Netspar

Network for Studies on Pensions, Aging and Retirement

NETSPAR INDUSTRY SERIES

An evaluation of the nFTK

Lei Shu
Bertrand Melenberg
Hans Schumacher

DESIGN 57

Lei Shu, Bertrand Melenberg and Hans Schumacher

An evaluation of the nFTK

DESIGN PAPER 57

NETSPAR INDUSTRY PAPER SERIES

Design Papers, part of the Industry Paper Series, discuss the design of a component of a pension system or product. A Netspar Design Paper analyzes the objective of a component and the possibilities for improving its efficacy. These papers are easily accessible for industry specialists who are responsible for designing the component being discussed. Design Papers are published by Netspar both digitally, on its website, and in print.

Colophon
May 2016

Design
B-more Design

Lay-out
Bladvulling, Tilburg

Printing
Prisma Print, Tilburg University

Editors
Nina Woodson
Netspar

CONTENTS

Affiliations

Lei Shu – Tilburg University
Bertrand Melenberg – Tilburg University
Hans Schumacher – Tilburg University

AN EVALUATION OF THE nFTK

Abstract

A new regulatory framework for Dutch pension funds came into force in 2015, replacing the earlier system that had existed since 2007. The revision, known as the new Financial Assessment Framework (abbreviated "nFTK" in Dutch), is meant to resolve some of the weaknesses of the earlier system that became apparent in the wake of the financial crisis. We carry out an analysis of the new framework based on a simulation study, focusing on economic scenarios and leaving aside the possible consequences of unanticipated changes in mortality. We use a stylized pension fund that has the same demographic structure as the Dutch population. The fund follows a fixed-mix investment policy and keeps contributions constant, except when reductions are permitted under the nFTK rules. Economic scenarios are generated by a VAR model. We find that although average funding ratios are high, fully wage-indexed pensions are still achieved in only approximately 60% of the scenarios. Under the worst scenarios, replacement ratios can drop to under 40%.

1. Introduction

In 2007, the Dutch government replaced the obsolete Pension and Savings Funds Act (Pensioen- en Spaarfondsenwet), which dated from 1952, with a new Pension Act. The new law was innovative in its use of funding ratios based on market value as an indicator of the financial health of collective pension funds. In the Netherlands, these funds play a very important role in providing retirement income, with a total asset value in 2014 of more than 160% of Dutch GDP. As a result of the financial crisis of 2008 and the ensuing prolonged period of low interest rates, however, the recovery measures triggered by underfunding under the terms of the new law quickly became a reality. Millions of retirees were affected by reductions in their nominal benefits, and many questions were raised concerning the fairness and effectiveness of the existing regulatory framework. While the debate continues with regard to restructuring retirement income provision systems, a revision of the Pension Act was introduced in 2015. The new law is commonly known as the "new Financial Assessment Framework" (nieuw Financieel Toetsingskader, or nFTK). Modifications with respect to the 2007 FTK include the following: replacing the funding ratio with an averaged version, called the "policy funding ratio"; placing less emphasis on the contributions level as an instrument for recovery; and tightening the conditions under which indexation of benefits may be applied. These modifications are intended to lead to a system that is more sustainable and maintains a better balance between generations.

We carry out an investigation of the performance of the nFTK over a fifty-year horizon, given a stylized pension fund combined with specific choices in terms of the contribution and investment policies and using a set of model-based scenarios. In particular, we focus on the evolution of the funding ratio and the indexation ratio over this time horizon. The funding ratio is defined as the ratio of the fund's assets to its liabilities. We define the indexation ratio as the ratio of the actual pension entitlements to the pension entitlements under full indexation. We use the indexation ratio to quantify the extent to which the pension system can provide fully indexed pension entitlements for both workers and retirees.

The stylized pension fund in our study has the same demographic characteristics as the Dutch population as a whole. We assume that the fund keeps contributions at a constant level, unless reductions are allowed under the nFTK. Raising contributions would be required under nFTK in situations in which newly accrued rights are expensive, in other words, during prolonged periods of low interest rates. Since we calibrate interest data from 1990 on, however, such scenarios hardly occur in our scenario set. Investment policy under the nFTK is not specified beyond the 'prudent person' rule. For the purposes of the simulation study, we assume that our stylized pension fund follows a simple fixed-mix policy, with 35% in stocks and 65% in ten-year bonds; no separate interest rate hedge is assumed beyond the protection already offered by the bond portfolio. In our scenario set, we concentrate on economic risks, leaving longevity risks aside. Scenarios are generated by a vector autoregressive (VAR) model that accounts for the variability in price inflation, wage inflation, stock returns, and long-term and short-term interest rates. The use of scenario sets to perform analysis is well established; early references on this methodology include papers by Wilkie [15, 16], Mulvey and Thorlacius [9], and Boender [2, 3].

The model we use to generate the scenario set is calibrated on equity data, interest rate, and inflation data starting from 1990.

Therefore, interest rates rise on average to levels that are typical of the last 25 years, and there is a substantial equity premium. As a result, we find many scenarios in which funding ratios are high. Nevertheless, the goal of full wage indexation is reached in only about 60% of the scenarios, even on a fifty-year horizon. On the downside, we find that, in bad scenarios (5% quantile), pension benefits fall far behind the level corresponding to full indexation; indexation ratios on a fifty-year horizon reach levels as low as 40%. Based on these outcomes, we conclude that, at least given our stylized pension fund and chosen contribution and investment strategy, improvements might still be needed in the new regulatory framework to deal with the extreme outcomes in a substantial fraction of the scenarios.[1]

Earlier asset-liability studies for pension funds have been conducted by, for instance, Bosch-Príncep et al. [4] and Dempster et al. [5]. Shortly after the introduction of the Dutch FTK in 2007, a simulation study of the consequences of the new system was undertaken by Bikker and Vlaar [1]. Subsequent studies of the regulatory system for Dutch collective pension funds and proposed modifications to it include those by van Rooij et al. [13], Nijman et al. [10], and van Stalborch [14]. These studies partly emphasize aspects not covered here, such as intergenerational fairness on a market value basis. The policy dilemmas for pension funds under a regulatory regime based on market valuation of nominal liabilities have been discussed by Kortleve and Ponds [8]. These dilemmas continue to exist under the nFTK; pension funds may look for investment policies that modify the consequences of the system, while balancing the interests of different generations. In

1 Alternatively, the pension fund might change its contribution and/or investment policies in extreme outcomes. We do not investigate this alternative in this paper.

the present study, however, we do not attempt to formulate such policies; instead, we assume a fixed-mix investment plan. This allows us to evaluate the performance of the nFTK with respect to a simple, but reasonable and common, investment policy.
The organization of the remainder of the paper is as follows. In Section 2, we describe our stylized pension fund. In particular, we state our assumptions concerning the choices that the stylized fund makes in various options left open by the nFTK. Section 3 describes the economic model from which our scenario set is generated. The main results follow in Section 4. We report statistics concerning the distribution of the indexation ratio and the funding ratio, and we also discuss the nature of the relationship of these quantities to economic determinants such as asset returns and wage inflation. In Section 5, we give some design recommendations. Finally, our conclusions are presented in Section 6. Additional information, including technical details, can be found in the appendix [11].

2. An implementation of the nFTK

2.1 Stylized pension fund set-up

In this section, we set up a stylized pension fund to facilitate the analysis of the nFTK. The appendix [11], to which we shall occasionally refer, contains the technical details. We assume our stylized pension fund covers all of the Dutch population over the age of 25. The demographic structure of our pension fund is taken directly from the real Dutch demographic structure for 2009, as obtained from the Human Mortality Database.[2] The maximum attainable age is 110, and the minimum age in this dataset is 0. We assume a constant influx of newborns every year, equal to the generation of newborns in 2009, which allows us to define an open fund with a workforce influx each year. The reason for choosing an open fund rather than a closed fund is that an open fund is more stable in terms of demographic structure. Each year, a new generation of 25-year-olds enters into our pension system. At the same time, there are outflows caused by the deaths of participants. The number of survivals is assumed to evolve according to the most recent forecast mortality table provided by the Dutch Koninklijk Actuarieel Genootschap (Royal Actuarial Society) [7]. This mortality table predicts the mortality rates for each age group through the year 2184. The maximum attainable age in the mortality table is 120, but in the population size data, it is 110 years old. We take the lower limit as the maximum attainable age in our study. We work with gender-neutral mortality rates, computed as the average of the male and female mortality rates.

