



GLOBAL FINANCIAL STABILITY

NOTES

Pension Funds and Financial Stability

Sneha Agrawal, Timo Broszeit, Ranjit Singh,
Nobuyasu Sugimoto, Jay Surti, and Suzette Vogelsang

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Pension Funds and Financial Stability

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and Suzette Vogelsang*

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Abbreviations

DB	Defined Benefit
DC	Defined Contribution
EIOPA.....	European Insurance and Occupational Pensions Authority
FSAP	Financial Sector Assessment Program
GDP.....	Gross Domestic Product
ICPF.....	Insurance Companies and Pension Funds
IOPS.....	International Organization of Pension Supervisors
OECD.....	Organisation for Economic Co- operation and Development

Introduction

Global pension savings are playing an increasingly significant role in financial markets. Statistics from the Organisation for Economic Co-operation and Development (OECD) put global pension savings at \$63.1 trillion at the end of 2023 (Figure 1). For the OECD's 38 member countries, this translated into 98 percent of their combined gross domestic product, almost three times the level 20 years earlier. As a result, the pension fund sector has become an important segment of the (nonbank) financial sector that warrants adequate risk surveillance and robust supervision in many jurisdictions.¹

This Global Financial Stability Note examines the growth of this sector and the potential financial stability implications. Historically, pension funds have been seen as a contributor to financial stability because of their long-term and well-diversified liabilities. However, the sector has undergone significant structural shifts accelerated by a prolonged period of low interest rates, increasing its exposure to traditional risks while introducing emerging risks; this is reflected in growing intra-financial sector interconnectedness and exposure to long-term sovereign bonds. The recent transition to higher interest rates should be positive for the pension sector, albeit its pace and abruptness has been associated with liquidity stress and contagion risks in some countries.

Pension systems comprise three pillars. Public pensions (Pillar 1) are provided by the government to support basic income needs. Occupational pensions (Pillar 2) are funded by contributions from both employers and employees, and decisions are typically taken collectively by them. Private pensions (Pillar 3) are voluntary savings and provided mainly by financial institutions such as insurers or pension funds.² The relative importance of the three pillars varies substantially across countries. In the Netherlands, old-age income is almost equally split between public pensions and occupational pensions. In Iceland, occupational pensions have become the most relevant source of income for pensioners.

Occupational pension plans are a major component of pension assets. Such plans are mandatory or quasi-mandatory in half the OECD countries and cover more than 75 percent of the working-age population in 12 of them. In Finland and Switzerland, employers must operate an occupational pension plan and contribution rates are set by law; mandatory plans are prevalent in Chile, Colombia, Costa Rica, and Mexico;³ in some countries, for example, Denmark, the Netherlands, and Sweden, the obligations—classified as quasi-mandatory—are determined through collective bargaining agreements for some economic sectors and participation rates are similar to those in countries with mandatory occupational arrangements. However, exemptions can exist for self-employed and seasonal workers.

¹ Significant differences exist across jurisdictions. In some, pension assets exceed 150 percent of GDP (Canada, Denmark, Iceland, the Netherlands, Switzerland); they are sizable in the United States and Australia and are as low as 11–12 percent (France, Italy, Spain) and even in single digits (Germany).

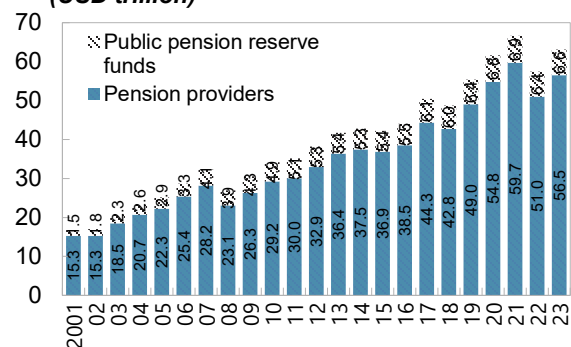
² Sometimes a Pillar 0 is referred to as a noncontributory social assistance, and a Pillar 4 would comprise other social programs such as health care and housing, informal support, and individual assets including home ownership and reverse mortgages.

³ Columbia's participation rate is a modest 55 percent despite a mandatory pension arrangement because of its large informal sector.

