

Staff Memo

The liquidity crisis in UK pension funds from a Swedish perspective

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January 2023

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Staff Memos

A Staff Memo provides members of the Riksbank's staff with the opportunity to publish advanced analyses of relevant issues. It is a publication for civil servants that is free of policy conclusions and individual standpoints on current policy issues. Publication is approved by the appropriate Head of Department. The opinions expressed in Staff Memos are those of the authors and are not to be seen as the Riksbank's standpoint.

Summary

GBP 1,600 billion, or more than two thirds of the gross domestic product of the United Kingdom. That's the value of the guaranteed pension liability that UK pension funds manage through *liability-driven investment* (LDI)—an investment strategy that contributed to the recent shake-up of the UK government bond market.

Pension funds use the strategy to create leverage on their interest-bearing assets. The purpose is to make the value of their assets increase or decrease at roughly the same rate as their liabilities. The leverage creates liquidity risks, however, because the funds need to continuously exchange collateral depending on how interest rates develop.

In September 2022, long-term UK interest rates rose sharply as a result of an unfunded UK government budget proposal. The interest rates caused several funds to encounter liquidity problems. This forced them to sell a large amount of government bonds on the market, creating a self-reinforcing negative price spiral. The situation became so serious that the Bank of England decided to intervene in the market and buy government bonds to stabilise it.

This Staff Memo analyses why these problems arose in the UK, what implications this has for financial stability and what the corresponding risks and vulnerabilities look like in Sweden.

Swedish pension companies with guaranteed pension commitments do not use leverage to protect themselves against interest rates to the same extent. Instead, they have a larger holding of other risky assets, which has allowed them to build up a capital buffer over time that makes them better equipped to cope with periods of falling interest rates. They therefore do not expose themselves to liquidity risks to the same extent.

However, it is important to remain vigilant about these risks and the interconnectedness of pension companies with other financial agents.

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¹ The author would like extend a big thanks to Anders Vredin, Andreas Blanck, Johanna Stenkula von Rosen, Kristian Jönsson, Mattias Hector, Olof Sandstedt, Petra Lennartsdotter, Robin Ahlén, Samantha Myers and Stephan Wollert for valuable comments on various drafts. The author would also like to thank the colleagues at Finansinspektionen for their comments.

1 Introduction

In September 2022, we saw how liability-driven investment (LDI) contributed to the recent shake-up of the UK government bond market. LDI is an investment strategy used by UK pension funds to hedge themselves against their guaranteed pension commitments growing when interest rates fall. The strategy is based on leveraging their government bonds and entering into interest-rate derivatives, which results in the funds continuously exchanging collateral with different counterparties depending on how interest rates develop. When yields on UK government bonds rose sharply as a result of an unfunded budget proposal by the country's government, several funds encountered liquidity problems. This forced them to sell a large amount of government bonds in the market, creating a self-reinforcing negative spiral of falling prices and more selling.

The situation became so serious that the Bank of England decided to intervene in the market and buy long-dated government bonds to stabilise it. The pricing of government bonds underpins the UK's financial system and the lending of GBP 2,000 billion to the real economy through broader credit markets.² Therefore, had the UK central bank not intervened, spillover effects and stability problems in the financial system could have led to a severe tightening of the credit supply to UK households and companies.

In order to avoid or counteract similar situations in Sweden, it is important to understand and learn lessons from what happened in the UK. As far as Sweden is concerned, it is largely a matter of analysing the incident in terms of Swedish pension management and investigating whether something similar could happen to it.

Swedish pension companies play an important role in the Swedish economy as they lend our pension savings to the capital market, creating economic growth over time. These savings are large and pension companies are therefore important investors in the financial markets.³ But these companies are also often closely linked to other financial agents and thus are also of significance for the stability of the financial system. How they manage these savings can therefore have a major impact on the markets.

In this Staff Memo, I will focus on the management of occupational pensions with guaranteed commitments and their links to financial stability. Such occupational pensions come in many forms but all guarantee a certain amount of pension in the future. In Sweden, most occupational pension capital is managed by life insurance and occupational pension companies.⁴ In the UK, by contrast, the lion's share is managed in pension funds set up by employers.

² Such as the corporate bond and fixed-rate mortgage markets.

³ See Nilsson, Söderberg & Vredin (2014) for an overview of the Swedish pension system.

⁴ In Sweden, the traditionally managed occupational pension capital, i.e. when the company bears the investment risk, of life insurance and occupational pension companies amounted to SEK 3 200 billion at the end of the third quarter of 2022 (Insurance Sweden, 2022).

Most occupational pensions come in either defined benefit (DB) or defined contribution (DC) forms. A DB occupational pension provides a pension that is usually a percentage of the final salary and is based on how many pensionable years the employee has worked. A DC occupational pension provides a pension whose size depends on the premiums paid during the working life and the return on the assets in which the premiums have been invested.⁵ In Sweden, it is common to have a mixed system where DC pensions guarantee a certain level of future pension payments, relative to the premiums paid.⁶ About half of the Swedish occupational pension liability can be linked to DB schemes or DC schemes with financial guarantees.⁷

In the UK, however, pure DB schemes are more common. They account for just over three quarters of UK occupational pension liabilities, amounting to GBP 1,800 billion in December 2021. Of this total, GBP 1,600 billion, or just over two-thirds of the UK's gross domestic product, is managed through LDI.⁸ This means that the investment strategy is of considerable significance for financial stability.

In this Staff Memo, I outline the conditions that led to such an explosive increase in LDI management that caused it to quadruple in size over ten years, how LDI management works in practice, and the risks involved. I also compare the LDI strategy with how we manage guaranteed occupational pensions in Sweden and the risks of similar liquidity problems to those we saw in the UK arising here. Finally, I discuss the implications of pension managers protecting themselves against falling interest rates.

⁵ A DB pension therefore means greater uncertainty for the employer, while a defined benefit contribution means greater uncertainty for the employee.

⁶ For example, the occupational pension company Alecta offers a DC pension which guarantees the highest of paid-in premiums and 70 per cent of the pension capital at the time of the first pay-out.

⁷ See EIOPA (2022a). Refers to those pension companies that report to the European Insurance and Occupational Pensions Authority (EIOPA) as occupational pension companies.

⁸ See The Investment Association (2022).

2 UK pension management

2.1 Fundamentally requires substantial capital when interest rates are low

Managing defined benefit (DB) pensions is as easy in theory as it is difficult in practice. In the 1990s, actuarial methods were established that use market rates to calculate what a future pension liability is worth today—its present value.⁹ Subsequently, it became common practice for the authorities or public bodies supervising pension management to require managers to use either government bond rates or swap rates for such calculations, i.e. as discount rates.¹⁰ This replaced fixed discount rates, which made the value of the pension liability more volatile.