One of the cash inflows for the pension fund is the contributions made by workers. Total contributions are determined by

2 http://www.mortality.org.

three factors, namely the pension base, the number of workers in the pension fund, and the individual pension contributions. The pension base of each working generation is the wage minus the franchise (a deduction made in view of the existence of the state pension). The individual pension contribution is defined as a fraction of the pension base. We assume that this fraction will be kept constant at a level that is fixed at the beginning of the simulation, except when a reduction is allowed by the nFTK. The amount for the total annual contributions made by each worker is defined as the individual pension contribution times the worker's pension base; the total contribution is the sum of the individual contributions of all workers.

The cash outflow of the pension fund consists of the pension benefits paid to retirees. We consider only payments to retirees and leave additional payments (e.g., to the spouses of deceased participants) out of consideration. To determine the pension payment, we need the pension entitlements of each retired generation, in addition to the number of retirees. The pension entitlements for each generation are built up during their working life. When a new generation comes into the pension fund, the members of that generation will build up a pension entitlement that is a certain fraction of the pension base in that year. Following the latest revision of pension rules, this fraction has been set at 1.875%. Before retirement, the pension entitlement will first be indexed and then increased by the pension entitlements accrued in that year. After retirement, there is no further accrual, but indexation may still take place. Given the actual pension entitlements, the total pension payments paid at the beginning of the period is the sum of the pension entitlements for all retirees.

Given the cash outflow and inflow of the pension fund, we can determine the assets at hand. At the beginning of each period, pension payments are made, and at the end of each period, pension contributions are received. We assume that the stylized pension fund invests its assets in a portfolio consisting of 65% bonds and 35% stocks. Therefore, the pension assets at the beginning of each period will be the assets of the previous period, after deduction of pension payments, plus the proceeds of investments and pension contributions. We do not assume any recovery contributions from a sponsor.

The stylized pension fund applies indexation according to a policy ladder, as is usual for Dutch collective pension funds, within the restrictions set by the nFTK. Whether or not full or partial indexation occurs depends on the financial status of the fund. Although one might argue that the option value of conditional indexation should be taken into account when determining the market value of liabilities, in practice the value of liabilities is computed from unconditional liabilities only (i.e., conditional indexation is not taken into account). Based on the current pension entitlements for each generation, we can project current and future pension payments. The value of the liabilities is the discounted value of those pension payments. Discounting takes place on the basis of the current term structure of interest rates for non-defaultable bonds, extended by an Ultimate Forward Rate (UFR). The scenarios generated by our economic model include possible future term structures and allow computation of future UFRs in a manner recommended by the UFR Committee [12] (see Sections 3.3 and 3.4 in the appendix [11] for details).

The funding ratio is defined as the ratio of the current value of assets to the current value of liabilities. In the proposed revision of the law, a new concept is being introduced, called the Policy

Funding Ratio ("beleidsdekkingsgraad"). The Policy Funding Ratio (PFR) is defined as the 12-month moving average of the actual funding ratio. Because our simulation is on an annual basis, we define the PFR as the average of the current actual funding ratio and the funding ratio of the previous year. The initial PFR in our simulation exercise is set at 104.3%, which not only reflects the current situation of low funding ratios, but also satisfies the lower bound given by the Minimum Required Funding Ratio (MRFR) (see Section 2.3).[3]

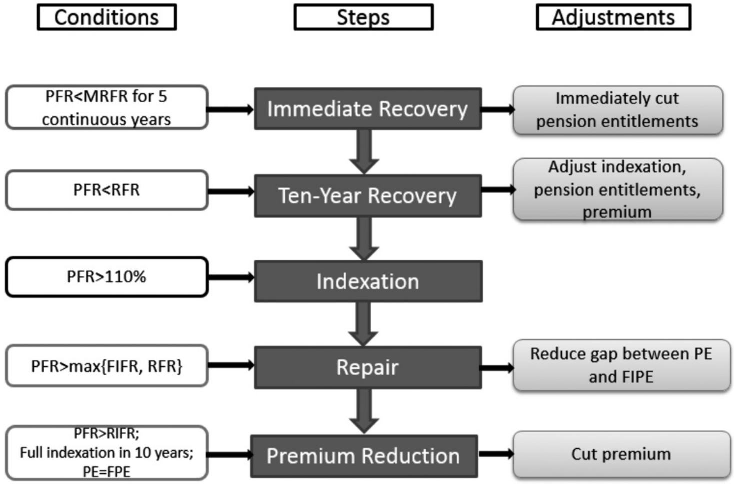
2.2 Determining the individual pension contributions

Individual pension contributions are set at the beginning of the simulation and will not be raised under any scenario. To calculate this contribution, we choose a term-structure-based pension contribution with cushioning, among the various options left open by the regulatory requirements. Cushioning is based on the average of the term structures in the past ten years.[4] The individual pension contribution is set such that the total pension contributions made by all workers in a year is equal to the Required Funding Ratio (see next section) times the present value (according to the averaged term structure) of the accrued pension entitlements of those workers within that year. This individual pension contribution in our model turns out to be 16.33%.

3 Actually, the value of 104.3% was chosen more or less arbitrarily (but to some extent reflects the current low values of the funding ratios). Since we work on a long time horizon, the effect of the initial PFR is not likely to be large.

4 The ten-year averaged term structure is higher than the current term structure. This means that applying cushioning will result in lower pension contributions than without cushioning. From a longer term perspective, also assuming that the past is representative for the future, applying cushioning to determine pension contributions seems plausible.

Figure 1.



At the beginning of each period, the Policy Funding Ratio (PFR) is given. Depending on its value, the pension fund will decide which policies to implement. If the PFR has been below the Minimum Required Funding Ratio (MRFR) for five consecutive years, an immediate recovery plan has to be implemented. In this case, pension entitlements for current and future retirees will be cut immediately. The liabilities will be recomputed given the reduced pension entitlements. If the PFR is below the Required Funding Ratio (RFR), a ten-year recovery plan has to be implemented. The implementation of the ten-year recovery plan guarantees a recovery of at least 10% during the first year. If the PFR is larger than 110%, indexation may be possible. If the PFR exceeds both the RFR and the Full Indexation Funding Ratio (FIFR), then repair policies may be implemented. Finally, pension contribution reductions may be possible when full indexation has been given during ten consecutive years, pension entitlements are equal to the full indexation pension entitlements, and the PFR is larger than the lower bound for pension contribution reductions.

2.3 Recovery, indexation, and repair policies

Under the nFTK, the behavior of pension funds in various possible states of financial health (as measured by the Policy Funding Ratio) is prescribed in considerable detail. There are five different situations that can arise, which are illustrated graphically in

Table 1. Abbreviations

PFR	Policy Funding Ratio
MRFR	Minimum Required Funding Ratio
RFR	Required Funding Ratio
IFR	Indexation Funding Ratio (lower bound for indexation)
FIFR	Full Indexation Funding Ratio (lower bound for full indexation)
RIFR	Reduction Indexation Funding Ratio (lower bound for pension contribution reduction)

Figure 1. The determination as to which situation applies is related to a set of critical levels for the PFR (cf. Table 1).

The first of these critical levels is the Minimum Required Funding Ratio, which determines whether the immediate recovery plan needs to be implemented. We take MRFR = 104.3%, in accordance with existing regulations. When the PFR drops below the MRFR for five consecutive years, an immediate recovery plan is called for. This consists of a reduction in all pension entitlements. The reduction factor is not completely prescribed in the nFTK; we choose a factor such that after the recovery plan, the maximum of the PFR and the actual funding ratio would be equal to the MRFR. So, there is no reduction in pension entitlements when the current PFR is above the MRFR, nor when the current actual funding ratio is above MRFR, while the PFR is below MRFR, as permitted by the nFTK.[5] If neither of these conditions holds, however, pension entitlements will be reduced. If the previous funding ratio is smaller than the MRFR, we choose a reduction factor to bring the current actual funding ratio back to MRFR;

5 In the latest revision of the law, this rule has been further refined; this modification has not been incorporated into our model, but is assumed to have little effect.

otherwise, we make the PFR equal to the MRFR. The new liabilities and pension entitlements will then replace the old ones in the future calculation and simulation. This results in a lower value for the indexation ratio, since the numerator of this ratio will become smaller, while the denominator remains unaffected.

