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Systemic Aspects of Pension Funds and the Role of Supervision

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Introduction

Systemic risk is a subject that has started receiving a lot of attention since the financial crisis of 2007/08. Most of the discussion is on the relation between the banking system and systemic risk. In a previous article (see Beetsma and Vos 2016), we explored the relationship between systemic risk and the financial stability of pension funds, and highlighted some important issues regarding this relationship. In particular, we briefly discussed why pension funds have a number of features – including a long-term investment horizon, restrictions on borrowing and the use of derivatives – that act as a stabilising influence in the financial system. We also discussed some recent empirical evidence on the presence of these features (see, for example, EIOPA 2016; Broeders *et al.* 2016), and finished by discussing different ways in which potential systemic risks can arise from pension funds, and how proper supervision can alleviate these risks. This article delves deeper into the role that pension funds play in the financial system and how pension fund supervision may mitigate any systemic risks related to pension funds. We conclude by assessing actual supervision practice in European countries and how it may be improved from the perspective of mitigating systemic risks.

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Pension funds and systemic risk

Following the global financial crisis of 2007/08, a substantial body of literature on systemic risk has appeared. There is no single clear-cut definition of systemic risk; Bisias *et al.* (2012) provide a broad survey of existing definitions of systemic risk, and of different proposed measures of systemic risk. However, the general perception is that systemic risk concerns the functioning of the financial system as a whole. Systemic risk is higher if a single (combination of) event(s) can lead to a chain reaction that threatens the functioning of the financial system in its entirety. An example is a financial system in which banks are interconnected, because they have liabilities to each other. If a bank fails, other banks do not get paid back, implying the potential failure of other banks with large stakes in the initial bank. These banks may go under, and a domino effect could lead to the collapse of the entire banking system. Systemic risk does not need to arise from external shocks, although the existence of severe external shocks could enhance systemic risk. It may also arise endogenously from within a financial system, e.g. through unsound management decisions that cause a bank to fail. Predicting a systemic crisis is also difficult. Nevertheless, there are potentially promising directions in this regard. Giglio *et al.* (2015) combine nineteen individual measures of systemic risk into an aggregate 'systemic risk index'. Individually, the measures do not perform particularly well in predicting a financial crisis, but combined into the index their predictive performance becomes quite strong.

Systemic risk has mostly been studied in connection with the banking and the insurance sector. However, an interest in the potential systemic risk of the pensions sector has recently emerged. EIOPA (2016) has conducted stress tests on pension funds, concluding that systemic risks associated with pension funds are low. In contrast to banks, in particular, several of their characteristics lower the potential systemic risks associated with pension funds, as they contribute to financial stability in various ways. Firstly, the average duration of their obligations is high, which makes them natural investors for the long run. Secondly, they are

only allowed to borrow to meet their short-run liquidity needs, but not for speculative purposes. Thirdly, while they can become technically insolvable, they cannot go bankrupt. Solvency issues are handled by deploying existing instruments, such as (sponsor) contributions and reduced indexation. Finally, they are only allowed to use derivatives for hedging purposes (in practice mostly to hedge interest and currency risk), and not for speculative purposes. In fact, pension funds may even contribute to the stability of the financial system through policies of rebalancing their portfolios: when adverse price movements push down the relative weight of a specific asset class in the fund's portfolio, the fund buys additional instruments in this class to restore the original share allocated to the class. An empirical analysis by Broeders *et al.* (2016) for forty large Dutch funds over the period 2009–2014 confirms this finding. This behaviour of pension funds counters the destabilising behaviour typically observed in other parts of the financial sector: when asset prices fall, equity positions deteriorate. Leveraged institutions like banks have to sell assets, thereby putting further pressure on asset prices. In addition, during distress on the financial markets, we typically observe higher margin requirements, larger haircuts and a decrease in risk appetite, which all put more pressure on asset prices (see Brunnermeier *et al.* 2009).

Macroeconomic and systemic risk when pension funds act independently

Pension funds can be the source of two types of aggregate risk. The first is macroeconomic risk: when pension funds are in financial difficulties, pension contributions may have to be raised and/or the level of the pension benefits may have to be reduced. Both types of measures depress disposable income and, thereby, aggregate demand. The second type of risk is systemic risk. Systemic risk concerns their potential effect on financial markets or segments thereof.

In the economics literature, there is a clear connection between macroeconomic and systemic risk. Macroeconomic risk may arise from a number of sources, typically aggregate demand or supply shocks that may be due to a wide-ranging set of causes. Systemic risk is seen as one possible source of macroeconomic shocks: systemic problems in the financial sector spill over to the wider economy and cause an economic downturn (see He and Krishnamurthy 2014; Brunnermeier and Sannikov 2014). Thus, systemic problems in the financial sector typically result in macroeconomic problems. The reverse is not necessarily the case. Macroeconomic problems can arise without any consequences for the financial system as a whole, although a negative feedback spiral between problems in the financial sector and a macroeconomic downturn may well be present.

Different types of pension arrangements are potentially associated with different degrees of macroeconomic risk.[1] In the case of a defined contribution (DC) plan, contributions are given and the eventual benefits depend on the investment returns on these contributions. Low asset returns and, to the extent that newly-released pension capital is annuitized, low interest rates would result in low benefits, thereby affecting macroeconomic demand. In the case of a defined-benefit (DB) plan, a pension fund that has too few financial resources to guarantee existing commitments needs to restore its financial position by raising contributions or by reducing (the growth in) pension entitlements. This also affects the macro-economy. The advantage of a DB pension fund is that the presence of asset buffers and gradual restoration may help to dampen macroeconomic demand effects and spread these effects over time. *A priori* it is difficult to rank the macroeconomic demand effects of DC and DB funded pensions.

