit. It is important therefore to spell out that although some of the current participants might lose some value they may still be better off in terms of replacement rates and welfare.

Furthermore, these results show that designing a contract that is fair in terms of all these three outcome measures is very difficult in practice. Take again the group of participants born around 1980. As long as the interest rate is positive abolishing uniformity pricing creates a loss for these generations in market value which is not easily compensated if one opts for the standard method for conversion. By definition the VB-ALM method can do better in this respect as it can directly shift capital between generations, and thus precisely target generation neutrality in market value terms. But this method has its drawback too as it is more complex to apply and to communicate to participants. In addition, it is sensitive to the underlying assumptions on the market prices and requires estimates for factors for which markets are lacking.

The main difference between the two conversion methods is that the VB-ALM method allows for direct transfers in capital between cohorts of participants. Figure 5 illustrates the direct transfer in capital in case of the VB-ALM method for three

[25] For new generations in the near future there may be a loss in welfare. This can be due to fact that in our modelling we do not target on a neutral distribution in net benefit value within the group of future generations. As discussed above, in our calculations generations in the near future (up to birth year 2040), may end up with some lower market value under the new contract than under the current contract.

different initial funding ratios. In the case of 100 percent funding ratio some capital is taken from pensioners and redistributed to younger generations to compensate them for the remaining net effect of the 'double transition'. For lower initial funding ratios the transfer from pensioners may reverse as in this case the current contract requires pensions to be cut in nominal terms in the short term. The large changes for young generations in the graph are due to the fact that the effects are measured as a percentage of capital in the account (which is low for young generations).

4.1 Sensitivity Analysis

As mentioned earlier the results may be quite sensitive to the assumptions on the model and the underlying stochastics (Metselaar & Zwaneveld, 2020b; Werker & Muns, 2019). This section presents some variants and sensitivity tests of the basic model. We will look at the sensitivity for the initial position and, the stochastic set, and then consider alternative rules for the solidarity reserve.

4.1.1 Different Initial Position

Pension funds in the Netherlands are quite diverse and may face different initial positions. Initial positions may also vary over time; funding ratios in particular are very sensitive to the interest rate term structure. Our basic pension fund is modeled after the average of pension funds in the Netherlands at an initial funding ratio of 100 percent. Figures 6 and 7 show the results in terms of net benefit and welfare at alternative initial funding ratios of 110 percent and 90 percent, respectively. At an initial funding ratio of 110 percent the pattern in net benefit is roughly similar for the standard conversion method, but the size of the gains for the elderly and losses for younger participants tend to be somewhat bigger. For the case of underfunding with an initial ratio of 90 percent the pattern changes more dramatically: here elderly tend to lose out while younger generations now benefit from the transition to the new contract. This is because the initial underfunding is immediately resolved at the transition, meaning that benefits of current pensioners will be cut. In the current pension contract there would have been a longer recovery period. For the VB-ALM method there is no significant change as it aims at neutrality in terms of net benefit from the outset. Nevertheless, a small effect can be seen in case of underfunding; this is because the boundary condition is invoked here: the new individual account can never be smaller than the value of the benefits based on entitlements accrued at the moment of the transition.

4.1.2 Alternative Scenario set

Next we consider the sensitivity of the results to an alternative scenario set (see also Metselaar et al. (2020b)). Figure 8 presents the difference between two scenario sets: our basic set—taken from the APG pension fund (Vlaar (2020))—and the alternative KNW(1.5%) scenario set.[26] We initialize the pension fund with the

[26] Metselaar and Zwaneveld (2020a). The KNW(1.5%) scenario set is named after its long term interest rate in the long run (1o0 years) of 1.5%. The set features a long term short interest rate of 0.5% and