The second critical level is the Required Funding Ratio. It should be set such that, with a probability of 97.5%, next year's actual funding ratio is at least equal to one. We use its current average value of 126.6% in the simulation, which we assume to remain constant over the fifty-year time horizon. As soon as the PFR is below the RFR, a recovery plan has to be implemented, which should result in the PFR recovering to at least the level of the RFR in no more than ten years, with at least 10% recovery in the first year, using the values of the expected returns and inflation according to the "Advies Commissie Parameters" (Parameters Committee Recommendations, ACP).[6] The ten-year recovery plan includes a series of adjustments which may apply to indexation, pension contributions, and pension entitlements. We choose a plan in which pension contributions are not modified. We first try to find an indexation factor to make the increase in the PFR equal to the desired increase of 10% in the gap between the RFR and the PFR, without any reduction in pension entitlements. If zero indexation by itself is not sufficient, then we supplement this with a reduction factor that will be applied to pension entitlements to increase the PFR by the desired amount. We calculate the required forward rates using the yield curve provided by our model.

The third critical level is the lower bound for indexation, the Indexation Funding Ratio (IFR). Its value is not prescribed in the

6 See website: https://www.rijksoverheid.nl/documenten/rapporten/2014/03/21/advies-commissie-parameters.

proposed Pension Act but is subject to lower-level regulation; it has been announced that the IFR will be set at 110%. (Partial) indexation will only be allowed if the PFR is higher than the IFR. The nFTK framework allows pension funds to use an indexation target in either absolute or relative terms with respect to a given index, such as wage or price inflation. We use a relative indexation target with respect to wage inflation. Since IFR is less than RFR for our stylized fund, the fund could provide indexation, but at the same time it is constrained by the recovery rules. When there are no constraints from recovery, indexation is determined by the rule that after pension payments at the beginning of the period have been made, the resulting funding ratio must be equal to at least the IFR. The funding ratio is computed under the assumptions that indexation is applied to the present and future periods based on expected wage inflation and that liabilities are discounted on the basis of the Expected Return on Stocks (ERS) using the ACP parameter values. The indexation factor is set as high as possible given this rule, but not higher than current wage inflation. When the fund is in recovery, we use a lower indexation factor, determined by the recovery rules.

The fourth critical level is the lower bound for full indexation (denoted by FIFR for "Full Indexation Funding Ratio"). It is the funding ratio that corresponds to the situation in which full indexation according to expected wage inflation (using the ACP parameter value) is applied to present and future years. This lower bound plays a role when pension entitlements are lower than the fully indexed pension entitlement (i.e., the pension entitlements under the assumption of full indexation and no cuts; see Equation (4) in the internet appendix [11]). If, after indexation, we still have a policy funding ratio that exceeds the RFR and the FIFR, repair policies may be implemented. Repair policies are intended to decrease (or even close) the gap between the actual and fully indexed pension entitlements. When the conditions for a repair policy are satisfied, 20% of the excess funds may be used to reduce the gap between pension entitlements and fully indexed pension entitlements. However, the repair should be limited such that the funding ratio after application of the repair policy is still at least as large as the maximum of the RFR and the FIFR.

The fifth and highest critical level is the Reduction Indexation Funding Ratio (RIFR), the lower bound for a reduction in pension contributions set by the pension fund. We set it as equal to the RFR. This criterion is relevant for pension contribution reduction policies. When the PFR is at least equal to the lower bound for pension contribution reduction (RIFR), full indexation has taken place in the previous ten years, and pension entitlements are at the same level as the fully indexed pension entitlements for all generations, then there can be an immediate reduction in pension contributions. We continue to use the term-structure-based pension contribution. The pension contribution is reduced to a level under which the resulting funding ratio is equal to RIFR.

3. Economic setting

We want to investigate the performance of the nFTK in different economic situations. To do so, we want to simulate the PFR, indexation ratios, and pension entitlements for a period of fifty years and examine the relationships between the indexation ratio, PFR, asset return, and wage inflation. We use a vector autoregressive (VAR) model to generate economic scenarios and determine the term structure of interest rate. We assume that prices for all of the assets in the economy are determined by a state vector which follows a VAR process in the form of

$$x_{t+1} = \alpha + \Gamma x_t + \Sigma \varepsilon_{t+1} \tag{1}$$

where $\varepsilon_{t+1} \overset{i.d.d.}{\sim} N(0_{n\times 1}, I_{n\times n})$. We can use the VAR model to generate many future scenarios; for each scenario, a model-based affine term structure can be determined. Our model is a discrete time model, in the spirit of the continuous time model of Koijen, Nijman, and Werker [6]. We use monthly data to estimate the VAR model. Time-to-maturity is measured in half years.

The set of common factors consists of five components (n = 5), which are the German annualized zero-coupon federal securities rate with remaining time to maturity of 0.5 years; the Dutch inflation rate; the MSCI world stock return in excess of the six-month rate (i.e., in excess of the first component); the German ten-year zero-coupon federal securities yield spread; and the Dutch nominal wage inflation rate. The six-month rate and the ten-year rate are downloaded from Deutsche Bundesbank.[7] Both series are available from September 1972. The inflation rate is derived from the Netherlands consumer price index, which is obtained

7 http://www.bundesbank.de/Navigation/EN/Statistics/statistics.html.

Table 2. Symbols and Meanings of Variables

Variable Name	Definition
$y^{(1)}$	Annualized six-month zero-coupon federal security rate
cpi	Inflation
$r_s - y^{(1)}$	Stock return premium
$y^{(20)} - y^{(1)}$	Ten-year zero-coupon federal security yield spread
$wage$	Nominal wage inflation

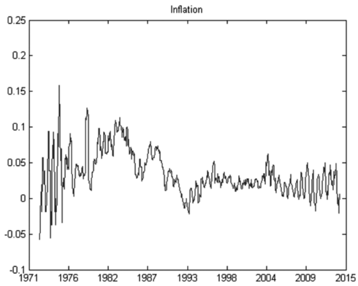
Table 3. Sample Statistics for the State Variables

	average	std.dev	minimum	maximum
$y^{(1)}$	3.48%	2.52%	-0.06%	9.63%
cpi	2.20%	1.35%	-2.04%	6.25%
$r_s - y^{(1)}$	2.86%	28.62%	-118.71%	67.41%
$y^{(20)} - y^{(1)}$	1.40%	1.19%	-1.76%	3.59%
$wage$	2.29%	1.30%	0.18%	6.23%

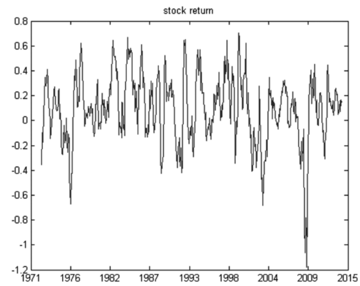
from Datastream. Nominal wage inflation is derived from the CAO wage index, also obtained from Datastream. The CAO wage index is available starting from January 1990; consequently, taking into account that time to maturity is measured in half years, wage inflation is available from July 1990. The excess stock return is derived from the MSCI world total return stock index downloaded from Datastream. The MSCI world total return index has been available since 1969. Table 2 shows the names and meanings of each variable used in the VAR model; Table 3 presents the sample statistics; and Figure 2 plots the development of each variable since the initial date.

