



## NETSPAR'S ACADEMIC RESEARCH PROGRAM 2015-2019

### 1. Introduction

Major uncertainties impact today's economic and social developments in the Netherlands and Europe. Particularly hard to project are individual life events (job market career, death of a spouse, divorce, disability, health care needs) life expectancy and developments on financial markets. Dealing with these inherently quite different uncertainties in an effective manner will largely determine the success or failure of the institutions providing old-age insurance. The complexity caused by these uncertainties depends also on their effects on, and interactions with, individual household decisions in labor and financial markets, social relationships and policies of pension funds, other financial institutions and governments.

The ambition of Netspar's academic research programme is to understand the main drivers and responses to the uncertainties that are challenging the societies in which people live substantially longer than in the past. What are the main determinants of longevity, morbidity, disability, social integration, health and wellbeing of the retired population as well as the returns on assets? This calls for more adequate modelling of uncertainty in life expectancy and financial markets, as well as of the responses of individuals and institutions on labor and financial markets. Using the insights gained from the research in this programme, pension providers will be able to tailor their products to increased heterogeneity in preferences and household composition without losing the benefits of collective systems. The research programme will also provide answers on how to build pension systems that optimally share risks across generations while at the same time dampening macroeconomic fluctuations. Moreover, pension funds and governments will be supported in developing financial instruments and tax regimes that optimally share systematic risks such as wage inflation and longevity. Last but not least the research program will indicate how pension products and institutional arrangements can be better aligned with the needs and preferences of individuals related to housing and health care provisions.

The research program is structured in four themes. The research program deals with micro uncertainties that the individual faces surrounding longevity, health and life time events (theme 1), and with macro uncertainties on financial markets (theme 2), but also considers the effects on individual decisions e.g. on labor and financial markets (theme 3), and governments and pension funds (theme 4):

1. *Uncertainties on longevity, health and life time events and their financial impact.* This theme combines insights from economics, demography, actuarial science and epidemiology to explain past developments in longevity and health expectancy, to predict future trends and uncertainties, and to investigate consequences of these trends for the provision of income and insurance geared to the needs at old age. Likewise the consequences of life time events, including job changes and housing decisions, will be considered.
2. *The financial economics of pensions, aging and retirement.* This theme investigates financial markets and institutions. It explores optimal and actual individual decisions on pension saving,

investment and insurance, taking a broad perspective including saving for long term care and housing wealth.

3. *Individual behavior: retirement preparation and the labor market for older age groups.* Using innovative micro data this theme employs insights from economics and psychology to explain individual behavior in labor, saving for old age, and financial markets, and how this can be influenced by communication.
4. *Macroeconomic redistribution and risk-sharing.* This theme aims at an integrated analysis of how pension systems and tax-transfer systems – including long term care and housing wealth - impact redistribution and risk-sharing across and within generations.

## **2. The structure of the program**

### *Major individual and economy-wide risks...*

Various uncertainties impact economic and social developments in Europe. Individuals face a large number of life time risks, including uncertainty about their career pattern, marriage and divorce, health, disability, and time of death. A longstanding trend affecting all generations is aging. Its magnitude, however, is surrounded by substantial uncertainty. Life expectancy is particularly difficult to project. In addition to demographic risks, other systemic risks (such as financial and political risks) impact the institutions providing old-age insurance in Europe. Indeed, also the global financial crisis that gave rise to serious fiscal problems in Europe challenges the sustainability of the European welfare states as we know them today. To relieve the burden on their pay-as-you-go pension systems in the face of increased longevity, several European governments are raising statutory retirement ages—but it is unclear to what extent individuals are able and productive enough to work longer in the face of increased longevity. Several countries are also introducing and extending private, funded components in their pension systems. This shift raises the importance of financial market risks for old-age insurance. Increased individual heterogeneity in preferences and household composition is another impetus for the development of more private pension provisions that give households more individual discretion over their specific arrangements for old-age insurance.

### *...challenge individual households and public and private institutions*

The aggregate uncertainties described above raise the question how private individual households respond to these trends in their decisions on the labour market (e.g. retirement decisions) and the financial markets (e.g. savings, portfolio and insurance decisions). Whereas European countries are delegating more responsibility for old-age insurance to the private households, many of these households seem to lack the basic financial knowledge, ability and willpower to implement optimal financial planning. Indeed, financial decisions often give rise to major governance problems, as financially illiterate individuals have difficulty disciplining providers of financial services. Furthermore, financial markets suffer from various imperfections. The financial crisis has provided ample new evidence for this. These behavioral and market imperfections call for institutions beyond markets, including private institutions such as pension funds and insurance companies as well as public institutions such as supervisors and publicly designed and financed pension and long term care programs. Also social institutions such as households, families, neighborhoods and social networks can play a role in protecting the elderly. This raises the question of how these private and public institutions respond to the described aggregate trends and risks.



## Research questions and program overview

*The research program starts with uncertainties surrounding life time events, longevity, health, need for care...*

This research program takes up the most important research questions that are raised by the above-mentioned challenges confronting European welfare states. The starting point for the program is an assessment of the main micro and macro risks that impact citizens in Europe and the world at large. By combining insights from demography, actuarial science and epidemiology, we explain past developments in longevity and health expectancy of distinct groups in various countries, predict future trends and quantify uncertainties. Likewise, the determinants of life time events such as disability and divorce will be modelled.

*...and financial markets,*

Another major macroeconomic uncertainty is the development of asset prices and interest rates on financial markets. Just as in the case of longevity developments, the academic challenge here is to develop better models to project these uncertain trends and describe the uncertainty surrounding them. In the aftermath of the financial crisis, researchers are reconsidering the traditional paradigm of diversification of investments in frictionless markets. Among other things, the crisis has shown that in extreme events risks are correlated and assets are exposed to liquidity risks.

*.....but also considers the individual life time events and the effects on individual decision making,....*

The next step in the research program assesses how these life time events and the macro demographic and economy-wide developments impact individuals and individual decision-making on financial markets and labor markets. Exploring individual decision-making has become important now that governments are delegating more responsibility to individual households for their old-age insurance. The research program aims at understanding how individuals make their decisions in labor and financial markets as well as the causal mechanisms driving their wellbeing. Our research pays particular attention to individual heterogeneity because this is in fact a major impetus for delegating more decisions to individual households. A part of our research focuses on optimal life-cycle behavior of individuals in terms of saving, portfolio behavior and old-age insurance, including long term care. Another part explores how people actually do behave. This may differ from optimal behavior because financially illiterate individuals suffer from various behavioral biases. The gap between optimal and actual behavior also raises the question how institutions such as pension funds, insurance companies and the government can help individuals reach more optimal decisions closer to the optimal decisions or can implement optimal decisions on behalf of households.

Also social relationships may protect people in old age. In the face of an extended retirement period, social integration of the retired population is increasingly important for both the elderly themselves and society at large. While contributing to active and, healthy aging and informal help, social integration is also a condition for receiving this informal help when an older individual needs it. We pay particular attention to differences in social integration across various European countries and heterogeneous groups. We also investigate the consequences for individual wellbeing during retirement.

*...and governments, insurance, and pension funds*

Our research studies also how institutions like governments and pension funds respond to the macroeconomic uncertainties identified above. A potential strength of these latter institutions compared to financial markets is that they can share risks across non-overlapping generations, redistribute within and across generations and conduct macroeconomic stabilization. Despite the increased role for financial markets and increased funding of pensions, European governments thus continue to play an important role in old-age insurance. We investigate how governments and pension funds can enhance intergenerational risk-sharing. In particular, we explore whether governments can facilitate private pension provision by providing new financial instruments (such as bonds linked to wage inflation or longevity), reinsurance of private schemes or tax benefits. We also analyze the optimal design of redistributive tax-transfer systems and pay-as-you-go pension systems in aging societies. As regards macroeconomic stabilization, we investigate the optimal design of redistributive public pensions and cyclical behavior of pension policies.

#### **Ambition**

The ambition of the Netspar-consortium is to create a scientifically sound base to restructure old-age provisions. This base should provide more detailed and specific scientific insight on:

1. the main drivers and trends of micro and macro risk factors such as morbidity, disability, longevity and returns in financial assets;
2. adequacy of income during old age, taking a broad perspective, including long term care and housing wealth;
3. adequate modeling of risk and uncertainty both in financial markets and in life expectancy and in life time events;
4. new approaches to handle parameter and model uncertainty in modeling such key variables in intrinsically uncertain environments;
5. the response of individuals and labor markets to increased statutory retirement ages and increased longevity;
6. how providers of long-term financial services can address financial illiteracy of individuals in a socially responsible manner;
7. how private pension providers and governments should deal with increased heterogeneity in preferences and household composition without losing the benefits of collective systems;
8. how pension systems optimally share risks across generations and how pension systems can help dampen macroeconomic fluctuations;
9. how tax regimes should be geared to optimal saving for old age;



## 1. UNCERTAINTIES IN LONGEVITY, HEALTH AND LIFE TIME EVENTS AND THEIR FINANCIAL IMPACT.

### 1.1. The financial impact of life time events

Retirement income of private households is often strongly affected by several types of major life time events, concerning the composition of the household (such as marriage or divorce) or labor market shocks such as variation in earnings and deviations from the expected earnings career, the loss of a job and unemployment of one of the earners in the household, transitions between wage employment and self-employment, or a work limiting health shock leading to reduced earnings and, possibly, disability benefits.