The potential role for systemic risks seems to be larger for DB pension funds than for DC funds, because, in order to limit the chances of further deterioration of the funding ratio, i.e. the ratio of assets over liabilities, DB funds may be forced to reduce investment risk, which could lead to a sell off of risky assets and thus affect the prices of these assets. However, pension funds tend to be recognised as 'slow' market participants and will generally sell assets only after a thorough decision process accompanied by a careful execution. Alternatively, for example in Britain, the sponsoring company is obliged to make up for any funding gaps. However, in a world with mature pension funds that have become sizable relative to the sponsoring company, it is conceivable that its obligation to guarantee the pension benefits may cause serious financial problems for the sponsor, and even push the latter towards bankruptcy. The likelihood of this danger rises

[1] We focus here on pension funds. However, also non-funded pension arrangements could pose a risk to financial markets, although this risk is indirect. The generosity of many current pay-as-you-go systems is unsustainable and would lead to levels of public indebtedness that may lead to sovereign debt crises that threaten the stability of the financial system.

in the correlation with the financial health of the fund and the health of the macro-economy.

In the remainder of this section, we assume that pension funds act independently of each other. That is, we assume that the shocks that hit pension funds are independently distributed. Moreover, we assume that if a pension fund reacts in response to such a shock, then this does not affect the behaviour of other pension funds. Both assumptions are tenuous. However, we make them for now, in order to sharpen our insight into the potential sources of systemic risk.

Under these assumptions, the potential role of pension funds in generating macro-economic or systemic risk depends on at least two crucial factors. One is the size of the pension sector. The smaller this sector is relative to the economy or the financial sector, the smaller both types of risk associated with the pension sector, *ceteris paribus*. The size relative to the economy is likely to be more relevant for the macroeconomic risks associated with the pensions industry, although the two types of risk may interact with each other: recessionary effects from the restoration of pension buffers, or maybe only the anticipation of those effects, may spill over to the asset markets. The size of the pension sector relative to (segments of) the financial sector is likely to be more relevant for the systemic risk associated with the pensions sector. In this regard, it is interesting to notice that there tends to be a rather strong home bias in pension fund asset holdings (Amzallag *et al.* 2014) and that this home bias is inclined to strengthen during periods of market turbulence. This may reinforce the interaction between the macro-economy and domestic asset markets through the decisions taken by DB pension funds. In particular, a domestic asset market decline would have a relatively strong influence on funding ratios, leading to instrument adjustments that, in turn, affect the macro-economy.

A second factor concerns the size *distribution* of pension funds. Under the above assumptions and if the chances that individual pension funds run into financial difficulties are equal, then systemic risk is minimal if all of the funds are equally large. In that case, each individual fund is likely to be too small to cause systemic risk when it runs into financial trouble. When the size distribution is highly unequal, there may be funds that are so large as to cause systemic problems when they fall into financial distress.[2] Table 1 summarises the risks associated with pension funds and the role of their size (distribution). Below we provide some descriptive information about the size of the pension sector in various countries and the size distribution of pension funds according to their assets.

Table 1

Risks and size (distribution)

Measure	Macro-economic risk	Systemic risk
Risk type	Depressing domestic demand, either through higher contributions or lower entitlements	Instability in the (relevant segment of the) financial markets
Relevant size pension sector	Large relative to GDP	Large relative to financial market(s) invested in
Size distribution pension sector	Policy measures at large pension funds have higher macroeconomic impact	Concentrated pension fund investment portfolios have more potential for causing instability

Source: Authors' compilation.

Table 2, based on data from OECD (2016a), reports the top-10 countries in terms of pension fund assets at the end of 2014.[3] Worldwide, by far the largest country is the United States with 14.5 trillion US dollars of pension assets. Lagging a long way behind the United States, we find Britain (2.68 trillion US dollars),

[2] In normal circumstances, large pension funds are aware of this. They therefore diversify their investments and use many counterparties to limit this risk.

[3] We present assets under management in private pension funds. This does not include savings through public pension reserve funds, pension savings with insurance companies or in individual retirement accounts.

Table 2

Top-10 countries in terms of pension fund assets 2014

(excluding public pension reserve funds)

Country	Pension fund assets (billion US dollars)	Pension fund assets (% of GDP)
USA	14,460	83
UK	2,684	96
Australia	1,639	110
Canada	1,298	76
Netherlands	1,282	159
Japan	1,221	30
Switzerland	788	120
Brazil	251	12
Germany	236	6.7
Mexico	181	16

Source: OECD Pension Statistics (2016).

Australia (1.64 trillion) closely followed by Canada (1.30 trillion), the Netherlands (1.28 trillion) and Japan (1.22 trillion). Table 2 also reports pension assets as a fraction of GDP. The picture changes slightly – the Netherlands now moves to the top.

Table 3a

Largest public pension reserve funds

Country	Public pension reserve fund	Pension fund assets in billions of US dollars
USA	Social Security Trust Fund	2,789
Japan	Government Pension Investment	1,136
Norway	Government Pension Fund	873
South Korea	National Pension	427
China	National Social Security Fund	251

Source: OECD (2016b) and annual reports.

Table 3b

Largest private pension funds

Country	Pension fund	Pension fund assets in billions of US dollars
Netherlands	ABP Civil Servants	473
USA	Federal Retirement Thrift Savings Fund	428
USA	California Public Employees	297
Singapore	Central Provident Fund[a)]	210
Netherlands	PFZW Healthcare	196

Note: [a)] Singapore's Central Provident Fund contains private savings for pensions, housing and healthcare expenditures.

Sources: OECD (2016b) and Towers Watson (2015b) and annual reports.

Confining ourselves to the EU, EIOPA (2016) provides an overview of pension assets. DB pension funds hold around 85 percent of all the pension fund assets, and DC pension funds 15 percent. The three largest countries with DB assets are Britain with 48.1 percent of occupational DB pension assets, the Netherlands with 39.4 percent of DB pension assets and, thirdly, but trailing far behind, Germany with 6.9 percent of DB pension assets. Together, these three countries hold 95 percent of all the occupational DB pension assets in the EU. On the DC side, Britain holds by far the most assets, 65.1 percent of all DC pension assets in the EU. Italy is second with 19.6 percent and Ireland third with 7.8 percent of the DC pension assets.