In the estimation, we only use data from July 1990 to March 2014. First off, this is because most variables, such as inflation, short rate, and ten-year rate, behaved very differently after the market crash at the end of the 1980s. For instance, we see in

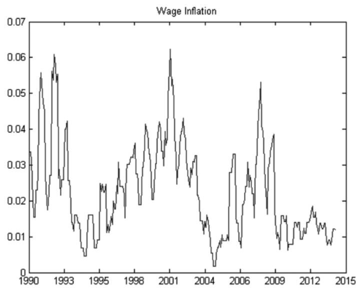
Figure 2. Historical data



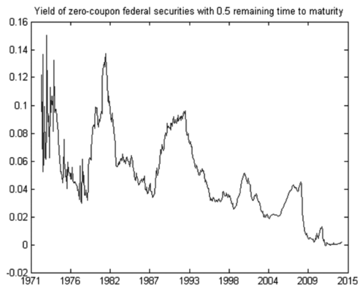
(a) Inflation



(b) MSCI Return

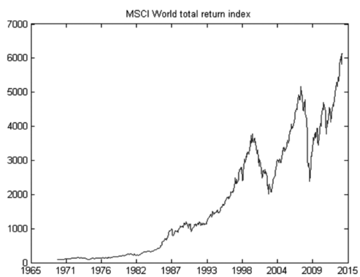


(c) Wage Inflation



(d) Short Rate

(e) Ten-year Rate



(f) MSCI

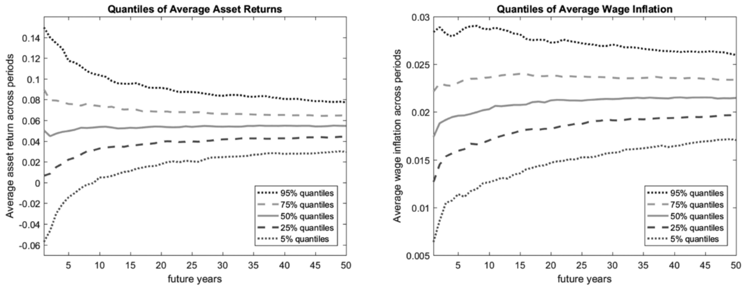
Table 4. Estimation Results of the VAR(1) Model

	α	Γ				
$y^{(1)}$	0.0044	0.9602	−0.0237	0.0013	−0.1048	−0.0465
	0.0012	*0.0178*	*0.0259*	*0.0011*	*0.0368*	*0.0298*
cpi	0.0027	0.0006	0.768	0.0029	−0.0289	0.1194
	0.0018	*0.0255*	*0.037*	*0.0016*	*0.0526*	*0.0426*
$r_s - y^{(1)}$	0.0269	0.3727	−1.3627	0.8635	0.7079	−0.6779
	0.0321	*0.4638*	*0.6747*	*0.0289*	*0.9587*	*0.7762*
$y^{(20)} - y^{(1)}$	0.0008	−0.009	−0.0135	−0.0009	0.9698	0.0154
	0.0006	*0.0082*	*0.012*	*0.0005*	*0.017*	*0.0138*
wage	0.0059	0.0018	−0.0559	0.0009	−0.1177	0.8672
	0.0013	*0.0194*	*0.0281*	*0.0012*	*0.04*	*0.0324*
			Σ			
$y^{(1)}$	0.0052	0	0	0	0	
cpi	0.0019	0.0072	0	0	0	
$r_s - y^{(1)}$	−0.012	0.0071	0.1356	0	0	
$y^{(20)} - y^{(1)}$	−0.0005	0.0001	0.0001	0.0024	0	
wage	0.0017	0.001	−0.0001	0.0005	0.0053	

The VAR model is described by Equation (1). The variables in the first column are the state variables. In the upper panel of this table, the estimated coefficients of α and Γ are presented, with the corresponding standard errors in italics. In the lower panel of this table, the estimated coefficients of Σ are presented.

Figure 2a that inflation was very volatile in the 1970s and 1980s. The second reason for this is that wage inflation data is only available since July 1990. We use the maximum likelihood method to estimate the coefficients of the VAR model. The estimation results are shown in Table 4. Next, we calibrate the price of risk to fit an affine term structure to the observed term structures of interest rates. A detailed description of this calibration can be found in the appendix [11].

Figure 3. Quantiles of the pension fund's average annual asset returns (left panel) and average nominal wage inflation (right panel)



(a) Pension fund's asset returns (b) Nominal wage inflation

With the estimated VAR model, we can simulate economic scenarios for future interest rates, stock returns, price inflation, and wage inflation. Using the simulated term structures, we can derive the bond returns and discount factors needed for calculating pension liabilities. Given the bond and stock returns, the pension fund's asset returns can be determined as a weighted average of the bond returns and the stock returns, with 65% invested in bonds (i.e., zero-coupon bonds with a maturity of ten years) and 35% in stocks (with returns given by r_S). Assuming the initial wage base is 1, the wage inflation gives us enough information to simulate the wage base for fifty future years, and the full indexation pension entitlements can thus also be determined. The number of workers and number of retirees for each generation are fully determined by the population distribution of the pension fund and the 2014 cohort life table. With this information, we can update the pension assets, liabilities, pension entitlements for each generation, actual funding ratio, and PFR at each period in each path.

To illustrate the model outcomes, Figure 3 shows the development over time of the quantiles of two of the main drivers determining outcomes, namely the average (across time) of the pension fund's annual asset returns (Panel [a]) and the average (across time) of the nominal wage inflation (Panel [b]). As the figure shows, in most scenarios the pension fund's average annual asset returns at the time horizon (i.e., fifty years from now) is between 3% and 8%, and the average nominal wage inflation is between 1.6% and 2.6%.

As the main measure of success of a pension scheme, we use the *indexation ratio*[8] in this paper. We define the indexation ratio for a given generation as the ratio of actual pension entitlements (incorporating the cumulative effects of conditional indexation) to fully indexed entitlements, computed cumulatively from the start of a working career.[9] In the case of retired generations, the indexation ratio is defined as the ratio of paid-out benefits with respect to the benefits that would have been received if full indexation had been applied throughout the generation's participation in the pension scheme. Table 5 presents, at a time horizon of fifty years from now, the correlations between the indexation ratios of the cohorts in age groups 25, 45, and 67 at the start of the simulation, the PFR, the pension fund's average annual asset returns ("return index," abbreviated RI), and the average wage inflation ("wage").[10] The correlation between the indexation ratios of the different cohorts is close to one, indicating that in the long run, there will only be minor differences between

8 We use this term rather than "pension results" in view of the fact that several different definitions of that notion have been given in the literature.

9 See Equation (4) in the appendix [11]. We exclude negative indexation due to negative wage inflation.

10 At the time horizon, the generation whose current age is 67 years does not exist anymore in our model. However, the model allows us to calculate the indexation ratios that would apply to this generation.

Table 5. Correlation matrix

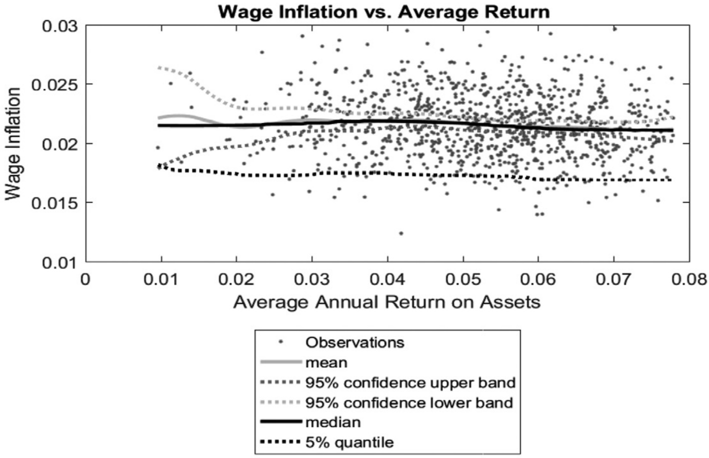
Ind 25	Ind 45	Ind 67	PFR	RI	wage
1	99.3%	99.2%	35.3%	50.5%	-21.0%
99.3%	1	100.0%	35.4%	50.9%	-20.7%
99.2%	100.0%	1	35.3%	50.9%	-20.7%
35.3%	35.4%	35.3%	1	90.7%	-21.1%
50.5%	50.9%	50.9%	90.7%	1	-9.3%
-21.0%	-20.7%	-20.7%	-21.1%	-9.3%	1

The correlation matrix at the time horizon is shown for the indexation ratios of the current 25-year-olds (Ind 25), 45-year-olds (Ind 45), and 67-year-olds (Ind 67), the policy funding ratio (PFR), the pension fund's average annual asset returns ("return index," abbreviated RI), and the average wage inflation ("wage"). The table is based on all paths at the fifty-year horizon.

the cohorts in terms of their indexation ratios. There is a positive correlation around 0.51 between the RI and the indexation ratios and a positive correlation around 0.35 between the indexation ratios and the PFR. The correlation between the PFR and the RI is high, around 0.91. We find a negative correlation around −0.21 between wage inflation and the indexation ratios and PFR. Finally, the correlation between the two main drivers, RI and wage inflation, is around −0.09. This negative correlation is of the same order of magnitude as the negative correlation we observe in-sample between the pension fund's annual asset returns and annual wage inflation (where both are not averaged in-sample), namely around −0.14.