*How will financial resources and needs of the older population develop under different scenarios?*

Financial wellbeing of the current and future elderly is studied extensively in ongoing Netspar research, using micro-simulation models and register data on income, wealth, and, in the future, also pension entitlements (as well as labor market transitions and demographic variables) obtained from Statistics Netherlands. See, for example, Knoef et al. (2013a,b) who analyze the adequacy of future pension income under many different scenarios, and Kalwij, Alessie and Knoef (2013), analyzing the relation between income and mortality. This research also has an internationally comparative component, as part of an OECD project where pension adequacy in several countries is studied using similar methodologies. This research takes a broad perspective on income and needs at old age, including long term care and housing.

The consecutive generations of these models incorporate more and more realistic features of the actual choices and life cycle events of Dutch individuals and households, including the micro risks referred to above. While the standard models assume that many things remain constant over the remaining life cycle, the more advanced micro-simulation models that are being developed will work with transition probabilities that account for the life time risks. This makes it possible to account for the uncertainty due to life events in the projections of pension income and its purchasing power under various macroeconomic scenarios and under different policy reforms. It will make it possible to get better insight in the future distribution of retirement income and the standard of living of the older part of the population. Moreover, it will make it possible to quantify how much risk is due to, for example, unemployment risk. These issues can be studied at the individual level (what if the standard of living in retirement will fall below a certain threshold, with and without accounting for certain life time events) and at the aggregate level (how much of the heterogeneity in replacement rates is induced by unemployment risk?)

*What are the households' own retirement expectations, how do they relate to objective forecasts, and do the expectations affect actual preparation for retirement?*

Netspar has funded data collection on retirement expectations in the Netherlands and these data have been analyzed in several studies (e.g., van Santen et al., 2012; De Bresser and van Soest, forthcoming). In future research it will be useful to link the administrative data to survey data on the individual's own subjective expectations of retirement age and income. This line of research is vital to

understand the micro consequences for heterogeneous individuals of recent adjustments in the maximum accrual rate (e.g. the Dutch Witteveen kader) and adjustments in the pension contracts. Will individuals adjust their replacement rate and retirement age expectations and if so, will they also respond by, for example, adjusting third pillar savings for retirement?

*How do pension reforms affect wellbeing of the elderly?*

Wellbeing of the elderly focuses not only on economic status but also on housing, health and psychological wellbeing, inter- and intra-generational transfers, social contacts, time use and daily activities — the various dimensions of social inclusion (Devicienti and Poggi, 2013; Giambona and Vassallo, 2013). For those younger than about 70, also formal work and other socially productive activities matter. Attractive working conditions and socially productive activities after retirement can contribute to higher wellbeing. At older ages, physical and mental health problems are often a growing concern, increasing the need for adequate housing and formal and informal health care. Measuring and evaluating the various domains of wellbeing has received a lot of attention since the Stiglitz, Sen and Fitoussy (2010) report, and will be high on the future research agenda. Researchers have become more interested in how retirees spend their time and how this influences their quality of life (see, e.g., Stancanelli and van Soest, 2012). Time use is particularly relevant around the time of retirement, since an increase in the time spent on household production may explain the stylized fact that consumption expenditures substantially fall upon retirement. The role of pension adequacy for time use and wellbeing after retirement seems particularly important here, since they may have a direct effect through consumption and financial wellbeing as well as indirect effects through daily activities, living arrangements, or affordable care. Future research will similarly explore how adequate pensions contribute to wellbeing in nonfinancial domains, measured as satisfaction with domains of life such as social contacts, daily activities, and health, and how pension policies affect not only financial wellbeing but also wellbeing in other domains.

## **1.2. The impact of uncertainties in the date of death**

One of the main risk factors in pension planning obviously is the uncertainty in the date of one's death, or that of one's spouse. In many countries pension provision is based on targeted decumulation of financial wealth without insurance against the individual survival risk. Annuities on the contrary provide a life time income and insure against this risk. It is of importance first of all to understand the financial risks that are taken by not insuring longevity risk, e.g. for those with pension provision through bank saving or ownership of real estate or a firm in the Netherlands. A subsequent question is how proposals to relax the restrictions on decumulation of pension wealth would affect the impact of this risk.

These questions are directly related to several other issues.

*What new pension and insurance products would help individuals?* Knowing that individuals are limited in executing the optimal financial policies, an obvious question arises: can we design new financial products that offer a practically feasible simple near-optimal solution? An example of a newly developing market are life-cycle funds, which replicate an investment strategy in which the risk

exposure varies with age, consistent with the life-cycle advice that households should reduce their risk over time. Further innovative products aim at converting housing wealth into liquid retirement income. The large literature on annuity markets (e.g., Davidoff et al. 2005) has shown that the design of successful products and markets is not easy and depends on numerous demand and supply factors. *What are the costs of suboptimal investment behavior and of insurance mistakes?* The optimal policies derived from life-cycle models are often at odds with standard investment advice, and the costs of suboptimal policies are often non-trivial. Calvet et al. (2007) provide evidence that a substantial fraction of Swedish households is underdiversified or non-participating in financial markets, while another group may be over-exposed to risk. Campbell (2006) documents that it is primarily the poor and unsophisticated households that make mistakes. Kojien et al. (2012) provide a measurement of the total costs of insurance mistakes using data from the Health and Retirement Study, and show that the costs are large and can amount to about 25% of total wealth.

*Should retirement income be paid out as an annuity or (partly) as a lump sum?* Many Netspar researchers (e.g., Kojien, Nijman & Werker 2011) have analyzed how to optimally design the decumulation of pensions, which now varies from taking pure lump sums at retirement (Australia; DC plans in many countries) to specific monthly income streams until death (Netherlands, DB plans in the US). As very few individuals voluntarily purchase annuity products (e.g. Büttler & Teppa 2007), it is important to analyze the pros and cons of mandatory conversion to annuities at a certain age. Such a requirement exists in the Netherlands, has just been abolished in the UK, and has many advocates in the US policy debate, arguing that it is at least a good default option.

*What is the relation between health risk, long term care and retirement wealth?* Health risk is an important source of uncertainty for everyone. Uncertainty regarding one's future health affects many choices, including retirement saving decisions and wealth allocation. Several studies show that high health risk is associated with lower proportions of wealth invested in equity as well as a decrease in labor supply (Rosen & Wu 2004; Berkowitz & Qiu 2006). However, there are important questions about health risk that remain unanswered. How damaging are health shocks for retirement wealth? Do healthcare institutions shield people's retirement wealth against health shocks? The findings will improve our understanding of the health-related factors that could put people's pension savings at risk. This will in turn help pension funds to design products that can protect their affiliates against these risks. This will also provide insights into the relationship between public health and healthcare policy (which invariably affects the demographic developments in a country) and pension incentives and design.

### **1.3 Uncertainty in future survival probabilities**

Increased longevity poses great challenges to the welfare state, not only by threatening the sustainability of pension systems, but also by inducing a greater demand for social services, including health care (Koopmanschap, De Meijer et al. 2010). While a continuation of the increase in longevity is generally taken for granted, considerable uncertainty exists about the speed with which longevity

will increase in the next decades. For example, three recent projections of life expectancy at birth for the Netherlands in the year 2020 vary by about two years (Peters, Nusselder et al. 2012).

This uncertainty partly reflects a lack of understanding of the main drivers of increased life expectancy. Life expectancy is a highly aggregate measure that reflects underlying trends in mortality at many different ages and from a range of different causes of death, each of which have their own determinants (socioeconomic conditions, lifestyle factors, health care innovations, ...). Trends are often poorly understood, as is illustrated by the case of the Netherlands, where a slowdown in mortality improvement occurred during the 1980s and 1990s (Nusselder & Mackenbach 2000), followed by a sharp upturn since 2001. It has been shown that the stagnation could partly be attributed to cohort patterns in smoking (Janssen 2005) and that the upturn is likely to be due to expanding health care for the elderly facilitated by a sudden relaxation of budgetary constraints (Mackenbach, Slobbe et al. 2011).

