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Longevity risk transfer markets: market structure, growth drivers and impediments, and potential risks

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Longevity Risk Transfer Markets: Market Structure, Growth Drivers and Impediments, and Potential Risks

Executive Summary

The ageing population phenomenon being observed in many countries poses serious social policy and regulatory/supervisory challenges. Not only are people living longer, but longevity risk – the risk of paying out on pensions and annuities longer than anticipated – is also becoming more of a concern in terms of sustainability of existing "saving for retirement" products.

Total longevity risk is significant when measured from a financial perspective, with each additional year of life expectancy adding about 3-4 percent to the present value of the liabilities of a typical defined benefit pension fund (IMF, 2012). Estimates of the total global amount of annuity- and pension-related longevity risk exposure ranges from $15 trillion to $25 trillion (CRO Forum, 2010, and Biffis and Blake, 2012). Hence, a one year longevity underestimation will in aggregate, cost risk holders from $450 billion to $1 trillion.

To manage this risk, pension funds in some countries are increasingly looking to transfer their longevity risk. There are basically three types of transactions that are being used to transfer longevity risk that differ in terms of the types of risk transferred and the types of risk created:

- A **buy-out** transaction transfers all of the pension plan's assets and liabilities to an insurer in return for an up-front premium. Hence there is full risk transfer (investment and longevity, plus inflation in the case of indexed plans). However, pensioners become exposed to the risk of insurer (as opposed to sponsor or pension guarantor) failure.[1]
- In a **buy-in**, the pension plan sponsor retains the assets and liabilities, but pays an up-front premium to an insurer to receive periodic payments that match the pension payments. In this case, the risk transfer is only partial because there is still counterparty risk to the insurer, and the sponsor remains directly responsible to pensioners.
- In a **longevity swap (or insurance)** transaction, periodic fixed payments are made to the swap counterparty (or (re)insurer) in exchange for periodic payments based on the difference between the actual and expected pension or annuity mortality experience. As in the case of a buy-in there is counterparty risk and the sponsor remains directly responsible to pensioners, but retains the investment risk.

Longevity risk transfer (LRT) markets are a rather uncharted territory for analysts, academics as well as for supervisors. The objective of this report prepared by the Joint Forum is to give a first and preliminary analysis of the size and structure of the LRT markets, the factors affecting their growth and development, and to raise awareness of the associated potential risks and cross-sectoral issues for market participants, policymakers and supervisors.

Until recently, virtually all LRT activity had occurred in the United Kingdom, but 2012 saw three large non-UK transactions – a $26 billion pension buy-out deal between General Motors and Prudential

[1] However, in the United States bought out liabilities can be put back to plan sponsors if the insurance firm does not meet the US Department of Labor Interpretive Bulletin No. 95-1 "safest available annuity" standards. In Germany, even when the plan is organised via an external fund or insurance company, it is still the employer that remains liable (the so-called 'ultimate liability of employer' pursuant to Section 1 (1) of the German Law on Retirement Pensions (BetrAVG)).

Insurance, a €12 billion longevity swap between Aegon and Deutsche Bank, and a $7 billion pension buy-out between Verizon Communications and Prudential.[2] However, as impressive as these volumes are, they represent only a small fraction of the aforementioned multi-trillion dollar potential market size.

An important explanation for the small size of LRT markets is the relatively lenient regulatory treatment of longevity risk in pension funds compared to (re)insurers in many jurisdictions. Other obstacles to LRT include selection bias ("lemons") risk, and in the case of some longevity swaps, basis risk (see Chapter 4.2).

While LRT markets are not sizeable enough to present immediate systemic concerns yet, their massive potential size and growing interest from investment banks to mobilise this risk make it important to ensure that these markets are safe, both on a prudential and systemic level. In that regard, the Joint Forum puts forward the following recommendations:[3]

1. Supervisors should communicate and cooperate on LRT internationally and cross-sectorally in order to reduce the potential for regulatory arbitrage.
2. Supervisors should seek to ensure that holders of longevity risk under their supervision have the appropriate knowledge, skills, expertise and information to manage it.
3. Policymakers should review their explicit and implicit policies with regards to where longevity risk should reside to inform their policy towards LRT markets. They should also be aware that social policies may have consequences on both longevity risk management practices and the functioning of LRT markets.
4. Policymakers should review rules and regulations pertaining to the measurement, management and disclosure of longevity risk with the objective of establishing or maintaining appropriately high qualitative and quantitative standards, including provisions and capital requirements for expected and unexpected increases in life expectancy.
5. Policymakers should consider ensuring that institutions taking on longevity risk, including pension fund sponsors, are able to withstand unexpected, as well as expected, increases in life expectancy.
6. Policymakers should closely monitor the LRT taking place between corporates, banks, (re)insurers and the financial markets, including the amount and nature of the longevity risk transferred, and the interconnectedness this gives rise to.
7. Supervisors should take into account that longevity swaps may expose the banking sector to longevity tail risk, possibly leading to risk transfer chain breakdowns.
8. Policymakers should support and foster the compilation and dissemination of more granular and up-to-date longevity and mortality data that are relevant for the valuations of pension and life insurance liabilities.

[2] Transaction volumes are measured in terms of underlying assets.

[3] The terms 'supervisors' and 'policymakers' are as defined in Joint Forum (2010), that is, the former encompasses all supervisory and/or regulatory authorities whereas the latter has a broader scope and may also include legislative authorities.

Chapter 1 – Introduction

1.1 Mandate

The Joint Forum has in the past done extensive work on risk transfer markets focusing predominantly on credit risk transfer. This report on longevity risk transfer (LRT) complements its previous work. The aim of the present report is threefold. First, it provides a comprehensive picture of the market for LRT. Second, it investigates the incentives that drive insurers, pension funds, banks, reinsurers and other parties to participate in LRT markets (or not). And third and finally, it assesses the potential risks and cross-sectoral issues arising from LRT, for pensioners, market participants, policymakers and supervisors. To this end the report illuminates the linkages between and across firms that are created by LRT and analyses the potential breakdown of the risk transfer chain in case of stressed longevity scenarios. Recommendations are made to promote an orderly functioning of LRT markets, now and in the future.

1.2 Background

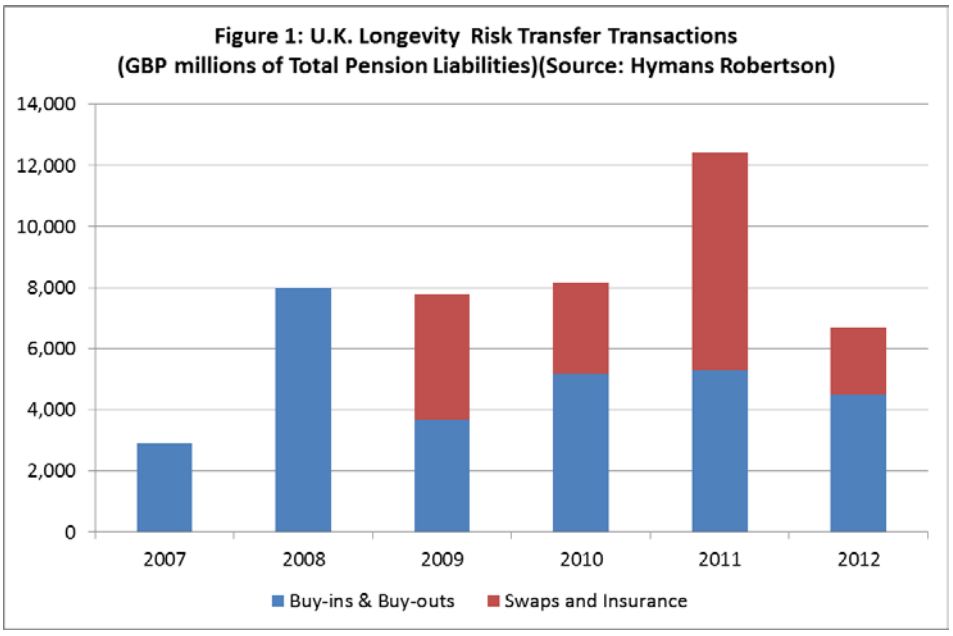
Until recently, virtually all LRT activity had occurred in the United Kingdom, where "there are many defined benefit (DB) schemes, disclosure of pension liabilities is highly transparent and annuitization of defined contribution (DC) schemes is effectively compulsory" (Swiss Re, 2010).[4] However, 2012 saw three large transactions in the Netherlands and the United States. Nevertheless, outstanding volumes of such transactions remain small in comparison to the total amount of longevity risk in the private and public sectors. For example, at end-2011 about $20 trillion of pension assets were held by private pension plans, of which about 65 percent were DB plans.[5]