Figure 1. Major Pension Savings Markets

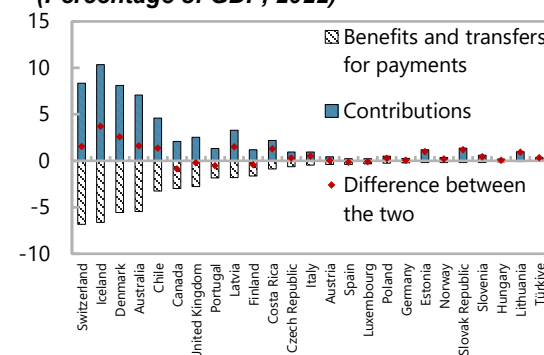
Assets for retirement have grown steadily in OECD jurisdictions.

1. Assets Earmarked for Retirement in the OECD (USD trillion)



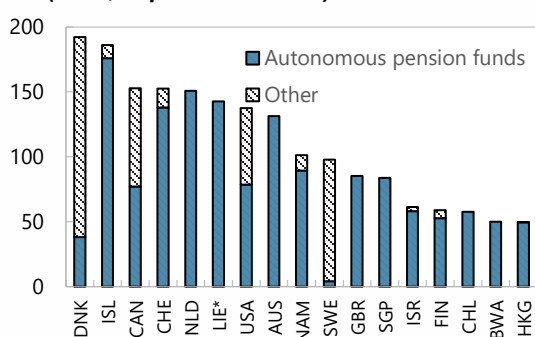
Contributions and pension benefits flows are quite different among jurisdictions.

2. Contributions and Pension Benefits Flows (Percentage of GDP, 2022)



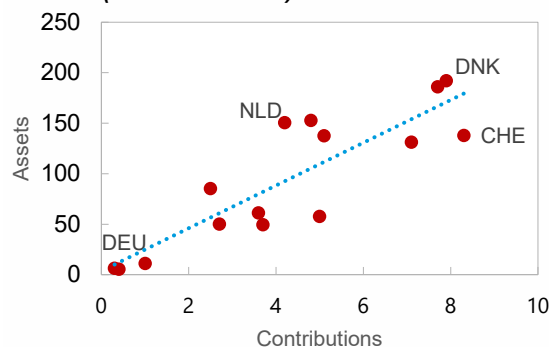
In five countries, pension savings amount to more than 150 percent of GDP, while another four countries reach more than 100 percent.

3. Size of the Pension Savings Sector (2022, in percent of GDP)



High contributions are correlated with the total size of pension savings.

4. Assets and Contributions (Percent of GDP)



Notes: 2021 data for Liechtenstein. Data labels in the figure use International Organization for Standardization (ISO) country codes. OECD = Organisation for Economic Co-operation and Development.

Source: OECD Global Pension Statistics.

Pension savings are offered by different types of institutions, with autonomous pension funds⁴ managing about 60 percent of the global market.⁵ Nearly two-thirds of OECD members have set up public pension reserve funds.⁶ Other relevant types of pension savings include book reserves, pension insurance

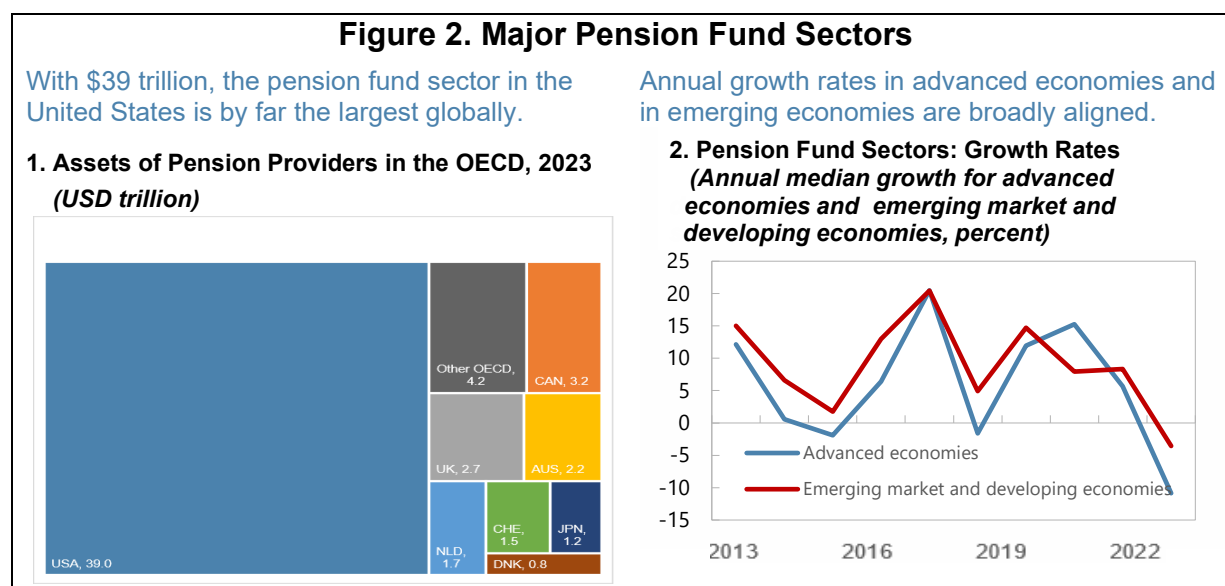
⁴ Autonomous occupational pension funds are separate institutional units established for the purpose of providing retirement income for specific groups of workers, organized, and directed, by private or public employers or jointly by the employers and employees. Autonomous pension funds can also be offered by financial institutions, for example, Chile and Mexico.