In the UK, The Pension Regulator (TPR) requires pension fund managers to use long-dated government bond rates as discount rates. In theory, this means that a UK employer can fund a DB pension by investing the same amount as the present value of the pension liability in government bonds with the same maturity as the liability—simple!

In practice, however, there are a host of factors that complicate such a simple investment strategy. For example, it is not possible to know in advance how much an employee's final salary will be or how long they will live. But perhaps the biggest sticking point is low interest rates. In order to pay the promised pension in the future, the amount of capital that the employer has to invest and lock up in low-yield government bonds is considerably greater than in high-yield ones. On the next page you will find an example calculation that illustrates this. At low yields, the amount of capital can be very large in relation to the employer's total assets.

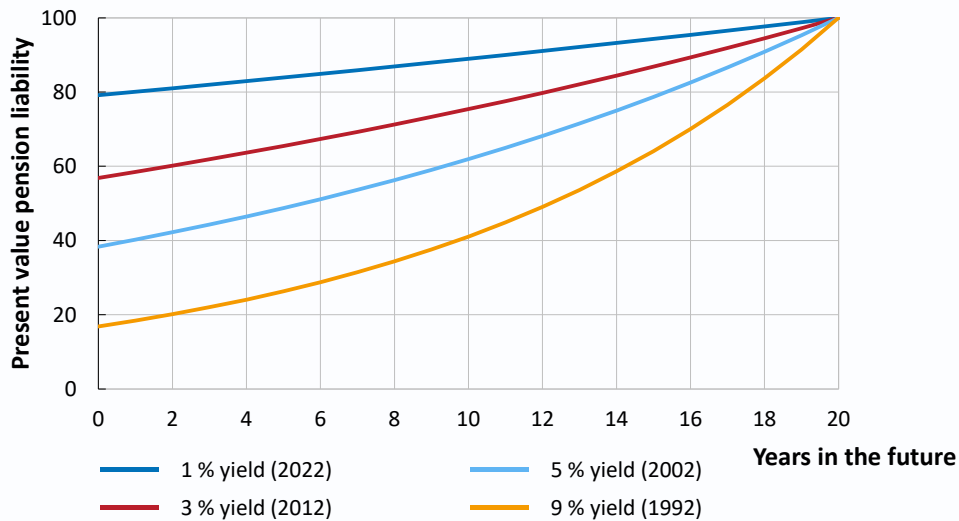
⁹ See Exley, Mehta & Smith (1997).

¹⁰ Swap rates are the fixed rates that investors demand to enter into interest-rate swaps for different maturities in exchange for paying variable interest. Interest-rate swaps are discussed in more detail in section 2.2.

EXAMPLE CALCULATION – Defined benefit pension

An employer promises to pay out GBP 100 in pensions to its employees in 20 years. Since the employees “own” the pension liability, so to speak, it can be thought of as a bond. The employer can therefore invest a certain amount in a government bond with the same maturity as the pension liability, i.e. 20 years, and with certitude pay out GBP 100 to its future pensioners.¹¹ How much the employer has to set aside depends on the government bond yield. 0 illustrates how much the employer has to set aside to reach its target of GBP 100, based on nominal UK government bond yields on four occasions over the last 30 years.

Diagram 1. Theoretical pension liability discounted by 20-year UK government bond GBP



Note. The author’s calculations. $NV = 100/(1 + y)^t$ where NV is the present value of the pension liability, y the nominal government bond yield and t the number of years until payout.

Source: Macrobond

In the chart we can see that it is a different amount of money at different times. In the early 1990s the employer would have been able to set aside GBP 17 to meet their payments, whereas GBP 79 would have been needed in early 2022. This illustrates the large effect that interest rates have on how much capital needs to be set aside for the employer to meet their guaranteed commitments if the capital is invested in government bonds.

This is a very simplistic example. In reality, pension commitments have increased since the 1990s as wages have risen. Pensioners also do not usually receive a lump sum on the day they retire, but part-payments for several years afterwards. It is also common for payments to be index-linked, for example by being adjusted upwards in line with inflation.

¹¹ Here I assume that UK government bonds are a risk-free investment because of the country’s high credit rating.

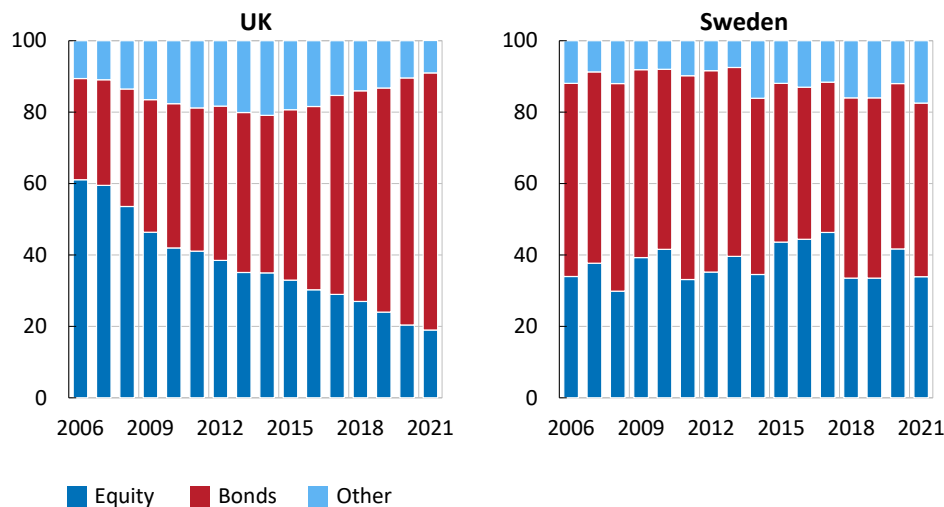
Risky assets to cope with low interest rates

More capital is needed today to finance DB pensions by investing pension provisions in government bonds. This is because market rates have fallen since the 1980s. In Sweden and many other countries, pension managers have instead partly chosen to invest in riskier assets, such as equities. Since they are expected to yield higher returns than government bonds, less capital is required to fund future pension payments. Of course, this depends on the performance of the equity market, for example, over the period corresponding to the long time that pension managers have to manage the pension liability.

UK DB pension funds also invest in equities. However the share of equities in their portfolios has fallen dramatically since the mid-2000s (See Diagram 2). One reason is that many pension funds have been closed to new members, which has led to a gradual increase in the average age of existing members.¹² As the average age goes up, managers look to reduce the risk in the fund in order to obtain more secure pension payments. Another reason is that the investment incentives of the funds have changed following new pension legislation introduced in the 1990s and 2000s.

Diagram 2. UK pension funds have progressively reduced their holdings in equities while Swedish counterparts have kept them relatively constant

Per cent



Note. UK DB pension funds and Swedish occupational pension companies with guaranteed commitments.