A second and equally fundamental reason for uncertainty about future increases in longevity is the failure of previous attempts to forecast life expectancy. During the past three decades demographic projections have systematically underestimated realized increases in life expectancy, and the accuracy of the projections has not improved (Keilman 2008). More importantly, there is no consensus within demography, actuarial science, epidemiology or any other discipline about what the best method for projecting life expectancy is. Basically, there are three groups of methods: expectation (projection on the basis of expert opinions), extrapolation (projection on the basis of time-series analysis) and explanation (projection based on causal modeling) (Booth & Trickle 2008). While expectation methods are generally considered inferior, and consensus is building that extrapolation methods may be better than explanation methods, many questions remain. For example, it is still a matter for discussion whether and how determinants whose mortality effects can be projected with reasonable certainty (such as smoking histories and educational achievement) should be taken into account. This “model uncertainty” adds importantly to the “longevity risk” of pension systems.

While the consequences of an estimated increase in longevity for the pension and health care systems are qualitatively evident, they are quantitatively uncertain. Part of this uncertainty arises because of our lack of understanding of the relationship between life expectancy and health expectancy (i.e., the number of years one can expect to live in good health, e.g. free of chronic disease or disability). Does longer life expectancy go together with living longer without disability, or with surviving longer with disability (Nusselder 2003; Mackenbach, Nusselder et al. 2010)? This will affect whether higher ages of retirement are feasible, because exit from the labor force partly depends on the prevalence of health problems around retirement age (Mayhew 2009; Majer, Nusselder et al. 2011). Similarly, the extent to which increased longevity will increase health care expenditure largely depends on underlying trends in ill-health (De Meijer 2012). The relationships between longevity and labor force participation and health care utilization actually run in two directions. Higher life expectancy may necessitate a longer working life, but a longer working life may in its turn increase life expectancy (Burdorf 2010). Similarly, living longer may imply more health care utilization, but more health care utilization may also increase life expectancy.



Finally, there are important questions about the distribution of increased longevity and its consequences. Increases in longevity are not equally shared between subgroups of the population. In contrast to earlier periods, current increases in longevity are concentrated in the higher age-groups (Cutler & Meara 2004; Vaupel 2010), which may lead to a further shift of the distribution of health care and pension costs from the young to the old. Due to faster increases of life expectancy among men, the gap between male and female life expectancy is partly closing in many countries (Mesle 2004), which may reduce the imbalance in health care and pension expenditure between the sexes. Depending on whether life expectancy increases are relatively slower or faster in the lower than in the higher socioeconomic groups, socioeconomic inequalities in longevity will widen or narrow, which may change the distribution of health care and pension costs between socioeconomic groups. With the costs of health care and pension systems continuing to rise, the distribution within the population of the contributions to and benefits from the health care and pension systems will become increasingly important for policy making, but as even current distributions are partly unknown we are faced with considerable uncertainty on these issues as well.

The Netspar research program will aim to reduce these uncertainties by (a) improving our understanding of past trends in life expectancy, (b) developing an approach for projecting life expectancy that makes best use of our understanding of past trends and quantifies model uncertainty, (c) improving our understanding of the links between life expectancy and workability, and (d) improving our understanding of the distributional consequences of increased longevity for the health care system.

## 2. THE FINANCIAL ECONOMICS OF PENSIONS, AGING AND RETIREMENT

In an increasing number of countries, pension provision relies significantly on wealth accumulation during the working life and wealth decumulation during retirement. Wealth accumulation is not necessarily required to generate pension income, as some components of pension systems can also be designed as “Pay as you go”, whereby the current workers pay the pensions of the current retirees. Whereas PAYG systems are quite vulnerable to demographic changes and fiscal deficits, funded systems are sensitive to shocks in financial markets. Optimal pension systems, as advocated by the Worldbank, balance the risks and contain both funded- and PAYG elements.

Whenever a pension system has funded components, retirement income becomes dependent on risk and returns on financial markets. This dependence leads to a range of questions related to saving and investment of the accumulated wealth. One should decide how much money to accumulate during the working life, how to invest it, and how investment and insurance risks are to be shared with others. All of these decisions are conditional on our understanding of the behavior of interest rates, stock prices and returns for other financial asset classes. The first goal of the research agenda of this theme is therefore modeling the uncertainties in financial returns and their relation with macroeconomic developments.

The second goal of the finance theme is to analyze the implications of financial market opportunities and risks for decisions on adequate pension saving, investment and decumulation. Life-cycle models derive optimal savings and investment decisions given assumptions about returns on financial markets, individual preferences and labor income. The standard models imply that young people should hold a large proportion of their financial wealth in equity, and gradually reduce their investment exposure as they become older. Investments in equity are attractive in these models for three reasons: the large historical equity premium, mean reversion in equity returns making them less risky for long-term investors, and limited human capital risk.

Current research considers optimal risk management in more realistic settings that account for heterogeneity in individual preferences, human capital risks and other illiquid wealth components such as homeownership. The challenge is to understand the large discrepancies between the normative prescriptions on optimal decisions and actual household behavior as studied in microeconomics. The discrepancies are due to a combination of behavioral biases, limited financial literacy, poorly understood preferences and inadequate models of financial returns. Each of these four potential explanations gives rise to new research questions: (i) What are the costs of financial mistakes? (ii) What simple standardized products could be near optimal without requiring financial sophistication? (iii) How could communication about pensions be improved? (iv) What are essential improvements in financial models? (v) How do these new models affect common advice on savings and investments? Questions (i)-(iii) are strongly related to the individual behavior research theme in this proposal. Question (iv) is the first goal on the research agenda of the finance theme. Question (v) leads back to the normative portfolio choice of life-cycle models.

Most capital invested in financial markets is not invested by individuals, but flows through the hands of investment managers. Professional portfolio management may alleviate the problems of inadequate

financial decisions of households, but the use of professional managers also involves costs in managing, monitoring and supervision. This line of research aims to develop approaches to balance the costs and benefits of professional asset management. What are adequate institutional arrangements, how to organise supervision, how to monitor the performance and risk-taking of the managers? Since evaluating the investment process of pension funds requires an understanding of financial market returns, there is a direct link to the first part of the research agenda of this theme.

Pension plan designs differ markedly across the world, from pure defined-contribution (DC) plans to pure defined-benefit (DB) plans. The academic literature suggests that the best pension contracts are hybrids between DB and DC. One of the advantages of these contracts is that pension funds can pool the individual assets to share and reallocate risks among the fund participants. This creates internal markets that make up for insufficiently developed financial markets to hedge macroeconomic risks of inflation and longevity. Much is still unclear on the optimal design of these hybrid pension plans: How much intergenerational risk-sharing is desirable? What alternative risk-management strategies and contracts are optimal if contributions and sponsor guarantees cannot be used as a mechanism to reduce risk?

The finance research agenda faces several methodological challenges. Estimating risk and return in financial markets requires development and application of advanced econometric techniques. While firmly rooted within the efficient markets paradigm, understanding the trade-offs between risk and return builds on models that go well beyond the standard analysis to incorporate tail risk and changing correlations, illiquidity and other frictions, and deep links with macroeconomic risks. Research is now also aware that even the model itself is uncertain, which affects thinking about contract design, supervision and household advice. Understanding behavior of financial institutions requires further advancement in economic theories of agency costs and supervision. Lastly, learning about actual behavior of households and pension funds calls for exploration of new data sets. Details on methodology will be included in the discussion of specific research questions on the three main topics: the dynamics of financial markets; management of pension plans; and optimal individual investment and insurance choices.

## **2.1. The dynamics of financial markets**

The turmoil of the recent recession has underscored the importance of understanding and managing the risks in financial markets. Our focus is on different risk characteristics such as volatility, tail risk and liquidity risk. The aim is to understand the time-varying correlations among multiple risks and their relation with expected returns. This part of the Netspar research program overlaps with some of the main research questions in asset pricing in general. The research program covers e.g. the following topics:

*How to make long-run predictions and how uncertain are these?* Whereas most early models concluded that equity investments are less risky for long-term investors, recent literature claims that long-run risk of equity has been underestimated. Pastor and Stambaugh (2012) obtain much higher long-run risk estimates due to uncertainty about the average long-run return. Using different

techniques, Hoevenaars et al. (2013) reach similar conclusions for other asset classes. A problem with both studies is that they derive the long-run risk estimates from models designed to fit the short-term predictability of returns. What is needed is the separation of the low frequency movements (relevant for long-run average returns and long-run risk) and the short-term dynamics (relevant for dynamic trading strategies). An early example in this direction is Schotman et al. (2008), where the persistence is estimated semi-parametrically. New econometric techniques for estimating confidence intervals for long-term growth rates are currently being developed (e.g. Müller & Watson 2013). Our research aims to contribute to the development of these techniques and to apply them to long-run returns in financial markets.

