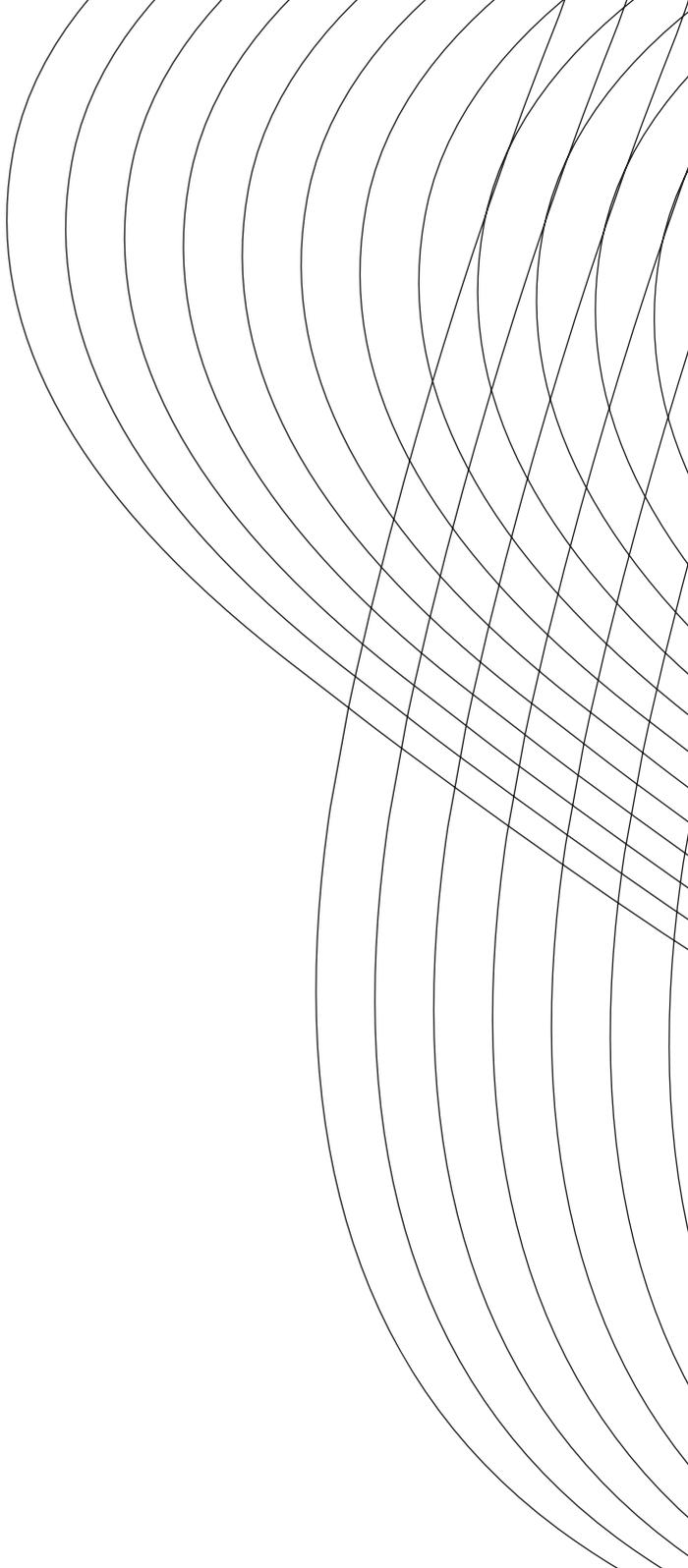
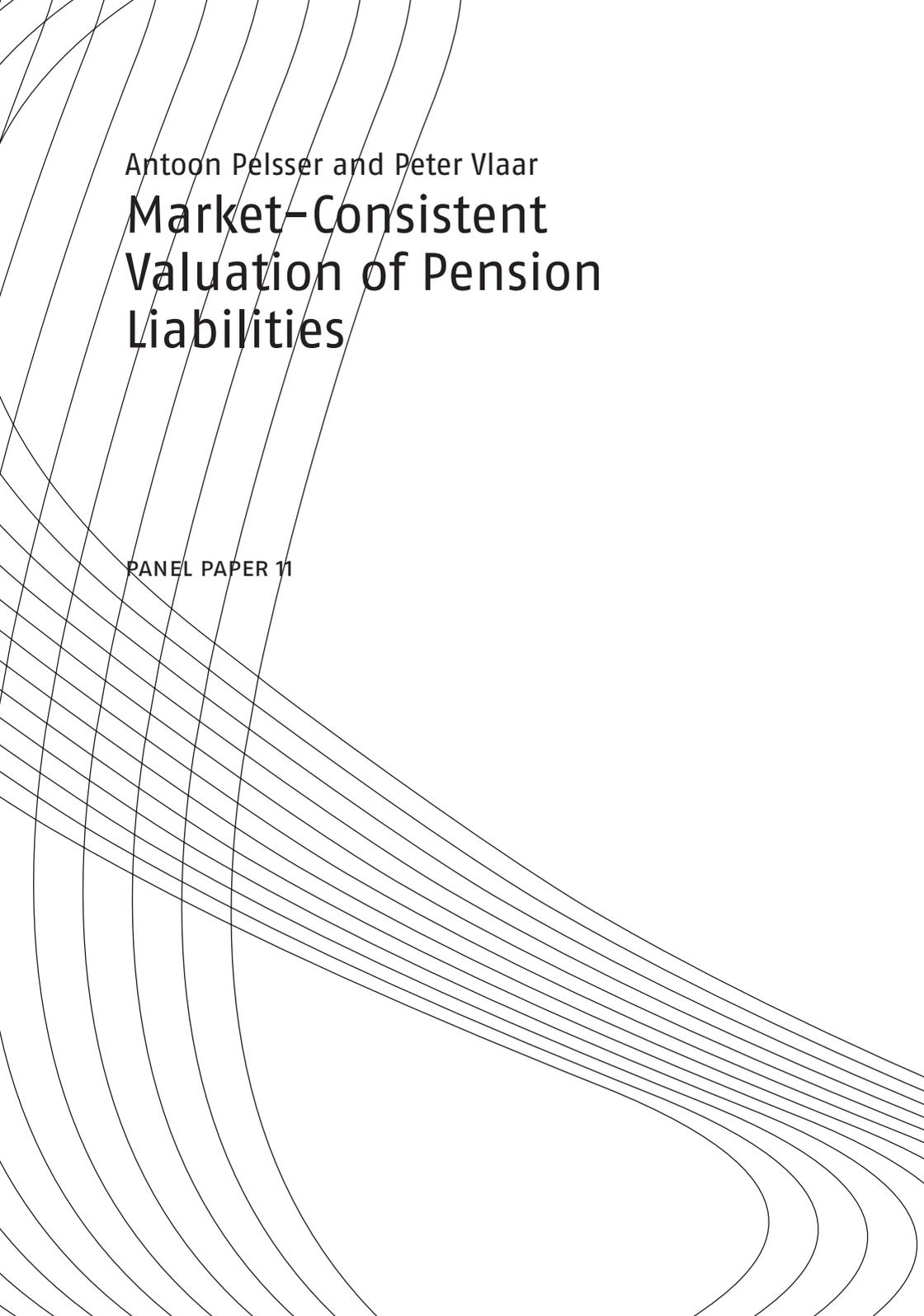