Figure 4 plots the wage inflation against the RI at the time horizon. The figure includes the conditional 5% quantile, the conditional median, and the conditional mean, the latter together with 95% uniform confidence bands, of the wage infla-

Figure 4. Wage inflation in relation to the pension fund's asset return



tion, conditional on the return index.[11] As the figure illustrates, the negative correlation of around −0.09 corresponds to a slightly negative linear relationship between the wage base and the RI. This suggests, according to the model outcomes, that the scenarios with a high value of RI are not necessarily the scenarios where a high value is needed for wage indexation, and, similarly, the scenarios with a low value of RI are not necessarily the scenarios with a lower need for wage indexation.

11 More precisely, the figure shows nonparametric Kernel estimates of Med(w|r = r), Quant0.05(w|r = r), and E(w|r = r) for different values of r, with w standing for the random wage inflation per year and r standing for the random return on the index per year, both measured at the time horizon. The estimates are calculated based on the scenarios. The estimates of E(w|r = r) are supplemented with 95% uniform confidence bands.

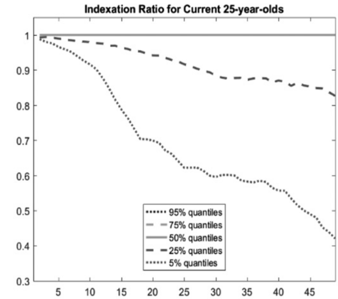
4. Evaluation of the nFTK

In this section, we use our stylized pension fund to evaluate the nFTK, taking the contribution and investment policies of the pension fund as given. We focus on the pension fund's real ambition, which we assume to be reflected in fully indexed pension entitlements. The actual pension entitlements might be less than the fully indexed entitlements. Therefore, we quantify the real ambition in terms of the indexation ratio, which we define as the ratio of the actual pension entitlements to the fully indexed pension entitlements (see previous section). We take a long-term perspective, a time horizon of fifty years. We investigate to what extent the pension fund will be able to fulfill its real ambition at the time horizon, and, if so, whether this ambition can be fulfilled without overfunding. We use the economic setting described in the previous section. In particular, we assume that pension contributions will be kept constant, even under less favorable circumstances, and we assume that the pension fund's asset portfolio composition (i.e., 65% bonds and 35% stock) will also be kept constant over time, irrespective of the economic circumstances. Our study therefore shows the effects of the regulatory framework on a pension fund that follows such a relatively simple policy.

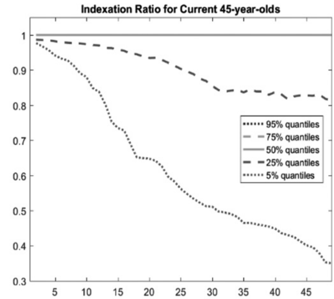
Figure 5 shows the development over time of the quantiles of the resulting indexation ratios for the three age cohorts – 25-years-old (Panel [a]), 45-years-old (Panel [b]), and 67-years-old (Panel [c]) – at the start of the simulations.[12] Figure 6 shows the corresponding quantiles of the resulting evolution of the PFR up to the time horizon. Table 6 gives the exact percentages of underfunding and overfunding at various horizons. In the last

12 See Footnote 10.

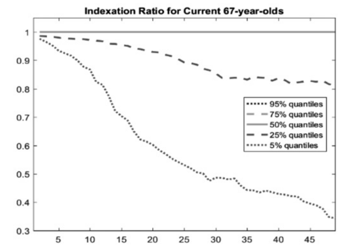
Figure 5. Quantiles of the indexation ratios for current 25-year-olds (Panel [a]), 45-year-olds (Panel [b]), and 67-year-olds (Panel [c])



(a) Current 25-year-olds



(b) Current 45-year-olds

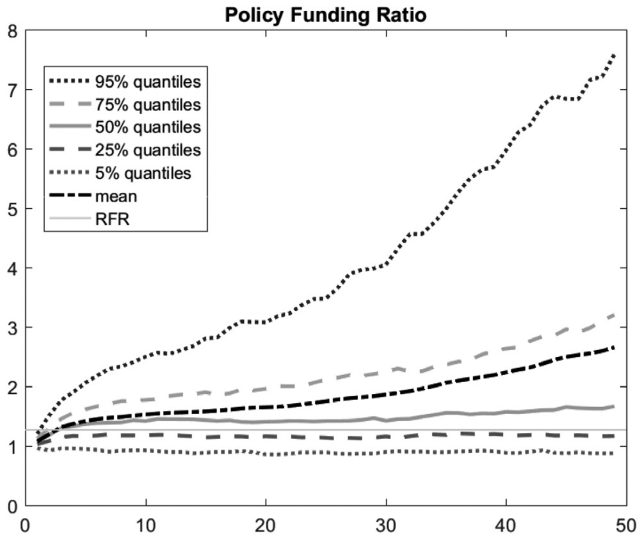


(c) Current 67-year-olds

column of Table 6, we also present the percentages of the simulations in which the indexation ratios for all generations still alive are equal to one for different future years.

The 5% quantile in Panel (a) of Figure 5 shows that the indexation ratio for the generation whose current age is 25 can decrease to less than 50% at around retirement age in at least 5% of the scenarios. Similarly, the 5% quantiles of Panels (b) and (c) of Figure 5 show that the indexation ratio for the generation whose current age is 45 or 67 can decrease to less than 50% within

Figure 6. Quantiles of the Policy Funding Ratio (PFR)



between 25 to 30 years in at least 5% of the scenarios. Such low indexation ratios are a result of less-than-full indexation and pension entitlement cuts, under the assumptions (which we make) that pension contributions are kept constant even under less favorable circumstances and the pension fund's asset portfolio composition is kept constant over time.

In the median case, the indexation ratio equals one in all three cases. In fact, full indexation at the end of the simulations occurs in close to 60% of the scenarios (see last column of Table 6), which also means that in around 40% of the scenarios, the real ambition of an indexation ratio equal to one is not achieved. To clarify the outcomes, we present in Figures 7 and 8 the indexation ratios for the cohorts of current 25-year-olds (Panel [a]) and current 45-year-olds (Panel [b]) at the time horizon in relation to

Table 6. Probability of Underfunding and Overfunding

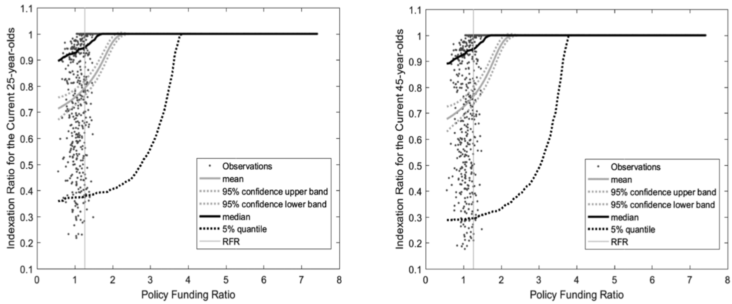
Year	PFR < 100%	PFR < 104.3%	PFR > 110%	PFR > 126.66%	PFR > 150%	Full Ind. Ratio
1	15.10%	34.40%	34.20%	0.90%	0.00%	–
2	12.50%	17.70%	71.40%	30.40%	5.40%	58.50%
3	8.30%	12.30%	80.90%	54.20%	19.70%	59.10%
4	8.10%	12.00%	82.90%	58.60%	29.80%	61.50%
5	8.80%	12.20%	82.10%	62.40%	34.90%	61.90%
10	9.30%	12.30%	82.80%	64.70%	43.20%	63.40%
15	12.70%	15.70%	78.80%	63.00%	44.40%	63.40%
20	12.50%	15.60%	80.20%	63.40%	43.10%	57.70%
25	11.00%	14.40%	79.10%	62.50%	45.70%	56.90%
30	11.20%	15.80%	79.30%	63.20%	46.20%	57.70%
35	9.90%	12.30%	82.90%	67.30%	51.80%	58.60%
40	10.50%	13.70%	81.70%	67.40%	52.70%	60.00%
45	11.40%	13.40%	80.20%	65.90%	53.30%	59.80%
49	12.20%	15.00%	79.00%	66.70%	53.60%	60.70%

We summarize the probability of the Policy Funding Ratio (PFR) being below 100%, below the Minimum Required Funding Ratio (MRFR), above the lower bound for indexation, above the Required Funding Ratio (RFR), and above 150% at various horizons. The probability of full indexation is given as well. Both the pension entitlements and the fully indexed pension entitlements start at the same level, so the indexation ratio is not relevant for the first year.

the PFR (Figure 7) and the pension fund's average annual asset returns (Figure 8).[13] The figures include the conditional 5% quantile, the conditional median, and the conditional mean, where the last variable is also accompanied by a 95% uniform confidence band. The vertical line indicates the RFR. These figures are constructed analogously to Figure 4. As these figures show, given a PFR that is approximately the same as the RFR, the indexa-

13 We do not include the graph for the current 67-year-olds since that generation will no longer exist in our model at the time horizon. See also Footnote 10.