Sources: European Insurance and Occupational Pensions Authority (EIOPA) and Pension Protection Fund (PPF)

¹² In 2007, half of the members of UK DB pension funds were in so-called open-ended funds. By 2021, this figure had fallen to 23 per cent (PPF, 2021). It is also worth mentioning that there has been an ongoing shift from DB to DC schemes in the UK, in connection with many DB funds closing to new members since the early 2000s. This shift accelerated after the global financial crisis of 2007-2010. In the fourth quarter of 2019, 65 per cent of all occupational pension provisions went to DB schemes (ONS, 2020).

Rules created incentives to protect funding ratios against falling interest rates

In the 1990s, new rules were introduced with a new funding requirement for UK DB pension funds. It required the market value of the fund's assets to cover the present value of the liabilities the fund had to its members—at any point in time.¹³ If the fund did not meet this requirement, it was classified as underfunded. The company that had set up the fund then had to capitalise it further. The purpose of this requirement was to ensure that pensions would be paid even if the company went bankrupt.

In the 2000s, the requirement was relaxed somewhat and became more of a funding target.¹⁴ At the same time, the Pension Protection Fund (PPF) was launched, a state pension fund whose purpose is to act as a lifeboat for members of funds that have become insolvent and compensate them with an equivalent pension. Managers of underfunded funds are now required to pay a risk-based levy to the PPF and risk intervention by the public regulatory body, The Pension Regulator (TPR), if they do not address their funding shortfall within an agreed time-frame.¹⁵

In this way, UK DB pension funds have strong incentives to protect their *funding ratio*, i.e. fund assets divided by guaranteed commitments, against falling interest rates that cause commitments to grow faster than assets. One way to do this is to invest the fund's capital in the assets used to discount the commitments, i.e. long-dated government bonds. The problem, as I mentioned earlier, is that this is a strategy that requires a lot of capital when interest rates are low. This might be a reason why many funds have historically been underfunded (see Diagram 3). Underfunded pension funds can protect their funding ratio against falling interest rates by investing the capital into government bonds, but not their funding shortfall in money terms.¹⁶

¹³ See Pension Act 1995. Assets were required to be equal to at least 90 per cent of liabilities.

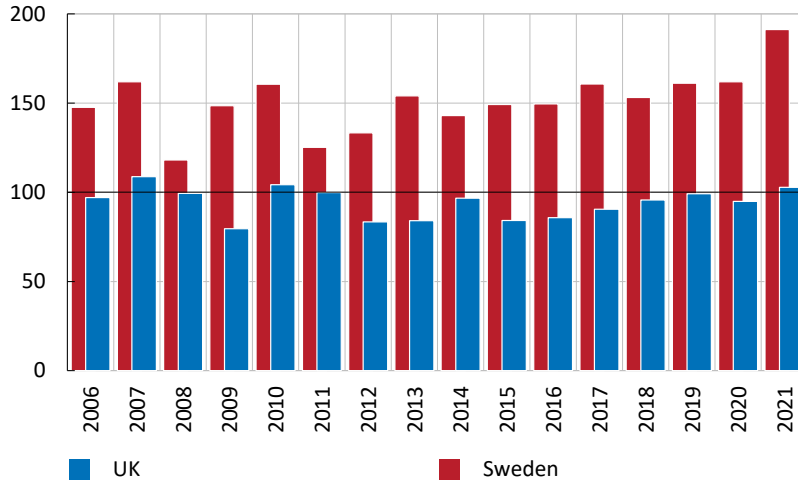
¹⁴ See Pension Act 2004. The so-called "minimum funding ratio requirement" was replaced by the "statutory funding objective". Pension fund managers were also given a greater say in how pension liabilities were valued.

¹⁵ The levy partly takes into account the fund's solvency and investment risks.

¹⁶ To provide an example: A pension fund has a funding ratio of 80 per cent. The fund owns government bonds worth GBP 80 and has liabilities with the present value of GBP 100. Now, interest rates fall, which means that the value of the fund's assets and liabilities increase by, for example, 20 per cent. The assets and liabilities are then worth GBP 96 and GBP 120 respectively. The funding ratio is the same as before, i.e. 80 per cent, but the funding shortfall in money terms has increased by GBP 4.

Diagram 3. Funding ratio of UK DB pension funds and solvency ratio of Swedish counterparts over time

Per cent



Note. Funding or solvency ratio is assets divided by guaranteed commitments. A ratio of 100 per cent means that the pension fund or company has just enough capital to cover its commitments. Pension companies are those companies that report to EIOPA as occupational pension companies.

Sources: European Insurance and Occupational Pensions Authority (EIOPA) and Pension Protection Fund (PPF)

2.2 Liability-driven investment strategy became the solution

In the 2000s, UK DB pension funds began to look for ways to protect their funding ratios against falling interest rates and try to improve it over time. But in a way that required less capital than investing directly in long-dated government bonds. The solution was liability-driven investment (LDI)—an investment strategy that invests a portion of the pension fund’s capital in such a way that the total value of the fund’s assets track the present value of the pension liability when interest rates fluctuate. An underfunded fund is then able to protect both its funding ratio and the value of its funding shortfall against interest rates, just like a fully funded fund that only invests in government bonds. At the same time, it gets capital left over to invest in riskier assets that are expected to give a higher return than government bonds over time.

For this to be possible, leverage is required. Leverage means borrowing to invest—in this case—in interest-bearing assets. This provides the ability to increase the interest-rate sensitivity (duration) on the asset side of the fund so that it matches the duration on the liability side, with less invested capital. The strategy has two key ingredients: debt-financed government bonds and interest-rate swaps. The first creates financial leverage by leveraging the fund’s bond holdings. It does this by entering into repurchase transactions whereby the fund sells its government bonds to a counterparty (usually a bank) and is then obliged to buy them back at a predetermined price. This is also known as a repo, and is a type of secured loan. From the repo, the fund receives cash for which it buys additional government bonds. From now on I will call this “repo-financing” government bonds.

The second ingredient, interest-rate swaps, are derivative contracts in which the fund agrees with a counterparty (also usually a bank) to exchange interest-rate flows of a certain notional amount over a fixed period of time. In this Staff Memo, I will use the term “interest-rate swaps” to refer to plain vanilla interest-rate swaps where the pension fund receives fixed interest payments in exchange for paying variable interest, unless otherwise specified. Interest-rate swaps create so-called synthetic leverage, as usually only the interest rates, and not the nominal amount, are exchanged. The fixed interest rate payments mean that an interest-rate swap can be viewed as a representation of a coupon-paying bond. In this way, it increases the duration of the asset side because its value rises when interest rates fall. Interest-rate swaps can have very long maturities and are often used as a substitute for long-dated bonds.