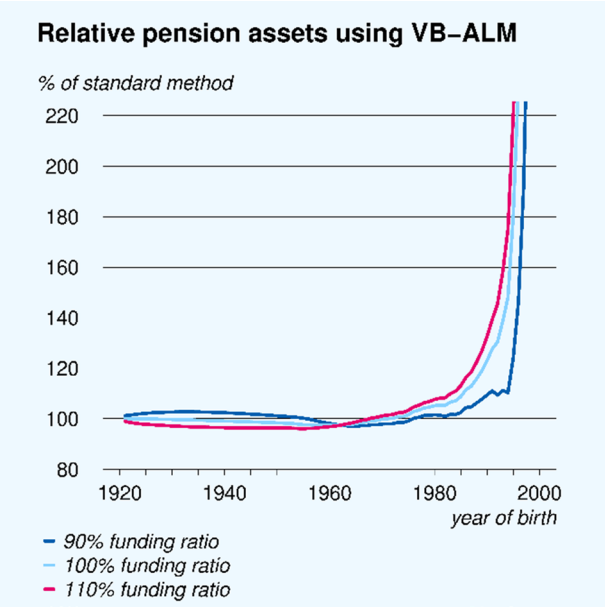

Fig. 5 Redistribution of capital in case of VB-ALM (percentage change, standard method = 100%)

APG scenario set and using the standard method. The total assets and every participants' personal account are in both calculations initially exactly equal. A different financial-economic development leads to redistribution effects: in the KNW(1.5%) economic scenario set pensioners are similarly well off compared to the APG scenario set, but younger participants are projected to be better off in terms of certainty equivalent. Comparing the two panels in Fig. 8 it can be seen that the alternative set is more favorable in terms of spread of the future pensions: the APG scenario set includes on average lower bond returns and higher stock returns, but with a larger volatility. Note that we do not include net benefit here; conceptually it would not be right to use one risk neutral scenario set to distribute personal capitals and a second one, calibrated on a different date, to evaluate.

Pension may also differ in the choice of investment strategies and contract details. Zwaneveld et al. (2019) show that the magnitude of impact of these factors is significantly smaller than the differences from different funding ratios.

4.1.3 Alternative Rules for the Solidarity Reserve

At the moment of writing this paper the modeling of disbursement rules for the solidarity reserve is still debated. This section considers two alternative rules for the

Footnote 26 (continued)
a ten year interest rate of 1.3%. Expected price inflation is 1.3% and expected wage inflation 1.8%. The expected stock return is 4.4%. Median and average values are similar in this scenario set.

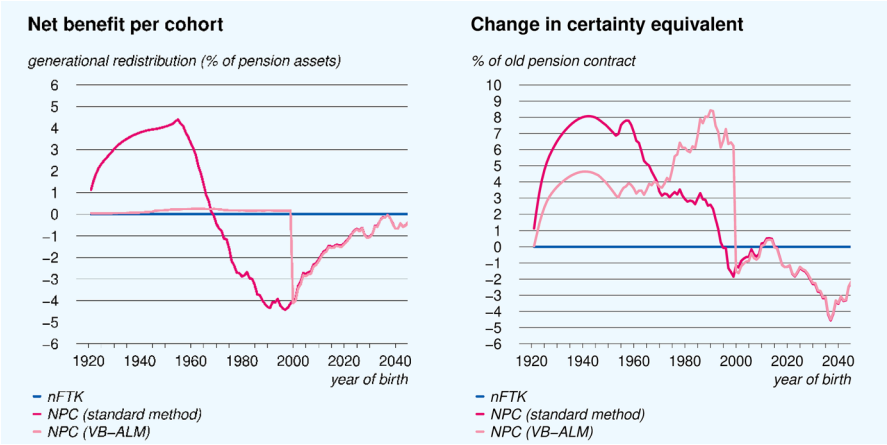

Fig. 6 Transition effects at a funding ratio of 110%: difference with current nFTK contract