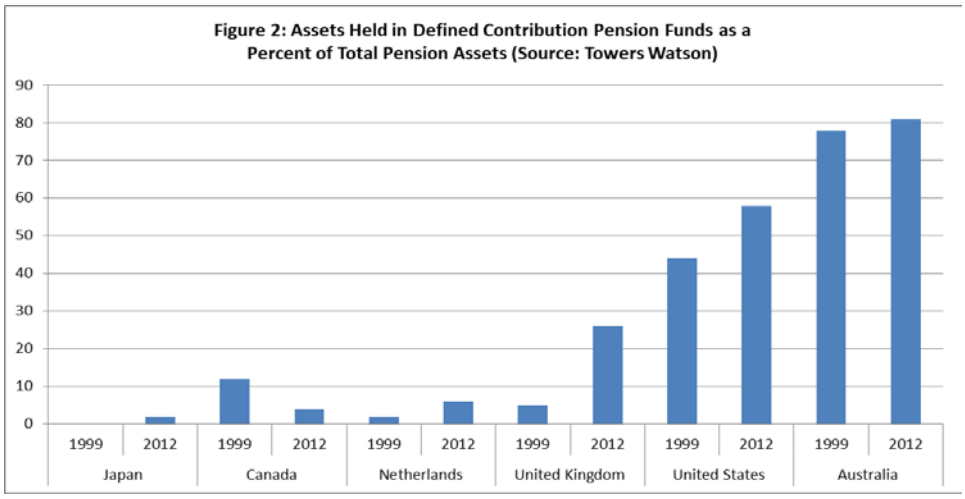
Total liabilities of UK DB pension plans amount to about £1 trillion, but there have only been about £50 billion of DB de-risking transactions since the market started up in 2004 to end-2012 (Figure 1). In 2012 there were three large transactions – a $26 billion pension buy-out deal between General Motors and Prudential Insurance, a €12 billion longevity swap between Dutch insurer Aegon and Deutsche Bank, and a $7 billion pension buy-out between Verizon Communications and Prudential. Plus Canada has seen a small but steady stream of pension fund buy-out transactions – about C$1 billion per year since 2006. In some cases, DB plan longevity risk is being mitigated by closing DB plans to new employees, closing DB accruals to existing employees and converting DB plans to DC plans (Figure 2). However, these actions only limit the growth of the problem, and the plan sponsors may remain on the hook for already accrued DB benefits. Also, closing DB plans and accruals merely transfers the longevity risk to employees who, by choice or compulsion, will look to annuity markets for their personal de-risking needs. However, annuitization markets are far smaller than predicted by rational decision-making models, although some countries, such as Italy, the Netherlands and Singapore, make annuitization of DC plan proceeds compulsory upon retirement (Fong et al., 2011).[6] OECD (2012a) argues that an explanation for the small size of annuity markets is in fact the lack of financial instruments to hedge against longevity risk.

[4] See Monk (2010) for a discussion of the factors that have motivated the surge of UK longevity risk transfer since 2007.

[5] According to OECD (2012b) all OECD private pension markets were valued at about $30 trillion, of which about $20 trillion was held by pension funds, $5 trillion in retirement products provided by banks and investment managers, and $4 trillion by insurers.

[6] A number of academic papers explore the under-annuitization puzzle. For example, Brown et al. (2008) link it to irrational decision making. They find that consumers are inclined to annuitize when the sales pitch is framed in terms of consumption, but not so inclined when it is framed as an investment.





Another option is for DB plan participants to share some of the longevity risk with sponsors, for example, by linking retirement benefits to life expectancy. This happens to be the case in the Dutch pension system, where a pension fund shortfall is typically regarded as a joint responsibility of the employer and its (current and past) employees.[7] In an effort to make the risk sharing more explicit ex ante, Italy introduced the linkage between pension benefits and life expectancy in 2010.[8] Also, a new pension contract is under development in the Netherlands that will link pension benefits explicitly to life expectancy. Accordingly, longer working lives can offset longer life spans, essentially keeping the number of years in retirement (and thus financial retirement needs) fairly constant. For future pension benefits still to be accrued, introduction of the new contract is relatively straightforward. It is legally challenging, however, to declare the new pension contract applicable to accrued pension rights.

7 Ponds and Van Riel (2009) contrast the risk sharing in Dutch DB pension plans to the set up of Anglo-Saxon plans, where the employer is regarded solely responsible for correcting pension plan underfunding.

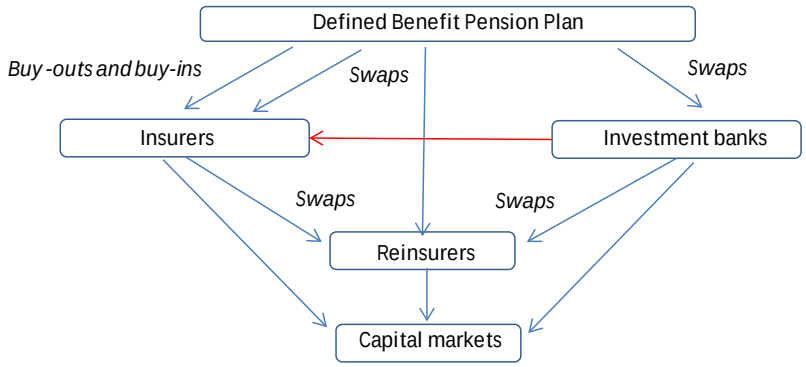
8 According to law n.120/2010 the Italian minimum retirement age is updated every two years based on a life expectancy index calculated by the National Bureau of Statistics (ISTAT).

Chapter 2 – Longevity Risk Transfer Instruments

2.1 Overview

In this chapter, the basic transaction types will be explained – buy-outs, buy-ins, longevity swaps, and longevity bonds.[9] Who uses which technique depends greatly on the type of counterparty (Figure 3). Insurers are associated with pension buy-ins, buy-outs and longevity insurance, whereas longevity swap transactions are associated with investment banks and reinsurers. Also, in most jurisdictions, banks are not allowed to issue or take on longevity risk in the form of annuities, buy-ins and buy-outs, but can take it indirectly via swap transactions. On the other side of the transactions, the choice of transaction type can have very different implications for the plan sponsor. Longevity bonds remain only a concept for now – there have been several attempts at issuing them, but none successfully.

Figure 3: Structure of Longevity Transfers by Defined-Benefit Pension Plans, by Type of Counterparty

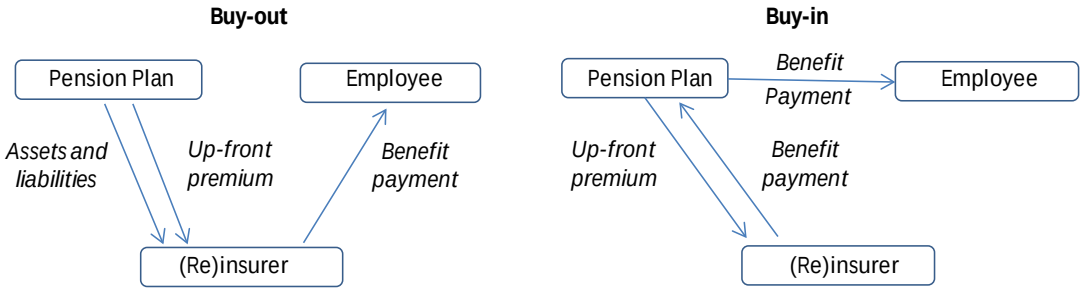


2.2 Buy-ins and Buy-outs

In a buy-out transaction all of the pension fund's assets and liabilities are transferred to an insurer in return for an up-front premium (see left-most panel of Figure 4). The pension liabilities and their offsetting assets are removed from the pension fund sponsor's balance sheet and the insurer takes over full responsibility for making payments to pensioners. In a buy-in, the sponsor pays an up-front premium to the insurer who then makes periodic payments to the pension fund sponsor equal to those made by the sponsor to its members. This "insurance policy" is held as an asset by the pension plan for which the premium is the cost of the insurance policy that guarantees payments even if retirees live longer than expected.

[9] Longevity risk can also be transferred to capital markets via "life settlement" securitisations. A life settlement occurs when the owner of a life insurance policy sells the policy for an amount below the face value of the policy (i.e., the amount paid when the policyholder dies). The purchaser becomes responsible for making premium payments in return for collecting death benefits. Although life settlement volumes have been recently growing, they have not reached the point at which securitisation becomes viable on a large scale. For example, credit rating agencies have been reluctant to rate life settlement securitisation transactions because the pools are comprised of too few heterogeneous policies to estimate statistically stable cash flows (A.M. Best, 2009, S&P, 2011). Also, A.M. Best (2009) expresses concerns about "the wide range of opinions on life expectancies of legacy portfolios." (Life settlements should not be confused with "viatical" settlements that involve sellers with life expectancies less than two years. The viatical settlement market started in the late 1980s and was aimed at people terminally ill with AIDS. It collapsed in 1996 with the advent of drugs that significantly extended AIDS victims' lives (Stone and Zissu, 2006).

Figure 4: Structure of Pension Buy-Out and Buy-In Transactions



The apparent high cost of buy-outs and buy-ins is a result of insurance companies being typically subject to more stringent regulation than pension funds, such as the necessity to hold resilience test reserves in case of extreme scenarios—while pension funds can temporarily run funding gaps (where the discounted present value of their liabilities exceeds the value of their assets.[10] Additionally, buy-outs can appear expensive, in part, because any initial underfunding requires a lump-sum payment by the sponsor to reach full funding before the plan can be sold to a third party. This option nevertheless remains the most used in the UK pension market because many corporate sponsors prefer not to have a DB plan weigh on their balance sheets. Buy-outs appear to be particularly attractive to smaller pension schemes for whom the pricing gap is not as significant, and who do not have the capability to hedge individual risks on their own.[11] In fact, almost all of the large UK LRT transactions (i.e., larger than £500 million) since 2007 have been either buy-ins or longevity swaps. Furthermore, all of the recent large LRT transactions in the United States have been buy-outs. Compared to the other types of longevity risk transfer, buy-outs have the potential disadvantage for employees that the government-backed guarantee of their pension entitlements is lost, that is, should such a guarantee exist.