Antoon Pelsser and Peter Vlaar
**Market-Consistent
Valuation of Pension
Liabilities**

Netspar Panel Papers





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Market-Consistent Valuation of Pension Liabilities

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CONTENTS

<i>Preface</i>	7
<i>Summary</i>	9
1. <i>Introduction</i>	13
2. <i>Brief overview of the Dutch pension system</i>	15
3. <i>Market-consistent valuation of pension liabilities</i>	18
4. <i>Who should use market valuation of liabilities?</i>	22
5. <i>Market valuation and pension-fund policy</i>	26
<i>References</i>	36
<i>Summary of discussion</i>	38

PREFACE

Netspar stimulates debate and fundamental research in the field of pensions, aging and retirement. The aging of the population is front-page news, as many baby boomers are now moving into retirement. More generally, people live longer and in better health while at the same time families choose to have fewer children. Although the aging of the population often gets negative attention, with bleak pictures painted of the doubling of the ratio of the number of people aged 65 and older to the number of the working population during the next decades, it must, at the same time, be a boon to society that so many people are living longer and healthier lives. Can the falling number of working young afford to pay the pensions for a growing number of pensioners? Do people have to work a longer working week and postpone retirement? Or should the pensions be cut or the premiums paid by the working population be raised to afford social security for a growing group of pensioners? Should people be encouraged to take more responsibility for their own pension? What is the changing role of employers associations and trade unions in the organization of pensions? Can and are people prepared to undertake investment for their own pension, or are they happy to leave this to the pension funds? Who takes responsibility for the pension funds? How can a transparent and level playing field for pension funds and insurance companies be ensured? How should an acceptable trade-off be struck between social goals such as solidarity between young and old, or rich and poor, and individual freedom? But most important of all: how can the benefits of living longer and healthier be harnessed for a happier and more prosperous society?

The Netspar Panel Papers aim to meet the demand for understanding the ever-expanding academic literature on the consequences of aging populations. They also aim to help give a better scientific underpinning of policy advice. They attempt to provide a survey of the latest and most relevant research, try to explain this in a non-technical manner and outline the implications for policy questions faced by Netspar's partners. Let there be no mistake. In many ways, formulating such a position paper

is a tougher task than writing an academic paper or an op-ed piece. The authors have benefitted from the comments of the Editorial Board on various drafts and also from the discussions during the presentation of their paper at a Netspar Panel Meeting.

I hope the result helps reaching Netspar's aim to stimulate social innovation in addressing the challenges and opportunities raised by aging in an efficient and equitable manner and in an international setting.

Henk Don

Chairman of the Netspar Editorial Board

SUMMARY

The European Union is currently preparing a new set of rules for the supervision of insurance companies, and is considering implementing these rules for pension funds as well. This framework is known as Solvency II. Similar to the Basle II framework for banking supervision, Solvency II is based on market-consistent valuation and risk management techniques.

Market-consistent valuation means that the value of any entry in a balance sheet is determined by the price for which an asset or liability could be traded in a market transaction between two willing and knowledgeable counter-parties. Thus, a "mark-to-market" approach should be used for assets and liabilities whenever the prices can be observed in a liquid market. In other cases, a "mark-to-model" approach must be used to value the assets or liabilities, where the valuations models should incorporate all of the relevant market information.

The benefits of market valuation are clearly found in increased transparency and accountability of pension schemes. However, there is a widespread fear – typically prevalent on pension fund boards – that market valuation based on the actual term structure of interest rates leads to excessive volatility in funding ratios. If regulators then impose solvency regulations in terms of these market-based funding ratios, contribution rates may become much more volatile. For pension fund boards, this means tougher negotiations with the sponsor of the pension scheme, and more frequent bad-news messages, caused by downward spikes in the discount rate. In order to circumvent these problems, the FTK still allows pension funds to use a smoothed or fixed discount rate to determine contribution levels, even though their solvency is always determined by the prevailing term structure of interest rates. Moreover, the solvency rules are applied only to guaranteed (in practice, nominal) pension rights.

The use of market-consistent valuation- and risk management techniques is not uncontroversial in the case of pension liabilities – particularly for pension liabilities with conditional indexation.

This paper addresses the following questions:

- Is it possible to define a market-consistent value of conditionally indexed pension rights?
- Who should use the market-consistent valuation of the liabilities?
- To what extent should pension fund policy anticipate changes in market prices, and what should be the reaction if they occur?

Policy Implications

- Market-consistent valuation of pension liabilities provides useful information for policyholders and regulators, but conditional elements should not be made subject to market-consistent solvency requirements.
- When determining market-consistent value of real pension rights using OAT€i-based real rates, it is important to factor in the basis risk between the (sector-specific) wage and the HICP price inflation.
- Pension funds should explicitly communicate that conditional indexation is in fact a risk-sharing arrangement where active participants pay a lower premium, but are exposed to the risk of potential indexation cuts in the future.
- Contribution rates should be based on a conservative estimate of long-term economic averages, and should not reflect day-to-day market fluctuations, nor be unrealistically optimistic.
- Indexation policy of pension funds should be based both on the market valuation of nominal liabilities, and on the real liabilities calculated using the same fixed discount rate as used for the cost-covering contribution rate.

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MARKET-CONSISTENT VALUATION OF PENSION LIABILITIES

1. Introduction

In the Netherlands, market valuation of liabilities has become regulatory practice since 2007. Until recently, the traditional method of discounting in the Netherlands used a fixed actuarial interest rate, in which the maximum permitted rate was prescribed by the supervisory authority. This maximum permitted actuarial interest rate had remained constant at 4% for pension funds since October 1969. The new regulatory framework (called 'Financieel Toetstingskader' or FTK) stipulates that liabilities have to be marked to market. In the international context, the FTK is one of the first regulatory frameworks to be based on market valuation (see Ambachtsheer 2005).

The European Union is currently preparing a new set of rules for the supervision of insurance companies, and is considering implementing these rules for pension funds as well. This framework is known as Solvency II. Similar to the Basle II framework for banking supervision, Solvency II is based on market-consistent valuation and risk-management techniques.

Market-consistent valuation means that the value of any entry in a balance sheet is determined by the price for which an asset or liability could be traded in a market transaction between two willing and knowledgeable counter-parties. Thus, a "mark-to-market" approach should be used for assets and liabilities whenever the prices can be observed in a liquid market. In other cases a "mark-to-model" approach must be used to value the assets or liabilities, where the valuations models should incorporate all of the relevant market information.

The benefits of market valuation are clearly found in increased transparency and accountability of the pension schemes. However, there is a widespread fear – typically prevalent on pension fund boards – that market valuation based on the actual term structure of interest rates leads to excessive volatility in funding ratios. If regulators, in turn, impose solvency regulations in terms of these market-based funding ratios, then contribution rates may become much more volatile. For pension fund

boards, this means tougher negotiations with the sponsor of the pension scheme, and more frequent bad-news messages, caused by downward spikes in the discount rate. In order to circumvent these problems, the FTK still allows pension funds to use a smoothed or fixed discount rate to determine contribution levels, even though their solvency is always determined by the prevailing term structure of interest rates. Moreover, the solvency rules are only applied to guaranteed (in practice nominal) pension rights.