*What are the risks of illiquid investments?* It is often claimed that long-term investors are well positioned to invest in illiquid assets (such as private equity, real estate and infrastructure). Whereas these assets are more risky because they are difficult to trade, they may also offer a higher expected return in the form of a liquidity premium. A problem with assessing the risk of illiquid assets is the absence of market prices. Driessen et al. (2011) make methodological advances in this area that enable them to quantify the premium and exposure to market risk for private equity. Other forms of illiquidity relate to market conditions. Whereas markets for interest rate swaps and credit risk are mostly very liquid, the liquidity may dry up quickly in crisis periods, creating substantial funding problems for financial institutions. Liquidity issues are equally relevant at the household level—for example, when much of retirement wealth is in the form of a house. Deeper issues that require much more research are the relations between liquidity risk and other financial and real risks, since these often appear to occur simultaneously.

*How do returns correlate with each other and with macroeconomic factors?* Correlations change over time. We have learned much about correlations among a limited number of asset classes only. Examples include Driessen et al. (2009) for correlation risk in equity markets, and Baele et al. (2010) for the correlation between stocks and bonds. There is as yet no coherent view on risk, liquidity and co-movement across asset classes and geographic regions. Recent papers (e.g. Asness et al. 2012) have begun to search for global pricing factors across asset classes. This research aims at identifying shocks that are truly aggregate and thus have implications for asset pricing more broadly. In this respect, Kojien et al. (2012) show that the carry of a security, which equals the forward discount, predicts returns across asset classes, while the dynamics of carry relate to local and global business cycles and are highly correlated during global recessions. As the risks are clearly linked to macroeconomic developments, there is a clear link to the proposed macro research here.

Learning more about joint occurrences of extreme events in different assets and/or different countries may fruitfully benefit from the combined use of high frequency financial data and extreme value analysis. Extreme value analysis has become common ground in the analysis of tail risk in financial markets (see, e.g., Embrechts et al. 1997). Stylized facts are that sharp falls in asset prices are “fat-tailed” and that extreme market risks co-move. In analogy to “realized” volatility or “realized” correlations, one may develop realized versions of co-crash probabilities (across sets of assets, markets). High-frequency data may be used to address causality issues relating to phenomena such

as financial contagion. Given the speed at which information is absorbed into current-day financial market prices, it is to be expected that contagion happens within the same trading day.

## 2.2. Investment management by pension funds

The second part of the research agenda of this theme concerns the questions regarding the performance, management, supervision, investment decisions and pension contract design of pension funds and insurance companies.

*What type of pension contracts can improve intergenerational risk-sharing?* The risk for participants in a collective pension fund depends crucially on the investment strategy of the fund. Risks may be reallocated within the fund such that young participants have different exposures to investment risk than older and retired participants, consistent with the implications of the life-cycle model. Since explicit forms of the new types of pension contracts are relatively recent, not much research has been done on the optimal design of the contracts. Gollier (2008) develops a stylized model in which the optimal contract has two elements: setting both the benefits at retirement as well as the investment in risky assets equal to fixed percentages of the sum of current financial assets and the present value of expected future contributions. Gollier (2008) already acknowledges that implementation of this first-best rule raises many issues. First, even though aggregate welfare is maximized ex-ante, ex-post there will be young cohorts who will not voluntarily enter the fund at times when the financial assets of the fund are low. Exactly how much underfunding is sustainable is not clear. Cui, De Jong and Ponds (2011) provide some rough calculations that this may be in the order of 10%, but informative results require a richer model. Sustainability may therefore require minimum return guarantees leading to a nonlinear payout scheme and requiring option-pricing techniques to project and value benefits for different cohorts.

A second problem is that the first-best solution requires a balance sheet containing the present value of future contributions. As this is not a regular balance sheet item, it will involve issues with the supervisor. A further challenge is what happens if more risks are added. The basic model assumes the simplest possible model with equity returns that are uncorrelated with any real economic risk. What investment strategies will be optimal for the risk-sharing pension contracts given more realistic financial market models? And how does this affect the optimal pension contract? This also raises questions as to how risk transfers can be priced, lacking complete financial markets. Reliable valuation will be essential to allow portability of pension wealth when participants change jobs and to enable collective pension systems where contract adjustments do not imply changes in economic value.

*How do pension funds perform?*

One question here concerns the actual risk exposures of pension funds. The strategic asset allocation literature reveals much about optimal dynamic portfolio strategies and exposures to common

benchmarks. But do pension funds follow these benchmarks? A DC-type fund, for example, may wish to exploit the mean reversion of equity markets, in which case we would expect that the fund would not decrease its equity holdings following bad equity returns. If investments are liability-driven, however, we would expect some portfolio insurance type of behavior. Theoretical models (e.g., Ang et al. 2012), predict that funds start to take on more risk when their funding ratio is either far above or below the fully funded situation.

A second set of questions relates the costs of delegated portfolio management. This question involves understanding the importance of agency problems in investment management. Pension funds allocate large amounts of capital, thereby making it necessary to delegate some of the decision making to specialized investment managers. The board allocates mandates to individual managers, who then construct their specialized portfolios. Due to this multi-step portfolio selection, the fund is not optimally diversified. Lastly, in delegating capital to investment managers, the CIO may be uncertain about the managers' ability and risk preferences. Binsbergen et al. (2008) show that the costs arising from the decentralized structure of many institutional investors are non-trivial and that this organizational structure can introduce inefficiencies of scale. The aim of further research is to quantify and understand the implications of the organizational structure and investment mandates on the performance of institutional investors. This includes the design of optimal compensation contracts, investment benchmarks and risk limits. Cremers et al. (2009) demonstrate how appropriately designed director incentives can improve performance in mutual funds, while Blake et al. (2013) provide some first direct estimates for UK pension funds. The current models are highly stylized, and it is insufficiently clear which frictions matter quantitatively in realistic settings. For an empirical study we will use the CEM database, which provides extensive coverage of pension fund investments over a wide range of asset classes including alternative assets. All asset classes are different and require devotion of monitoring capacity and distinct knowledge. With the data we can examine the role of fund (dis)economies of scale and the role of investment approach on pension fund performance.

### **2.3. Optimal individual investment and insurance choices**

Since the Campbell and Viceira (2002) textbook treatment of this literature a decade ago, the underlying models have become progressively richer and account for a variety of macro and idiosyncratic risks associated with inflation, housing and mortgage financing, labor income, asset markets, and health- and life expectancy. Many of these developments have been at the core of recent Netspar research, for example, Koijen, Nijman & Werker (2010, 2011). The important next step in this agenda is the confrontation with the microeconomic results on actual household behavior. In this line of research it is also vital to understand the implications of less standard assumptions on individual preferences such as habit formation and loss aversion.

Models have become much more complicated, but still explore limited forms of household heterogeneity or restrict attention to a few risks at a time. Realistic life-cycle models should also include the interaction between the various risk factors. A big problem is that solutions tend to be quite complicated and sensitive to specification details. “Optimized” strategies may perform far from optimally under slightly different parameter values. Diris et al. (2011) provide examples where complicated optimized rules do not outperform simple myopic rules out-of-sample. It would be valuable to develop robust solutions—that is, fairly simple heuristics—that are near-optimal and not overly sensitive to specific parameter values. Such strategies may be helpful in developing default options for pension schemes.



### **3. INDIVIDUAL BEHAVIOR: RETIREMENT PREPARATION AND THE LABOR MARKET FOR OLDER AGE GROUPS**

To meet the future challenges of the aging population, it is crucial to understand preferences, opportunities and decision processes that drive decisions on labor supply and retirement as well as savings and portfolio choices aimed at guaranteeing financial wellbeing in case of unforeseen life time events after retirement. This particularly applies in the current institutional environment in which many countries increase flexibility for households but also shift the responsibility for life time risks and for old-age financial security to individual households. This theme analyzes the heterogeneous behavior of individuals and households to get a better understanding of how people make their decisions, how and why these choices vary across different groups, how they affect wellbeing in older age, and how the decisions can be influenced by public policy. Understanding decisions at a micro-economic level is key to analyzing the functioning of institutions and markets and to understanding the consequences of economic and non-economic policies. The program accounts for the recent change in paradigm that the traditional economic view of a homo economicus (making individual rational decisions in isolation from other agents) no longer applies. Agents often make suboptimal and time-inconsistent decisions based upon behavioral rules and irrational expectations, and cannot be isolated from their households and social networks. While theoretical work in these areas has advanced substantially over the past decades, empirical work is lagging behind. This program focuses on applied empirical work.