Figure 7. Indexation ratios for current 25-year-olds (Panel [a]) and 45-year-olds (Panel [b]) in relation to the Policy Funding Ratio (PFR), measured at the time horizon. The vertical line indicates the Required Funding Ratio (RFR).

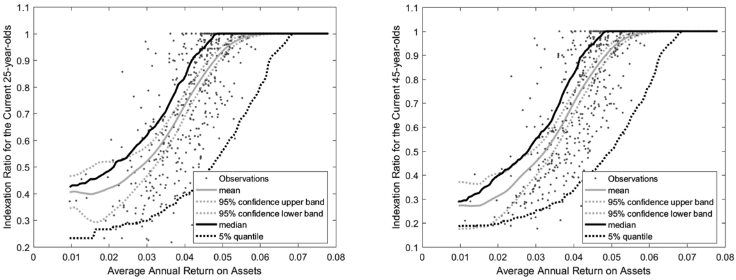


Current 25-year-olds (b) Current 45-year-olds

tion ratio will be around 95% or more in 50% of the scenarios (according to the estimated conditional median); the average indexation ratio will be just below 80%; and the indexation ratio can be as low as 35% in 5% of the scenarios (according to the estimated conditional 5% quantile). Thus, based on the worst 5% of cases, we find that a value of the PFR equal to the RFR at the time horizon of fifty years is no guarantee that the pension fund will be able to fulfill its real ambitions. It is highly likely that under such poor conditions, with indexation ratios dropping to 35%, there will be mounting pressure for changes in the system.

On the other hand, circumstances under which the PFR is close to 400% or the pension fund's average annual asset return is around 7% will result in full indexation in at least 95% of the scenarios (according to the estimated conditional 5% quantiles). To achieve full indexation in at least 50% of the scenarios, a PFR of close to 200% or average annual asset return of close to 5%

Figure 8. Indexation ratios for current 25-year-olds (Panel [a]) and 45-year-olds (Panel [b]) in relation to the pension fund's average annual returns, measured at the time horizon.

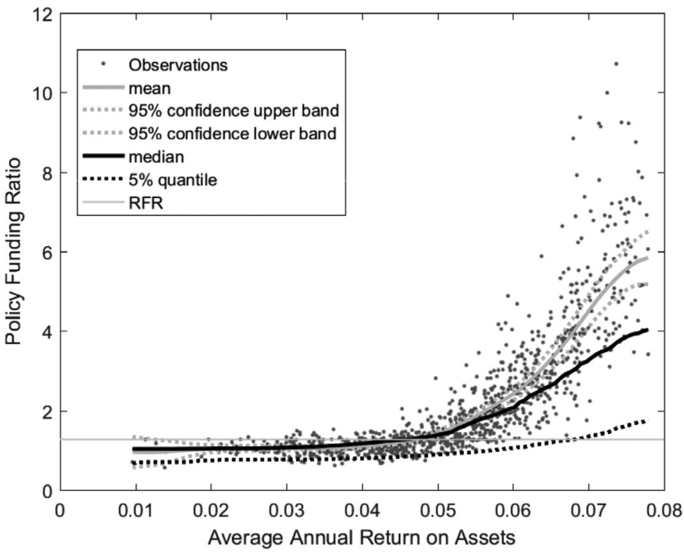


(a) Current 25-year-olds (b) Current 45-year-olds

seems to be required (according to the estimated conditional medians). Thus, under favorable conditions (average annual asset return of around 7% or more), the pension fund is able to fulfill its real ambitions (at the time horizon) to a large extent. But given the current nFTK, such favorable conditions will likely result in PFRs far above the RFR. This is confirmed by Figure 9, which shows the conditional 5% quantile, the conditional median, and the conditional mean (accompanied by a 95% uniform confidence band) of the PFR measured at the time horizon, conditional on the pension fund's average annual asset returns.[14] The horizontal line in this figure represents the RFR. As the figure shows, given average annual asset return of around 7%, the PFR will be over 325% in 50% of the scenarios (according the conditional median estimates). Such high PFRs are achieved by taking into account the pension contribution reduction policies under the nFTK (but also assuming no change in the composition of the pension fund's asset portfolio over time). Therefore, there will be pressure

14 The qualitative nature of this figure might not come as a surprise; we include this figure because of its quantitative information.

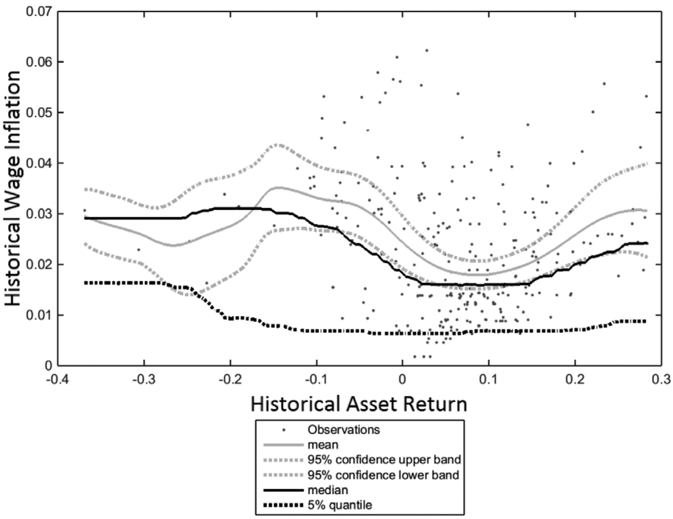
Figure 9. The Policy Funding Ratio (PFR) in relation to the pension fund's average annual returns, measured at the time horizon. The horizontal line indicates the Required Funding Ratio (RFR).



for changes of the system even under favorable circumstances. We have assumed a fixed investment mix here; if the nFTK is sustained, this assumption is not likely to remain valid. However, it is nevertheless likely that under such circumstances, the regulatory system will also be under pressure to allow more benefits to be paid to current generations.

Our model therefore indicates that in both bad-weather and good-weather scenarios, it is likely that the nFTK will not be sustained. We should point out, however, that the predicted effect may be due in part to limitations in the model in combination with the available data. Figure 4 shows that the negative correlation between the pension fund's average annual asset

Figure 10: The in-sample annual wage inflation in relation to the in-sample pension fund's annual asset return.



return and average wage inflation in our model corresponds to a slightly downward sloping line when the average wage inflation is considered in relation to the average annual asset return. This means that in our model, the pension fund's asset return does not hedge against wage inflation. The negative correlation in our model between the pension fund's average annual asset return and average wage inflation is in line with the observed in-sample correlation between annual wage inflation and annual asset return (equal to around −0.14). However, the actual relationship between average wage inflation and average annual asset return may be nonlinear, as indicated by Figure 10. This figure shows the conditional 5% quantile, the conditional median, and the conditional mean (accompanied by a 95% uniform confidence band) of the in-sample annual wage inflation in relation to the in-sample pension fund's annual asset returns. The relationship between annual wage inflation and the in-sample pension fund's annual asset returns appears to be nonlinear, with a more or less unclear pattern for annual returns of less than −15% (due to a lack of observations), followed by a more or less clear U-shaped pattern for annual returns above −15%.[15] If there is a positive correlation between asset returns and wage inflation in scenarios with either very good or very bad returns, then the large spread of outcomes that we get from our model would be mitigated. However, to capture a relationship as presented in Figure 10 requires a more flexible, and likely heavily nonlinear, model, which is beyond the scope of this paper.[16]

15 As reported, this nonlinear relationship corresponds to a linear correlation of around −0.14.

16 Moreover, more flexible nonlinear models might improve the in-sample fit but typically perform rather poorly out-of-sample due to the possibility of overfitting.