With these two ingredients, the pension fund has a recipe for using leverage to increase the duration on its assets to better match the duration on its liabilities—with less capital input. The fund can then use the remaining capital to invest in risky assets that are expected to generate a higher return than government bonds, thereby also seeking to improve its funding ratio over time.

Large pension funds exercise LDI internally or outsource management to an external fund manager. Smaller pension funds often co-invest with other funds in so-called pooled accounts with an external manager. When I talk about LDI in the rest of this Staff Memo, I will do so from the perspective of an external LDI manager.

2.3 LDI gives rise to liquidity risks

To manage some of the counterparty risks arising from repo or interest-rate swap agreements, the parties to the agreement exchange collateral with each other based on the performance of the fixed-income market.¹⁷ If the government bonds pledged by the LDI manager as collateral to the bank in the repo decline in market value, the bank may require the manager to pledge additional collateral. If the value rises instead, the bank may have to repay some of the collateral. In the case of interest-rate swaps, it is a legal requirement in the UK and the EU that the parties exchange so-called variation margins each trading day, which corresponds to the change in value of the derivative contract.¹⁸

The requirement to exchange margins is part of the comprehensive regulatory framework that emerged from the lessons of the global financial crisis. It also requires, among other things, interest-rate derivatives to be cleared by a central counterparty (CCP). When a contract is CCP-cleared, the counterparty risks that the manager and

¹⁷ More specifically, in a repo, the bank cannot be sure that the manager will be able to buy back the assets when the contract expires. Similarly, the manager cannot be sure that the bank will retain the asset. For interest-rate swaps, the parties cannot be certain that the counterparty will be able to deliver the contracted interest payments in the future.

¹⁸ See the EU European Market Infrastructure Regulation (EMIR) and the UK EMIR (the UK version).

the bank take in relation to each other are transferred to the CCP.¹⁹ While pension fund managers are temporarily exempt from the requirement, both UK and Swedish managers often choose to CCP-clear some of their interest-rate derivatives anyway, in order to obtain better terms in their contracts.²⁰ UK pension managers also CCP-clear a small proportion of their repos, but not to any great extent.²¹

When the LDI manager has a bank as a counterparty, it is often liquid assets, such as government bonds or cash, that change hands to meet the variation margin. If the counterparty is a CCP, there is usually a requirement for the variation margins to be cash. Having to hand over liquid assets, in some cases cash, on a daily basis can put a lot of pressure on even the most solvent firms under certain market conditions. The market value of both government bonds and interest-rate swaps declines when interest rates rise. Therefore, if rates rise both sharply and rapidly, this can result in a liquidity need that is greater than the liquid assets of the company. I will discuss this in more detail in the next section.

2.4 LDI management in practice when interest rates rise

Imagine a scenario where an underfunded pension fund, i.e. where the present value of the pension liability is greater than the assets, wants to protect its funding ratio against falling interest rates and try to improve it over time. The fund therefore tasks an external LDI manager to invest half of the pension fund's capital in assets that change in value at a similar rate and direction to the pension liability when interest rates move. The fund invests the other half in riskier assets that are expected to yield higher returns than government bonds in order to improve its funding ratio over time.

The LDI manager starts by buying long-dated government bonds in the market. The manager then goes to the bank and repo some of its bonds in exchange for cash and buys more bonds in the market. Let's say half of the bonds are now repo-financed. This means that the manager has an implicit leverage of twice its equity.²² Therefore, should the price of the bonds fall or rise by a certain amount, the value of the equity

¹⁹ A CCP acts as an intermediary between the buyer and seller in a securities transaction, transferring the counterparty risks to the CCP. See the fact sheet "What does it mean to be a participant in a CCP?" in Sveriges Riksbank (2022) for how a CCP works in practice.

²⁰ See Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories. The exemption also applies to "legal entities set up by [pension companies] for investment purposes and acting exclusively in their interest". As pension companies have long-term commitments, the opportunity cost for them of holding cash is high. Therefore, they tend not to hold a large amount of cash, which makes it less suitable to exchanging them as variation margins on CCP-cleared derivative contracts. The exemption under EMIR was created to allow time to develop a technical solution for the transfer of non-cash variation margins. The exemption has been extended a number of times and at the time of writing runs until 18 June 2023 (ESMA, 2022).

²¹ The UK clearing organisation LCH enabled CCP clearing for UK pension and LDI funds in 2017 by allowing them to go through banks. By the end of 2021, 27 pension funds were members of RepoClear, LCH's repo-clearing service. Although pension funds do not generally CCP-clear through a bank, in many cases the bank may act as a market maker and take a reverse repo position with another bank, in which the transaction is CCP-cleared. In practice, the bank then requires margins from the pension fund when the value of the first contract declines even when the pension fund technically does not have the CCP as a counterparty.

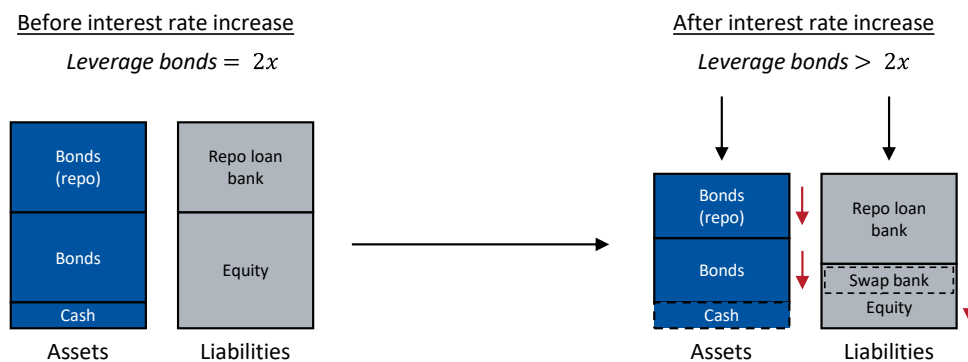
²² The Bank of England estimates that before the liquidity crisis in September 2022, leverage averaged between 2-4 times equity.

is reduced or increased twice over. The LDI manager’s equity, which is the capital contribution from the pension fund, can be seen as a capital buffer that the manager has to absorb losses on its bonds.

Furthermore, the manager enters into an interest-rate swap contract with the bank and commits to making regular variable interest payments in the future. In exchange, the manager receives a fixed interest rate from the bank. The aim is to further increase the duration of the assets. Unlike the repo above, the derivative contract is cleared at a CCP and the variation margins that must be posted when there are mark-to-market losses on the contract must therefore be in cash.