The main methodological innovation of the program is the combination of up-to-date economic theory, new and original data with advanced econometric models and techniques specifically designed to address the relevant research questions. The program merges longitudinal survey data and administrative data from various sources, adds innovative survey questions and experiments to large-scale socioeconomic surveys representative of broad populations, and develops rich econometric models that account for heterogeneity in preferences, opportunities and expectations. The increasing availability of harmonized data in various countries makes it possible to exploit variation in institutions such as pension and social security systems across countries. Netspar aims to play a key facilitating role by supporting the collection and use of new survey and administrative data in various ways. This empirical approach creates unique opportunities for breakthroughs in understanding heterogeneity in behavior in societies characterized by large variation in institutional arrangements, socioeconomic characteristics, cognitive skills, health, financial literacy and motivation, helps us to approach important research questions that could not be adequately addressed without these data and methods.

The program will focus on several broad themes: (1) labor-market issues for the older age group; (2) financial preparation for life cycle events and for retirement; (3) housing investments and their relation to life cycle risks and to preparation for retirement (4) the impact of out of pocket health care expenditures. These themes are relevant for society but have also received ample attention in the recent scientific literature. Whereas theoretical models have been developed, thorough empirical work on testing these models and estimating their parameters is lagging behind. By combining innovative data collection and empirical modeling, we expect important breakthroughs in the empirical knowledge in this field.

### 3.1. The labor market and older age groups

Retirement and labor-supply decisions of older workers are core issues in micro-economic research and involve the key policy concern how to raise the labor-force participation of elderly workers. There is common agreement that financial incentives in pension systems and tax rules play a major role, but other factors also matter (quality of work, social networks, health, and peer group behavior). Labor demand is important as well, particularly when policies successfully increase labor supply — demand will then have to adjust to the increasing supply. This raises research questions such as: How can the productivity of older workers be maintained? Which demand-side adjustments will be necessary, concerning, e.g., hiring policies, wage costs, training of older workers, accommodating workers with a health problem, and facilitating gradual retirement?

*Which factors determine retirement and labor supply of older workers?* One of the most-studied topics in the economics of aging is the sensitivity of labor supply and retirement decisions for financial incentives. See, for example, Gruber and Wise (2004), who investigate the links between state pensions and labor-force participation in 12 OECD countries and find a close correspondence between the eligibility age for early and normal retirement benefits and departure from the labor force. Moreover, disability and unemployment programs often provide alternative exit routes before the statutory retirement age. The large cross-country variation in the tax burden on work affects the incentives to withdraw from the labor force— and this explains a large part of the variation in retirement patterns. A recent Netspar contribution is Bloemen (2011), who analyzes the effect of private wealth on retirement transitions using survey data. Current plans include the use of population-wide administrative data on household wealth, pension and social security entitlements as well as health care use to analyze retirement behavior and alternative exit routes. This will be done not only with reduced-form models but also with the advanced structural dynamic programming models for retirement behavior, as recently developed by French and Bailey Jones (2011), in combination with accurate administrative data. This work will be extended to collective models of household behavior, accounting for features that can explain joint retirement, such as complementarities in leisure or partner allowances in pension entitlements. The models that will be developed can be used for policy simulations, to analyze, for example, the effects of potential future changes in the tax treatment of pension benefits and wealth of the elderly.

*When and how do people want to retire, and how does this differ from actual behavior?* An alternative line of research on retirement uses stated preferences data, where people are asked, for example, to choose between several hypothetical scenarios, such as early retirement with a low pension or later retirement with a higher pension (see van Soest and Vonkova 2013). Using hypothetical scenarios circumvents the need to have accurate information on all detailed retirement trajectories that retirees may have access to, and allows for consideration of options that are currently not commonly available, such as, in the Netherlands, retirement after age 65. In future work we plan to extend this work with the analysis of (joint) retirement of couples. Here, stated preferences are particularly useful, since additional data (with separate information on, for example, which joint retirement path both spouses would choose and what is the most likely outcome of the household decision process) can be used to solve identification problems inherent in many cooperative or non-cooperative models of household

decisions based upon individual preferences (e.g., Michaud & Vermeulen 2011). This can lead to a breakthrough in the empirical content of collective models, replacing un-testable assumptions by identifying information in the form of innovative data.

*How does health affect employability and retirement?* Another part of Netspar's agenda on labor-market issues aims to analyze the relation between the labor-market position of older workers and health and work disability. Garcia-Gomez, Von Gaudecker and Lindeboom (2011) analyzed the trend in the Dutch disability benefit rolls and found that only part of this can be explained by the reforms of the disability benefit system. Future plans include expanding this work to longitudinal studies on measuring work disability and the dynamic relations between genuine work disability, work disability reports, and labor-market status, accounting for the potential problem that disability benefits recipients and other non-workers tend to over-report their work disability problems. This will exploit the increasing longitudinal dimension of data sets like SHARE and the recent development of panel data models that exploit the timing of events to identify causal effects controlling for unobserved heterogeneity and reverse causality.

*Are older workers productive enough and attractive for employers?* To accommodate a larger supply of older workers, an increasing demand for older workers is crucial. A relatively low productivity vis-à-vis their wage costs and negative employer attitudes (such as stereotyping) that are not rational from an economic point of view have been suggested as explanations for the fact that older workers, once they lose their jobs, have a hard time to find new jobs. The empirical evidence on these issues is, unfortunately, scarce and inconclusive (see, e.g., Chui et al. 2001, Henkens 2005, Garibaldi et al. 2010, Van Dalen et al. 2010, Van Ours & Stoeldraijer 2011). This program aims to fill this gap. From a policy perspective, it is particularly relevant whether on-the-job training and life-long learning help to enhance productivity. We will use unique longitudinal matched employer-employee data that recently became available at Statistics Netherlands, as well as new survey data on employer attitudes and stereotyping, which will assist importantly in making important empirical progress on these issues.

### **3.2. Preparation for retirement, saving and portfolio choice**

Financial security in old age can be provided through state and occupational pensions, but current policy reforms in many countries are increasing the role of voluntary household savings for retirement—for example, in the form of life insurance (third-pillar pensions). Moreover, general household savings and owner-occupied housing (with a reverse mortgage) can be used to finance (part of) the cost of living in old age. In some countries financial support by family members also plays a role. Retirement preparation focuses on household decisions on pensions and other retirement savings (e.g., portfolio choice, housing), consumption patterns before and after retirement, decisions to annuitize or not, financial knowledge, accounting for psychological factors that lead to decisions that are not in the households' own long-run interest, such as status quo bias and procrastination, and so forth. Health plays a role through the financial risks of health shocks and health (and work disability) insurance. Adequate financial preparation for retirement has been a hot topic in the literature (see e.g. Scholz, Seshadri & Khitatrakun 2006). Recent work on this combines traditional

life-cycle models with insights from behavioral economics, showing the relevance of defaults, procrastination, status quo bias, reference groups, etc. This program aims at improving our insight into preferences, perceptions of probability distributions and risks, and decision strategies. This will be achieved by using laboratory experiments, surveys and experiments with probability samples covering a broad population, and field experiments.

*What are the risk attitudes and time preferences of households saving for retirement?* Von Gaudecker et al. (2011) measured risk and loss aversion in an experimental way, relying on economic psychology theories of risk attitudes, and found evidence of substantial risk- and loss-aversion differences between population groups. In the future we want to combine risk preferences with experimental measures of time preferences and analyze how they relate to actual financial decisions. This will require large-scale experiments in a representative population sample, combined with stated-preferences survey questions, and panel data models accounting for unobserved heterogeneity in the population.

*How do people make financial decisions on saving and portfolio choice?* Netspar researchers study retirement preparation combining insights from economics and psychology. Van der Heijden et al. (2012) focus on the role of defaults and framing in financial saving and investment choices, addressing the well-known problem that defaults may lead to suboptimal choices. Dellaert, Donkers and van Soest (2012) showed that choice decision strategies and the tendency to make suboptimal decisions vary with aspects of choice complexity—and this applies in particular to decisions on retirement savings products. Brown, Kapteyn and Mitchell (2013) find evidence of framing effects on claiming old age social security benefits. Binswanger and Carman (2012) studied decision strategies for long-term saving decisions using novel survey questions, and found large deviations from economic rationality. In ongoing research, Internet tools are developed to measure how risk preferences and factors like saving targets, information channels, and salient product characteristics affect financial decisions (see, e.g., Van Schie, Dellaert & Donkers 2012). Netspar will clearly promote further research on decision strategies, choice behavior and satisfaction of consumers who select pension products using Internet applications, existing data and field experiments where choice complexity and framing can be manipulated, and with econometric models that account for heterogeneity in preferences and decision strategies. Financial decisions to protect against life cycle events such as disability and or death of a spouse that have not attracted too much attention in earlier Netspar years have been added to the research agenda for the period 2015-2019.