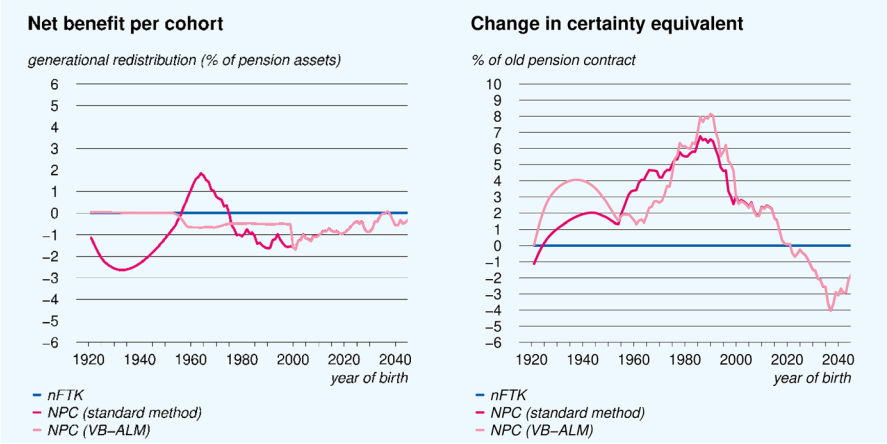

Fig. 7 Transition effect at a funding ratio of 90%

solidarity reserve, the basic linear design used in our analysis so far, and the alternative where disbursements are made dependent on projected replacement rates at the given state of market prices. The idea is that additional payments from the solidarity reserves in unfavorable states could shield pensioners from e.g. inflation risks that are not modeled in the set-up of the solidarity reserve. We model this by introducing a lower limit for the replacement rate beyond which the projected replacement rate cannot fall. This can be seen as adding an option to the otherwise linear contract comparable to put options offered on financial markets. To avoid the buffer becoming negative we make this option conditional on the size of the buffer. The replacement rate can be regarded as a proxy for the total—real—return on investment

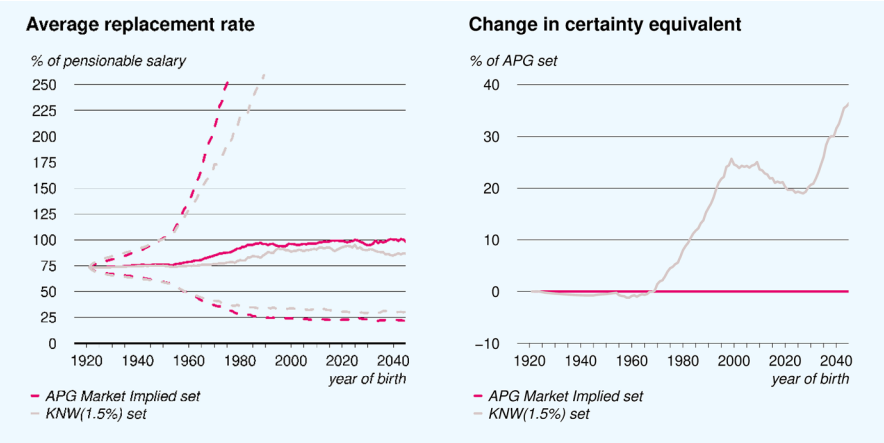

Fig. 8 Difference in replacement rate and certainty equivalent using the standard method at a funding ratio of 100%, for the KNW(1,5%) scenario set compared to the APG scenario set

participants receive, because pension premiums are kept constant in our calculations. The overall investment policy of the fund as a whole remains the same. More specifically, the two options are modelled as:

i. *Basic linear case*: Every year 1/15th of the total solidarity reserve is divided over the personal accounts of participants, in proportion to the size of their personal accounts.
ii. *Lower limit*: Pensioners receive a contribution for a specific year from the solidarity reserve when their projected replacement rate falls below a certain limit in that year, given the restriction that the solidarity reserve is large enough. At most 20 percent of the current size of the solidarity reserve can be used in any individual year. The contribution from the solidarity reserve is capped based on the size of the solidarity reserve:

1. Solidarity reserve < 5% sum of personal accounts: minimum replacement rate = 50%.
2. 5% < solidarity reserve < 10% sum of personal accounts: minimum replacement rate = 70%.
3. 10% sum of personal accounts < solidarity reserve: minimum replacement rate = 70%, after which 1/15th of the solidarity reserve is divided over the personal accounts of participants, in proportion to the size of their personal accounts, taking into account the limits on the solidarity reserve and not using more than 20% of the buffer.

Figure 9 compares the alternative modelling with the basic linear case. The result for the basic case is identical to results for the 'New Pension Contract (standard

method)' in Fig. 4.[27] The alternative with a lower limit leads to larger welfare gains for all generations born after 1960, the difference being about ten percent for generations born after 2000. For cohorts born between 1920 and 1960 the certainty equivalent is more or less the same as before. Median replacement rates are slightly lower than they would have been with the linear design, due to the fact that the solidarity reserve is slightly larger in median scenarios.

The positive effect for current generations may be due to a change in the payg element in the solidarity reserve as well as improvements in risk sharing for risks that are not traded in markets, in particular (wage) inflation risk.[28] The lower limit design serves as insurance against low replacement rates.