Through repo-financed government bonds and an interest-rate swap, the LDI manager has increased the interest-rate sensitivity of the pension fund’s assets so that they are as sensitive as its liabilities—using half of the fund’s equity. In Diagram 4 I illustrate the impact on the LDI manager’s balance sheet when market rates rise.²³

Diagram 4. Illustration of the change in assets and liabilities of LDI managers with rising interest rates



Note. “Swap bank” represents the increased variable interest payments that the manager must make to the bank in the future on the outstanding interest-rate swap contract.

Sources: Bank of England and the Riksbank

When interest rates rise, the price of government bonds falls. Because of the leverage, the capital buffer is reduced by twice as much.²⁴ In the example, the capital buffer consists of directly owned bonds and cash. After the rise in interest rates, the leverage has increased to more than twice the equity.

Rising interest rates also reduce the value of the interest-rate swap on behalf of the manager because the manager has to pay higher variable interest to the bank in the future while the manager receives the same fixed interest rate as before the rise in interest rates.²⁵ The present value of these payments, which thus corresponds to the

²³ The Bank of England has a similar example with government bonds only, where it is assumed that long-dated government bond yields rise more than short-dated yields, thus improving the funding ratio of the pension fund (see <https://committees.parliament.uk/publications/30136/documents/174584/default/>).

²⁴ The price of government bonds moves in the opposite direction to interest rates, as higher interest rates lead to less demand for the return that holding the bond provides and vice versa.

²⁵ Technically, payments are made to the CCP, which is the bank's legal counterparty for the duration of the contract.

mark-to-market losses on the contract, is shown as “swap bank” in the chart. In the example, the manager has just enough cash on hand to meet the increased margin calls to the CCP. This can be seen by the fact that “cash” under assets corresponds to “swap bank” under liabilities, in terms of size.

If interest rates rise more than they do in the example above, the manager continues to make losses on their government bonds and interest-rate swap contract. The capital buffer is then at risk of being completely eroded, leaving the manager unable to maintain its repo and interest-rate swap contracts. The bonds pledged as collateral in the repo will then fall to the bank and the manager will go into technical default on their interest-rate swap contract with the CCP, which will try to sell the contract in the market. It is also conceivable that the bank will attempt to sell the bonds.

However, there are a number of steps that the manager can take before this happens. One measure is to ask for more capital from the pension fund. In the scenario above, this would mean that the fund would have to sell some of its riskier assets. Another measure is to sell government bonds in the market to reduce leverage, which means that the capital buffer is not depleted as quickly. In September 2022, the first measure proved difficult to implement for some LDI managers, particularly those managing pension capital for several smaller funds in pooled accounts.²⁶

2.5 Unfunded budget proposal led the central bank to intervene

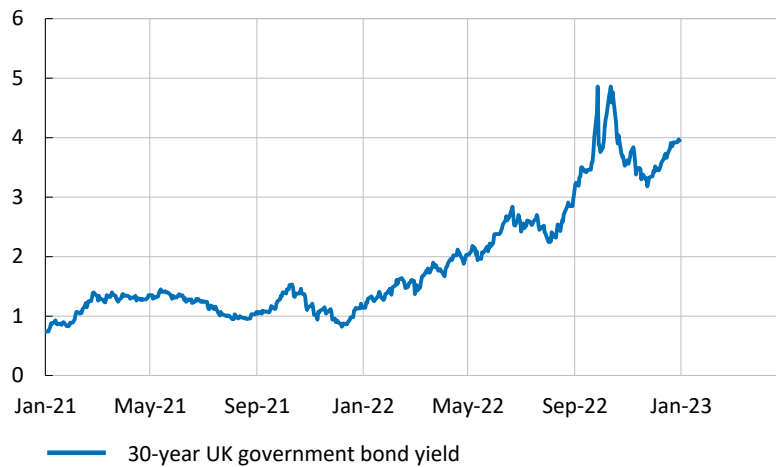
In 2022, global financial markets were already volatile due to Russia’s invasion of Ukraine and problems with rising inflation. Then, when the UK government unveiled a proposal for unfunded tax cuts on 23 September, UK long-dated government bond yields soared (see Diagram 5).²⁷ This put a lot of pressure on several LDI investment fund managers as the market value of their government bonds and interest-rate swaps fell sharply, in much the same way as in the illustration above. As a result, they had to post additional collateral in their repo and interest-rate swap contracts while their capital buffers shrank. Several managers were unable to raise capital quickly enough from the parent pension funds and were forced to sell a large amount of government bonds in the market at falling prices to reduce their leverage and to avoid insolvency. As mentioned above, this was mainly the case for those managing assets for several smaller pension funds in pooled accounts.

²⁶ Around 15 per cent of the assets under management in DB pension funds in the UK are estimated to be in pooled accounts. See TPR (2019).

²⁷ There were two daily increases in the 30-year rate of more than 35 basis points, while the largest daily increase since 2000 before that had been 29 basis points.

Diagram 5. UK long-term rates soared after unfunded tax cuts

Per cent



Source: Macrobond

When the LDI managers sold government bonds, a self-reinforcing negative price spiral was created. The sales caused government bond yields to rise further, which led to an even greater need for liquidity and capital from pension funds. Managers attempted to sell quantities far in excess of the normal daily trading volume in the market, which, according to the Bank of England had a very negative impact on the functioning of the market. Several LDI funds risked eventual insolvency if developments did not stabilise.

The situation prompted the Bank of England to temporarily purchase long-dated government bonds in order to safeguard financial stability and to give pension funds time to capitalise their LDI funds. They wanted to reduce the risk that market malfunctioning would ultimately lead to an undesirable tightening of financing conditions and a reduced supply of credit to the real economy.

The purchases ran from 28 September to 14 October 2022 and were designed not to interfere with the UK central bank's monetary policy strategy, as the central bank had announced before the liquidity crisis that it would start selling part of its government bond holdings in early October, which it had to postpone. In addition to being targeted and temporary, the Bank of England designed the purchases to offer to buy as many bonds as needed to restore stability to the market—and not to achieve a certain quantity of bonds or a certain level of interest rates.

The purchases stabilised the market relatively quickly. Their combined value was GBP 19.3 billion, less than the GBP 65 billion that the Bank of England had announced it was offering to buy.²⁸ On 12 January 2023, the central bank stated that they had sold these bonds.

²⁸ The Bank of England made some changes during the buying period, mainly to include real interest bonds. Of the purchases of GBP 19.3 billion, GBP 12.1 billion consisted of long-dated government bonds and GBP 7.2 billion of indexed-linked bonds.

3 Swedish pension management

3.1 Uses less leverage

It was primarily leverage that was the villain in the UK pension drama. Managers of UK defined benefit (DB) pensions created it by repo-financing some of their government bonds and entering into interest-rate swap agreements in which they received fixed interest rates. When UK long-term interest rates soared in September 2022, it created a liquidity crisis. However, Swedish pension companies do not use leverage to the same extent.