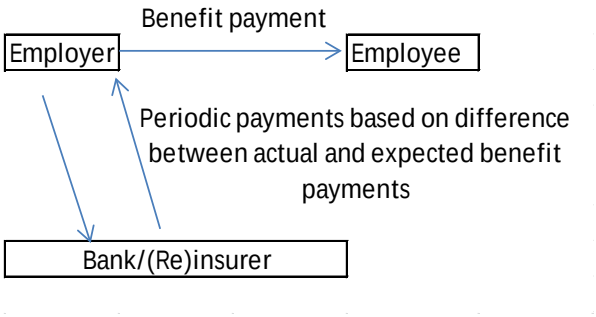
2.3 Longevity Swaps and Insurance

In a longevity swap, the pension fund obtains a similar protection from higher-than-expected pension payouts. The plan sponsor makes periodic fixed “premium” payments to the swap counterparty, which in turn makes periodic payments that are based on the difference between the actual and expected benefit payments (Figure 5). The sponsor maintains full responsibility for making benefit payments to its employees. An advantage of buy-ins and swaps is that they can be used to hedge the longevity risk associated with specific subsets of the underlying population. An advantage of swaps is that longevity risk can be isolated, whereas buy-in and buy-out transactions typically also transfer the investment risk of the assets. Longevity swaps can also be combined with other types of derivative contracts, such as inflation, interest rate and total return swaps, to create so-called “synthetic” buy-ins that do transfer all of the risks.

[10] However, in the Netherlands and United Kingdom, both life insurers and DB pension funds are obliged to value their insurance/pension liabilities on a market-consistent basis using similar liability discount rates.

[11] Smaller pension schemes are subject to higher longevity risks in that their populations of workers may be vulnerable to idiosyncratic risks, such as the top management with the highest pay-outs from the plan living longer than rank-and-file members.

Figure 5: Structure of a Longevity Swap Transaction



Furthermore, swaps are more likely to activate broader capital markets interest. For example, the €12 billion longevity swap between Dutch insurer Aegon and Deutsche Bank used standard International Swaps and Derivatives Association (ISDA) documentation. Also it had a 20-year maturity with a close-out mechanism that determined the final payment, as opposed to the open-ended maturities of more traditional transactions. In addition, the longevity-indexed floating payments are floored and capped so that investors are not exposed to open-ended risk if longevity is either under- or overestimated. Finally, it used a longevity index based on publicly-available data to drive cash flows, as opposed to the actual longevity experience of Aegon's annuity book.[12]

Longevity swaps require the posting of high-quality liquid securities as collateral which can potentially involve significant costs (IMF, 2012). However, the collateral requirements are based on only the net payments - the difference between what each swap participant owes the other. Biffis et al. (2011) show that the cost of collateral to secure longevity swaps can be relatively low, especially when counterparty default risk and collateral rules are symmetric. However, transactions with (re)insurers typically take the form of insurance contracts that may not involve collateral posting.

While there are similarities between insurance and swap transactions, there is an important difference regarding counterparty risk. In longevity insurance, the risk ceding party is exposed to an insurance company and to an insurance company only. In swaps, the risk may be distributed more broadly, yet may return to the swap intermediary (which could be an investment bank) in case of a tail event (e.g. cure for cancer). Whether this matters in terms of the economics depends on how the committed risk-capital of the investors and the investment bank on the one hand compare to the committed risk-capital of the insurer on the other. There is reason to suspect that, because of more stringent regulation, insurance-based transactions lead to more complete risk transfer, as a result of lower counterparty risk.

The counterparty risks associated with different modes of LRT are further discussed below.

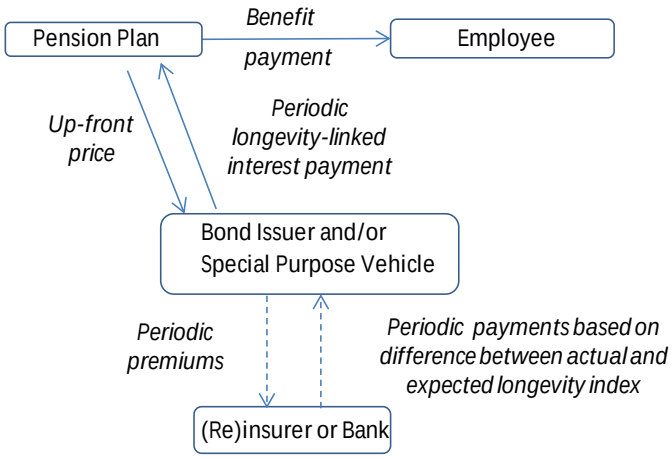
2.4 Longevity Bonds

The payout on longevity bonds depends on the longevity experience of a given population, so that the payment is related to the number of survivors in the population. Basically, it would pay out more, the higher the proportion of survivors in the reference population. One disadvantage is that, unlike a swap, the bond buyer makes a large up-front payment to the issuer, resulting in counterparty risk exposure to the issuer. However, counterparty risk would be minimised if the bonds are issued by a highly-quality

[12] The Aegon –Deutsche Bank transaction references Dutch population mortality data published by the Dutch National Office for Statistics. See Sagoo and Douglas (2012) for more detail.

sovereign or supranational, or by a special purpose vehicle that invests the proceeds in low risk highly liquid fixed income securities, the income from which covers the bond payouts.[13] The issuer might also transfer some or all of the longevity risk to a reinsurer probably via a longevity swap contract.

Figure 6: Structure of Longevity Bond Transaction



To date, there has been no successful longevity bond issuance although there have been several false starts.[14] This contrasts with the much more active market for "mortality" bonds that transfer medium-term (three to five year) risk associated with catastrophic mortality events such as pandemics. In fact, Blake and Biffis (2012) propose that an optimal format for a longevity risk bond would a tranched principal-at-risk instrument very much like a catastrophe bond.

Chapter 3 – Longevity Risk Transfer Market Drivers and Impediments

3.1 Overview

Although there have been a number of large longevity risk transactions, total LRT volumes are as yet a small fraction of total pension fund and (re)insurer longevity risk exposure. In this chapter, potential explanations are given for the relatively small size of the LRT market. Before going into these LRT market impediments, though, possible reasons to transfer longevity risk are discussed.

3.2 LRT Drivers

As mentioned in the introduction, the principal holders of longevity risk are DB pension funds. Given the dire funding position of most DB pension funds today (Towers Watson, 2011; Swiss Re, 2012), a significant longevity shock could undermine corporations' ability to compete and prosper. Accordingly,

[13] A special purpose vehicle is a subsidiary company with a balance sheet structure and legal status that makes its obligations secure even if the parent company goes bankrupt. It is most commonly seen in securitisation transactions.

[14] The European Investment Bank tried to issue a longevity bond in 2004, but it was cancelled due to lack of interest on both the buy- and sell-side (Biffis and Blake, 2009). The World Bank tried a similar product in 2010, but it also did not succeed (Zelenko, 2011).

there may be an incentive for companies to transfer longevity risk off their books, especially since this risk is potentially large. For smaller pension funds, the case for LRT may be relatively strong, as such funds tend to have a larger longevity risk exposure as a result of undiversified idiosyncratic longevity risk.

Regulations may stimulate LRT when this leads to reserve relief for longevity risk sellers similar to the relief provided by more traditional reinsurance arrangements. As with traditional reinsurance, though, relief is only provided if the risk transfer is effective and material basis risk is absent (Groome et al., 2011). For example, UK DB pension plans can get regulatory relief by holding assets with payouts that mirror the behavior of their liabilities, yet they have to demonstrate the effectiveness of the risk transfer. Under Solvency I regulations in Europe, the capital charge for life insurers is based on the size of the technical provisions, and only traditional reinsurance transactions may provide regulatory relief. Given that traditional reinsurance is indemnity based, there is no basis risk. With Solvency II, the menu of acceptable de-risking transactions may broaden, though discussions are still ongoing. Solvency II will introduce a capital requirement for longevity risk that will allow for risk-mitigation techniques, albeit only under certain conditions. First, the protection buyer needs to show that the contractual arrangement does not result in the creation of new risks that are not reflected in the capital requirement. Second, the proposed risk-mitigation instrument should not involve material basis risk. Similarly, Canadian regulations recognise the risk mitigation benefits of longevity risk reinsurance contracts, only as long as there is no material basis risk.