For risk-management purposes, one usually defines a Value-at-Risk (or Surplus-at-Risk) type measure. The Value-at-Risk (VaR) is defined as the largest (negative) change in the surplus that can occur with a probability of 97.5% over a 1-year horizon. In a market-consistent framework, the VaR measures the change in the market-consistent surplus due to a shock that occurs in a given set of risk drivers. The set of risk drivers covers both market risks (such as equity and interest rates) and non-market risks (such as longevity or operational risk).

The use of market-consistent valuation and risk-management techniques is not uncontroversial in the case of pension liabilities, particularly for pension liabilities with conditional indexation.

The remainder of this paper is organized as follows. Section 2 provides a brief overview of the Dutch pension system. Section 3 discusses the market-consistent valuation of pension liabilities. Section 4 analyzes who should use the market-consistent values of pension liabilities. Finally, Section 5 discusses pension fund policy in the light of market-consistent valuation.

2. Brief overview of the Dutch pension system¹

Three layers, or pillars, characterize the Dutch pension system. The pay-as-you-go financed state pension (AOW) constitutes the first pillar. On top of that, over 90% of employees participate in compulsory savings plans for retirement through their employer.² The employer makes premium contributions on behalf of its employees to a pension fund.³ These retirement savings are capital funded. The same applies to the third layer of pension savings, which consists of all other provisions made by consumers themselves.

Pension funds play an important role in the Dutch pension system. Their capitalization equals roughly 700 billion (or 130% of GDP) and is among the highest in the world. With regard to pension funds and plans there is a lot of heterogeneity: with over 700 pension funds, ranging from very small company funds to very large industry-wide funds. Very few (5%) pension plans are defined-contribution pension (DC) plans – most of them collective. The vast majority (85%) of pension fund members build up pension according to a conditional average-wage defined-benefit (DB) type, i.e. a nominal pension benefit (based on current wage) is guaranteed, whereas indexation and pension premiums may fluctuate over time. Indexation is conditional upon a discretionary decision by the pension board. In practice, full indexation with respect to either wage or price inflation – depending on the terms of the pension contract – will be given if the coverage ratio is high enough. Only about 3% of the pension fund participants still build up pension rights linked to their final salary.

The rules regulating pension funds were laid down in the new Pension Act that was put into force from 2007 (replacing the old Pension and Savings Funds Act, which goes back to 1952). Currently, pension funds also have to comply with the new supervisory regime that is developed along the principles of the new Pension Act. Key elements of the new regime, the Financial Assessment Framework (or FTK; acronym of the Dutch term

- 1 The material in this section is taken from Section 2 of Van Rooij, Siegmann, Vlaar (2008), and has been included here for the reader's convenience.
- 2 This number is quite high compared to many other developed countries. See Van Els, Van Rooij, and Schuit (2007) for a discussion.
- 3 Some employers do not have a pension fund but have a direct agreement with a life insurer. About 10% of Dutch employees build up their pension this way. These retirement plans are primarily of the DC type.

'Financieel ToetsingsKader'), are market valuation – with respect to both assets and liabilities – and risk-based supervision. Hereby, the FTK makes a sharp distinction between guaranteed (in practice nominal) pension rights and conditional ones (in practice indexation).⁴ Although no rules are imposed with respect to the investment policy of the fund, more risk-taking leads to higher mandatory capital buffers.

With respect to the guaranteed rights, the intention is permanent full funding (where liabilities are measured against the (almost) risk-free term structure of interest rates based on swap rates). If the (in case of a nominal guarantee) nominal coverage rate falls below 105%, the pension fund has to report this immediately to the prudential supervisor (De Nederlandsche Bank or DNB) and demonstrate how it will restore the coverage rate to a level above the minimum 105% within three years, at most. Pension funds are required, moreover, to have a solvency buffer reflecting the 'riskiness' of their investments (i.e. their ability to withstand negative shocks to the value of their assets). The target coverage ratio reflecting guaranteed rights should be such that there is at most a 2.5% probability that the pension fund will become under-funded within a year. For the typical pension fund, this results in a required nominal coverage rate of about 125%. If the coverage rate falls below this level, the supervisor requires the pension fund to draft a recovery plan to indicate the actions that the fund will take to get back in line with the required coverage rate within a period of at most fifteen years.

With respect to conditional pension rights (indexation), no formal funding rules are prescribed – although investment and contribution policies and actual indexation should be consistent with the expectations previously communicated.

The cost-effective contribution level under the FTK contains four elements: normal costs of guaranteed pension rights, administrative

4 Especially under an average earnings system this distinction is important for members, as inflation matters not only during retirement, but also during the active working career. Van den End, Van Els and Van Rooij (2004) show that pension participants value security quite a lot. See also Van Rooij, Kool and Prast (2007). However, hardly any pension fund gives guarantees on future indexation. The requirement to be permanently fully funded, where liabilities are measured against the prevailing risk-free real yield curve, makes these pension plans extremely hard to handle (Bikker and Vlaar, 2007). It is therefore argued that the regulatory and supervisory regime should be adjusted to better reflect real obligations (see e.g. Van Ewijk and Teulings, 2007).

costs, normal costs of conditional rights, and costs to build up the required solvency buffer. To calculate these costs, pension funds may use either the prevailing yield curve or expected returns (up to certain prescribed limits), a smoothed version of these interest rates or returns using a smoothing period of at most ten years, or a fixed value reflecting long-run returns. Actual pension premiums can be higher if the solvency buffer is too low (as part of the recovery plan). The premiums may be set below the cost-effective level if the coverage rate is high enough to ensure both conditional and unconditional pension rights without endangering the solvency position of the pension fund.

3. Market-consistent valuation of pension liabilities

The foundation for the market-consistent pricing of pension contracts is the notion of replication. Thus, if we can construct a portfolio of traded financial instruments that has exactly the same characteristics as the contract under consideration, then the market-consistent price of our contract will (by definition) be equal to the market price of the portfolio of financial instruments.

3.1 Overview of the literature

The valuation of pension liabilities, particularly conditionally indexed liabilities, has attracted a lot of attention recently. A comprehensive collection of articles can be found in the book *Fair Value and Pension Fund Management* (Kortleve, Nijman, Ponds, 2006). Exley (2006) argues that the use of fair value is beneficial in terms of economic welfare, since it allows economic agents to make better-informed decisions. Nijman and Koijen (2006) discuss models that can be used to determine the value of conditionally indexed pension liabilities by viewing them as (complicated) inflation derivatives. Bodie (2006) discusses applications of fair-value accounting in the US. Kocken (2006) emphasizes the use of option-pricing techniques to determine the value of pension liabilities. A problem in the valuation of conditionally indexed pension liabilities is that there is an interdependence between the assets and the liabilities, which makes a correct market-consistent valuation highly challenging. Recent theoretical advances by Dai and Schumacher (2008) and Kleinow (2008) indicate that it is possible, in some cases, to determine a market-consistent value that fully takes into account the interdependence between assets and liabilities. These are preliminary results, however, and much work remains to be done in this area.

Another problem in the valuation of index-linked liabilities is that the wage-inflation used to index the pension liabilities is not traded in financial markets. Hence, we are facing an incomplete market situation. De Jong (2008a,b) discusses several methods that can be used to price index-linked liabilities in incomplete markets, including an optimal long-term investment approach, utility-based approaches and arbitrage bounds.