Limiting legal scope for financial leverage...

In Sweden, pension companies may only borrow in order to improve the efficiency of their asset management or to meet temporary liquidity needs.²⁹ In addition, the law requires that the borrowing is of minor importance, taking into account, among other things, the size of the company's capital base.³⁰ This means that pension companies have limited scope to systematically create leverage by, for example, repo-financing their holdings of government securities. In practice, the use of repos is very limited. The net liquid funds received by pension companies from repos and those they place on reverse repos amounted to only 0.3 per cent of the market value of pension companies' investment assets at the end of the third quarter of 2022.³¹

... and synthetic leverage is used to a lesser extent

The regulatory framework limiting the borrowing capacity of Swedish pension companies allows the use of derivative instruments to reduce risk in the company.³² Like their UK counterparts, they therefore use interest derivatives such as interest-rate swaps to reduce their solvency risk, i.e. to protect themselves against their liabilities growing relative to their assets if interest rates fall. However, in terms of gross figures, I estimate that the use of interest-rate swaps is lower than in the UK and some other European countries (see Diagram 7 in the appendix).

Repo market an option for raising liquidity instead of leverage

Swedish pension companies also have government bonds to cover part of their long-dated guaranteed commitments. However, since they do not systematically repo-finance them to create leverage, it is conceivable that they have a greater opportunity than their UK counterparts to meet their liquidity needs in times of financial stress

²⁹ See the Swedish Insurance Business Act (2010:2043), Chapter 4, Section 6 and Swedish Act on occupational pension companies (2019:742), Chapter 4, Section 7.

³⁰ In individual cases, Finansinspektionen may decide to waive the requirement that borrowing must be of minor importance for special reasons.

³¹ See Insurance Sweden (2022). Excludes the value of deposit and unit-linked insurance assets where policyholders bear the financial risk.

³² See the Swedish Insurance Business Act (2010:2043) Chapter 6, Section 5 and Swedish Act on occupational pension companies (2019:742) Chapter 6, Section 9.

through the repo market. By this, I mean that when UK yields rose sharply in September 2022, several LDI managers had to reduce their leverage to avoid insolvency. In other words, they needed less leverage, not more, and therefore could not use the repo market to raise liquidity. However, it must be borne in mind that the leverage of Swedish pension companies must still be reasonable in relation to their capital base, which will be an interpretation that Finansinspektionen will have to make.

A well-functioning and accessible repo market can therefore be an important part of pension companies' liquidity management. Of course, repos require the presence of a bank willing to enter into the repo, especially in times of financial stress. However, banks may be willing counterparties to a certain extent because they want to maintain their commercial relationship with pension companies in the future. Some banks also make money from being market makers by taking an opposite position with another market participant. The amount of liquidity available through the repo market also depends on the bank's risk appetite as such transactions affect the bank's balance sheet.³³

Banks also probably have a lower wrong-way risk against Swedish pension companies than what UK banks have against LDI managers. By wrong-way risk, I mean the risk that the value of the government bonds that the pension company is collateralising in the repo falls in the scenario where the company becomes insolvent. Since the Swedish companies have a higher proportion of equities in their portfolios than their UK counterparts, it is conceivable that insolvency would come from large falls in equity prices, rather than rising interest rates.³⁴ Periods of large equity price falls are often accompanied by a so-called "flight-to-safety" episode in the market, where investors sell risky assets to buy government bonds. A lower wrong-way risk may therefore increase banks' incentive to be a counterparty in repo transactions.

3.2 Assumed to have liquid funds to cover increased margin calls on interest-rate swaps

What might the liquidity need of Swedish pension companies look like if interest rates rapidly rise in Sweden? To give an indication, I calculate the potential mark-to-market loss that would have arisen on the interest-rate swap holdings that reference Stibor for a sample of Swedish pension companies at 22 September 2022.³⁵ I value the holdings as a portfolio of interest-rate forwards and parallel shift the swap curve momentarily upwards by a certain number of basis points. I then relate the loss to the companies' liquid funds at the beginning of the year and report it at an aggregate level in Diagram 6.

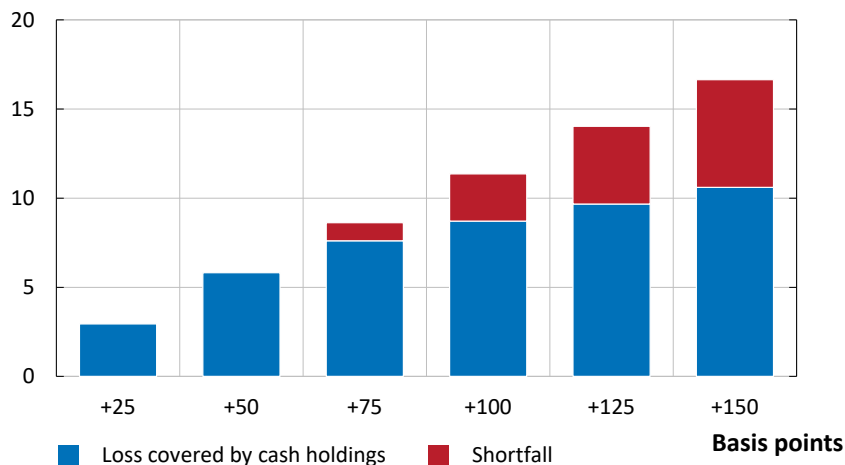
³³ See Jensen & Achord (2019) for technicalities on liquidity provision via repos and the impact on banks' balance sheets. If the bank acts as a market maker, it also affects the bank's net stable funding ratio (NSFR).

³⁴ Equity price falls are a risk that both the Riksbank and Finansinspektionen highlight in their stability reports. See Sveriges Riksbank (2022) and Finansinspektionen (2022).

³⁵ A total of ten of the largest life insurance and occupational pension companies and mutual benefit societies by market value that have holdings in interest-rate swaps where variable interest is primarily paid.

Diagram 6. Large interest-rate movements before pension companies' cash holdings no longer cover increased margin calls on interest-rate swaps

SEK billion



Note. The author's calculations. Cash holdings refer to the item cash on hand and at bank on the pension company balance sheet. Holdings are as of 22 September 2022. Interest-rate swaps referring to Stibor where the pension company receives a fixed interest rate have been offset against those where they receive a variable interest rate. See the appendix for further methodological description.