Tables 3a and 3b demonstrate the worldwide top 5 public pension reserve funds, respectively of private pension funds in terms of assets under management, while Table 4 reports for each of the top 10 countries in terms of pension assets the top-3 pension funds in terms of size. Overall, by far the largest funds are the Social Security Trust Fund in the United States (2,789 billion US dollars), the Government Pension Investment fund in Japan (1,148 billion US dollars) and the Government Pension Fund in Norway (884 billion US dollars).[4] All three are public pension reserve funds. The next three funds have assets worth between 400 and 500 billion US dollars. These are two private pension plans for civil servants (Dutch ABP being the largest with 473 billion US dollars, and the US Federal Retirement Thrift second at 428 billion US dollars), and one more public pension reserve fund, the South Korean National Pension fund 427 billion US dollars). Remarkably, even although the United States is largest in terms of total private pension fund assets (see Table 2), its largest private pension fund, the Federal Retirement Thrift fund, is not the largest private pension fund worldwide. Glancing at the top-3 pension funds in each country, we observe that for Britain, Canada and Australia the landscape is in fact very 'flat', as the pension landscape is not dominated by a single or a few large pension funds. In the United States and Japan, there is one very large public pension reserve fund, followed by a relatively flat distribution of private pension funds. The Netherlands, by contrast, has about 30 percent of its overall pension assets in the ABP Civil Servants fund.

In fact, the size of ABP is more than half of the Dutch economy. Moreover, in some other countries that are not included in Table 4 – in particular, Norway, China, South Korea, Singapore – pension assets are 'strongly concentrated'. In these countries there is one large pension fund that holds a large majority (i.e. over 60 percent) of all the country's pension assets. While China's largest pension fund is small relative to its economy, this is not the case for Norway, South Korea and Singapore. A single pension fund that is large relative to the national economy and at the same time highly exposed to the national economy, for example because of a home bias in its assets, might *a priori* be

[4] The latter fund is not a pension fund in the usual sense. Its assets are derived from the sale of Norwegian oil rather than from pension contributions by employers and employees. Moreover, the fund's assets are also not intended for pensions only: up to 4 percent of the fund's value may be used for the national government's budget (Government Pension Fund Global 2016).

expected to pose a heightened risk to the financial system.

Systemic risk in the absence of independence

The former section discussed systemic risk under the assumption that the likelihood of a pension fund getting into financial distress is identically and independently distributed across pension funds. In this section, we discuss three reasons why this assumption does not hold in practice, and what the consequences are of this assumption failing to hold when there is a significant interdependence in investment actions among pension funds. Moreover, we elaborate on why recent trends in supervisory best practices and proposed legislation may actually lead to an unintended increase in systemic risk in the (global) pension fund sector, and probably the financial sector overall. We provide an explanation of and solution for three important issues: mark-to-market valuation under a risk-based capital requirements regime, the increased importance of benchmarking and the resulting herding behaviour, and (systemic) liquidity risks arising from proposed (global) banking regulation.

Mark-to-market valuation under a risk-based capital requirements regime

Over time, mark-to-market valuation of pension fund liabilities has become more prevalent. For example, to calculate pension liabilities expected pension benefits in the Netherlands are discounted against a 'risk-free' market interest rate. The benefit of the mark-to-market approach is that it provides the most recent and accurate assessment of the transfer value of the liabilities, given the information that is available. However, since (financial) markets are volatile, it may also introduce sharp movements in measured liabilities. This directly results in an unstable funding ratio, thereby potentially leading to unduly abrupt policy actions (e.g. cutting pension benefits as a result of underfunding).

This danger may be compounded by a simultaneous presence of risk-based capital requirements. It is conceivable that a sharp fall in the interest rate causes a fall in the funding ratios that force pension funds to trade risky assets for safe assets, with the purpose of limiting the risk of a further deterioration of the funding ratio. When one medium sized pension fund reacts this way, there are most likely to be no further consequences. However, a significant (downward) movement in interest rates could result in a widespread shock if a large part of the pensions sector is forced to de-risk. This will also harm the solvency of other institutions through downward pressure on risky-asset prices.

Table 4

Top 3 pension funds of countries with the largest pension sectors[a)]

Country	Pension Fund	Billions of US dollars
USA	Social Security Trust Fund	2,789
	Federal Retirement Thrift Savings Fund	428
	California Public Employees	297
UK	BT Group	68
	Universities Superannuation	65
	Lloyds Banking Group	59
Japan	Government Pension Investment	1,148
	Local Government Officials	194
	Pension Fund Association	98
Australia	Future Fund	89
	AustralianSuper	69
	QSuper	45
Canada	Canada Pension	228
	Ontario Teachers	133
	Ontario Municipal Employees	62
Netherlands	ABP Civil Servants	473
	PFZW Healthcare	196
	Metal Workers Pension Fund (PMT)	71
Switzerland	Bundes Pensionskasse	38
	BVK des Kantons Zurich	29
	Nestle	24
Brazil	Previ	63
	Petros	25
	FUNCEF	21
Germany	Bayerische Versorgungskammer	75
	BVV	30
	VBL	25
Mexico	Afore XXI Banorte	42
	Afore Banamex	28
	Afore Sura	25

Note: [a)] We followed the top 10 from Table 1. Thus, Norway, South Korea and China (which have limited pension fund savings aside from the savings in the public pension reserve funds) are not included in Table 4. Data on Singapore seem to be lacking from the OECD database. It can therefore not be considered for Table 4.

Sources: Towers Watson (2015b) and OECD (2016b).

The risks associated with imposing risk-based capital requirements may be even more significant if the same (or similar) capital requirements are imposed on the entire financial sector. This is most likely to prompt similar investment portfolios of financial parties to adhere to the universal regulatory regime. As a result, when these institutions are hit by a common shock, they will probably respond in a similar way to that shock. For example, if portfolio compositions among financial institutions become more similar, institutions may all be simultaneously faced with liquidity constraints and all try to sell assets at the same time to generate cash. These risks are real and present, particularly in the European Union, where banks subject to Basel III/CDR IV regulation, insurance companies subject to Solvency II regulation, and pension funds subject to domestic 'Solvency II-like' requirements all operate under rather similar risk-based capital requirements.