3.2 *Nominal rights*

With regard to nominal rights, it is relatively straightforward to determine the market-consistent value. A portfolio of discount bonds may be constructed explicitly that replicates the expected nominal cash flows. The market-consistent value of the nominal liabilities is then equal to the market price of the replicating portfolio. This is equivalent to discounting the nominal cash flows against the nominal term structure of interest rates. DNB provides on a monthly basis the term structure of interest rates that pension funds must use for their calculations.

It is important to note that nominal pension liabilities are still subject to risks that cannot be hedged in financial markets. An example of such a risk is uncertainty with regard to future mortality developments, leading to longevity risk. In a true market-consistent pricing framework, one should calculate a *market value margin* (MVM) that quantifies the certainty equivalent that is needed to compensate for these 'unhedgeable' risks. Under the current legislation in the Netherlands, pension funds need only to reflect the *current estimate* of these unhedgeable risks in the projection of the nominal cash flows; the pension funds are not required to calculate a market value margin that reflects the uncertainty around the current estimate.

3.3 *Real rights*

Pension funds in the Netherlands have, in principle, the ambition to protect their participants against the effects of inflation. Inflation-protected pension rights are *real rights* ("real" being the opposite of "nominal"). Real pension rights are typically determined by increasing the nominal rights on an annual basis by an amount based on the realized price inflation, or wage inflation. This annual correction is called *indexation*. Typically in the Netherlands, active workers in the pension fund receive indexation based on wage inflation, whereas retirees receive indexation based on price inflation. On average, wage inflation is higher than price inflation.

A method to determine the market-consistent value of the real rights, which is used by most pension funds, is to discount the nominal cash flows of the nominal pension rights with a real interest rate that reflects the expected inflation. To be market-consistent, many pension funds use the real interest rate inferred from the prices of index-linked bonds issued by the French government (the so-called OAT€i bonds). Although

these are interest rates derived from market prices, they do not reflect fully the inflation component of Dutch pension funds, due to market incompleteness:

- The indexation base of OAT€i bonds is the European-wide price-inflation index HICP.
- Pension liabilities are indexed, however, using (sector-specific) wage inflation, which is typically between 1% and 2% higher than the price inflation.

Hence, if a pension fund wishes to determine the market-consistent value of the real rights, it must reflect the basis-risk between the HICP and the wage inflation. This can be achieved by using, for example, the incomplete market-valuation techniques outlined in De Jong (2008a,b).

3.4 Conditional indexation

Although we stated in the previous subsection that it is the ambition of pension funds to grant their participants full indexation, the premiums that would be needed to cover such unconditional indexation are generally perceived to be too expensive. For this reason, most pension funds in the Netherlands use a system of *conditional indexation*. This means that indexation is given to the participants in the pension fund conditional on the availability of sufficient surplus in the pension fund to cover the indexation expenses.

Conditional indexation is therefore a form of risk-sharing between the pension fund and the other stakeholders of the fund. By holding a strategic mismatch between liabilities and assets (i.e. the pension fund invests in equities and other risky investments), the asset portfolio yields, on average, higher returns than the liability portfolio does. Consequently, the active workers pay, on average, a lower fee. In return, however, all stakeholders in the fund accept the probability that indexations can be cut (for active workers or retirees) or that additional payments have to be made (by active workers or the sponsor) in bad economic scenarios, which typically correspond to low equity and low interest rate economic scenarios.

If the market value of conditional indexation can be calculated correctly, this will be very helpful to monitor the claims of various stakeholders in a fair and consistent manner. Unfortunately, calculating the market-consistent value of pension rights subject to conditional

indexation is extremely complicated. This is due to the fact that the current value of the liabilities depends on the future indexations; these depend on the development of the coverage ratio of the fund, which depends on the future development of the value of the liabilities. We thus see a "feedback loop". Recent theoretical advances (Kleinow, 2008 and Dai-Schumacher, 2008) show that, under strong simplifying assumptions, it is possible to determine the value of pension rights under conditional indexation as the "fixed point" of the feedback loop. However, even for the highly simplified examples, the calculations are already extremely complex, and it is not clear whether these results can be generalized to realistic pension deals.

4. Who should use market valuation of liabilities?

Exley (2006) is one of the few papers that explicitly addresses whether fair values are useful to all stakeholders in the pension fund. Exley argues that although market valuation is appropriate from a shareholder perspective, market values may give only an upper bound on the value for the beneficiaries.

This section provides a more elaborate breakdown of the usefulness of market valuation for the different stakeholders in the pension fund.

4.1 Sponsor

Market valuation, which gives the best approximation of the cost of a pension contract in the market, is the most appropriate tool with which to value the pension liability of a sponsoring firm. If a sponsoring firm is (partly) liable for future shortfalls of the fund, there is no obvious reason why this liability should be valued differently from other future obligations. Consequently, for accounting purposes, market valuation is the only sensible standard to use.

4.2 Participants

Viewed from the perspective of the end user (employee or retiree), market valuation can be a useful tool. For instance, it can be used to determine the impact of changes in the pension contract for the different participants (generational accounting). It should be realized, though, that the economic value is not necessarily the best benchmark for all of the participants. This is due, first of all, to the fact that the market is not complete. Participants cannot trade their pension rights, and generally cannot choose the amount of risk taken by the fund. This lack of choice limits the value for the participants (Exley, 2006). Moreover, the type of contract offered by DB pension funds, including elements of intergenerational risk-sharing with future generations, is not available in the market. The certainty-equivalent value for the participant might therefore very well exceed the economic value. A second reason why economic value might not be the best benchmark for all participants is that, even if the market would become ever-more complete, most people do not have the knowledge to construct useful trading strategies to efficiently build up retirement savings (numerous examples in individual DC plans). The majority of those who do have the knowledge prefer to not think about it, and those who do are confronted with high transaction

costs (both direct costs and time consuming). Although the ideal world of market valuation will consequently never exist, it will always be an interesting benchmark, as losses that are too great in terms of economic value for some participants (especially new entrants) are likely to result in a lack of support for the fund.

4.3 Pension fund

The usefulness of market valuation for a pension fund probably depends on the way in which the pension fund is viewed. At the one extreme, a (company) pension fund can be seen as part of the sponsoring firm. If the fund acts primarily on behalf of the firm (a current-cost perspective), then market valuation seems to be the obvious choice. However, as the pension contract might be seen as an important term of employment, this view is too narrow once employees share some of the risks involved. At the other end of the spectrum, a pension fund can be seen as a collective savings fund (discounted cost- and benefit perspective) of its participants. As the members, in general, do not compensate for the fund's decisions in their personal investments, the behavior of the fund matters. Consequently, the evaluation of the fund's performance should be viewed not only in a market valuation perspective, but also in a utility-based one. In terms of economic value, the decisions of the fund result in a zero-sum game; in utility terms, the fund should add value. Unfortunately, utility functions are necessarily subjective. Moreover, it is not obvious what the utility of the fund really is. One way to look at this is to take the sum of the utilities of the individual participants (both current and future), where all contributions are attributed to the active employees. Although employers usually pay a large part of pension contributions, this assumption is still reasonable, as these payments are also paid from the total margin for pay. Higher employer pension contributions are likely to result in lower gross wages. Therefore, these employer contributions can be seen as an indirect cost for the employee.