5. Some design issues

We consider a stylized pension fund with a fixed investment and contribution policy (but where the contributions will be lowered if allowed by nFTK rules). Given this set-up, the policy funding ratios turn out to be high in many scenarios within the set generated by our economic model. After five years, the probability of the PFR exceeding 150% is around 35%; the median PFR goes over 150% after 35 years; and the 95% quantile soars to more than 700% at the end of the simulation period. The occurrence of such unrealistically high funding ratios is due to the restrictions that are placed on recovery indexation and pension contribution reductions, in combination with the assumptions that are built into our economic model.[17] Given that expected asset returns exceed wage inflation, funding ratios may still reach high levels even under full indexation; the additional instrument of reducing pension contributions can only be applied under very restrictive assumptions within the nFTK.

In spite of the high median funding ratio produced in our scenario set, the probability of less than full indexation is substantial, even after fifty years. This indicates that under the nFTK, pension fund participants cannot always take full advantage of favorable economic circumstances. In the set of scenarios corresponding to less than full indexation, realized funding ratios are distributed more or less evenly across a wide spectrum of outcomes. As can be expected, low indexation ratios tend to

17 In the revision of the Pension Act as originally proposed by the Dutch government, the amount that could be used for recovery indexation was maximized to 10% of the surplus. Parliament adopted an amendment which raised the maximum to 20%. In our calculations, we have applied the latter policy; however, the differences with the outcomes under the rule originally proposed are small.

be associated with scenarios under which there are low asset returns and/or high wage inflation. The 5% quantile corresponds to policy funding ratios that go down to almost 40%. It appears that, for a fund that maintains a fixed-mix investment policy, the nFTK system neither provides an effective cap on fund wealth nor protects pensions against adverse economic scenarios. Under such circumstances, the system is not expected to be maintained. The goal of providing a sustainable, future-proof system seems too ambitious to be achieved by the current design of the nFTK in itself. There is a "catch" in the system: full indexation occurs mainly in scenarios in which the funding ratio is at levels that are likely to lead to changes in the system. At the same time, under adverse scenarios, indexation ratios may drop dramatically.

The results could possibly be improved by adapting some of the parameters of the nFTK regulatory framework. For example, changing the conditions for the repair policy, such that 100% of the funds in excess of the RFR could be used to reduce the gap between actual and full indexed pension entitlements, would increase the probability of full indexation at a ten-year horizon from 63.4% to 66.7%, while the probability of underfunding at the same time horizon would only increase from 12.3% to 12.8%. Coupling such a change in the repair policy with replacing the ACP parameter values by the model-based parameters (e.g., increasing the expected stock returns from 6.75% to 7.5%) would increase the probability of full indexation at a ten-year horizon even further, to 69.2%, while the probability of underfunding at the same time horizon would increase only to 12.9%.

Alternatively, adopting investment policies that are more responsive to economic conditions than the fixed investment mix we created as a benchmark could help avoid the catch referred to earlier. More fundamental improvements, on both the upside and the downside, could be derived from introducing greater flexibility into the policies. Some interesting possibilities for investigation, as topics of future research, could be indexation policies that differentiate between generations or contribution-reduction policies that are more flexible and tied to, for instance, the PFR level.

6. Conclusion

In this paper, we investigate the stability of the nFTK based on simulations. We start by establishing a stylized pension fund that mimics the actual demographic structure of the Netherlands. New workers enter into the pension fund at the age of 25 and retire at the age of 67. We assume mortality according to the 2014 life table provided by the actuarial association of the Netherlands. The influx of workers is assumed to be constant. The contributions per individual as a fraction of the pension base are determined at the start of the simulations and assumed to be constant over time, except when a reduction according to the nFTK is permitted. The pension fund's investment policy is a simple fixed-mix policy, 35% in stocks and 65% in ten-year bonds. Pension liabilities are discounted according to the term structure constructed by our own model.

Next, we formalize the nFTK and the various actions that must be taken under different circumstances. We study how the stylized pension fund performs under the nFTK under different simulated economic scenarios. In particular, we investigate the evolution of the indexation ratio and the policy funding ratio of the pension fund in relation to each other and to wage inflation and asset returns. We find that the highly ambitious goal of providing a sustainable, future-proof system seems too great to be achieved by the current design of the nFTK alone, at least given our stylized pension fund and the investment, contribution, and benefits policies considered.

References

[1] Jacob A Bikker and Peter JG Vlaar. Conditional indexation in defined benefit pension plans in the Netherlands. *The Geneva Papers on Risk and Insurance Issues and Practice*, 32(4):494–515, 2007.

[2] Guus CE Boender. A hybrid simulation/optimisation scenario model for asset/liability management. *European Journal of Operational Research*, 99(1):126–135, 1997.

[3] Guus CE Boender, Paul C van Aalst, and Fred Heemskerk. Modelling and management of assets and liabilities of pension plans in the Netherlands. In JM Mulvey and WT Ziemba (Eds.), *Worldwide Asset and Liability Modeling* (pp. 561–580). Cambridge University Press, 1998.

[4] Manuela Bosch-Príncep, Pierre Devolder, and Inmaculada Domínguez-Fabián. Risk analysis in asset-liability management for pension fund. *Belgian Actuarial Bulletin*, 2(1):80–91, 2002.

[5] Michael AH Dempster, Matteo Germano, Elena A Medova, and Michael Villaverde. Global asset liability management. *British Actuarial Journal*, 9(01):137–195, 2003.

[6] Ralph SJ Koijen, Theo E Nijman, and Bas JM Werker. When can life cycle investors benefit from time-varying bond risk premia? *Review of Financial Studies*, 23(2):741–780, 2010.

[7] Koninklijk Actuarieel Genootschap (Royal Actuarial Society). Prognosetafel AG2014 (AS 2014 forecast table), September 2014. *http://www.ag-ai.nl/view.php?action=view&Pagina_Id=480*.

[8] Niels Kortleve and Eduard HM Ponds. Dutch pension funds in underfunding: Solving generational dilemmas. Working Paper 2009-29, Center for Retirement Research at Boston College, 2009.

[9] John M Mulvey and A Eric Thorlacius. The Towers Perrin global capital market scenario generation system: Cap:Link. In JM Mulvey and WT Ziemba (Eds.), *Worldwide Asset and Liability Modeling* (pp. 286–312). Cambridge University Press, 1998.

[10] Theo Nijman, Stephan van Stalborch, Johannes van Toor, and Bas Werker. Formalizing the new Dutch pension contract. Occasional paper, Netspar, 2013.

[11] Lei Shu, Bertrand Melenberg, and Hans Schumacher. An evaluation of the nFTK: Technical appendix, 2014. *http://ssrn.com/abstract=2796614*

[12] Ultimate Forward Rate Committee. Advies commissie UFR (UFR Committee Recommendation), 2013. *https://zoek.officielebekendmakingen.nl/blg-254010.pdf*.

[13] Maarten van Rooij, Arjen Siegmann, and Peter Vlaar. Market valuation, pension fund policy and contribution volatility. *De Economist*, 156(1):73–93, 2008.

[14] SM van Stalborch. An assessment for a sustainable and generationally fair pension contract reform. Master's thesis, Tilburg University, 2012.

[15] A David Wilkie. A stochastic investment model for actuarial use. *Transactions of the Faculty of Actuaries*, 39:341–403, 1984.

[16] A David Wilkie. More on a stochastic asset model for actuarial use. *British Actuarial Journal*, 1(05):777–964, 1995.