The buyers of longevity risk may be attracted by the limited or even negative correlation of longevity risk with other risk exposures. So far most ultimate “buyers” of longevity risk have been life insurers and reinsurers for whom longevity risk may provide a partial hedge for their insurance exposure. This is because the two risks potentially offset each other — life annuity liabilities increase when annuitants live longer whereas life insurance liabilities decrease.[15] That being so, life insurers may only get some of this offset or even no offset where they already offer life annuities to individuals. In fact, the longevity risk exposures of European (re)insurers was found to be more than five times higher than their mortality risk exposures by the 2011 European Insurance and Occupational Pensions Authority Solvency II Quantitative Impact Study. In addition, reinsurer capacity to take on longevity risk may already be approaching the limit (which market participants interviewed as part of the background work for this report estimate at around $15 billion per year), so a broader investment base would be required to match the large potential seller volume. A relatively untapped pool of potential buyers of longevity risk consists of asset managers, sovereign wealth funds and hedge funds. Asset managers and sovereign wealth funds may be encouraged by the fact that longevity risk is likely to be largely uncorrelated to the other risk factors in their portfolio.[16] However, hedge funds may be put off by the long duration of the contracts and by the potential need to make collateral arrangements over this time frame, which may make them inappropriate for most hedge fund investment styles.

Reverse Mortgages

Regulatory arbitrage may also be a reason to engage in LRT. Indeed, a key lesson from the CRT market has been the importance of aligning regulations and rules across regulated sectors, and regulatory

[15] Cox and Lin (2007) and Dowd et al. (2006) discuss the role that longevity risk-based derivative contracts can play in such hedging. Mortality risk can be used in part to hedge longevity risk, but the risk reduction may be much lower than expected because mortality risk contracts are short-term in nature (typically 1-5 year maturity) with a large exceptional element (e.g., pandemic risk), while longevity-risk is a longer-term risk (typically 20-80 year horizon) and reflects largely unanticipated changes in trend. Thus, while a pandemic may have a large impact on current mortality, its impact on longevity would in principle be much lower.

[16] Even so, the value of instruments for transferring longevity risk is correlated with interest rate levels via their role in the present value discounting of future pay-outs, so the lack-of-correlation rationale may be weaker than expected.

arbitrage into unregulated sectors (e.g., shadow banks). Reverse mortgages may be an instance of a regulatory loophole as such mortgages transfer longevity risk to the banking sector where there is no specific Basel Accord Pillar 1 capital charge for longevity risk. In a reverse mortgage the lender advances payments to the borrower in the form of an up-front lump sum payment or periodic payments. The loan accrues interest and is settled using the proceeds from selling the property when the borrower moves or dies. The loan is nonrecourse, in that the lender does not have access to the assets of the borrower or his/her estate to cover any shortfall (see Box 1).

Box 1

Reverse Mortgage Primer

In a reverse (or 'equity release') mortgage the lender advances cash to the borrower in the form of an up-front lump sum payment or annuity-like periodic payments. The loan accrues interest and is settled using the property sale proceeds when the borrower moves or dies.[17] The loan is nonrecourse, in that the lender does not have access to the assets of the borrower or his/her estate (beyond the collateral property) to cover any shortfall.

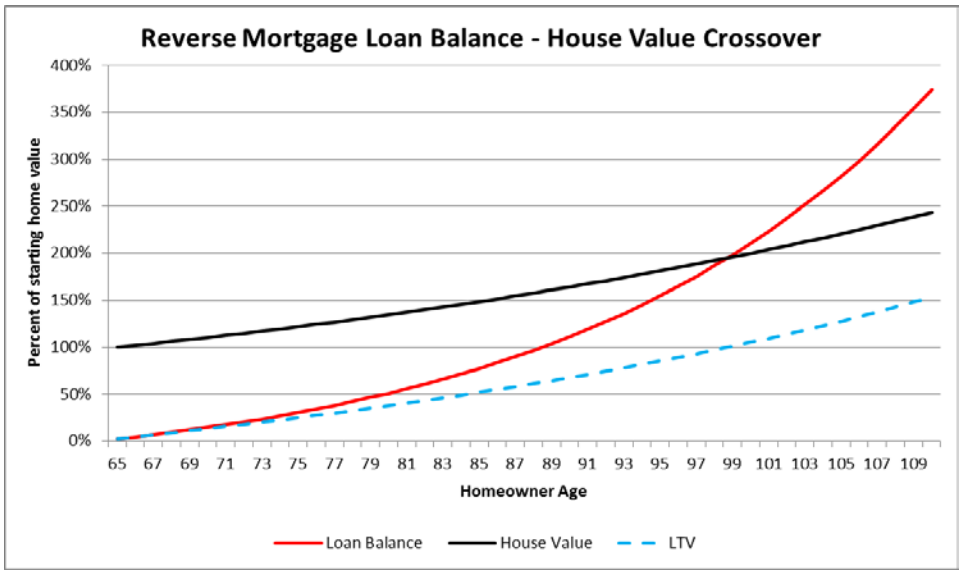
The figure below shows the evolution of the principal and interest accrual versus the house value for a hypothetical reverse mortgages with an annuity-like payout to a 65-year old homeowner.[18] It shows that in the early days the loan-to-value (LTV) ratio is extremely low, but after the "cross-over point" (when the homeowner is about 90 years old here) the LTV exceeds 100 percent and keeps rising. For the lender, this is where the mortgage becomes a money loser, because the home sale proceeds are not enough to cover the advances and accrued interest.

There are three main sources of risk to the lender; borrower longevity, house price depreciation, and rising interest rates (if it is an adjustable-rate mortgage). Models have been advanced to measure and price these risks, and in some countries lenders can access government-run mortgage insurance to eliminate them.[19]

[17] The settlement amount is equal to the minimum of the proceeds and the then-current loan balance (advances plus accrued interest). There may also be other charges and a "contingency payment" that consists of a participation share of any house price appreciation.

[18] The example uses an interest rate of 5 percent, an assumed annuity payment of 2.138 percent of the starting house value, and a 2 percent annual house price appreciation rate.

[19] See Lee, Wang, and Huang (2012) for one such model and the references therein for others. See Szymanoski (1990 and 1994) for the methodology used by the US Federal Housing Administration (FHA) Home Equity Conversion Mortgage (HECM) to price its reverse mortgage insurance.



In most countries, reverse mortgages on bank balance sheets are treated much the same as other residential mortgages. For example, according to Basel II, regular residential mortgages are 75 percent risk-weighted, unless the loan-to-value (LTV) ratio is less than 80 percent, in which case they are 35 percent risk-weighted. Similarly, in the United Kingdom, reverse mortgages are 35 percent risk-weighted, but for an outstanding balance that exceeds the 80 percent LTV, a 75 percent risk weight applies, and any balance that exceeds the value of the property is treated as a loss.[20] On the other hand, reverse mortgages are treated like other residential mortgages in most other countries' banking regulations.

To reduce the potential for regulatory arbitrage, communication and cooperation between those with supervisory responsibility for entities that hold or trade financial instruments containing longevity risk is important. In many jurisdictions pension funds are not under the same regulatory umbrella as (re)insurers. For example, in the United States pension funds are supervised by the Department of Labor (DOL), and in the United Kingdom it is The Pension Regulator that regulates pensions, whilst insurance and banking products are dual-regulated by the Prudential Regulatory Authority (PRA) and Financial Conduct Authority (FCA). In France, Germany and the Netherlands, however, pension funds and (re)insurers are covered by the same prudential supervisors. In Canada, supervision depends on the province of incorporation of the pension plan sponsor or (re)insurer, although the vast majority of insurance is supervised by the federal Office of the Superintendent of Financial Institutions and most pension plan sponsors are provincially incorporated and supervised.

3.3 LRT Impediments

Obstacles to broader interest in buying longevity risk include "lemons" risk because pension funds may have a better idea of how healthy their pension holders are likely to be. The presence of asymmetric

[20] Canada has reverse mortgage rules similar to those in the United Kingdom, except that the 35 percent risk weight applies to mortgages with an initial LTV up to 40 percent and a current LTV up to 60 percent. Otherwise, mortgages with current LTVs up to 60 percent are 50 percent weighted. A 75 weight applies to reverse mortgages with current LTVs above 60 and up to 75 percent, and 100 percent to mortgages with LTVs above 75 percent, except when the LTV exceeds 85 percent, in which case the balance exceeding the 85 percent is treated as losses. In addition, Canadian banks have to undertake an actuarial review of their longevity risk and hold capital for that risk in addition to other Basel capital requirements.

information may create fears of selection bias whereby only those pension funds with the longest-living populations may want to hedge longevity risk. This risk can be priced into proposed transactions, but that could undermine the attractiveness of the transaction on the other side. Alternatively, transactions could be based on the longevity experience of sample populations, such as those tracked by government statistical agencies.

Basing transactions on standardised cohorts would also improve market liquidity. In that regard, the Life & Longevity Markets Association (LLMA) is pushing for the development of a more standardised and liquid index-based LRT market.[21] They are working from the ground up, setting up standardised term sheets and pricing methodologies for such swap transactions, and pushing for the production of granular and more frequently updated life tables.[22] Also, Deutsche Boerse has introduced longevity swaps based on their XPect® family of longevity indices.[23] These swaps settle based on changes in expected life curves over shorter time periods.

However, basing transactions on standardised population cohorts leaves longevity risk sellers with possibly unacceptable levels of basis risk. Basis risk can be large, caused by significant differences in life expectancy at age 65 depending on sex, employment history, income and geographic location. For example, for a higher-income female in the southeast of England life expectancy at 65 is approximately 22 years, whereas for a low-income male living in the north it is just under 13 years (Cass Business School, 2004). Recent research by Coughlan et al., (2011) and Li and Hardy (2011) proposes index-based hedge methodologies to reduce such basis risk, but scepticism remains. Also, credit rating agencies only give partial credit for index-based transfer structures due to the basis risk. Reinsurance arrangements are typically recognised, although some allowance may be given for counterparty risk.