A good example of the risks associated with the *combination* of mark-to-market valuation and risk-based capital requirements concerns the Dutch pension funds' (interest rate) derivatives portfolios. Firstly, mark-to-market valuation implies that pension funds have to value the liabilities of all maturities using market interest rates. Secondly, there are risk-based capital requirements for exposure to interest rate risk. To limit these capital requirements, pension funds need to hedge at least part of their interest rate risk. If they do not hedge interest rate risk, they need to hold a substantial amount of capital, while changes in the interest rate will cause substantial swings in the market value of the liabilities and the level of pension benefits. To hedge interest rate risk for shorter maturities, pension funds can use combinations of government bonds, corporate bonds and interest rate swaps. However, for higher maturities (30+ years), only interest rate swaps (and, occasionally, government bonds) are available. Therefore, virtually all pension funds are in need of high maturity interest rate swaps. As a result, pension funds have similar (and often very substantial) positions in high maturity interest rate swaps. While this decreases their individual mark-to-market interest-rate risk and required capital buffers, it makes the sector as a whole more vulnerable to liquidity needs in case of a sudden increase in interest rates (followed by margin calls on all the interest rate swaps) or to unexpected changes in derivatives regulation such as the European Market Infrastructure Regulation (EMIR).

Peer group pressure

A second reason why the effects of shocks are unlikely to be independent is the fact that benchmarking and comparison with peers is an increasingly popular mechanism to evaluate the performance of individual pension funds along multiple dimensions. This happens, for example, with administrative and asset management costs, asset management returns (both per asset type and for the portfolio as a whole) and the funding ratio.

On the one hand, peer group comparison or 'benchmarking' may provide more useful insight into the relative performance of pension funds. On the other hand, it provides an incentive to have a policy that is comparable to that of peers. This happens because with peer group comparison, the focus may also be on whether the results of the pension fund are better or worse than those of the peers, and not only compared to the individual goals of the pension fund. Thus, having low asset returns when other funds also have low returns would not be perceived as problematic, while having the same low returns when other funds have high returns would be perceived as problematic and would single out the pension fund as a weak performer. This 'peer group comparison' mechanism provides an incentive for portfolio compositions to become more similar, which results in broad parts of the pension fund sector becoming exposed to the same shocks.

Liquidity risks arising from proposed banking regulation

Currently, European derivatives regulation is changing. Pension funds face requirements for the central clearing of derivatives under the EMIR legislation. Where previously two market parties signed and cleared derivatives contracts on a bilateral basis, under EMIR there is an intermediary (the central clearing house) that takes over the clearing activities.[5] After an interest rate change, the value of the swap contract has decreased for one party to the contract and increased for the other party. The party for which the value of the contract has decreased is required to post collateral,[6] called 'variation margin'. In the bilateral

[5] EMIR does not apply to all derivative contracts. It does not apply to many exotic and non-linear types of derivatives, but it does apply to vanilla interest rate swaps.

[6] To be more precise: when the value of the swap contract changes more than a certain specified amount between the counterparties, a margin call is triggered. Furthermore, for most derivatives contracts there is a daily exchange of Variation Margin Collateral.

market, variation margin can be posted either using cash or using liquid, high quality (government) bonds. Under central clearing, the variation margin requirement is restricted by the central clearing houses and clearing members to cash only. This produces new substantial liquidity risks for pension funds, that are generally fully invested and do not hold large cash buffers. Under the new legislation, a decrease in the market value of interest rate swaps may trigger significant cash margin calls across the board for pension funds. Especially when these margin calls are substantial due to a strong interest rate increase, this may force many pension funds to start selling assets in order to generate the required cash, potentially starting a fire sale cycle. While holding high cash reserves mitigates these liquidity risks, this would also reduce the available budget for investing. This lower budget has a negative impact on aggregate investment returns, undermining the goal of providing adequate old age pension benefits.

Moreover, the current central clearing setup entails the use of a clearing member bank next to a clearing house. The clearing member bank guarantees the transactions of the pension fund at the clearing house. However, only a limited number of clearing member banks and clearing houses are available. Access to clearing member banks in particular is perceived to be very limited for smaller pension funds. These will have to rely on so-called 'indirect client arrangements', accessing a clearing member house through another bank. This situation causes significant concentration risks, because all derivatives exposures will be concentrated in a small number of clearing houses and clearing member banks. In an ideal situation, central clearing should happen using a number of non-commercial intermediaries in order to mitigate market externalities arising from the central clearing obligation under EMIR.

Moreover, the proposed Basel III banking legislation on the Net Stable Funding Ratio (NSFR) and the Basel III Leverage Ratio framework (LR) could increase systemic risk. Pension fund use of high quality government bonds as collateral for Variation Margin in derivatives transactions is further restricted due to the fact that High Quality Liquid Assets (HQLA) are not recognised proportionally in the proposed banking legislation. Only cash is fully recognised for offsetting purposes. This has a direct implication for executing derivatives transactions, in which only cash can be posted as a variation margin. As a result, pension funds need to hold large cash buffers or rely on the repurchase (repo) market. However, both Basel III regulations (NSFR and LR) are also harmful to the functioning of the repo-market. Firstly, the collateral in repo transactions will be assigned a significant Required Stable Funding factor according to the proposed Net Stable Funding Regulation. Secondly, the Leverage Ratio Framework does not treat cash and high quality government bonds equally for netting purposes regarding the exposure measure in repo transactions. Therefore, under the currently proposed Basel III banking legislation, liquidity needs and risks in the pension fund sector – and probably the whole financial sector – will sharply increase. In order to mitigate systemic risks, it is crucial that these new legislations recognise high quality government bonds as eligible for variation margin (capital calls) in derivatives transactions, so as to ensure a proper functioning of the short term financing (repo) and derivatives market.

Scope of derivatives portfolios and impact of EMIR (central clearing)

The derivatives portfolios of pension funds are quite substantial. Table 5 is taken from DNB Statistics, the official statistics publication website of the Dutch Central Bank. This table shows the decomposition of the Dutch pension sector into different types of asset classes. While the interest rate and currency derivatives only have a total market value of 75 billion euros by the end of 2015, their notional value is much higher. Assuming that the market value of the derivatives is, for instance, 10 percent of the notional value, a rather common order of magnitude, the total amount of notional derivative exposure outstanding is 750 billion euros.