In theoretical models like Brennan and Xia (2000, 2002) there are no protective put options in the optimal investment strategy. In practice the investment strategy may differ from the theoretical optimal mix due to a number of reasons. The theoretical optimal result for the Brennan and Xia model is achieved for a fully individual defined contribution contract assuming complete markets. More generally, it can be shown that when economic agents share risks collectively, it is nearly always possible to find a Pareto-improving solution that leaves all agents better off compared to the autarky (=non-sharing) solution (Aase, 2002). In our case in particular, we assume that inflation risks are not well tradable on financial markets and we introduce a payg element. The Dutch state does not offer inflation linked bonds and alternative strategies for hedging inflation risk (and wage risk) are hard to find. Furthermore, taking a short position in cash and bonds may also not always be desirable or achievable for a pension fund, which leads to an investment strategy with restrictions on short selling.

There can be other reasons too for introducing options in the pension contract. Balter et al. (2021) explore another reason for building in a lower limit in the pension contract, but now on the deficit transferred to future generations. This is meant to make the contract incentive compatible if future participants have an option—possibly at some cost—not to join the pension fund. This option is thus meant to avoid the risk of discontinuity of the pension fund if too large a deficit is shifted to future generations. In the new pension contract this is taken into account by the maximum of 10 percent of the pension contribution going to the solidarity reserve together with the nonnegativity constraint for the buffer.

[27] Compared to the NPC without a solidarity reserve, the proposed linear design does actually lead to slightly lower certainty equivalents in the long run, while certainty equivalents in the short run are slightly higher. This can be explained by the implicit payg element in the solidarity reserve or by allocation of risks over the lifecycle. The solidarity reserve is distributed in proportion to the size of personal accounts which creates a bias towards older generations who have built up more capital. This effectively shortens the duration of investments. This can be improved by distributing the same amount to all participants, independent of the size of the personal account; in that case certainty equivalents in the short run are slightly lower, but in the long run slightly higher than they would be in a similar contract without a solidarity reserve. In both cases the difference in certainty equivalent compared to a contract without a solidarity reserve is small: about one percentage point.

[28] Welfare effects also arise when the initial modelling of the contract is suboptimal, that is when e.g. the investment mix does not match with the preferences. In our modelling the mix is chosen to match with the assumed risk aversion of 2.5.

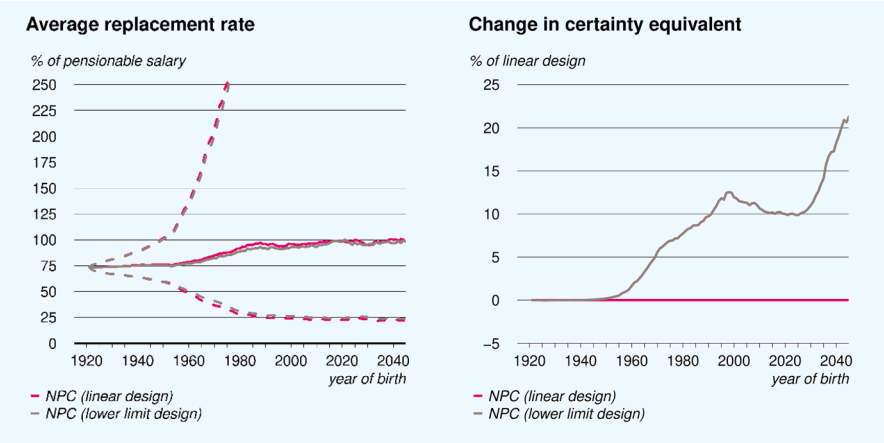

Fig. 9 Average replacement rate (left) and difference in certainty equivalent (right) of alternative lower limit design in comparison with standard linear option

Of course, there are many more possibilities for designing the distribution rules of the solidarity reserve.[29] The implementation we have shown here has not been optimized explicitly. Van Bilsen et al. (2021) investigate the effects of different designs of the solidarity reserve.