4.4 Supervisor

While market valuation is an important tool for a supervisor, it should not be used for all of the problems at hand. The supervisor should protect the rights of the current- and future members of the fund, without obstructing sensible pension fund policy. On the one hand, the rules should be strict enough to ensure that promised benefits can indeed be

fulfilled – and not at the cost of one (future) generation. On the other hand, too-strict supervisory rules might impair the attractiveness of a pension deal, and thereby lead to the closure of DB funds. Solvency rules based on market values have the big advantage that pension funds have to be realistic regarding the cost of the pension deal. Pension funds might otherwise become too optimistic (or willing to take risk), as higher expected returns reduce contribution rates in the short run. The fact that most Dutch pension funds continued to work with a 4% discount rate up until 2006, despite the considerable drop in interest rates, shows that this risk is not just theoretical.

The use of market valuation for solvency requirements regarding conditional elements in the pension deal (indexation) is not a good idea, however.⁵ The reason is that the supervisor should protect the pension benefits of participants, whereas the focus of market valuation is measuring the current cost of the deal (which is most relevant for the shareholders of the sponsoring firm). From a participant protection point of view, the wealthier a sponsor is, the higher the probability is that future shortfalls can be made good, and the lower the importance is of being fully funded right now. The market valuation principle works the other way around. The higher the likelihood of future indexation is, the higher the market valuation of this conditional right becomes, and thereby the higher the current liabilities. If solvency requirements are based on the market valuation of total liabilities, then a more credible promise to make up shortfalls in the future if they occur results in higher solvency requirements today. Moreover, perverse incentives are created, as policies resulting in a certain but low level of indexation lead to higher total funding ratios than policies with (from the perspective of the participants) better but uncertain indexation outcomes. If the fund holds a replicating portfolio for the nominal liabilities, and the nominal funding ratio is exactly 100%, then the option value of conditional indexation is zero, and consequently the total funding ratio is 100% as well – despite the lack of indexation. Risk-taking is discouraged, as more

5 This mistake was made in Solvency II, the solvency requirements for insurance companies. As a consequence, life insurance companies that offer 'with-profit' contracts have to make a reservation to protect them against having to share high future profits. In the UK, a similar mistake was also made, leading to a drop in the popularity of with-profit contracts. This is one of the reasons why Solvency II should not be applied without adjustment to pension funds.

risk-taking results in higher (indexation) option values, and thereby *ceteris paribus* lower total funding ratios.

Besides their tendency to engender perverse incentives, option-based solvency requirements also lead to circular reasoning if the option value (plus technical provisions) is higher than the risk buffer. Suppose that the risk buffer for nominal pension rights is 25% of nominal liabilities, and the indexation option value at a nominal funding ratio of 125% equals 30% of nominal liabilities. In that case, the pension fund is still underfunded at a nominal funding ratio of 125%. An extra contribution by the sponsor of 5% of liabilities will not completely remedy this, however, as this extra money increases the indexation option value (given fixed policy ladders and investment policy). The equilibrium required funding level is likely to be close to 100% of the real liabilities. This is clearly at odds with the intended conditionality of indexation.

Due to the Dutch FTK stipulation that pension funds have to make a reservation for conditional rights if the conditions are fully specified, Dutch pension deals are deliberately vague. Many pension funds even try to downplay their indexation ambition. This negative side effect of the FTK has been significantly mitigated by recent changes in legislation on discretionary liabilities. The supervision model has been changed so that the reservation of conditional pension rights has been transferred from the solvency test to the continuity test.

It is very important that the pension fund communicates as openly and as realistically as possible about the indexation ambitions of the fund. These ambitions, in combination with the investment and premium policy, can then be investigated by way of a continuity test to see whether the fund's overall ambitions are in line with the current investment and premium policies in the long run.

5. Market valuation and pension-fund policy

In order to understand the usefulness of market valuation for pension funds in everyday policy, we first need to decide whether or not it is desirable for pension funds to hold a replicating risk-free portfolio. If markets are complete and without transaction costs, then the investment policy of the fund is hardly relevant, as all transactions by the fund can be reversed by its participants on their private accounts. In practice, of course, this premise is not valid, as participants, for instance, can't borrow against their future pension rights. Moreover, many of them save primarily via their pension plans. The more appropriate premise is that pension funds invest on behalf of their members (De Jong, Schotman and Werker, 2008). In general, it is already less than optimal for an individual to take no investment risk at all. This is even more so the case for pension funds, as they are probably better equipped than most other market participants to take risk. At least three reasons can be mentioned. One important characteristic of pension funds is, for example, that they have a very long investment horizon. The average duration of Dutch nominal pension liabilities is about fifteen years (in real terms, it is even longer). Second, as employees cannot choose between pension funds (unless they change jobs), future contributions are almost guaranteed – so that liquidity problems are virtually absent. A third factor in favor of pension funds being better equipped to take on risk has to do with the efficient adjustment mechanisms that pension funds have nowadays. Especially the indexation cut option can be an efficient tool to keep funding ratios at acceptable levels. Shortfall contributions may help, moreover, although this mechanism becomes less and less effective for an ageing pension fund. These three characteristics imply that pension funds should have a long-term view in their investment policy. They should exploit liquidity and risk premiums and accept mismatch risk. Consequently, a liability-replicating portfolio is generally not optimal. On the other hand, taking too much investment risk may not be optimal, either. As argued by Kortleve and Ponds (2006), investments that provide a low return in states of the world that are also personally bad for participants lead to a poor pension deal, from the participant's point of view.

Given that the fund should not aim at replicating the liabilities in its investment policy, is a market-based real (or total) funding ratio still informative? What is relevant here is whether or not the conditionality of indexation is included. If conditionality is taken into account, then

market valuation provides the best measure of the total costs of the pension deal. This is important information for shareholders of the sponsoring firm. It is also a useful tool, preferably supplemented by a utility-based approach, which can be used to analyze the costs and benefits of alternative policies for the different stakeholders. In theory, market valuation should also be used to transfer pension rights from one pension fund to another. In practice, however, the lack of a complete market complicates matters considerably – especially in case of conditional pension rights. The problem is that model-based valuation is not fully objective. The value of the implicit options in the contract depends on the specification of the stochastic discount factors. For instance, it could make a difference whether a constant volatility (Vasicek) model is used for the term structure of interest rates, or a heteroskedastic one (CIR). With respect to indexation, index-linked bonds related to wage inflation, or even Dutch prices, do not exist. Consequently, the indexation option value can be determined only by using a (necessarily subjective) model. These subjectivities enter into the calculation of the economic value of not only the old pension contract, but also the pension rights in the new pension fund, given the amount of money brought in.

The market-based real funding ratio including option elements is not very informative regarding expected future benefits. The reason is that the target asset level of the pension fund is no longer determined solely by the fund's ambition regarding the pension arrangement it provides, but also by the probability of reaching this ambition. Higher total funding ratios (defined as total assets divided by the market value of both conditional and unconditional pension rights) may in this case reflect a number of things: higher asset levels, higher expected returns (e.g. higher interest rates), lower expected indexation or a higher market price for risk-taking (e.g. a higher spread between government bonds and junk bonds). Compared to a fixed discount-rate method, taking account of changing expected returns probably improves transparency, but this is more than offset by the counterintuitive fact that worsening indexation perspectives (which are clearly not in the interest of the pension fund's participants) also result in higher total funding ratios.