In order to give an idea of the magnitude of the liquidity risks associated with this derivatives exposure, we provide an illustrative example of an average pension fund under EMIR. The composition of the investment portfolio of this average pension fund is reported in Table 6. The table also sets out how the different derivatives and assets help to hedge against interest rate and currency risks. Total assets amount to 1 billion euros. Liabilities are 1 billion euros as well, with a duration (interest rate sensitivity) of 20 years. Consequently, the funding ratio is 100 percent, while 50 percent of the fund's interest rate risk is hedged.

From Table 6 the pension fund can also be deduced to hold the following assets:

Table 5

Total assets of Dutch pension funds

Asset type	Q4 2014 (billion euros)	Q4 2015 (billion euros)
Direct equity	154	169
Bonds and loans	322	332
Derivatives (interest rate and currency)	106	75
Participations in investment funds	620	630
Equity	246	231
Bonds and loans	233	238
Derivatives	2	2
Other/unknown	139	159
Other	50	49
Total	1,252	1,255

Source: DNB Statistics for pension funds.

- EUR 400 million in government bonds;
- EUR 300 million in European equities;
- EUR 300 million in US equities.

The pension fund also has a portfolio of Over-The-Counter (OTC) derivatives (interest rate and currency swaps), so as to increase its interest rate hedge from its original value of 25 percent (as a result of holding government bonds) to 50 percent and fully hedge the currency risk. The fund's total derivatives portfolio comprises:

- EUR 250 million in notional interest rate swaps, no market value;
- EUR 300 million in notional currency derivatives, no market value.

Initially, the pension fund made arrangements with counterparty (investment) banks in the bilateral derivatives market to exchange physical collateral to cover changes in the market value of the derivatives (high quality bonds are used for the variation margin). The fund's EUR 400 million sovereign debt portfolio is eligible as collateral in this respect. As a result, its liquidity risk is very low, as the fund has a large buffer of bonds available to meet its collateral obligations arising from changes in the value of derivatives. The chances of the fund defaulting are therefore virtually zero. With regard to the currency swaps, the fund needs to settle these trades within relatively short periods of time (on average 3 months), but payments may be spread out over time. These payment obligations can be met using 'repurchase transactions' (repos) to generate cash or by maintaining a small long-term cash buffer. The pension fund in this example uses repos and has no long-term cash buffer.

Once derivative contracts are cleared in accordance with EMIR, the pension fund's liquidity needs will change substantially. The effect is twofold. Firstly, the pension fund will need to post 'initial margin' collateral that acts as a buffer in times of crises. Physical collateral is allowed and the fund can use its government bond portfolio to this end. Initial calculations have revealed that, in practice, the initial margin requirement translates into approximately 10 percent of the nominal value of the cleared OTC derivatives. However, in times of crisis, the initial margin requirement may increase to around 20 percent, based on the average contract terms of a pension fund with a clearing member.

Secondly, the pension fund will need to deliver variation margin daily. Central clearing parties do not allow government bonds to be used for this purpose; variation margin is restricted to cash only. This means that an average pension fund, if fully invested, will have a potential liquidity problem if the fund cannot access cash in the repo markets. When derivatives develop a negative value, the full market value must be paid in cash. If a pension fund does not succeed in generating sufficient cash to meet the variation margin

Table 6

Balance sheet of the pension fund (assets side)

Asset mix	Market value (million euros)	Nominal or notional value[a)] (million euros)	Duration	Share of interest rate hedge in %	Share of currency hedge in %
Government bonds	400	400	12.5	25	0
Interest rate swaps	0	250	20	25	0
US equities	300	300	0	0	0
European equities	300	300	0	0	0
Currency swaps	0	300	0	0	100
Total	1,000			50	100

Note: [a)] 'Nominal' and 'notional' are both frequently used, and have the same meaning here. Hence, they are used interchangeably in this section.

Source: Authors' compilation.

Table 7

Liquidity needs of the pension fund in a stress scenario

Liquidity needs	Variation margin requirement (million euros)	Variation margin (% assets)	Initial margin requirement (million euros)	Initial margin (% assets)
Interest rate swaps	23	2.25	50	5.00
Currency swaps	21	2.10	60	6.00
Total	44	4.35	110	11.00

Source: Authors' compilation.

call (on a daily basis), there is a risk that the entire position is closed even although the pension fund is solvent (it has a funding ratio of over 100 percent). In such a situation, the reputation and creditworthiness of a pension fund will be seriously damaged. This may result in serious (contractual) consequences, such as the loss of the complete derivatives position with (bank) counterparties.

Table 7 shows the pension's funds liquidity needs in a stress scenario. The stress scenario includes a 0.45 percentage point (i.e. 45 basis points) rise in the interest rate and a 7 percent depreciation of the euro against the dollar. The variation margin increases. Moreover, the initial margin requirement set by the clearing member bank increases from 10 percent to 20 percent of the notional value of the cleared OTC derivatives.

The amount of cash the pension fund needs increases from zero to 44 million euros (4.4 percent of the total portfolio),[7] because only cash is eligible to fulfil the variation margin requirement. The daily exchange of variation margin could actually lead to the fund having to sell its bonds or shares directly in order to generate cash. This could even trigger fire sales in which the pension fund would have to sell its assets under pressure at high discounts in order to generate cash. If the pension fund were to fail to deliver the 44 million euros in cash, it would be in default on its derivatives contracts and would have to face the consequences, namely the loss of the entire derivatives position with (bank) counterparties. The initial margin requirement also increases from 55 million to 110 million euros, or 11 percent of total assets. Moreover, at the same time the value of the existing bond portfolio, which is used as a buffer to meet the initial margin requirement, declines by 22.5 million euros.[8]

[7] The variation margin requirement for the interest rate swaps is calculated as the interest rate increase (0.0045) times duration (20) times notional amount (250), which equals 22.5 million. The variation margin requirement for the currency swaps is calculated as deprecation (0.07) times notional amount (300).