The degree to which pension plans are incentivised to pursue longevity de-risking are also impacted by regulations. For example, while insurers generally have to use the most current mortality projections to value their annuity liabilities, in many countries pension funds face less stringent actuarial requirements.[24] Also, in most jurisdictions, the interest rates used to discount future pension fund liabilities exceed those used by insurers.[25] In the Canada and the United States, for example, pension

21 The LLMA is a non-profit group made up of several investment banks, insurers and reinsurers interested in facilitating the structuring longevity risk transfer deals.

22 Credit Suisse and Goldman Sachs have both tried and given up. Credit Suisse introduced a US longevity index based on publicly-available US government mortality tables in 2006, but quietly pulled it sometime later. In 2007 Goldman Sachs introduced a mortality/longevity index (QxX) on the US insured population over the age of 65, aimed primarily at the life settlement industry. However, they shut that operation down in late-2009. Also in 2007 JP Morgan introduced similar annually updated indices ("LifeMetrics") covering Germany, the Netherlands, the United States, England and Wales. In April 2011, JP Morgan transferred the maintenance and dissemination of the index date to the LLMA.

23 The monthly XPect® indices are based on data from Germany, the Netherlands and United Kingdom. They track a number of male and female cohorts defined by birth dates (1900-19, 1920-39, 1940-59, 1960-79 and 1980-99).

24 A rationale for more lenient pension plan regulations stems from the fact that there tends to be additional protection provided by the sponsor. Even so, in the Netherlands pension funds do have to use the latest actuarial insights on mortality improvements in the valuation of their pension liabilities.

25 For example, in the United States discount rates for corporate pension liabilities can be based on corporate bond yields, which may be higher than the discount rate on insurance liabilities. In Germany, generally since 2012 life insurance undertakings have to use 1.75 % to discount liabilities, whereas pension funds are allowed to use higher discount rates. In Italy the interest rate used by pension funds to calculate technical reserves is fixed annually by the Minister of Labour and Social security and cannot be above the interest rate used to make medium /long term projections for the public debt, which is currently higher than the "risk-free" rates used to discount insurance liabilities. By contrast, in the Netherlands and the United Kingdom "risk free" interest rate curves must be used to discount both projected pension fund and (re)insurer liabilities.

funds' use of out-of-date mortality projections and higher discount rates may be at least partially responsible for the lack of a vibrant LRT market there.

Few jurisdictions impose specific longevity risk charges on pension funds and insurers, although prudent technical provisions play a somewhat similar role.[26] However, Solvency II will impose a specific longevity risk charge on insurers, plus a "risk margin" to cover non-hedgeable risks such as longevity risk. There is a "standard formula" base "solvency capital requirement" (SCR) based on a simulated across-the-board stressed mortality rate reduction, and an "internal model" approach that calibrates the SCR on a 99.5th percentile worst-case scenario. As such, under Solvency II it will become relatively capital-intensive for European insurers to assume longevity risk.

Another example of a regulatory restriction is the US DOL Interpretive Bulletin No. 95-1 that sets the "safest available annuity" standards that some say has restricted pension de-risking in the United States.[27] On the other hand, as an example of broadening the array of de-risking options, Canada's Office of the Superintendent of Financial Institutions (OSFI) has deemed that buy-in annuities are permissible investments of the pension funds they regulate, and that they would be accounted for in solvency ratio calculations.

Firms seeking to de-risk their DB pension plans have seen few rating and market benefits. However, it cannot be said that the rating agencies do not recognise the benefits of these transactions. For example, Fitch Ratings said that the $26 billion June 2012 GM buy-out transaction with Prudential Financial was "incrementally positive to GM's credit profile" but this was offset by the huge size of the remaining underfunded pension plans and the incremental fees and top-ups paid to Prudential (Fitch, 2012).[28] More generally, the results of empirical studies of the market impact of pension funding decisions are rather ambiguous, suggesting that debt markets price in underfunding to some degree, but not equity markets (see Box 2).

The most sophisticated longevity risk managers use specific population data that get down to (and even inside) the postal code level, accounting for socio-economic factors. In contrast, publicly available data are very high level and usually lagging by years, which is hard to build a vibrant market around. In principle, LRT transactions could be based on more granular life tables – e.g., down to the

[26] For example, in Europe, Solvency I does not impose a specific longevity risk charge, but there is a 1% charge on unit-linked annuities (i.e., where all of the investment risk remains with the annuitant) and a 4% charge on traditional life annuities. However, Canadian insurers have to add a margin to the estimated present value of their annuity liabilities to account for various longevity risk improvement and shock assumptions. The basic capital requirement is one percent of the so-calculated liability valuation, which includes any portion of the liability that does not involve life contingencies. On the other hand, there is no specific longevity risk charge on annuities in Germany, Japan and the United States.

[27] According to Waddell (2010), DOL 95-1 dilutes the de-risking impact of a buy-out transaction because the liability could come back to the plan sponsor if the insurance firm to which the plan was effectively transferred to fails and it is deemed that the sponsor did not buy the "safest available annuity" according to the DOL 95-1 standards. Also the effort and cost of doing the appropriate due diligence may make such de-risking transactions feasible for only the largest firms.

However, the NAIC has formed a working group with representatives of the DOL, the White House Council of Economic Advisors, the US Department of the Treasury and any other appropriate federal agencies to consider possible options for easing plan sponsor concerns with the financial soundness of annuity providers as related to the DOL annuity safe harbor plan sponsor selection of annuity provider and fiduciary responsibility requirements.

[28] Similar offsetting points were made in Moody's (2012) and S&P (2012). Also, Moody's (2009) points out that "increased pension fund liability unlikely to be sole driver of ratings downgrades where issuers have adequate liquidity, sufficient resources to alleviate their funding deficiency over time and financial metric contraction is modest for their rating category." Nevertheless, Carroll and Niehaus (1998) found that unfunded liabilities are reflected in credit ratings, but not the benefits of overfunding, concluding that "this asymmetric is consistent with the view that unfunded pension liabilities are corporate liabilities that compete with debt claims, but that there are costs associated with quickly accessing excess pension assets due to the mandated sharing of reverted excess assets."

economic group level. While such granularity would reduce basis risk, it would also create an illiquid market, thereby keeping investors out.

Box 2

Market Impact of Pension Funding Decisions

The results of empirical work on the market impact of pension fund under- and overfunding are rather ambiguous, suggesting that debt markets price in pension underfunding to some degree, but not equity markets. Cardinale (2007) finds that credit spreads reflect unfunded liabilities for investment-grade (IG) firms, but not for non-IG ones. Gallagher and McKillop (2010) find that pension disclosures are reflected in credit default swap (CDS) spreads

McFarland et al. (2009) find that pension underfunding is generally not reflected in equity prices. However, this could be an opacity issue, because they also find that the shares of firms with severely underfunded plans underperform those of firms with healthier pension plans for at least five years after the underfunding is first revealed. With regards to opacity, it is notable that all of these studies cover pre-2007 US-centric data, and it was not until 2007 that the enhanced disclosure requirements of FAS 158 came into effect. (Similarly enhanced disclosure came to the United Kingdom in 2003 via FRS 17.)

Finally, both sides of the market are also affected by a lack of reliable and sufficiently detailed information about longevity developments. Life tables are not updated frequently and are only available for relatively aggregated groups in the population. Sophisticated longevity risk management and transfer would benefit from much more disaggregated demographic data (including, for example, by postal code and cause of death), which can reduce basis risk; indexes of such data would facilitate the design and trading of LRT instruments. However, using more granular, disaggregated data sets leads to smaller samples in each data group, therefore potentially raising credibility issues.

Chapter 4 – Risk Management Challenges, Systemic Risks and Stress Scenarios

4.1 Overview

Although LRT markets are not sizeable enough to present immediate systemic concerns, their potential size is enormous. LRT leads to linkages between and across firms involved in the risk transfer chain. These linkages are important from a microprudential perspective, yet may even become an issue on a macropudential or systemic scale.

The potential size is to a large extent dependent on official policy regarding longevity risk transfers away from corporate pension funds, which seems quite ambivalent in many jurisdictions. Plus in some countries the public sector owns most of the longevity risk (e.g., France and Japan) and in others most corporate funds have transferred their longevity risk to their employees and pensioners via DC plans. In the end, policy decisions with respect to LRT markets are very much intertwined with policy positions regarding the optimal “home” for longevity risk.

4.2 Risk Management Challenges

A key risk that may arise from LRT is counterparty default risk. Buy-ins, longevity swaps, longevity insurance, and longevity bonds all create counterparty risk to the cedent, though to varying degrees. By contrast, buy-outs usually do not expose the cedent to counterparty risk. In fact, following a buy-out, except in Germany and the United States the cedent's obligations to employees typically cease to exist.[29]

Table 1 describes the counterparty risk originating from different types of transactions, and the risk management approaches that could be used to mitigate this risk. In the case of buy-ins and longevity insurance, the longevity risk cedent is exposed to the ability to pay by the (re)insurer. While it surely helps that (re)insurers are regulated entities, experiences of the financial crisis of 2008-09 have highlighted the importance of sound risk management regardless. Note that a buy-in leads to a larger counterparty risk exposure than a comparable longevity insurance transaction, as principal and investment risk are also exchanged in case of buy-ins.