If conditional indexation cuts are not taken into account, then the real funding ratio reflects the percentage of real liabilities that can be guaranteed. Although this is certainly informative, this benchmark is to some extent arbitrary, as the actual portfolio will deviate from the

liability-replicating portfolio. A real funding ratio of exactly 100% does not mean that indexation is always given – and a number of, say, 90% might still indicate that the probability of full indexation may well be over 95%. It is not straightforward that we should always aim at 100% coverage against certainty. Given that the expected return on the optimal portfolio is higher than the one on a replicating portfolio, this would lead to a frontloading of pension liabilities. On average, future generations pay less than the generation that builds up the implicit buffer. This might be reasonable, as they also bear the risk of having to pay extra shortfall contributions. Given that the market is not complete, 100% coverage against certainty is not necessarily the best benchmark.

5.1 Should we base contributions on current market values?

There are at least two good reasons why contribution rates should not fully reflect current market values. First, given that we do not aim at a replicating portfolio, and that we choose to accept mismatch risk, the average contribution can be lower than one based on certainty (based, for instance, on price inflation, at which wage indexation aims). Second, for 'tax-smoothing' reasons and for prevention of pro-cyclicality, stable contribution rates are preferable. It is therefore probably better that contributions are based on a fixed discount rate instead of current market rates (assuming that interest rates are mean reverting and that pension funds have a long-run perspective).

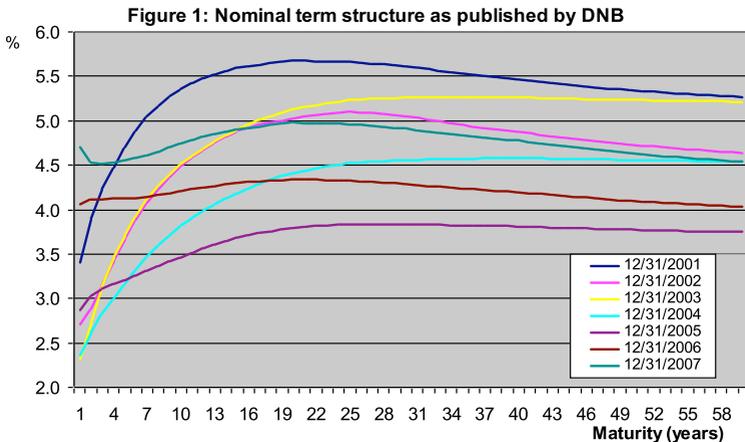
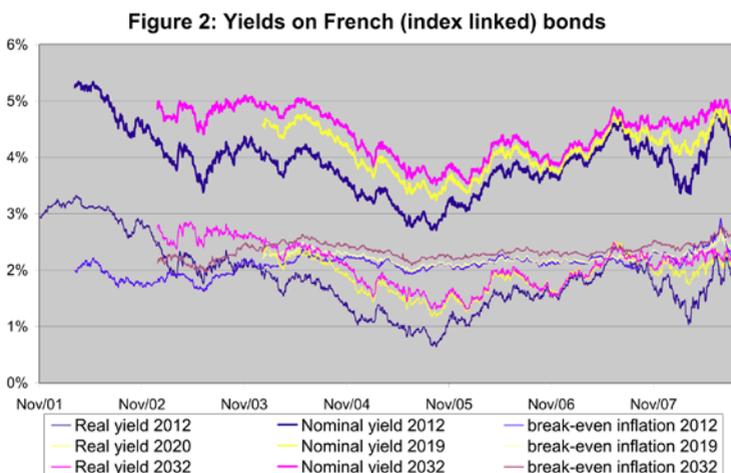
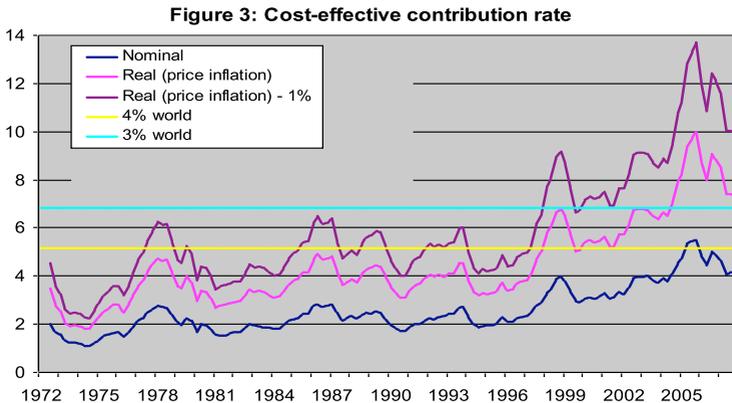


Figure 1 shows the nominal term structure of interest rates for maturities of one to sixty years as published by the Dutch supervisor DNB. As of January 2007, pension funds are obliged to use this term structure to calculate the market value of their nominal liabilities. We see that the annual differences in nominal interest rates can be quite substantial. The volatility is not restricted to the short end of the maturity spectrum. For instance, also the sixty-year rate dropped 1.5 percentage points between 2003 and 2005.



Over this recent period, the volatility of long-term interest rates cannot be explained by changes in inflation expectations. Although the history of index-linked bonds in the euro area is fairly limited, the evidence from the French market shows that real rates are only slightly less volatile than the nominal ones are (see Figure 2). Break-even inflation rates have been very stable between 2% and 2.5%. The break-even inflation on long-term bonds has been slightly higher than the one on shorter maturity bonds, probably because of higher inflation risk premiums. Over the first couple of years, break-even inflation rates seemed to be lower and somewhat more volatile. The most likely reason for these results is the lack of liquidity of the inflation-linked bond market in the early years. Figure 3 shows the average cost of providing a pension of one euro per year, starting from the age of 65. The age profile of the participants is based on the average incomes, participation rates and number of persons

per age group in the Netherlands at the end of 2002. As long maturity bonds (or swaps) have only been traded actively since 1996, the term structure of interest rates is model-based.⁶ We use the model of Vlaar (2006). In this affine three-factor term-structure model, long-term rates are modeled as a function of current short-term rates, expected inflation and a stochastic risk-aversion factor. Real rates are determined as the nominal rates minus the expected inflation over the maturity (given the same interest rate model), thereby implicitly assuming a zero-inflation risk premium.⁷ The real rates – 1% curve approximates the market value of the cost of a wage-indexed pension, where it is assumed that real wage increases are 1% per year. Apart from the cost using market rates, the figure also shows the costs assuming a 4% discount rate and the costs for a 3% discount rate.



The figure shows that market-based contribution rates are extremely volatile. For instance, between 1996 and 1999, the deferred annuity cost for a nominal pension doubled from 2 to 4 euro, to return to 3 euro in 2000. For real annuities, the fluctuations are similar. The slightly lower

6 For the period in which market data are available (starting September 2001), the difference in contribution rate for nominal liabilities using market data or model-based data is at most 14 basis points.