5 Conclusion

This paper analyses the generational effects of the proposed pension reform in the Netherlands. All current DB type contracts in the collective second pillar are expected to be converted into more personal DC contracts by the year 2027. In order to maintain some of the collective features a special new DC contract has been designed as an alternative to existing DC contracts. This 'new pension contract' (NPC) is a DC contract with some collective add-ons such as collective investments and a solidarity reserve that allows for intergenerational risk sharing. We analyze the transition to this new contract focusing on the intergenerational distribution.

Additionally, we explore alternative designs for the solidarity reserve. The solidarity reserve aims to contribute to intergenerational risk sharing also covering risks that are not typically traded on markets, such as inflation risk. It may be an interesting option to introduce a lower limit on projected replacement rates for participants, below which participants receive an additional contribution from the solidarity reserve.

[29] Metselaar et al. (2020c) investigate the effect of the lower limit solidarity fund design for different scenario sets, different investment mixes for the pension funds as a whole and different hedging and excess return parameters and find similar results as presented here.

For the evaluation of the pension reform we investigate three alternative measures for pension outcomes: the—projected—distribution of pensions (in replacement rates), the net benefit (based on risk neutral or market valuation of pensions less contributions), and welfare, all measured over the full remaining lifecycle. In general, we find that current participants and pensioners are better off in the new pension contract compared to the old contract when looking at replacement rates and welfare. Both benefit from lower solvency requirements for the new DC contract, leading to smaller carry-over of buffers to future generations, thereby enlarging the upward potential of pensions in the near future. However, when considering the results in terms of market value (net benefit) a mixed picture emerges; in particular current generations half-way through their career tend to be worse off. They will miss the subsidy from younger to older workers that is implicit in the system of uniformity pricing (equal accrual and contributions rates for all ages) that was present in the current DB type contract. We do not see this loss, however, in terms of actual replacement rates nor in welfare; there all current generations tend to benefit. Note that net benefit is a zero-sum game, since the market value of the pension fund is divided among participants. This means that no distribution can be found in which all current and future participants are better off.

The diverging, and sometimes even contradictory results for the alternative measures is remarkable, and troublesome from a policy perspective. There is no univocal answer on what is the right measure; this may depend on the 'beliefs' on the economy, on the context of the evaluation, and last but not least on the position of the individual household. In theory, welfare or well-being offers the comprehensive measure for the impact of a reform on (generations of) households. However, these concepts require specific assumptions on the consumer preferences. Market value has also the advantage of offering a comprehensive measure, but requires in theory that all consumers have perfect access to complete markets for all types of risks, which is not realistic in the real world. Finally, one may look at pension results but this requires some arbitrary judgement of the distribution of pension results; focusing on just expected replacement rates is not sufficient as one has to weigh this at least against the spread in outcomes.

In addition to these conceptual issues, there are also important practical difficulties with each of the alternative measures. First of all, it should be emphasized that all results found depend on a range of—uncertain—assumptions. To begin with one has to assume complete rules for both the old and the new pension contract, in all possible states of the world whereas contracts are typically incomplete in practice, in particular for extreme scenarios. Furthermore, assumptions must be made about demographic developments, such as life expectancies and birth, labor participation and government policy for retirement ages. Next, one needs a consistent set of market prices as well as financial-economic (risk neutral) scenario sets to value current entitlements and to make predictions about future developments. These scenario sets are uncertain and also requires market-consistent estimates for risks that are not traded on markets, like inflation risk and longevity risk. Also, it should be decided on what date the reform is evaluated. For example, market prices and prospects on pensions on December 31st 2019 (the date used in this paper) will likely be different from the situation in 2027, when the actual transition will take place. Finally, there

is large heterogeneity among participants in terms of human capital, investment portfolios, preferences and access to financial markets. And similarly for pension funds may vary a lot in pension contracts, funding ratios and investment strategies.

Yet, in actual policy making a position should be chosen when preparing and evaluating policy reforms. We do not propose one of these measures to be exclusively relied on. Given all these uncertainties a serious sensitivity check of the formal results is indispensable in any practical analysis to provide insight into the robustness of the findings. Furthermore, it is very dangerous to rely on one measure or indicator for the policy result. Instead, our overall conclusion is that the best strategy for policy evaluation is to rely on a multiple criteria approach taking account of all different aspects of pension outcome. In the event of diverging or even contradictory results a closer look will be necessary into the underlying causes of the differences in results, so that a well-informed judgement can be made on how to deal with these uncertainties.

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