*How do people form and use subjective expectations?* In intertemporal models where agents account for the future consequences of their current decisions, expectations about future outcomes and opportunities play a major role. Traditionally, expectations were not observed and an identifying assumption had to be made. More recently, substantial progress has been made on measuring expectations of individual agents by using subjective probability questions (see Manski 2004). It has been shown that the answers to such questions provide useful information, demonstrating that many agents do not have rational expectations, but also suffer from typical reporting errors such as rounding, “fifty-fifty” answers and non-response. Recent methodological work focuses on modeling the expectations as well as reporting behavior (Van Santen, Alessie & Kalwij 2012; Kleinjans & van Soest

2013). The current challenge is to develop joint models for forming and updating expectations (on, e.g. future health, employment opportunities, pension income or stock market returns) and for economic outcomes (e.g. savings or portfolio choice) driven by these expectations. This research has the potential to replace the paradigm of rational expectations and replace it by alternative mechanisms of expectation formation that have a solid empirical foundation. Moreover, in life-cycle models an important distinction is that between transitory income and permanent income.

### **3.3 Housing investments and their relation to life cycle risks and to preparation for retirement**

*Can wealth portfolios be adjusted to housing?* Basic insights from financial economics suggest that one should regard all household wealth components – pension wealth, the owner-occupied house and the associated mortgage, and other assets, simultaneously when deciding about (dis)investments (e.g. Cocco, 2004). The fact that investment in housing is often driven by consumption motives imposes limits on the possibilities for portfolio diversification (Brueckner, 1997). Adjusting the other portfolio components is hampered further by the fact that regular pension contracts ignore that households also have other assets. It would clearly be of potential relevance to adjust investments of pension savings to differences in exposure to housing market risks. Obviously, this calls for more flexibility and heterogeneity in the possibilities to save and invest for retirement. Young owners may perhaps be offered the possibility to substitute part of their pension savings for investment in housing and can be offered the possibility to choose an investment strategy of their remaining pension's savings that takes the housing market risk into account as well.

*Should pension funds invest in mortgages and in the housing markets?* Mortgage markets differ markedly over countries (Campbell, 2012) and the Dutch system that attracts money from the international capital market to cover the funding gap between the demand for mortgage loans and domestic household savings experienced problems during the recent financial crisis. Since pension funds control a large amount of compulsory savings of Dutch households, they could relieve the problem. This 'natural' solution – which requires investments in illiquid assets - does, however, not necessarily fit in the optimal investment strategy of these funds. If it does, there could be substantial benefits for banks that can remove part of the mortgage debt from their balances, as well as for the functioning of the mortgage and housing markets. The absence of a private rental market outside Amsterdam and the Hague and the changes in the social rental sector may offer pension funds interesting possibilities for investing in non-social rental housing. Alliances of housing corporations, pension funds, insurance companies and providers of care could contribute substantially to the development of flexible arrangements for long term care.

*What are the consequences of aging for housing markets?* Aging can have a profound impact on housing demand. Long ago, Mankiw and Weil (1989) studied a scenario for the U.S. in which house prices decrease substantially after the disappearance of demographic pressure. Actual developments have differed markedly from their predictions, but there is little doubt that shrinking populations can



have a major impact on housing markets (Gyourko and Glaeser, 2005). Aging will almost inevitably result in a long run excess supply of housing and decreasing house prices. The implied disappearance of a huge amount of home equity will have consequences for the heritages that can be expected by the offspring off the current owner-occupiers, who should also not expect capital gains on their own houses. The Mankiw and Weil example shows that it is risky to make predictions in this area, but the phenomenon is clearly important enough to warrant further attention so as to increase our understanding of the mechanisms involved as well as the consequences for current and future generations.

*How to develop smart reactions?* It is clearly important to develop appropriate strategies to deal with the problems and imperfections that have been discussed above. The current organization of housing, financial and pension markets is the outcome of a long history and changes are usually not easy to implement. A useful way to increase our insight into the various (im)possibilities is to learn from abroad: many countries are currently in a situation in which aging affects the demand for housing and long term care, but their responses differ. Some of the solutions applied elsewhere can possibly, perhaps after suitable adaptation, be fruitfully be used in the Netherlands as well.

Exploration of the possible developments of new products or institutions that mitigate or eliminate problematic aspects of the current situation is an important possibility to consider. The possibility to liquidate home equity by sell-and-rent back constructions is in principle attractive but difficult to realize if the required rate of return on housing investments is much higher than the return offered on an annuity (Conijn et al., 2014), but it is not clear if this is an inherent feature of the products involved or a market imperfection that can be overcome by organizing the market for this combination of products in a different way. Differences in tax treatment of pension wealth, owner-occupied housing and liquid wealth complicate attempts to integrate investment decisions. Stated preference techniques are useful to explore the interest in financial products that do not yet exist.

*What are the implications of aging in place for the demand for long-term care?* Aging in place must be expected to be common in the future and this raises many questions. Mobility on the housing market decreases with age, especially for owner-occupiers. The problems of old age do not induce many elderly to move to a more suitable house, as the (perceived) difficulties of moving also increase and it is not clear if the immobility results mainly from preferences or constraints. Although large-scale construction of houses specifically designed for elderly people therefore does not seem to be appropriate, the disappearance of a large share of nursing home capacity will probably have consequences for the housing market. Adjusting existing housing to the needs of elderly people with deteriorating health will probably be of growing importance, and in some cases moving to housing that is better adjusted to one's health status may be inevitable. Our insight in the preferences of the elderly with respect to consumption and savings and the role that precautionary motives and (perceived) restrictions play is still incomplete, but the need for adjusting housing to one's health situation, as well as the increase of co-payments for long term care will probably make the possibility to use part of the home equity to finance the needs of older age increasingly valuable. Low mobility rates and sorting of households related to age will also have implications for the spatial distribution of the demand and provision of long term care that have hardly been considered thus far (Aronson et al., 2010).

### 3.4 The impact of health care expenditures

LTC expenditures are expected to increase substantially in the coming decades (Van Ewijk et al, 2013). Population aging is an important driver of this expenditure growth, particularly for the LTC sector because LTC is more affected by the increasing prevalence of disability that comes with population aging (e.g. De Meijer et al. 2011, 2012). Consequently, the sustainability of the current LTC financing schemes is challenged. This is particularly true for the Netherlands, since the Dutch public LTC insurance scheme (AWBZ) is the most comprehensive within the OECD and public LTC expenditures are the highest (OECD, 2011). The combination of comprehensive public insurance coverage and pay-as-you-go funding with population aging is expected to substantially increase mandatory cross subsidies for the younger generations. Therefore, in 2013 the Dutch government decided on a radical reform of the public LTC insurance scheme that will substantially increase the role of private financing. This development urges the need to explore changes in LTC financing, particularly to what extent comprehensive public insurance coverage can be replaced by private financing, which are the most promising types of private financing, and what are the implications for pensions?

#### *Scenario's for the future costs of health care and long term care, and the implications for adequacy of pensions*

The shift towards private financing of LTC expenditures, combined with a further rise in expenditures, means that elderly will have to spend a larger part of their disposable income on care. If the burden of LTC financing is shifted towards later phases of life, higher pensions may be needed to compensate for this trend and to keep consumption at the same level after retirement.

- Identify drivers of cost of health care and long term care in long run.
- Derive scenario's and analyse the implications for adequacy of total old age income and pensions in particular
- Combine with micro data (Netspar projects Knoef, Alessie)

#### *Alternative systems for financing long term care*

Capital funding, i.e. a system of earmarked savings has been applied to public LTC insurance in Singapore. Singapore has chosen for a voluntary, individual LTC insurance (ElderShield). At the age of 40, citizens are automatically signed up for ElderShield but they can opt out (Singapore Ministry of Health 2012). The Singaporean system and other health savings accounts systems, e.g. in China and the US and their performance might yield important lessons (Barr 2001, Chia and Tsui 2005, Lo Sasso et al. 2010, Charlton et al. 2011). Experience with other alternatives for LTC financing may be helpful in identifying the advantages and disadvantages of each of these alternatives, e.g. private LTC insurance, which is offered in France and US. In addition, we will look beyond the literature LTC financing and include experience from life insurance and pension systems. While the literature on saving for LTC is limited, the merits of PAYG pension systems and of capital funding and handling transitions are main themes in the pension literature. Compared to keeping the public PAYG financing system, a transition to a (partially) savings-based system might improve the ability to deal with the consequences of population aging and affects (intergenerational) redistribution and risk sharing, while differences in the rate of return between both systems have been highly debated (e.g. Aaron 1966;

Barr and Diamond 2009; Sinn 2000). Similarities between pension financing and LTC financing allow for careful use of the experience in pension financing to improve the sustainability of LTC financing.