7 We assume that the equilibrium inflation rate is 2%. Although this number seems to be most realistic for the current situation, it is likely to be too low for the past, as average inflation was 3%. Consequently, the market-based contribution rates for real liabilities over the past might be too low and volatile.

real rate volatility compensates for the higher real duration, due to the lower rates. Obviously, charging market rates for contributions would lead to unacceptable fluctuations in labor costs (if employers pay) or income (if employees do). Moreover, it will be highly inefficient, as the highest contributions are paid if interest rates (and thereby expected returns) are the lowest.⁸ Assuming that the costs of contributions are more or less constant over time, it is more efficient to save more if expected returns are high. An implicit assumption in this line of reasoning is that interest rates are mean reverting, such that low interest rates can be expected to be followed by higher ones. The figure also shows the danger in using a fixed discount rate. Over the period 1972 – 1996 pension costs indeed fluctuated around a stable mean. Over this period the use of a 4% discount rate was prudent enough to both avoid the volatility implicit in market rates and still cover all costs most of the time. Indeed, indexation was always given, and most participants did not even know that indexation was conditional on the financial position of the fund. By contrast, since the second half of the nineties interest rates have moved to a lower level. Using a 4% discount rate, even indexation to the price level could no longer be guaranteed. In response, many pension funds reacted by investing more in risky assets, thereby increasing expected returns. These higher expected returns had a price tag, however: an increase in risk. Many participants became aware of this risk only after the stock market crash of 2000–2002. While the average participant might prefer to take this risk, it should at least be made clear to them beforehand. Market values certainly help in that respect. Most pension funds departed from the 4% world only after the introduction of the FTK in 2007. In general, they still use a fixed discount rate to calculate contributions, although instead of using 4%, they use a more realistic 3%. This rate can be seen as a prudent estimate of expected real portfolio returns in the long run. Although indexation cannot be guaranteed at this rate, participants are nowadays at least informed about the risks. To conclude, contribution policy based on a fixed discount rate has many advantages over a market-based policy. Market values should not be ignored completely, however, as the 'equilibrium' level of interest rates

8 If the drop in interest rates is caused by a flight to quality, then low interest rates do not necessarily imply low expected returns, as risk premiums are relatively high. Consequently, low returns on treasuries might be compensated by higher expected returns on, for instance, stocks and credits.

might change over time. In order to prevent having to adjust the discount rate too often, the value of the discount rate should be set below the expected long-run return of the representative investment portfolio.

5.2 Should investment policy reflect market values?

The fact that pension funds should accept some mismatch risks by no means implies that liabilities should be ignored in the investment process. Indeed, one of the big advantages of the FTK is that Dutch pension funds have become much more aware of the interest-rate risk in their liabilities. In order to reduce this risk, they have responded by increasing the average duration of their assets. The optimal way to minimize interest-rate risk is not obvious, though. Pension funds face at least two problems in this respect. First, they are confronted with the dilemma between regulation focusing on nominal guarantees, on the one hand, and the real ambition of the pension plan, on the other. In order to reduce nominal mismatch risk, they should increase the nominal duration of their assets. This, however, increases inflation risk. The second problem faced by pension funds concerns the limited availability of both index-linked bonds and long maturity nominal bonds. Consequently, the duration of assets can be substantially increased only by means of swap strategies. This, however, increases short-term interest rate risk, as the short rate has to be paid in the swap transaction. As the short rate is more volatile and more asymmetric (positive outliers do occur, whereas at the lower bound nominal interest rates are always positive) than the long rate is, this introduces liquidity risks. As a result, the optimal reduction of the nominal mismatch risk is probably less than 100%. With respect to inflation risk, the supply of index-linked bonds is much smaller than the demand. Although the market for inflation swaps is rapidly increasing, it is not possible for large funds to get substantial protection. Moreover, as inflation risk is not disappearing in the swap transaction, and as the underlying market is of very limited size, it remains to be seen whether the counter-party risk in this swap transaction is still negligible once the protection is most needed.

5.3 Should policy ladders be based on it?

Pension funds in the Netherlands have two important targets: a nominal one that is guaranteed and an indexation ambition that is conditional on the funding position of the fund. With respect to the nominal guarantee,

it is natural to take the discontinuity approach of market valuation. As long as the market value of assets is higher than the market value of nominal liabilities, these pension rights can be transferred to a third party if desired. The solvency requirements of the Dutch supervisor are also based on the market value of this guarantee.

With respect to the real ambition of the pension plan, no guarantees are given. Since indexation is generally not fully funded, part has to be earned by taking investment risk. As indexation is only given if the funding position of the fund is good, day-to-day fluctuations in the market valuation are less important. Indeed, given that the funding of indexation is based on the long-run expected real return on the representative portfolio, the natural benchmark to evaluate the fund's position is a real funding ratio based on the same expected return. This way, existing total pension liabilities are valued the same as the new pension rights reflected in the cost-effective contributions. The fund can afford to take a long-run perspective, thereby exploiting time diversification aspects in asset returns and illiquidity premiums.

In order to keep the funding ratio of the pension fund more or less stable, many pension funds have introduced so-called policy ladders with respect to their indexation (and/or contribution) policy. Below a critical level of funding no indexation is given; above that level, indexation increases linearly in the funding level up to an upper limit, after which full indexation is given (and indexation cuts from the past might be made good). If the financial position of the fund is unfavorable, then the nominal guarantee is most important. Therefore, the lower limit of the policy ladders should ideally be based on the market-based nominal funding ratio (for instance, no indexation if the nominal funding ratio is below 100%). Moreover, as long as the fund does not fulfill the reserve requirements, the nominal guarantee is still at risk, so it makes sense to still reduce indexation. The upper limit of the policy ladders should therefore not be lower than the required nominal funding ratio of about 125%. Indeed, many pension funds nowadays use only these two limits on their indexation policy ladder.

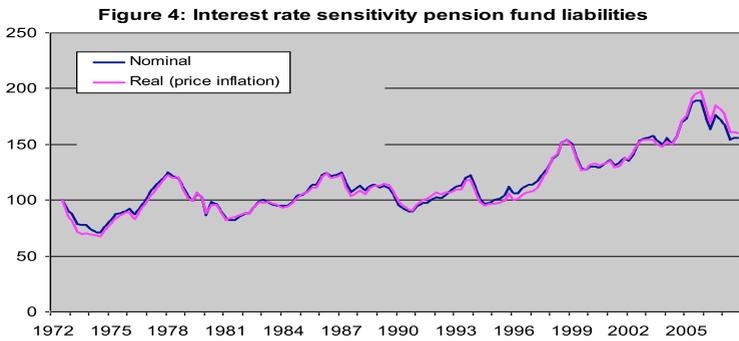
With respect to the upper limit, this policy might be too generous for current retirees. The focus of the long-term policy of the fund is the real ambition. It would therefore be rather strange to focus the adjustment mechanisms of the fund only on the nominal funding ratio. Full indexation should be given only if it does not seriously hamper the

probability of full indexation for future generations. A natural benchmark in this respect is to calculate a real funding ratio, based on the same discount rate as the one used for the contribution rate. After all, this rate is supposed to be sufficiently low to fulfill the ambition of the fund in the long run. Moreover, this ensures that new pension rights (in the cost-effective contribution rate) and old pension rights (in the current real-funding ratio) are measured the same way. If the funding ratio based on the same discount rate is less than 100%, then the fund starts at a deficit, and higher future returns are needed to get the same indexation results. Consequently, in order to be fair to future generations, the upper limit of the policy ladder should depend not only on the nominal funding ratio (to reflect the risk of nominal under-funding) but also on the real funding ratio (to reflect the real ambition). This real funding ratio should be calculated using the same fixed discount rate as the one used for the contribution rate (a conservative estimate of the long-run expected real return). Especially if inflation expectations rise, this supplementary rule will be binding, thereby protecting the younger generations.⁹