In traditional reinsurance transactions, ratings play an important role in the evaluation of counterparty risk. This market practice is also recognised in the latest drafts of the standard formula of the pending Solvency II regime in the European Union, where the probability of default (PD) is determined by the rating of the respective reinsurance company. Diversification, that is using different reinsurance counterparties, is also good practice. Both diversification and the use of ratings are equally valuable when dealing with counterparty default risk arising from LRT.

In longevity swaps, the direct counterpart of the risk cedent may not be a (re)insurer, and counterparty risk can also be mitigated through collateral arrangements. However, because new information on mortality rates is likely to become available with substantial lags, net exposures may still become sizeable. To promote a more frequent settlement of outstanding claims under a longevity swap, a pre-specified mark-to-model method could be used.

Counterparty risk originating from longevity risk transfer — Table 1

	Counterparty	Exposure	Risk management controls
Buy-in	(Re)insurer	Principal plus exposure contingent on investment and longevity risk	Credit risk due diligence (e.g., ratings and scenario analysis)
Longevity insurance	(Re)insurer	Exposure contingent on longevity risk	Credit risk due diligence and, in some cases, collateral posting
Longevity Swap	(Re)insurer Bank Capital Markets	Exposure contingent on longevity risk	Credit risk due diligence and collateral posting based on frequently updated mark-to-model.

Depending on the type of risk transfer, the cedent may also become exposed to basis risk. Basis risk occurs when the longevity hedge is imperfect, which is particularly obvious in case of index-based longevity risk transfers. Indeed, the longevity experience of the hedged exposure may differ from that of the index. Coughlan et al. (2011) describe how basis risk arising from index-based longevity hedges can be analysed and mitigated. Such methods were applied on the Aegon - Deutsche Bank longevity swap of January 2012. Nevertheless, basis risk remains a potential concern.

[29] See footnotes 1 and 27.

As longevity swap transactions tend to mature prior to the closure of the underlying pension plan, there is often so-called rollover risk. Indeed, when the swap comes to an end, the pension plan no longer is protected against longevity risk and may not be able to enter into a new longevity swap with similar terms. Related to this, there is some debate as to whether genuine risk transfer can be effected with a contract which lasts for a period of time which is significantly shorter than the length of the underlying contract (10 years, versus full annuity run-off).

Finally LRT may lead to opacity risk arising due to differences in the knowledge, skills and expertise of the buyer and seller of longevity risk. Opacity risk likely increases with the number of links in the risk transfer chain, as the original seller of longevity risk and the ultimate buyer become more and more apart.

For the institution or investor that accepts the longevity risk of a LRT the risk management may be challenging. Under normal circumstances, longevity risk portfolios include a high degree of diversification because death events can usually be considered to be independent. However, there are situations where diversification may largely disappear, for example when medical improvements or lifestyle changes positively affect the longevity of the whole portfolio. Also the diversification between longevity risk and financial risks may be overstated because the impact of longer life expectancy on the economy (in particular on corporates with pension liabilities) is overlooked. These tail dependencies make it difficult to assess, model and manage longevity risk effectively.

4.3 Potential Systemic Risk under Stress Scenarios

An important lesson from the credit risk transfer (CRT) market, which is much more developed, is that the transfer of risk may lead to undesired and unforeseen consequences. In the case of CRT markets, a proliferation of complex products resulted in the buildup of concentrated leveraged positions, much of them held by investors who did not fully appreciate the higher-risk nature of these products (Joint Forum, 2008). Furthermore, some forms of credit risk transfer, particularly those customised to investor preferences, lacked transparency in relation to what was being transferred and to whom, and markets turned illiquid under stress, which also made reliable valuation difficult.

In the case of longevity risk transfer, as in pre-crisis CRT markets, risk concentration seems especially likely, given the complexity and specialised nature of these transactions. In fact, currently only a handful of (re)insurers and investment banks are active in the LRT market. Also LRT instruments may lack transparency about the nature and size of the inherent risk, in particular where the longevity risk relates to an actual portfolio of annuities that is managed by the cedent of the risk. Even more than for CRT instruments, the valuation of LRT instruments may lack reliability because there are no liquid markets for these instruments. Where valuations are use models based on past longevity experience, uncertainty about future longevity developments may put the reliability of valuations in doubt.

Although investment banks generally act as intermediaries in LRT transactions, rather than holders, they are not invulnerable to sharp life expectancy increases. If their counterparties are unable to meet the contractual demands, the investment banks themselves become exposed to any crystallised longevity risk. If the sharp rise in longevity is systemic, for example because medical doctors have found a cure for cancer, conceivably all longevity risk contracts become ‘in the money’ and the longevity risk transfer chain potentially breaks down. When the market has had time to grow to sizeable proportions before a stress scenario occurs, longer life expectancy may have repercussions on the broader financial system, particularly given that (investment) banks are involved.

One way to avoid a breakdown of the risk transfer chain might be to cap the transfer of risk to a predefined amount. By posting collateral, possibly equal to the predetermined amount at inception with frequent re-posting as expected present values change, the risk transfer could be effectively guaranteed in theory.[30] Note that a cap on the risk transfer also enhances the marketability of longevity risk to the capital market, as recent transactions have shown. However, collateral posting and good risk management require reliable and widely accepted valuation methodologies, whereas these still look to be in the research stage at present. If there were liquid secondary markets for such products in a standardised form, valuations could be bootstrapped from market prices, but such markets have yet to develop (Barrieu et al., 2012, and Cairns, 2013). Also, even if a widely accepted model of longevity risk did exist, collateral requirement gaps could still be created by longevity shocks (e.g., a cure for cancer is discovered).

Another option might be to prohibit certain market participants from taking longevity risk. To some degree some jurisdictions already do this. For example, in most jurisdictions legislation and/or regulations prohibit banks from issuing life annuities and insurance contracts. Although banks are allowed to sell various retirement products, they are typically prohibited from offering guaranteed income streams linked to the lifespan of the purchaser. However, banks are generally permitted to do longevity swaps, and some own insurance subsidiaries.

Another issue involves the potential for opaque interconnections to be formed by chains of LRT transactions. In many cases, counterparties to the initial transaction (e.g., with a pension plan sponsor) transfer some or all of the risks on to other (re)insurers, and in the future, possibly to capital markets. Jurisdictions should consider the degree of interconnectedness of any losses arising from longevity risk. Not only is longevity risk likely to affect most owners/writers at the same time, but it is possible that, if banks (in particular) assume longevity risk, losses arising due to longevity risk may affect the stability of the financial system. This may not be a current concern given the small size of LRT markets, but it may be something to bear in mind for the future.

Due to inconsistent treatment of longevity risk across financial sectors longevity risk may accumulate where it is least regulated or not regulated at all. There may also be a tendency that transfers take place from parties that have risk expertise to parties that have less risk expertise. Consequently, risks may accumulate where they are least understood and are monitored and managed less effectively.

Chapter 5 – Main Findings and Recommendations

5.1 Main Findings

Longevity risk – the risk of paying out on pensions and annuities longer than anticipated – is a major risk for the sustainability of retirement systems around the world. While longevity risk holders are much focused on investment risks, a one year longevity underestimation is expected to cost them between $450 billion and $1 trillion in aggregate. Even on a global scale, these are massive amounts.

Corporate DB pension plans hold a large part of the world's longevity risk. In order to reduce the build-up of further longevity risk, many corporations have undertaken steps such as closing DB pension plans to new employees and closing DB accruals to existing employees. At the same time, it has become increasingly common for employers to offer DC plans, where the risk of living longer than

[30] In fact posting of collateral up front ("initial margin" or "independent amounts") and as valuations change ("variation margin") on all swap contracts, with rare exceptions, has been mandated by the Financial Stability Board (FSB, 2013).

expected is effectively borne by the employees rather than the employer. Though these changes in the pension domain have restrained the growth of the longevity risk exposure of plan sponsors, corporations tend to remain responsible for already accrued DB benefits. Hence, some of them have turned to LRT markets.

There are three primary types of LRT transactions: buy-outs, buy-ins and longevity swaps (or insurance). In a buy-out, all of the pension plan's assets and liabilities are transferred to a (re)insurer in return for a premium. In a buy-in, on the other hand, the assets and liabilities remain on the pension fund's balance sheet. While buy-outs and buy-ins transfer both investment and longevity risk, longevity swaps (and insurance) transfer only the latter. However, buy-ins and longevity swap (and insurance) transactions leave the pension fund with counterparty risk.

This Joint Forum report provides a first and preliminary analysis of the LRT market, including the associated potential risks and cross-sectoral issues for market participants, policymakers and supervisors.