#### *Saving or insuring for old age care*

Reducing collective insurance of long term care affects the risk profile for the elderly: their net income becomes more susceptible to health shocks. The distribution of LTC expenditures is highly skewed: there is a small group that faces very high cost, while for the majority costs turn out to be moderate. Moreover, these costs occur at the end of life, so that opportunities for smoothing are very limited. This implies that insurance will remain important. Apart from insurance, introducing varying levels of pension benefits during the pay out phase might be an instrument to accommodate shocks in LTC expenditures. This flexibility would mean that elderly could pay for part of their LTC need from their pension wealth.

#### *Markets for pensions and long term care insurance*

Identification of the problems that challenge the sustainability of current LTC financing systems. The pitfalls of private LTC insurance have been documented well (Brown and Finkelstein 2007; Barr 2010); private markets for LTC do not develop without some form of government regulation. The need for regulation and the optimal design depend on specific circumstances. So far, no research has been done for the case of the Netherlands.

Depending on the relationship between LTC use and longevity, integration of pensions and LTC insurance could be beneficial. A negative covariance between longevity risk and LTC risk may provide scope for joint insurance, thereby reducing adverse selection problems (Murtaugh et al. 2001).

#### *Social networks and informal care*

Reducing public LTC provision implies that informal care will become more important in the future. At the same time people are expected to work longer. Moreover families are smaller and spatially more dispersed, in the future even more so than nowadays. Empirical research using new sets of micro data (STREAM, PIAK) could provide insight into trends in informal care, labor market participation, and living conditions, and into individual behavior in different circumstances. A costs and benefit analysis of informal care requires of modeling of the substitution between informal and formal care, as well as between informal care and labor on a household level.

#### *Transition problems and the potential role of the financial sector and other actors*

The desirability of the financing alternatives is not only affected by their performance on the assessment criteria but also by implementation issues. International experience shows that coordination of the public and private contributions in future LTC financing is crucial. Therefore, fitting and dovetailing the public and private contributions will be a major policy challenge. Furthermore, it is crucial to discuss how to deal with problems that arise from the transition from the current public PAYG system to a hybrid financing system that combines public financing and private savings, private insurance. During this transition, the population or subgroups thereof might have to pay PAYG premiums for the current generation of LTC users as well as contributions to the capital funded system, which might have serious consequences for public affordability and solidarity.

#### **4. MACROECONOMIC REDISTRIBUTION, RISK-SHARING AND DYNAMICS**

Demographic and financial market developments have prompted governments to start implementing changes in their pension systems, such as raising the retirement age and promoting funded pensions. Changes in the roles of the different pension pillars and the government's tax-transfer system impact both the distribution of resources and the way risks are shared among groups, such as the different cohorts and income classes. Redistribution involves predictable shifts in resources, while risk-sharing refers to unanticipated changes in the distribution of resources. Both generate important feedback effects on the economy as a whole.

This theme aims at an integrated analysis of redistribution and risk-sharing generated by pension and tax-transfer systems, as well as their macroeconomic feedback effects. The entire theme will be split into the following four subthemes: intergenerational redistribution, intra-generational redistribution, intergenerational risk-sharing and macroeconomic interactions. These research areas are severely under-researched, implying substantial gaps in our knowledge, the most important of which include the following: First, the standard models are often so stylized that they fail to include important aspects of real-world pension systems, such as uniformity of contribution and accrual rates across all participants in a pension arrangement. Second, pension and tax-transfer arrangements are often studied in isolation, so that their combined effects for redistribution and risk-sharing are not assessed. Third, in the presence of factor mobility, national pension arrangements have cross-border macroeconomic spill-over effects that have received very little attention so far. Fourth, the lack or presence of financial instruments dealing with demographic risk has important consequences for saving- and investment decisions—and hence, for the macro-economy. Finally, the largest gap concerns the interactions between the design of the pension arrangement and the macro-economy. Only now are some first attempts being made to model the supply-side effects of pensions, while the modelling and analysis of demand-side effects is entirely missing. An important reason is methodological, because this requires incorporating short-run dynamics arising from price- and wage rigidities into long-run models that include pension and demographic blocks. The challenge is to explore the long-run consequences from each of these short-run dynamics.

##### **4.1. Intergenerational redistribution**

The consequences of pension arrangements for intergenerational distribution will be investigated from a number of angles. This project quantifies the amount of intergenerational redistribution in different pension systems and via the government's tax-transfer system. To measure intergenerational transfers, the analysis employs the technique of generational accounting (see Auerbach et al. 1994). This tool could be extended by incorporating uncertainty, including non-traded risk factors such as wages.

*How do occupational schemes redistribute across generations?* New contracts in occupational pension schemes in several countries introduce explicit risk for participants (Novy-Marx & Rauh 2012). This project investigates the intergenerational distributional consequences of pension rights

that are explicitly conditional on the financial performance of the fund. One can distinguish three aspects. First, the redistributive consequences of using alternative discount rates to value future pension benefits. Indeed, a change in the discount rate may lead to substantial redistribution across generations (see Novy-Marx & Rauh 2009; Buccioli & Beetsma 2011). Second, one can explore how different risk-sharing rules affect the allocation of the existing, anonymous buffers across participants. One can also explore the advantages and disadvantages of explicitly assigning the collective buffer to individual participants. Among other things, assigning specific rights to buffers will enhance the portability of pension capital when people change jobs. Third, implicit buffer formed by the employer acting as a last resort in the case of bad outcomes is to be valued. Under the new contract, employers will play a less important role in this respect.

*How do pension accruals in occupational schemes redistribute across generations?* Pension contributions in many occupational schemes are a constant percentage of the wage in excess of the franchise, while the accrual rate of additional annuities is also constant, irrespective of how close a participant is to retirement (see Bovenberg & Boon 2010). This violates actuarial neutrality because those close to retirement benefit from transfers from younger workers. The analysis will quantify the consequences of this system and of a possible move to a more actuarially neutral system, where due account is taken of the transition phase and the associated intergenerational and intra-generational distributional effects. The analysis will also explore the effects of such a transition towards a more actuarially neutral system on the incentives to supply labor during the life cycle, including retirement behavior.

#### **4.2. Intragenerational redistribution**

Most real-world occupational pension arrangements redistribute resources among heterogeneous agents. To illustrate, occupational pension schemes apply uniform contribution rates and accrual rates, which are typically determined as a fraction of the wage. These pension schemes drive a wedge between the market value of the new pension accruals and the actual contribution paid because the market value of the pension accruals depends on heterogeneous individual characteristics, such as age, gender, health and socioeconomic status. The associated differences between the market value of the accruals and the contribution rates result in intra-generational redistribution among heterogeneous individuals. Earlier work by Bonenkamp (2009) measures such redistribution in occupational pension schemes with uniform accrual and contribution rates. Sommacal (2006) considers intra-generational redistribution in unfunded schemes, while Adema et al. (2013) study the redistribution effects of flexible pension take-up.

*How do intra-generational transfers in pension schemes affect life-cycle decisions of heterogeneous agents?* To investigate this question, it would be relevant to develop an overlapping-generations model with a funded occupational pension scheme that includes the most important channels through which pension schemes redistribute resources among participants and the most important behavioral margins. Further, one can study the interactions among various individual decisions, such as the fraction of an individual's lifetime spent on schooling (see, e.g., Heijdra & Romp 2009), work and

retirement, and how pension savings are allocated over various assets. The analysis focuses in particular on how first- and second-pillar pension institutions impact these economic decisions made by heterogeneous agents. Important sources of individual heterogeneity in this connection are differences in life expectancy and the ability to acquire skills (see, e.g., Razin & Sadka 1999). Netspar research will explore the implications of reforms that improve actuarial fairness and can be more tailored to individual heterogeneity.