Sources: Companies' annual reports, Macrobond and the Riksbank

Assume that all contracts are subject to exchange of variation margins, i.e. the depreciation in the contracts must be covered by cash. In a parallel shift of the swap curve of 75 basis points, some individual company does not have sufficient cash holdings to cover the increased margin calls. The number of companies with shortfalls then increases, which explains why the aggregate shortfall does not evolve linearly. The fact that it appears to take relatively large interest rate rises before companies become short of liquidity at the aggregate level is in line with Finansinspektionen's view that Swedish pension companies have ample liquidity to meet increased margin calls.³⁶

By comparison, interest rates rose by 140 basis points in the UK in September 2022 in four days. If Swedish pension companies had only been exposed to increased margin calls on interest-rate swaps, they would probably have had sufficient liquidity to deal with such a scenario. However, liquidity needs would likely have arisen from other sources as well.³⁷ Interest rates also rose in 2022, which means that companies may have used their cash holdings to pay increased margin calls on interest-rate swaps on an ongoing basis during the year. This means that cash holdings may have been smaller than those reported in the scenario above.

³⁶ See Finansinspektionen (2022).

³⁷ For example, interest-rate shocks tend to be followed by shocks in exchange rates, which can create additional margin calls on foreign currency swaps that pension companies use to match assets and liabilities in the respective currencies.

3.3 Have more capital in relation to guaranteed commitments

Swedish pension companies with guaranteed commitments have more capital in relation to their commitments, the so-called solvency ratio, than their UK counterparts (see Diagram 3 once more). They also have the highest solvency ratio in the EEA.³⁸ This may mean that they are better equipped to cope with periods of low interest rates if their commitments grow faster than their assets. It may also be a reason why Swedish pension companies have chosen not use as much synthetic leverage, i.e. leverage created by, for example, interest-rate swaps. The capital buffer they have allows them to have a liability side that is more interest-rate sensitive than the asset side because it would take time before falling interest rates make it difficult for them to meet their solvency requirements.

One may then ask why it has become so. Swedish pension companies have had freer investment rules than UK pension funds. This has allowed them to invest more in other riskier assets such as equities and corporate bonds. The historically positive performance of the equity market, for example, has enabled Swedish companies to build up large capital buffers over time. However, a larger holding of these riskier assets entails other types of risk, but I do not present these here.

3.4 Internal management, operational risks and supervision

Swedish pension companies manage their assets in-house to a greater extent than their UK counterparts, giving them greater control over their own funding. The fact that a large proportion of UK pension capital is managed by an external LDI manager exposed pension funds to some operational risks during the liquidity crisis. This was most acute for smaller funds investing with other funds in pooled accounts with a manager. There, several decision-makers had to coordinate and make funding decisions at very short notice. There is also a risk of a game of “chicken” in such a scenario. That is, individual funds would wait to contribute capital because the benefit of weathering the crisis would have been borne by all funds, while the cost of not doing so would have weighed more heavily on the fund(s) that had contributed capital than those that had not done so.

In Sweden, Finansinspektionen is responsible for the supervision of both individual pension companies and the sector as a whole, i.e. for both micro and macro supervision.³⁹ In the UK, supervision can be seen as somewhat more fragmented. Although the Bank of England is responsible for the micro-prudential supervision of banks acting as counterparties to LDI managers through the Prudential Regulation Authority (PRA), it does not have responsibility for the supervision of pension funds themselves

³⁸ See the appendix to the Financial Stability Report 2022:2, Sveriges Riksbank (2022).

³⁹ The Riksbank, together with the Swedish Ministry of Finance and the Swedish National Debt Office, helps to identify vulnerabilities and disruptions related to pension companies that pose risks to financial stability, partly by having access to other sources of information and partly by making its stability assessments from different starting points.

or LDI managers. Instead, the Pension Regulator (TPR) and the Financial Conduct Authority (FCA) respectively have that responsibility. In addition, many LDI managers are based outside the UK, for example in Ireland, and therefore fall under the regulatory jurisdiction of other countries. Such a more fragmented regulatory framework may make it more difficult to identify vulnerabilities and disruptions that give rise to systemic risks. It may also make it more difficult, for example, to collect and harmonise data that can be used to identify these risks. However, it should be said that there are probably benefits to fragmentation as well, which I do not speculate on here.

4 The consequences of protecting against falling interest rates

Pension managers are always exposed to risks that may impair their solvency. In this Staff Memo, I focus on the risk that falling interest rates will cause managers' liabilities to grow more than their assets, negatively affecting solvency. One way of mitigating this risk is to invest the pension capital in long-dated government bonds, but as I have shown previously, this is a problem when interest rates are low because it requires a large amount of capital. Instead, they can use leverage to increase their exposure to market interest rates. In the UK, DB pension funds repo-finance some of their government bonds and enter into interest-rate swaps where they receive fixed interest rates. In Sweden, pension companies with guaranteed commitments also enter into interest-rate swaps, but to a lesser extent. When this is done, a different type of risk—liquidity risk—arises, as these strategies involve exchanging collateral.

In the UK, funds have strong incentives not to become underfunded due to the UK regulations. At the same time, few funds are open to new members. As a result, the primary objective of the vast majority of funds is to become funded and remain so.⁴⁰ To do that, they need to lower their solvency risk greatly. The consequence of this is that they end up with a high liquidity risk instead. Swedish pension companies with guaranteed commitments do not need to reduce their solvency risk as much because they have more capital relative to commitments. As a result, their liquidity risk is not as high.

However, both are incentivised to improve their solvency. In the UK, underfunded funds want to become funded without having to raise more capital from employers. In Sweden, pension companies want to distribute profits to their shareholders or increase returns to their members in mutually owned companies. It is conceivable that underfunded UK funds will relax their interest-rate hedges to some extent if they expect higher interest rates in the future than the market does, thereby attempting to benefit from rising interest rates. However, as an incorrect interest-rate forecast would result in a larger funding shortfall, they need to be careful. Instead, they rely on riskier assets to improve their funding ratios. The problem with these assets is that they often fall in value when interest rates rise. This makes it difficult for underfunded funds to become funded without having to raise more capital.

Swedish pension companies, on the other hand, have the opportunity to risk more of their solvency to improve their funding ratios. This gives them a greater possibility to act on their expectations of future interest rates and benefit from them if they are right. If they do, however, falling interest rates will have a greater negative impact on their solvency—like a double-edged sword, interest rate movements may become very favourable or unfavourable. Even so, it would take time and probably relatively

⁴⁰ Possibly with a margin to cover developments such as the average life expectancy of the fund's members being higher than expected.

large falls in interest rates before they could no longer meet their solvency requirements.

If pension managers expose themselves to significant liquidity risks it has implications for the wider economy and for the stability of the financial system. For example, during the earlier period of low interest rates, a large proportion of pension capital was directed to alternative investments such as infrastructure projects, property and unlisted equities because bond yields were low. These investments are illiquid and difficult to convert into cash, which can be problematic if rising interest rates lead to a great need for liquidity.⁴¹ During the liquidity crisis, UK pension funds sold their liquid assets to meet such a need, leaving them with illiquid assets that took up a larger share of the portfolio after the crisis than was intended. They have since sold off some of their illiquid assets simply to rebalance their portfolios. As the assets are illiquid, losses may be high if there is sudden and high selling pressure from several pension funds.