OVERZICHT UITGAVEN IN DE DESIGN PAPER SERIE

1 Naar een nieuw pensioencontract (2011)
Lans Bovenberg en Casper van Ewijk
2 Langlevenrisico in collectieve pensioencontracten (2011)
Anja De Waegenaere, Alexander Paulis en Job Stigter
3 Bouwstenen voor nieuwe pensioencontracten en uitdagingen voor het toezicht daarop (2011)
Theo Nijman en Lans Bovenberg
4 European supervision of pension funds: purpose, scope and design (2011)
Niels Kortleve, Wilfried Mulder and Antoon Pelsser
5 Regulating pensions: Why the European Union matters (2011)
Ton van den Brink, Hans van Meerten and Sybe de Vries
6 The design of European supervision of pension funds (2012)
Dirk Broeders, Niels Kortleve, Antoon Pelsser and Jan-Willem Wijckmans
7 Hoe gevoelig is de uittredeleeftijd voor veranderingen in het pensioenstelsel? (2012)
Didier Fouarge, Andries de Grip en Raymond Montizaan
8 De inkomensverdeling en levensverwachting van ouderen (2012)
Marike Knoef, Rob Alessie en Adriaan Kalwij
9 Marktconsistente waardering van zachte pensioenrechten (2012)
Theo Nijman en Bas Werker
10 De RAM in het nieuwe pensioenakkoord (2012)
Frank de Jong en Peter Schotman
11 The longevity risk of the Dutch Actuarial Association's projection model (2012)
Frederik Peters, Wilma Nusselder and Johan Mackenbach
12 Het koppelen van pensioenleeftijd en pensioenaanspraken aan de levensverwachting (2012)
Anja De Waegenaere, Bertrand Melenberg en Tim Boonen
13 Impliciete en expliciete leeftijdsdifferentiatie in pensioencontracten (2013)
Roel Mehlkopf, Jan Bonenkamp, Casper van Ewijk, Harry ter Rele en Ed Westerhout
14 Hoofdlijnen Pensioenakkoord, juridisch begrepen (2013)
Mark Heemskerk, Bas de Jong en René Maatman
15 Different people, different choices: The influence of visual stimuli in communication on pension choice (2013)
Elisabeth Brüggen, Ingrid Rohde and Mijke van den Broeke
16 Herverdeling door pensioenregelingen (2013)
Jan Bonenkamp, Wilma Nusselder, Johan Mackenbach, Frederik Peters en Harry ter Rele
17 Guarantees and habit formation in pension schemes: A critical analysis of the floor-leverage rule (2013)
Frank de Jong and Yang Zhou

18 The holistic balance sheet as a building block in pension fund supervision (2013)
Erwin Fransen, Niels Kortleve, Hans Schumacher, Hans Staring and Jan-Willem Wijckmans

19 Collective pension schemes and individual choice (2013)
Jules van Binsbergen, Dirk Broeders, Myrthe de Jong and Ralph Koijen

20 Building a distribution builder: Design considerations for financial investment and pension decisions (2013)
Bas Donkers, Carlos Lourenço, Daniel Goldstein and Benedict Dellaert

21 Escalerende garantietoezeggingen: een alternatief voor het StAr RAM-contract (2013)
Servaas van Bilsen, Roger Laeven en Theo Nijman

22 A reporting standard for defined contribution pension plans (2013)
Kees de Vaan, Daniele Fano, Herialt Mens and Giovanna Nicodano

23 Op naar actieve pensioenconsumenten: Inhoudelijke kenmerken en randvoorwaarden van effectieve pensioencommunicatie (2013)
Niels Kortleve, Guido Verbaal en Charlotte Kuiper

24 Naar een nieuw deelnemergericht UPO (2013)
Charlotte Kuiper, Arthur van Soest en Cees Dert

25 Measuring retirement savings adequacy; developing a multi-pillar approach in the Netherlands (2013)
Marike Knoef, Jim Been, Rob Alessie, Koen Caminada, Kees Goudswaard, and Adriaan Kalwij

26 Illiquiditeit voor pensioenfondsen en verzekeraars: Rendement versus risico (2014)
Joost Driessen

27 De doorsneesystematiek in aanvullende pensioenregelingen: effecten, alternatieven en transitiepaden (2014)
Jan Bonenkamp, Ryanne Cox en Marcel Lever

28 EIOPA: bevoegdheden en rechtsbescherming (2014)
Ivor Witte

29 Een institutionele beleggersblik op de Nederlandse woningmarkt (2013)
Dirk Brounen en Ronald Mahieu

30 Verzekeraar en het reële pensioencontract (2014)
Jolanda van den Brink, Erik Lutjens en Ivor Witte

31 Pensioen, consumptiebehoeften en ouderenzorg (2014)
Marike Knoef, Arjen Hussem, Arjan Soede en Jochem de Bresser

32 Habit formation: implications for pension plans (2014)
Frank de Jong and Yang Zhou

33 Het Algemeen pensioenfonds en de taakafbakening (2014)
Ivor Witte

34 Intergenerational Risk Trading (2014)
Jiajia Cui and Eduard Ponds

35 Beëindiging van de doorsneesystematiek: juridisch navigeren naar alternatieven (2015)
Dick Boeijen, Mark Heemskerk en René Maatman

36 Purchasing an annuity: now or later? The role of interest rates (2015)
Thijs Markwat, Roderick Molenaar and Juan Carlos Rodriguez

37 Entrepreneurs without wealth? An overview of their portfolio using different data sources for the Netherlands (2015)
Mauro Mastrogiacomo, Yue Li and Rik Dillingh

38 The psychology and economics of reverse mortgage attitudes. Evidence from the Netherlands (2015)
Rik Dillingh, Henriëtte Prast, Mariacristina Rossi and Cesira Urzì Brancati
39 Keuzevrijheid in de uittreedleeftijd (2015)
Arthur van Soest
40 Afschaffing doorsneesystematiek: verkenning van varianten (2015)
Jan Bonenkamp en Marcel Lever
41 Nederlandse pensioenopbouw in internationaal perspectief (2015)
Marike Knoef, Kees Goudswaard, Jim Been en Koen Caminada
42 Intergenerationele risicodeling in collectieve en individuele pensioencontracten (2015)
Jan Bonenkamp, Peter Broer en Ed Westerhout
43 Inflation Experiences of Retirees (2015)
Adriaan Kalwij, Rob Alessie, Jonathan Gardner and Ashik Anwar Ali
44 Financial fairness and conditional indexation (2015)
Torsten Kleinow and Hans Schumacher
45 Lessons from the Swedish occupational pension system (2015)
Lans Bovenberg, Ryanne Cox and Stefan Lundbergh
46 Heldere en harde pensioenrechten onder een PPR (2016)
Mark Heemskerk, René Maatman en Bas Werker
47 Segmentation of pension plan participants: Identifying dimensions of heterogeneity (2016)
Wiebke Eberhardt, Elisabeth Brüggen, Thomas Post and Chantal Hoet
48 How do people spend their time before and after retirement? (2016)
Johannes Binswanger
49 Naar een nieuwe aanpak voor risicoprofielmeting voor deelnemers in pensioenregelingen (2016)
Benedict Dellaert, Bas Donkers, Marc Turlings, Tom Steenkamp en Ed Vermeulen
50 Individueel defined contribution in de uitkeringsfase (2016)
Tom Steenkamp
51 Wat vinden en verwachten Nederlanders van het pensioen? (2016)
Arthur van Soest
52 Do life expectancy projections need to account for the impact of smoking? (2016)
Frederik Peters, Johan Mackenbach en Wilma Nusselder
53 Effecten van gelaagdheid in pensioendocumenten: een gebruikersstudie (2016)
Louise Nell, Leo Lentz en Henk Pander Maat
54 Term Structures with Converging Forward Rates (2016)
Michel Vellekoop and Jan de Kort
55 Participation and choice in funded pension plans (2016)
Manuel García-Huitrón and Eduard Ponds
56 Interest rate models for pension and insurance regulation (2016)
Dirk Broeders, Frank de Jong and Peter Schotman
57 An evaluation of the nFTK (2016)
Lei Shu, Bertrand Melenberg and Hans Schumacher

An evaluation of the nFTK

A new regulatory framework for Dutch pension funds has come into force in 2015, replacing an earlier system that existed since 2007. The revision, known as \nFTK" (new Financial Assessment Framework), is meant to resolve a number of weaknesses of the earlier system which became apparent in the wake of the financial crisis. Lei Shu, Bertrand Melenberg, and Hans Schumacher (all TiU) carry out an analysis of the new framework, based on a simulation study.

This is a publication of:
Netspar
P.O. Box 90153
5000 LE Tilburg
the Netherlands
Phone +31 13 466 2109
E-mail info@netspar.nl
www.netspar.nl

May 2016