Main findings

- LRT markets are still relatively small compared to their market potential. While the majority of LRT transactions have taken place in the United Kingdom, so far only £50 billion of DB pension liabilities have been de-risked (versus total DB assets of approximately £1 trillion). In 2012 there were three large transactions outside the United Kingdom – two large buy-outs in the United States (concerning $26 and $7 billion of underlying assets) and a €12 billion longevity swap in the Netherlands. Yet even with these transactions, LRT markets remain small in comparison to the multi-trillion dollar size of pension and annuity liabilities worldwide.
- Explanations for the small size of LRT markets include the relatively lenient regulatory treatment of longevity risk in pension funds compared to (re)insurers, selection bias ("lemons") risk and, in case of index-based transactions, basis risk. Another often-cited LRT market impediment is a lack of reliable and sufficiently detailed data on longevity developments, hampering the accurate valuation of pension and life insurance liabilities as well as the proper assessment of longevity risk.
- Techniques to broaden LRT markets tend to expose longevity risk sellers to new risks that may be substantial. For example, in order to reduce selection bias risk, LRT transactions may be based on population indices as opposed to the risk cedent's actual longevity experience. While this makes the transactions more attractive to capital market participants, it leaves the cedent with basis risk. At the same, the risk transfer chain tends to grow in length, which leads to more opacity risk due to differences in the knowledge and skills between the seller and the buyer of longevity risk.
- Regulatory arbitrage may also drive longevity risk transfer, as it did to the now much more developed CRT markets. For example, reverse mortgages may be an instance of a regulatory loophole, as such mortgages transfer longevity risk to the banking sector where there is no specific Basel Accord Pillar 1 capital charge for this type of risk. Though Pillar 2 of the Basel Accord requires banks to identify and assess their risks, and ensure that "capital targets are… consistent with their overall risk profile," banks that do not believe their longevity risk is material may not include it in their risk profiles. Plus, by not being in Pillar 1, longevity risk-related capital requirements could differ significantly between jurisdictions.
- Given their potentially large size, LRT markets may raise systemic risk concerns in the future. As in the case of CRT, LRT may lead to a buildup of risk, much of which is held by only a handful of investors. While investment banks typically act as intermediaries in LRT deals, not as primary holders, they still present risks to their counterparties that could materialise in case of a longevity tail risk event. This could even lead to a systemic risk event if and when LRT markets have grown to their potential size and breadth.

- In countries where government-backed pension guarantee schemes exist, employees may prefer that their pension benefits not be transferred through a buy-out, as the guarantee is lost. Other LRT instruments (buy-ins and longevity swaps/ insurance) do not share this drawback, yet leave pension fund sponsors and (re)insurers with counterparty risk. In case of a buy-out, pensioners effectively become exposed to the counterparty risk of a (re)insurer that is often more stringently regulated than their pension fund.
- The Joint Forum notes that in many jurisdictions policymakers have remained silent on the appropriateness of LRT activity in their jurisdictions. In most countries there appear to be few, if any, restrictions on transferring longevity risk across regulated sectors, and beyond. Even among regulated sectors, the regulatory treatment of longevity risk appears inconsistent.

5.2 Policy Recommendations

Whether or not policymakers should play a more active role in encouraging longevity risk transfer from private pension plans to (re)insurers and ultimately to broader capital markets depends on considerations regarding where this risk is best held. Answering this question is beyond the scope of this preliminary analysis, but some relevant factors are worth mentioning.

Advocates of more LRT (see, e.g., Towers Watson, 2011, and Swiss Re, 2012) point to already visible and unwieldy corporate pension benefit obligations and to the heavy underfunding of DB pension funds.[31] In this context, they recognise that not only are pension obligations a sizeable distraction to corporate core business lines, but a significant longevity shock could undermine the firm's own existence. In addition, they point out that some LRT instruments (namely buy-outs) may provide pensioners with a more stringently regulated (re)insurer counterparty.

In addition, policymakers may want to encourage (re)insurers to use LRT markets to free up capital in order to give (re)insurers (or any other entities allowed to provide annuity products) the possibility of writing more of these annuities, which are useful and unique retirement products. On the other hand, the transfer of risk from a mature sector with significant capital requirements to an LRT market that may not have these safeguards may not be in the employees' best interests, and may even create new systemic risks.

At the same time, when longevity risk is shifted from the corporate sector to a limited number of (re)insurers, with global interconnections, there may be systemic consequences in the case of a failure of a key player (as was the case in the CRT market). Most countries in which this view is shared incentivise the private sector to provide adequate retirement benefits to employees, sometimes providing explicit protection to corporate pension funds with government-supported guarantee schemes. In other countries, this view is expressed implicitly by allowing pension funds to value their liabilities with a discount rate that is higher than the one used for (re)insurers' reserves.

[31] The academic literature has put forward a number of different theories to explain why corporations might over- or under-fund the pension funds they sponsor. One such theory predicts that firms will underfund to maximise the value of an effective bankruptcy put option on fund assets provided by pension guarantee schemes such as the US Pension Benefit Guarantee Corporation (Sharpe, 1976, and Treynor, 1977). In fact, An et al. (2013) find evidence of pension put option maximisation-driven underfunding by financially distressed firms. On the other hand, profitable and well-capitalised firms tend to over-fund, which is consistent with theories that model pension funds as shelters for safe liquid assets on a tax-advantaged basis for future consistencies (Black, 1980, Bodie et al., 1987, and Francis and Reiter, 1987).

Motivated by the aforementioned preliminary findings, the Joint Forum proposes the following recommendations to supervisors and policymakers.[32]

1. *Supervisors should communicate and cooperate on LRT internationally and cross-sectorally in order to reduce the potential for regulatory arbitrage.* Adequate supervisory cooperation is key to reducing the potential for regulatory arbitrage, especially in those jurisdictions where pension funds and (re)insurers do not have the same regulatory/ supervisory authority.

2. *Supervisors should seek to ensure that holders of longevity risk under their supervision have the appropriate knowledge, skills, expertise and information to manage it.* Supervised holders should be prepared to demonstrate these abilities to their relevant supervisor, while appropriate education should be provided to the public with respect to retirement and life-long products.

3. *Policymakers should review their explicit and implicit policies with regards to where longevity risk should reside to inform their policy towards LRT markets. They should also be aware that social policies may have consequences on both longevity risk management practices and the functioning of LRT markets.* Such reviews should consider which sector is in the best position to bear and manage the risk, and the roles of pension and insurer guarantee mechanisms.

4. *Policymakers should review rules and regulations pertaining to the measurement, management and disclosure of longevity risk with the objective of establishing or maintaining appropriately high qualitative and quantitative standards, including provisions and capital requirements for expected and unexpected increases in life expectancy.* Standards will need to recognise differences across jurisdictions in the roles of various types of longevity risk buyers and sellers in bearing longevity risk uncertainty.

5. *Policymakers should consider ensuring that institutions taking on longevity risk, including pension fund sponsors, are able to withstand unexpected, as well as expected, increases in life expectancy.* Relatively lenient treatment of pension obligations in some jurisdictions has been noted as a market distortion that needs to be better justified by policymakers.

6. *Policymakers should closely monitor the LRT taking place between corporates, banks, (re)insurers and the financial markets, including the amount and nature of the longevity risk transferred, and the interconnectedness this gives rise to.* The financial crisis of 2008-09 has shown that the transfer of risk may lead to undesired and unforeseen consequences. Indeed, in the much more developed CRT markets, risk transfer actually led to risk concentration among a relatively small number of investors that were unable to bear the risk when this was most needed. In the case of LRT, risk concentration seems also likely, given the complexity and specialised nature of these transactions. In fact, only a few (re)insurers and investment banks are currently active in LRT markets. Transparency on longevity risk positions will be instrumental in preventing an undesirable buildup of this potentially large risk.

7. *Supervisors should take into account that longevity swaps may expose the banking sector to longevity tail risk, possibly leading to risk transfer chain breakdowns.* If the counterparties of investment banks are unable to meet their contractual demands under the longevity swap, the banks themselves become exposed to any crystallised longevity risk. If the sharp rise in life expectancy is systemic, for example because a cure for cancer has been found, conceivably all longevity risk contracts are 'in the money'. This could then lead to a failure of LRT market participants, including banks active as intermediaries in longevity swap transactions.

[32] See footnote 3 for definitions of the terms 'supervisors' and 'policymakers'.

8. *Policymakers should support and foster the compilation and dissemination of more granular and up-to-date longevity and mortality data that are relevant for the valuations of pension and life insurance liabilities.* Such data would also be instrumental to the measurement and management of longevity risk. Indeed, among other things better longevity and mortality data would help to reduce the basis risk created by risk transfer transactions based on standard indices.

References

Aegon, 2011, “Paying the Price for Living Longer: What is the Right Price for Removing Longevity Risk?” Aegon *Global Pensions View*.

A.M. Best, 2009, “Life Settlement Securitization,” Criteria – Insurance-Linked Securities, November 24.

An, Heng, Zhaodan Huang, and Ting Zhang, 2013, "What Determines Corporate Pension Fund Risk-Taking Strategy?" *Journal of Banking & Finance*, Vol. 37, No. 2, pp. 597–613.

Aon Hewitt, 2011, Global Pension Risk Survey 2011. Available at www.aon.com/netherlands/persberichten/2011/Aon_Hewitt_GRS_EURO_2011.pdf)

Barrieu, Pauline, Harry Bensusan, Nicole El Karoui, Caroline Hillairet, Stephane Loisel, Claudia Ravanelli, Yahia Salhi, 2012, "Understanding, Modelling and Managing Longevity Risk: Key Issues and Main Challenges," *Scandinavian Actuarial Journal*, Volume 2012, Issue 3, pp. 203-231.