There are several reasons why we prefer the fixed discount rate real funding ratio above more market-based alternatives. First, the method ensures consistency between the valuation of old and new pension rights. Second, the conditionality of indexation is taken seriously. Given that the expected return on the optimal portfolio differs from the one on the liability-replicating policy, actively aiming at full funding based on certainty implies that the current generation has to build a huge implicit buffer such that future generations can pay (on average) less. In order to have a more equitable balance between generations, one can either aim at less than 100% full funding or work with a higher discount rate. Third, true market values are not available, as Dutch wage inflation deviates considerably from French or euro-zone price inflation. One of the dangers of using a fixed discount rate is that expected returns are set too optimistically. In the absence of market prices for real wage increases, this problem is only slightly alleviated by the use of market prices. Fourth, using more market values increases pro-cyclicality, as indexation cuts are most likely if real interest rates are low, and low interest rates are more likely in economic downturns. Fifth, as long as the duration of assets

9 The upper limit might be set at a real funding ratio of more than 100% to reflect the extra risk taken by the current contributors.

is not substantially increased, market-based real-funding ratios are more volatile than ratios based on fixed discount rates. More volatility in indexation is not appreciated. Figure 4 gives an impression of the interest rate sensitivity of pension liabilities. Sixth, market valuation is expensive, as it is likely to lead to negative correlation between the implicit saving rate of retirees and interest rates. Under market valuation, indexation cuts are more likely if interest rates are low. This means that more money is invested if the expected return on these investments is the lowest (exactly because the expected return is so low). Using a fixed discount rate, low real funding ratios are more likely if interest rates increase. This leads to a more efficient timing of indexation cuts.



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SUMMARY OF DISCUSSION

By Renxiang Dai

Panel paper: Market-consistent valuation of pension liabilities

By Antoon Pelsser and Peter Vlaar

Chairman: Henk Don (Erasmus University Rotterdam)

Discussants: Dirk Broeders (De Nederlandsche Bank) and Gaston Siegelaer (Towers Perrin)

Netspar panel: October 16, 2008

The discussion

The first discussant, **Dirk Broeders**, focused on the paper's argument that conditionally indexed liabilities should not be valued by market valuation, but should use a fixed discount rate that is lower than the market interest rate. First, he stressed the importance of market valuation by pointing out that this valuation method minimizes opportunities for manipulation, and thus helps the pension fund board to monitor the claims of various stakeholders in a fair and consistent manner. Thus, his stance was in favor of market valuation.

For valuation purposes, pension liabilities can be decomposed into a non-discretionary part and a discretionary part. In the debate on market-consistent valuation, the focal point is the discretionary liability: namely, the indexation that pension funds grant to participants contingent on the current financial situation on an annual basis. Broeders pointed to a recent development in legislation related to discretionary liabilities. Under the new legislation, the indexation ambition, financing and realization should be mutually consistent. Based on a stochastic continuity analysis, this new legislation requires pension funds to meet the following two conditions: (i) starting from the required funding ratio, the expected cumulative indexation should be "sufficient", and (ii) starting from the minimum required funding ratio, the pension fund should be able to recover within 15 years.

The second discussant, **Gaston Siegelaer**, criticized the two main points in the paper. The first point was that the market valuation of pension liabilities is inappropriate for contribution policy, for indexation policy and for pricing of inflation guarantees. The second point was that pension funds should communicate with stakeholders about the pension as a risk-sharing arrangement. Siegelaer argued that, similar to the case of *nominal* pensions, market valuation of *real* pensions could be achieved through an estimation of replication costs. From the sponsor's perspective, the replication costs consist of structural pension contributions and embedded options. A market-value-based ALM analysis could inform the sponsor about the true cost of pension contributions— and this is what sponsors are eager to know. In response to the risk-sharing argument, Siegelaer contends that a defined-benefit plan could be an intergenerational Ponzi scheme, which artificially increases the wealth of each generation, but is intrinsically unsustainable. In this case, again, a market-value-based ALM analysis could be applied to reveal the amount of wealth transfer among generations.

Siegelaer argued that the pension fund should consequently not use a fixed discount rate to determine liability value; doing so might cause ex ante wealth transfers among different cohorts of participants and among different stakeholders. Moreover, artificial stability cannot protect participants from adverse financial market movement. He maintained that risk management based on market-consistent valuation is an appropriate tool.

General discussion

In the general discussion, **Theo Nijman** (Tilburg University) related the authors' criticism of market-consistent valuation to the role of pension contracts and, more generally, to the role of the pension regulator. If the role of pension regulator were solely to ensure that pension contracts are honored, then the authors' criticism of market valuation would largely disappear. Their criticism could also be interpreted as a specific opinion regarding the duties of the regulator. In addition, Nijman welcomed some specific suggestions in the paper, such as changing the reservations of conditional pension rights from the solvency test to the continuity test of FTK. **Hans Schumacher** (Tilburg University) then observed that the core issue is not whether to compute the market-consistent value, but how to use the computed number. He suggested that an ALM-type analysis under

a stochastic control framework could shed new light on the discussion of the effect of strategies based on several possible indicators. **Lans Bovenberg** (Tilburg University) commented on the desirability of being more concrete with regard to how to use the market information in a more sensible way – for example, how to derive the fixed long-term interest rate on the basis of market information.

Authors' reply

At the end of the discussion, the authors responded to some of the comments they received during the discussion of the paper. Regarding the market valuation of conditionally indexed liabilities, **Antoon Pelsser** argued that conditional indexation leads to an interdependence of the liability value and the asset value, and thus leads to a feedback loop. This feedback loop makes the market valuation of conditionally indexed liabilities extremely difficult, in that with the loop, replication is almost impossible. Pelsser stressed the distinction between the “hard” pension liabilities (nominal pensions) and the “soft”, conditionally granted pensions. He contended that it is appropriate not to harden the soft part through applying market valuation to this part, and to treat the conditionally granted pensions as a risk-sharing agreement. **Peter Vlaar** observed that the regulator’s role involves the creation of pension rules. From that perspective, the regulator should be well aware of the consequence of changing pension rules.

... seen in the context of the recent financial turmoil

The discussion of this panel paper reflected, to some extent, the recent financial turmoil and its impact on pension funds. In their presentations, both discussants referred to implications of the recent financial crisis for pension funds, especially for the application of market valuation to pension funds. Dirk Broeders opined that mark-to-market captures both trends and white noises, but that white noises should not interfere excessively with policy actions. In the face of volatile financial markets, there is no call for panicked reactions or forced adjustment in investment policy. What will be key to pension funds will be long-term financial planning, and the ability of the pension funds to demonstrate that recovery can be achieved in the time period allotted by the pension regulation. Gaston Siegelaer asserted that the key issue in the financial crisis is not the high volatility, but the lack of confidence. As restoring

confidence requires transparency, market-consistent valuation may help by making the hidden deficit and reserve explicit and by revealing risk exposure. For pension funds, he suggests that market valuation should be applied to reveal the market value of conditionally indexed pensions and of wealth transfer among different cohorts of participants. In the general discussion, finally, **Bas Werker** (Tilburg University) questioned which measure of pension fund risk taking should be applied.

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