[8] The increase in the interest rate (0.0045) times duration (12.5) times market value (400) equals 22.5 million.

Hence, while an increase in interest rates would in general have a positive effect in terms of the funding ratio, the disadvantage is that it would increase the fund's cash needs. In fact, the higher the interest rate hedge through derivatives, the smaller the improvement in the funding ratio and, at the same time, the larger the additional cash needed would be. Obviously, the fund could reduce the risk of not fulfilling the cash requirement to almost zero, by holding a very large cash buffer, but this would come at the cost of the return on the overall investment portfolio. The alternative of relying on the repo market may be risky or even impossible in view of the consequences for this market of the described changes in banking legislation.

If we were to apply the above stress scenario to the aggregate Dutch pension fund sector at the end of 2015, assuming that its investment portfolio is the same (in terms of relative weights of the various asset categories) as that of our example fund, then the increase in cash needs of the entire sector amounts to 4.35 percent times 1255 is almost 55 billion. Hence, this scenario, which is quite conceivable in view of historical movements in interest rates and exchange rates (witness the recent fall of the British pound), may have profound consequences for the pension sector, and possibly for the financial markets as a whole.

Regulatory and supervisory differences across pension sectors in the EU

Pension fund regulation and supervision differ substantially across EU countries. In this section, we briefly discuss the main differences for the countries with the top 3 amounts of DB pension assets in the EU. The descriptions of regulation and supervision are taken from EIOPA (2016).

The first major difference concerns the way in which future pension benefits are discounted. While Germany and Britain use a fixed discount rate, or the expected return to discount expected future benefits, the Netherlands uses a risk-free market discount rate (a swap-curve constructed on the basis of AAA public debt in the Eurozone).

Secondly, Britain treats inflation as part of the pension liabilities in DB pension arrangements, i.e. liabilities are calculated by discounting future pension benefits including their projected increase due to expected inflation. This reflects the fact that pension funds are obliged to raise DB entitlements with inflation. The latter is not the case for the Netherlands, nor for Germany, although indexation would often take place if it can be afforded. Liabilities in these countries are calculated by discounting benefits that are projected to stay constant in nominal terms.

Thirdly, the target funding ratio (i.e. the ratio of assets over liabilities) in Britain is 100 percent, in Germany there is a 4-percent Solvency I capital requirement, while in the Netherlands there is a capital requirement of 10–30 percent of the liabilities, depending on the overall riskiness of the asset portfolio. Since inflation indexation is part of the liabilities, the target funding ratio for Britain is set in line with the need to protect the purchasing power of the pension entitlements. In a sense, the capital requirement in the Netherlands is also in line with the aim to compensate for future inflation, because a nominal funding ratio of around 125 percent roughly corresponds to a real funding ratio (calculated by discounting the projected pension benefits against the risk-free real interest rate) of 100 percent, assuming inflation of 2 percent.

Fourthly, in Britain pension entitlements can only be cut if the sponsor (the employer) defaults or if all members agree,[9] while in the Netherlands and Germany entitlements may be cut as a measure of last resort, while the sponsor is not under any obligation to provide additional support if the fund is in financial distress. Hence, in Britain a DB pension fund may threaten the survival of the sponsor if the fund falls into financial distress, as the sponsor is obliged to indemnify the fund.

Finally, EU countries differ quite substantially regarding the way in which accumulated DC pension assets can be deployed. In Austria, Iceland and the Netherlands accumulated assets at retirement have to be converted into a life-long annuity. In Italy and Portugal part of the accumulated assets has to be converted into an annuity, while the remainder can be taken up as a lump-sum payment. Slovakia allows for annuities, temporary annuities and lump-sum payments, with the requirement that retirement income be spread over a minimum period of five years. A full lump sum take up is possible in Cyprus and Spain, which in the latter case receives a relatively favourable tax treatment compared to regular pension income. Finally, the Britain allows a wide range of variants, including taking up the entire pot in cash, a fixed annuity and flexible retirement income.

[9] There is also a fund that takes over the pension liabilities if the sponsor can no longer honor its obligations, called the Pension Protection Fund (PPF). All pension funds make annual contributions to the PPF, which can be thought of as insurance premiums.

Potential future legislation and systemic risks

Important developments, such as population ageing, increasing (labour) mobility, demands for more flexibility and unrest in financial markets, are putting legislators and pension supervisors under pressure to respond to these developments. However, changes in legislation and supervision may affect the systemic role of pension funds in a variety of ways. This section discusses the main effects.

Firstly, the importance of designing proper restoration policies is becoming more important with rising pressure on pension funding ratios resulting from ageing and low asset returns and interest rates. Close monitoring of pension funds combined with rules that require them to recover quickly already from small degrees of underfunding, can *a priori* be expected to have a stabilising influence on financial markets, because it limits the danger that the degree of underfunding gets so severe that it is beyond repair, calling for large-scale entitlement cuts that could potentially cause economic unrest. However, this conclusion comes with qualifications. Forcing pension funds to restore fast may destabilise an already feeble macroeconomy further, because of the demand effects from higher contributions and/or reduced benefits. Obviously, this is only a relevant concern if the size of the pension sector is substantial relative to the economy. To judge what would be the appropriate approach in this respect, it is important to ask whether the underfunding is the result of idiosyncratic (i.e. fund-specific) events, or whether it is the result of some common shock. In the latter case, a large fraction of all pension funds is likely to flow into underfunding at the same time, which would be an argument to make the restoration trajectory a function of the state of economy, i.e. to force pension funds to restore at a slower pace when the economy is particularly feeble. Otherwise, micro-based supervision, while effective at the level of individual institutions, could become harmful at the macroeconomic level. While this contribution is con-

cerned with the potential systemic relevance of pension funds for the financial sector and not specifically with their macroeconomic role, as already noted above, it is conceivable that the adverse macroeconomic consequences of pension policy spill over to the financial sector.