Liquidity risks can also lead to pro-cyclical investment behaviour that amplifies market developments in a particular direction.⁴² The European Insurance and Occupational Pensions Authority (EIOPA) recently showed that European insurance companies' use of interest derivatives in 2022 has reduced the volatility of their solvency ratios when interest rates have risen.⁴³ However, this has led companies to gradually sell off large amounts of bonds and shares in money market funds over the year, partly to meet increased margin calls on interest derivatives and partly to reduce their exposure to market interest rates.

⁴¹ The OECD (2022) warns of this in its pensions outlook.

⁴² Pro-cyclical investment behaviour is when investors sell when asset prices fall and vice versa.

⁴³ See EIOPA (2022b).

5 Concluding comments

Leverage has an important function in economy that allows households to borrow to buy homes or companies to borrow to invest in socially beneficial projects, for example. But the incident in the UK also exposed how leverage can amplify a liquidity crisis and create risks for the financial system. LDI is an investment strategy that works well in practice under normal market conditions but that can create major problems under stressed ones. While several external LDI managers were at risk of insolvency during the September 2022 crisis, UK defined benefit (DB) pension funds generally benefited from rising interest rates. At the time of writing, they have more assets relative to their guaranteed commitments than before the crisis.⁴⁴ This suggests that it was not how much interest rates rose that was the problem, but how quickly.

Although Swedish pension schemes with guaranteed commitments are not as exposed to liquidity risks, it is still important that they have good liquidity management. Interest rates are volatile in the current economic climate, making companies vulnerable. For example, this makes the value of the interest-rate derivatives that companies use to protect their solvency ratios against falling interest rates more volatile. This increases the likelihood of large margin calls.⁴⁵

There are good reasons to believe that pension companies' liquidity risks will increase in the future. If and when companies deem that there is a certain 'drop height' in interest rates, they are likely to make their assets more interest-rate sensitive in order to protect their solvency against a possible downturn in interest rates. If they do this with interest-rate swaps, they will expose themselves to greater liquidity risks. In addition, the exemption for CCP clearing of interest-rate derivatives is due to expire in the summer of 2023, which means that new such derivatives will have to be cleared through a CCP. This further increases liquidity risks as the exchange of variation margins on these contracts must be in cash.

Taken together, this makes it important that pension companies have good liquidity management and that their liquidity stress tests are calibrated even against volatile market movements. It can also be good if they do reverse stress tests, that is, starting from market movements that exhausts their liquidity and ask themselves how extreme market movements they can handle in practice. It is also important that they have channels to banks or CCP cleared repo markets to be able to borrow liquidity in times of financial stress.⁴⁶

From a financial stability perspective, a lack of liquidity can create difficult situations for pension companies that risk spilling over to other markets and agents. In the UK, the Bank of England chose to intervene temporarily to try to sort out the dysfunctional government bond market to which the forced sales by LDI managers were contributing. Swedish pension companies do not own as much national debt as their UK

⁴⁴ See PPF (2022).

⁴⁵ This is partly because higher market volatility increases initial margin calls and partly because of the higher probability of extreme changes in the value of contracts, which results in increased variation margin.

⁴⁶ These are suggestions that Jensen & Achord (2019) also raise for Danish pension companies.

counterparts do and are not expected to be able to influence the market as much as their UK counterparts.⁴⁷ However, they do have a significant presence in several markets, such as the corporate bond market, whose functioning could be damaged if they are suddenly forced to sell large parts of their holdings.⁴⁸ It is therefore important to remain vigilant about liquidity risks that may arise for financial intermediaries such as pension companies and the links they have with other agents in the financial markets.

⁴⁷ At the end of September 2021, insurance companies and pension funds owned 27.4 per cent of outstanding government bonds in the UK (HM Treasury, 2022) and at the end of 2021 they owned 20.6 per cent of them in Sweden (Statistics Sweden, 2022).

⁴⁸ The financial turmoil linked to the coronavirus pandemic exposed how sensitive the corporate bond market was to large fund outflows in March 2020. See Wollert (2020).

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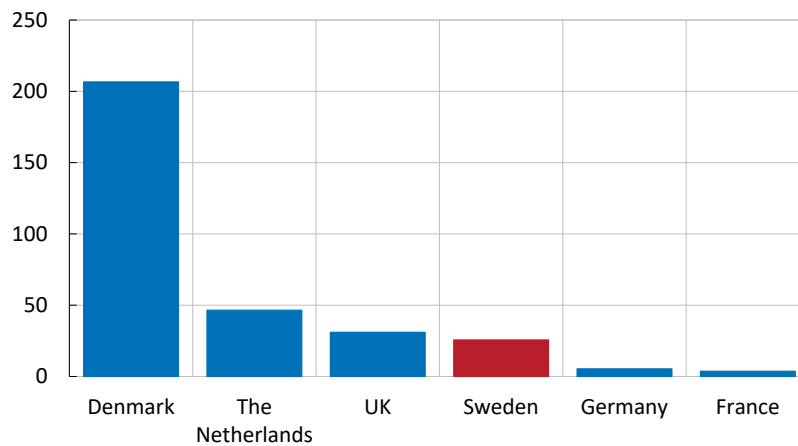
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APPENDIX

Comparison of the nominal value of interest-rate swaps

Diagram 7. Nominal value of interest-rate swaps as a share of total assets of insurance companies or pension funds in a sample of European countries

Per cent of total assets



Note. The author's calculations. The chart refers to the last quarter of 2021 and includes both life and non-life insurance companies. All countries except the UK are calculated using a combination of data from the EIOPA Financial Stability Report December 2022 and asset exposure statistics. The figures are gross figures.

Sources: European Insurance and Occupational Pensions Authority and The Pensions Regulator (TPR).

Methodology for the calculation of mark-to-market losses on interest-rate swaps in section 3.2

First, the nominal value of all outstanding interest-rate swap contracts where a fixed interest rate is obtained is offset against the value of contracts where a variable interest rate is obtained, for each maturity category and for each company.

In the analysis, I assume that the pension company and the counterparty swap interest rates once a year.

The effect of a parallel shift of the swap curve by X number of basis points (bps) for maturity t is then calculated as follows:

$$\text{Mark-to-market loss} = \sum_{i=1}^t \frac{\text{Nom} * \frac{\text{bps}}{10000}}{\left(1 + \text{swap rate} + \frac{\text{bps}}{10000}\right)^t}$$

Finally, the effect is summed for all maturities and for all companies.



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