*What is the optimal design of redistributive public pensions?* Public pensions aim at redistribution, poverty prevention and insurance of unfortunate labor-market outcomes and inadequate human capital during the working life. A key question is how the optimal design of redistributive public pensions changes in the face of the aging of the population, more flexible labor markets and a more heterogeneous older population in terms of longevity and health status. To illustrate, should public pension entitlements become more means-tested, and should rich pensioners contribute more to financing public pensions? Netspar research can address these questions by developing analytical optimal tax models. In addition, it can construct numerical models that include a richer representation of actual institutions. Various previous studies have already analyzed specific issues of optimal pension design. Sefton et al. (2008) and Kumru and Piggott (2009) explore the quantitative implications of various policy reforms for the UK's means-tested retirement benefit program. Nishiyama and Smetters (2008) compute the parameter values for the optimal social security formula in the US that maximizes long-run welfare. Fehr and Habermann (2008) quantify the welfare effects of progressive pension arrangements in Germany. Kudrna and Woodland (2011) analyze the abolition of means-testing within the Australian pension system. The approach of this latter study, in contrast to most previous studies, does not focus on long-run welfare consequences alone, but includes the effects for transitional cohorts. Building on earlier work (in particular, Sefton et al. 2008), one could develop a dynamic model for the Netherlands, including the Dutch institutional setting. Since most Dutch workers are mandated to save through occupational pension schemes, savings distortions associated with means-tested public pensions can be expected to be less serious in the Netherlands than in the United Kingdom. However, labor-market distortions, such as incentives to retire early, will tend to be larger in the Netherlands. It is vital to pay close attention to labor-market institutions and labor-market behavior. This line of research can also explore the redistribution through health-care insurance and how this interacts with redistribution through the pension system.

#### **4.3. Intergenerational risk-sharing**

Pension funds can enhance intergenerational risk-sharing compared to capital markets. In particular, capital markets can share risks only between individuals who are close to each other in age so that they can trade with each other on capital markets (see Bohn 2009). Moreover, some important risks (such as wage risks) are not (yet) traded on capital markets. Pension funds can trade some of these risks among various generations. By linking pension benefits to wage developments, for example, pension funds allow retirees to share in wage risks of younger participants. Furthermore, by linking contributions to the financial performance of pension funds, pension funds can expose young workers to financial market risks. In view of limited liability, these workers cannot themselves borrow against

their human capital to obtain this risk exposure, and thus benefit from risk premia in financial markets. Several contributions have begun to study intergenerational risk-sharing through pension funds (such as Krueger & Kubler 2006; Gollier 2008; Cui et al. 2011).

*How does labor-market behavior affect intergenerational risk-sharing?* This line of research explores risk-sharing through pension funds in a general equilibrium context. It extends Beetsma and Bovenberg (2009) and Beetsma et al. (2013) by including labor-market behavior and extending the model from a stylized two-period set-up towards a longer horizon. While some pension arrangements, such as defined wage-indexed benefits, can replicate the Pareto efficient social optimum in the absence of labor-supply decisions, this is no longer the case in the extended set-up, where a trade-off needs to be made between intergenerational risk-sharing and limiting labor-market distortions. Flexibility in labor supply, however, not only may result in distortions due to intergenerational risk-sharing but also may raise the willingness of individuals to bear financial market risks (e.g. Adema et al. 2011). The various implications of endogenous labor-market behavior for the risk that is optimally absorbed by various generations are to be investigated.

*How do preferences and macroeconomic risk impact optimal intergenerational risk-sharing?* Starting from the general theoretical framework by Bovenberg and Van Ewijk (2011), one can investigate how optimal pension arrangements depend on the preferences of participants and projected macroeconomic shocks. In the standard case of constant relative risk-aversion, it is optimal for all agents to equally participate in all macroeconomic shocks. This result breaks down, however, with more plausible preferences such as habit formation and keeping-up-with-the-Joneses preferences. As regards the specification of macroeconomic uncertainty, a number of shocks can be investigated in detail, including labor-market and demographic shocks. Indeed, it is important to move beyond the case in which financial shocks are the only source of uncertainty (see also Cocco et al. 2005). To illustrate, a crucial factor determining the size of the potential welfare gain due to intergenerational risk-sharing through pension funds is the correlation between wage risks and capital market risk (Benzoni et al. 2007). In an environment with richer preferences and uncertainty, we explore how actual pension contracts in occupational schemes can be improved so that they approach more closely optimal intergenerational risk-sharing.

*How can intergenerational risk-sharing be facilitated while also limiting discontinuity risk?* Possibilities to realize optimal intergenerational risk-sharing may be limited by the choice of participants to “vote with their feet” (Beetsma et al. 2013). This project explores the incentives to participate voluntarily in occupational pension schemes that share risks among generations beyond what is possible in capital markets. With the worsening of the financial position of pension funds and the growing uncertainty about the level of future pension provision, the support for mandatory fund participation is decreasing so that discontinuity risk (i.e. pension funds breaking up) increases. Indeed, in a situation of underfunding, workers may want to quit the system if they have to make up for the loss. In a situation of overfunding, in contrast, retirees would like to close the system and distribute the proceeds among the current participants. The envisaged analysis explores voluntary participation by incorporating pension buffers and modelling the possibilities to quit or shut down the fund explicitly as options on irreversible decisions. One can investigate how recovery and solvency rules can help promote

voluntary fund participation, thereby enhancing the trade-off between reducing discontinuity risk and facilitating intergenerational risk-sharing.

*How can government debt and other financial instruments facilitate intergenerational risk-sharing?* It is of interest to explore the scope for introducing richer financial instruments so that more macroeconomic risks can be traded in capital markets (see Lucas & Stokey 1983). Various types of indexed debt can be considered: price-indexed debt, wage-indexed debt and longevity-indexed debt. Wage-indexed debt promotes the sharing of wage risks among generations, while longevity-indexed debt allows sharing longevity risks. Governments may be discouraged from issuing this debt in view of the nominal measurement of deficits in fiscal rules (such as those included in the SGP, see Beetsma & Giuliodori 2010). The incentives of several parties to issue this type of debt—namely, not only governments but also mortgage banks and housing corporations— is to be explored. In particular, the questions whether the private sector can develop a market for inflation-linked instruments in the Netherlands is highly relevant.

#### **4.4. Macroeconomic interactions**

Pension fund policy affects the business cycle and the propagation of macroeconomic shocks through both the supply and the demand side. The supply-side channel has been explored by Romp (2012). The demand-side channel has been severely underexplored so far.

*What are the business-cycle effects of occupational pensions through the demand side?* Not only the specific instruments to be employed for the restoration of pension buffers after unexpected shocks, affect macroeconomic demand but also the speed with which they are implemented. Slower restoration of full funding implies that current disposable income and, hence, current demand are influenced to a lesser extent by business fluctuations. This is beneficial because pension buffers tend to decline during a recession. However, the danger is that the pension funds may become entangled in a trap in which it becomes more and more difficult to restore the buffers. This will particularly be the case when the group of participants is aging rapidly. Also, various instruments aimed at restoring buffers may have distinct macroeconomic effects. An increase in the contribution rate, for example, yields larger consequences for disposable income than less indexation of already accrued pension entitlements of workers, because the latter affects only future disposable income of workers. The role of disposable income in affecting demand depends on the share of households that are liquidity constrained. Demand-side effects and intergenerational risk-sharing issues can be combined into a single model to explore the possible trade-offs between optimal intergenerational risk-sharing and limiting business-cycle fluctuations.

*To what extent should the pension fund regulator weigh the macroeconomic effects in its supervision?* Supervision is aimed at individual pension funds. This approach is justified if funds are hit by idiosyncratic shocks. However, when funds are hit by common shocks, such as financial markets and demographic shocks, and the funded sector as a whole is large relative to the economy, policies aimed at individual funds may have profound and adverse consequences at the macroeconomic level.

For example, imposing rapid restoration of pension buffers on a large fraction of the funds would weaken the demand side of the economy through higher contributions and reduced indexation. A trade-off needs to be made between supervision at the micro level and avoidance of adverse macro consequences. A quantification of this trade-off is of great importance. Further, is it possible to design pension arrangements such that this trade-off becomes more favorable?

*How do pension policies differ across countries and what are the international macroeconomic spillovers of these policies?* This sub-project explores how pension systems in different countries respond to macroeconomic shocks. Various European countries differ substantially in the structure of their pension systems. Accordingly, each country will absorb macroeconomic shocks rather differently. In particular, countries that exhibit a more substantial funded component are more vulnerable to shocks in inflation and investment returns, whereas countries that rely to a greater extent on pay-as-you-go financing are more sensitive to demographic shocks affecting the dependency ratio. On the one hand, this may result in opportunities for international risk-sharing, as argued by e.g. Shiller (1999). On the other hand, it can lead to unintended international spillover effects that complicate international cooperation. These spillovers may be due to capital market mobility (Adema et al. 2008, 2009) and migration (e.g., Leers et al. 2004). Moreover, heterogeneous goods may yield international trade- and real exchange rate effects, which may amplify the international spillovers (Fedotenkov et al. 2012). This sub-project models the various spillover effects and investigates possibilities for international risk-sharing. We will formulate recommendations as to country-specific pension plan design and optimal international coordination aimed at properly internalizing the cross-border externalities of national pension policies.

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