Calls for enhancing flexibility in pension arrangements can be frequently heard. Countries differ in the degree to which pension savings can be accessed during working life, as well as during retirement. In many countries, participation in some given pension arrangement is mandatory, while in some countries pension savings can be taken up as a lump-sum as of a specific age. For example, in Britain a pension reform in 2015 made it possible for participants aged 55 or older in a DC-scheme to take out their pension savings as a lump-sum (Work and Pensions Committee 2015). It is frequently pointed out that this opportunity may trap individuals into frontloading consumption, so that once pension savings have been depleted, these individuals would turn to the government for help. However, initial anecdotal evidence seems to suggest that participants generally constrain themselves taking up their DC pension savings. Similarly, in Australia there are no restrictions during retirement on taking up accumulated pension savings as a lump sum. A substantial fraction of the retired make use of this possibility, and many of them use these lump-sums to pay off other debts or spend them (Deloitte 2013).

It is conceivable that relaxing participation restrictions, for example by giving individuals the opportunity to switch between pension funds or to take up at least part of their pension savings, could create risks similar to those associated with a bank run. The risks resemble those associated with the open-ended investment funds that have been on the rise since the start of this century – see ESRB (2016). They seem highest in the case of an abrupt alleviation of initial restrictions or if a fund threatens to go into underfunding. A sudden loss of confidence for some reason may trigger participants to withdraw their pension savings. If the threat of a large-scale withdrawal were to materialise, this could become self-fulfilling, as large groups of participants would rationally rush to the fund to recover their savings for fear that nothing will be left if they wait too long. A large-scale withdrawal of accumulated savings would force the pension fund to sell its assets for cash. If a single fund finds itself in this position, the effect on the financial market as a whole is likely to be small, unless the fund is very large. However, a loss of confidence could also be caused by some common shock and force the entire pension sector into fire sales at the same time, thereby causing a substantial drop in asset prices, leading to domino effects throughout the entire financial sector.

Hence, policies to withdraw pension savings should be carefully designed, especially when accumulated savings are large and unevenly distributed across institutional investors. Examples of sensible design are the introduction of limits on the amount that may be withdrawn at a given moment; or the introduction of a penalty for early withdrawal. Even if the danger of a bank run is ruled out, there are consequences of allowing early withdrawal. The pension fund must prepare itself, potentially forced by the supervisor, for the possibility of a substantial withdrawal of savings by holding more liquidity than it would otherwise do. This means that it has to forego the higher expected returns associated with illiquid, long-term investment. The lower expected return on the overall investment portfolio will eventually lower the pension benefits.

Supervisory policies that limit home bias and concentration risks in asset portfolios will generally be conducive to the stability of the financial sector. Home bias in pension portfolios can strengthen the feedback effects between the macro-economy and the financial health of the pension fund. With a substantial home bias, an impending weakening of the macro-economy may have relatively strong negative consequences for the value of the pension assets, which could in turn have relatively adverse feedback effects on the macro-economy if the financial position of the fund needs to be restored. Limiting concentration risks yields diversification benefits at the micro level and can *a priori* be expected to be stabilising for the financial markets as a whole. The impact of a fire sale is less likely to be concentrated on a specific asset or asset category, but more thinly spread over a wider range of assets or asset categories. Specific attention is warranted for policies that stimulate the hedging of interest risks, as is the case in the Netherlands. Again, such policies can be sensible at the micro level, but dangerous at the aggregate level. Concretely, a large fraction of long-run interest risk is hedged through interest rate swaps. These contracts may be concentrated on specific segments, because there are no alternatives to hedging interest rate risk in those segments (see our previous discussion in the fourth section).

Policy implications and concluding remarks

Authorities have recently started paying some attention to the potentially systemic role of pension funds. There are a number of reasons related to their characteristics and their regulation that explain why pension funds pose less of a risk to the financial system than banks and insurance companies. In fact, there is mild evidence that pension funds may have a stabilising influence on asset markets, because they try to rebalance their investment portfolios if price movements drive the portfolio weights of specific asset classes too far from their strategic values. Furthermore, there seems to be a trend towards pension funds taking over some of the traditional activities of commercial banks. In particular, Dutch pension funds are getting involved in mortgage financing, an activity that banks are trying to reduce their exposure to, in order to fulfil supervisory requirements. While this increases the exposure of pension funds to housing market risks, we expect this development to exert an overall stabilising effect on financial markets. The reason is that pension funds are better placed to take on these risks, because they are less leveraged than banks and invest for the long run. A similar argument can be made for pension funds investing in infrastructure and other illiquid asset categories. Obviously, the larger the investments in those illiquid assets, the harder it will be for the fund to free up cash when needed.

Nevertheless, it is conceivable that a large pension sector or extremely large individual pension funds pose a systemic risk, either directly in certain segments of the asset markets in which they are particularly active, or indirectly through their influence on the macro-economy and the potential knock-on effects into the asset markets. Recent developments, such as mark-to-market valuation of both assets and liabilities, and risk-based capital requirements – that are common in large parts of the assets markets – make sense from a micro point of view, but may create systemic dangers. Relaxation of pension participation requirements and opportunities to take up pension savings carry a danger of 'bank runs' on pension funds if not accompanied by appropriate restrictions.

The preceding discussion makes clear that there exists an important role for appropriate legal and supervision design to ensure that pension funds can fulfil their useful socio-economic role at a minimal risk to the financial system as a whole. An important question in this regard is which elements of fund supervision should be transferred to the European level. The latter should, in principle, be confined to aspects of pension fund policy that have cross-border consequences.

Firstly, the fact that capital markets have become highly integrated in Europe creates a potential case for European level supervision on pension fund investment policies. The conclusion of EIOPA was that the pension fund sector as a whole exerted a mildly stabilising influence on the financial markets during the global financial crisis, but that this influence varied significantly across countries. Dutch pension funds are particularly active in rebalancing their asset portfolio, possibly stimulated by strategic investment plans based on stable portfolio weights on the various asset categories (for a long as the current plan applies). Stimulating Eurozone-wide adoption of such strategic investment plans would be conducive to the stability of the Eurozone capital market.