Biffis, Enrico and David Blake, 2009, “Mortality-Linked Securities and Derivatives,” October 7. Available at SSRN: http://ssrn.com/abstract=1340409

Biffis, Enrico and David Blake, 2012, “How to Start a Capital Market in Longevity Risk Transfers,” Unpublished manuscript, September.

Biffis, Enrico, David Blake, Lorenzo Pitotti, and Ariel Sun, 2011, “The Cost of Counterparty Risk and Collateralization in Longevity Swaps,” Cass Business School Pension Institute Working Paper (London: City University, April.

Black, Fischer, 1980. "The Tax Consequences of Long-Run Pension Policy," *Financial Analysts Journal*, Vol. 36, No. 4, pp. 21-28.

Blake, David, Tom Boardman, and Andrew Cairns, 2010, “Sharing Longevity Risk: Why Governments Should Issue Longevity Bonds,” Cass Business School Pension Institute Working Paper, (London: City University, March).

Bodie, Zvi, Jay O. Light, Randall Morck, and Robert A. Taggart Jr., 1987. "Funding and Asset Allocation in Corporate Pension Plans: An Empirical Investigation," In: Bodie, Zvi, John B. Shoven, and David A. Wise, (Eds.), *Issues in Pension Economics*, University of Chicago Press, Chicago, pp. 15-47.

Brown, Jeffrey R., Jeffrey R. Kling, Sendhil Mullainathan, and Marian V. Wrobel, 2008, “Why Don’t People Insure Late Life Consumption? A Framing Explanation of the Under-Annuitization Puzzle,” National Bureau of Economic Research Working Paper No. 13748, January.

Cairns, Andrew J.G., 2013, "Modelling and Management of Longevity Risk," Unpublished Working Paper, March.

Cardinale, Mirko, 2007. "Corporate Pension Funding and Credit Spreads," *Financial Analysts Journal*, Vol. 63, No. 5, pp. 82-101.

Cass Business School, 2005, “Is longevity risk a one-way market?” Cass Business School Pension Institute. Available at www.pensions-institute.org/conferences/longevity/conference_summary_18.02.05.pdf.

Coughlan, Marwa Khalaf-Allah, Yijing Ye, Sumit Kumar, Andrew J.G. Cairns, David Blake, and Kevin Dowd, 2011, “Longevity Hedging 101: A Framework for Longevity Basis Risk Analysis and Hedge Effectiveness,” *North American Actuarial Journal*, Vol. 15, No. 2, pp. 150–76.

Cox, Samuel H. and Yijia Lin, 2007, “Natural Hedging of Life and Annuity Mortality Risks,” *North American Actuarial Journal*, Vol. 11, No. No. 3, pp. 1–15.

CRO Forum, 2010, “Longevity,” CRO Briefing Emerging Risks Initiative Position Paper. Available at www.thecroforum.org/publication/eri_longevity.

Dowd, Kevin, David Blake, Andrew J.G. Cairns, and Paul Dawson, 2006, “Survivor Swaps,” *Journal of Risk and Insurance*, Vol. 73, No. 1, pp. 1–17.

Financial Stability Report (FSB), 2013, “OTC Derivatives Market Reforms: Fifth Progress Report on Implementation,” April 15.

Fitch Ratings, 2012, “Pension Plan Changes Incrementally Positive to GM's Credit Profile,” Fitch Ratings Endorsement Policy, June 1.

Fong, Joelle H. Y., Olivia S. Mitchell, and Benedict S.K. Koh, 2011, “Longevity Risk Management in Singapore’s National Pension System,” *Journal of Risk and Insurance*, Vol. 78, No. 4, pp. 961-981.

Francis, Jere R., and Sara Ann Reiter, 1987, "Determinants of Corporate Pension Funding Strategy," *Journal of Accounting and Economics*, Vol. 9, pp. 35-59.

Gallagher, Ronan C., and Donal G. McKillop, 2010, "Unfunded Pension Liabilities and the Corporate CDS Market," *Journal of Fixed Income*, Winter, pp. 30-46.

Groome, Todd, John Kiff, and Paul Mills, 2011, “Influencing Financial Innovation: The Management of Systemic Risks and the Role of the Public Sector,” in Beder, Tanya, and Cara M. Marshall, 2011, *Financial Engineering: The Evolution of a Profession*, John Wiley & Sons Inc.

International Monetary Fund (IMF), 2012, *Global Financial Stability Report*, World Economic and Financial Surveys (Washington, April).

Joint Forum, 2008, *Credit Risk Transfer - Developments from 2005 to 2007*, July.

Joint Forum, 2010, Review of the Differentiated Nature and Scope of Financial Regulation, January.

Lee, Yung-Tsung, Chou-Wen Wang, Hong-Chih Huang, 2012, "On the valuation of reverse mortgages with regular tenure payments," *Insurance: Mathematics and Economics*, Vol. 51, pp. 430–441.

Li, Johnny Siu-Hang, and Mary R. Hardy, 2011, “Measuring Basis Risk in Longevity Hedges,” *North American Actuarial Journal*, Vol. 15, No.2, pp. 177–200.

Monk, Ashby H.B., 2010, “Pension Buyouts: What Can The USA Learn From The UK Experience?” International Journal of Financial Services Management, Vol. 4, No. 2, pp. 127-150.

McFarland, Brendan, Gaobo Pang, and Mark Warshawsky, 2009, "Does Freezing a Defined-Benefit Pension Plan Increase Company Value? Empirical Evidence," *Financial Analysts Journal*, Vol. 65, No. 4., pp. 47-59.

Moody’s, 2009, “Managing Ratings with Increased Pension Liability,” Moody’s Investor’s Service, March.

Moody’s, 2012, “Moody's says GM's Credit Profile and Rating Unchanged by Salaried Pension Actions,” Moody’s Investor’s Service, June 1.

Organisation for Economic Co-operation and Development (OECD), 2012a, “OECD Pensions Outlook 2012,” June.

Organisation for Economic Co-operation and Development (OECD), 2012b, “Pension Markets in Focus,” September.

Pension Protection Fund, 2011, “PPF 7800 Index,” United Kingdom Pension Protection Fund, October 31. (www.pensionprotectionfund.org.uk/Pages/PPF7800Index.aspx)

Ponds, Eduard, and Bart van Riel, 2009, “Sharing the Risk: The Netherlands’ New Approach to Pensions, *Journal of Pension Economics and Finance* 8, pp. 91-105.

Sagoo, Pretty, and Roger Douglas, 2012, “Recent Innovations in Longevity Risk Management; A New Generation of Tools Emerges,” Eighth International Longevity Risk and Capital Markets Solutions Conference, September 8. Available at www.cass.city.ac.uk/__data/assets/pdf_file/0008/141587/Sagoo_Douglas_presentation.pdf.

Sharpe, William, F., 1976. "Corporate Pension Funding Policy," *Journal of Financial Economics*, Vol. 3, No. 3, pp. 183-193.

Standard & Poor's (S&P), 2011, "Life Settlement Securitizations Present Unique Risks," Structured Finance Research, March 2.

Standard & Poor's (S&P), 2012, "General Motors Co.'s Proposed Actions On U.S. Salaried Pension Plans Do Not Affect Ratings," Standard & Poor's Bulletin, June 1.

Stone, Charles and Anne Zissu, 2006, "Securitization of Senior Life Settlements: Managing Extension Risk." Journal of Derivatives, Spring.

Swiss Re, 2010, *A Short Guide to Longer Lives: Longevity Funding Issues and Potential Solutions*. Available at http://media.swissre.com/documents/Longer_lives.pdf

Swiss Re, 2012, *A Mature Market: Building a Capital Market for Longevity Risk*. Available at http://media.swissre.com/documents/Mature_Market_EN.pdf

Szymanoski, Edward J. , Jr., 1990, "The FHA Home Equity Conversion Mortgage Insurance Demonstration: A Model to Calculate Borrower Payments and Insurance risk, U.S. Department of Housing and Urban Development, October.

Szymanoski, Edward J. , Jr., 1994, "Risk and the Home Equity Conversion Mortgage," *Journal of the American Real Estate and Urban Economics Association*, Vol. 22, No. 2, pp. 347-366.

Towers Watson, 2011, *Insights into Global Pension Risk*.

Treynor, Jack L., 1977. "The Principles of Corporate Pension Finance," *Journal of Finance*, Vol. 32, No. 2, pp. 627-638.

UK Pension Protection Fund, 2006, *The Purple Book: DB Pensions Universe Risk Profile*, Jointly prepared by the UK Pension Protection Fund and The Pensions Regulator. Available at www.pensionprotectionfund.org.uk/Pages/ThePurpleBook.aspx

Waddell, Melanie, 2010, "Biggest Barriers to Lifetime Income Adoption: Fiduciary Liability, Insurer Insolvency," AdvisorOne.com, September 14.

Zelenko, Ivan, 2011, "Longevity Risk Hedging and the Stability of Retirement Systems," World Bank presentation given at the Cass Business School Pension Institute Seventh International Longevity Risk and Capital Markets Solutions Conference, Frankfurt, September 8