Secondly, pension fund regulation and supervision are still largely a national affair, resulting in substantial differences in these areas across EU countries. This certainly hampers the integration of the market for pension services. However, occupational pension provision is currently organised in very different ways in EU countries. A number of countries have even made fundamentally differing choices, such as providing occupational pensions through pay-as-you-go or through funded arrangements; or not providing occupational pensions at all. It is therefore not clear if European regulation should take place at the level of pension funds (excluding non-funded and non-occupational pensions), occupational pensions (including both pay-as-you-go and funded pension arrangements, but excluding non-occupational pensions), or pension provision in general.

In the meantime, the absence of European regulation and supervision also makes it less likely that pension funds all react simultaneously and in the same way to shocks, thereby limiting their influence on the capital markets. Further centralisation of regulation and supervision at the European level may be quite likely, which carries the risk that the pension sector becomes a source of larger fluctuations in asset markets. An important example concerns the rules for calculating pension liabilities. Mark-to-market valuation has become increasingly popular over time. Future yields are largely unpredictable, hence the best predictor of future yields is the current yield curve. This limits the

chance of large long-run deviations of a pension fund's assets from its liabilities. The disadvantage, however, is that the yield curve is subject to short-run market fluctuations. An EU-wide application of the identical mark-to-market valuation of pension liabilities could cause substantial volatility in aggregate (total EU) pension liabilities, adding to macroeconomic and asset market volatility if across the entire EU pension funds have to respond simultaneously and on short notice to a rise in pension liabilities by, for example, raising pension contributions or reducing portfolio risk. Coordinating the speed at which pension funding ratios are to be restored at the supranational level may alleviate the aforementioned externalities. Similarly, coordination of the rules regarding the take up of pension assets may alleviate financial market volatility. An example could be a common rule that a lump-sum take up should be confined to some specific use, such as the purchase of a house. In other words, shifting parts of pension fund supervision to the EU level may require complementary coordination.

Thirdly, the choice has been made to centrally clear derivatives transactions. A new public institution could have been entrusted with this task, but the choice has been made to leave this task to the private sector. This has placed a limited number of private parties in an oligopoly-like position to impose conditions on institutions trading in derivatives. We see this happening in the conditions for posting collateral: collateral that is eligible according to legislation is in practice, however, not accepted by central clearing parties. Imposing a Eurozone-level requirement on clearing houses to accept government bonds of sufficient quality as collateral would correct a situation that is probably the result of insufficient competition among the clearing houses, and would mitigate liquidity risk in the pension fund sector. Under the alternative, pension funds run the risk that they cannot fulfil their cash requirements, particularly due to new Basel III regulations (Net Stable Funding Ratio and Leverage Ratio Framework), which increases the chances of the repo market drying up. Eventually, the ECB may end up as a lender of last resort for troubled pension funds; or pension funds might be forced into fire sales to meet (contractual) cash requirements.

Finally, the *interaction* between risk-based capital requirements and mark-to-market valuation seems to lead to increasingly similar portfolio compositions of financial institutions and pension funds. This makes their exposure increasingly similar, and means that a shock that hits them may be amplified much more strongly, because all affected institutions react in the same way. One way to partially break this link could be to introduce simple capital requirements that are related to the amount of leverage an institution has on its balance sheet, but not to the specific investments (see Brunnermeier *et al.* 2009).

Another effect of risk-based capital requirements seems to be pro-cyclical mismeasurement: after a period of low volatility and asset price growth, backward looking risk measures will provide the signal that risk is very low, while often after such a phase (that could be identified as 'the build-up of a bubble') a strong decrease in asset prices occurs. After this crash, risk indicators will provide the signal 'very risky', when the crash has effectively already occurred and risk has fallen once again. To address this flaw in signalling, momentum-based indicators could be used. These provide information on how long asset prices have gone in the same direction, and may therefore provide a warning as to how likely a future crash actually is.

References

Amzallag, A., D. Kapp and C. Kok (2014), *The Impact of Regulating Occupational Pensions in Europe on Investment and Financial Stability,* ECB Occasional Paper Series 154.

Beetsma, R. and S. Vos (2016), *Pension Funds and Systemic Risk,* VoxEU.org, 23 February.

Bisias, D., M. Flood, A.W. Lo and S. Valavanis (2012), *A Survey of Systemic Risk Analytics,* US Department of Treasury, Office of Financial Research, Working Paper 1.

Broeders, D.W.G.A., D.H.J. Chen, P.A. Minderhoud and C.J.W. Schudel (2016), *Pension Funds' Herding,* De Nederlandsche Bank and Universiteit van Amsterdam, mimeo.

Brunnermeier, M., A. Crockett, C. Goodhart, A. Persaud and H. Shin (2009), *The Fundamental Principles of Financial Regulation,* Geneva Reports on the World Economy 11.

Brunnermeier, M. and Y. Sannikov (2014), "A Macroeconomic Model with a Financial Sector", *American Economic Review* 104, 379–421.

Deloitte (2013), *Dynamics of the Australian Superannuation System,* Deloitte Actuaries and Consultants.

EIOPA (2016), *IORPs Stress Test Report* 2015, 26 January.

ESRB (2016), *Macroprudential Policy beyond Banking,* An ESRB Strategy Paper, July.

Government Pension Fund Global (2016), *About the Fund,* https://www.nbim.no/en/the-fund/.

He, Z. and A. Krishnamurthy (2014), *A Macroeconomic Framework for Quantifying Systemic Risk,* NBER Working Paper 19885.

Mercer (2016), *Melbourne Mercer Global Pension Index 2015.*

OECD (2016a), *Pensions Indicators Database,* http://stats.oecd.org/Index.aspx?DatasetCode=PNNI_NEW.

OECD (2016b), *Annual Survey of Large Pension Funds and Public Pension Reserve Funds 2015,* Paris.

Persaud, A. (2015), *Reinventing Financial Regulation: A Blueprint for Overcoming Systemic Risk,* VoxEU.org, 20 November.

Towers Watson (2015a), *Global Pension Assets Study,* February, www.towerswatson.com.

Towers Watson (2015b), *The World 300 Largest Pension Funds – Year End 2014*, September, www.towerswatson.com.

Work and Pensions Committee (2015), *Pension Freedom Guidance and Advice,* First Report of Session 2015–16, House of Commons, London.