⁵ Occupational pension funds can be distinguished according to the type of contractual arrangements with employers. Single-employer funds serve only one employer (or a group of related entities) and tend to experience greater fluctuations in membership, contributions, and non-retirement payouts. Multi-employer funds cover the general labor market, an economic sector, or a region. In some countries, for example, Botswana and Namibia, the sector is dominated by one pension fund catering to the public sector.

⁶ The public pension reserve funds support public pension arrangements, usually financed on a pay-as-you-go basis. By the end of 2022, these funds in Organisation for Economic Co-operation and Development countries managed \$6.4 trillion in assets, largely concentrated in the United States (43 percent of global public pension reserve fund assets), Japan (23 percent), Korea (11 percent), and Canada (7 percent).

contracts,⁷ and funds managed by investment companies and banks.⁸ In most countries, autonomous pension funds are the most important providers, but there are notable exceptions. In Denmark, the largest pension savings market as measured by assets-to-GDP, most pension savings are through insurance companies, similar to Sweden.

Among assets of pension providers in the OECD, more than half of global assets are with US pension funds. By 2023, these had accumulated \$38.97 trillion (Figure 2). Other notable markets in absolute numbers include the United Kingdom (\$2.71 trillion), Australia (\$2.21 trillion), Canada (\$3.17 trillion), and the Netherlands (\$1.74 trillion). Since 2013, pension assets in advanced economies have grown by nearly 6 percent annually (and by almost 9 percent in emerging economies), but with significant volatility.



Source: OECD Global Pension Statistics.

Notes: Median growth for MCD only shown from 2019 because of small coverage before. Data labels in the figure use International Organization for Standardization (ISO) country codes. OECD = Organisation for Economic Co-operation and Development.

Pension funds contribute to financial stability by offering liquidity even in times of market stress. Several studies have noted the financial diversity and stability benefits of the sector because of its long-term investment horizon, with predictable cashflows supported by well-diversified member contributions and limited redemption options. There is also some evidence that pension funds have acted countercyclically during past financial stress episodes. Pension funds could enjoy additional returns from such countercyclical investment and illiquidity premiums, although these benefits might have been attenuated without appropriate liquidity risk management.

⁷ Pension insurance contracts specify pension contributions to an insurance undertaking in exchange for pension benefits, which are paid when members reach a specified retirement age or on earlier exit of members from the plan.

⁸ Book reserves are provisions on sponsoring employers' balance sheets, a typical form of pension savings, for example, in Germany.

Pension systems have been shifting from defined benefit (DB) to defined contribution (DC) plans to address the complex challenges associated with interest rate, inflation, and longevity risks. DB plans, predominant in countries such as Japan and the United Kingdom, guarantee specific benefits, exposing funds and pension plan sponsors to significant financial risks. DC plans, increasingly popular in the United States and Italy, transfer investment risk to the individual.⁹ Many pension systems have been transitioning toward a greater share of DC plans owing to the cessation of existing DB plans and new contributions made predominantly toward newly created DC plans. Furthermore, the transition from DB to DC is often supported by hybrid arrangements where the sponsor and the members share the investment risks. However, even after the shift, pension funds often need to continue to manage DB plans corresponding to existing members' accumulated benefits.¹⁰

In a low-interest-rate environment, pension funds have been incentivized to search-for-yield by increasing their leverage and exposure to illiquid assets. Lower interest rates increase the present value of DB pension liabilities. In response, some of the world's largest pension funds have significantly increased their allocations to illiquid investments while actively using derivatives and other forms of leverage.¹¹ Although DB pension funds with diversified member contributions buttressed by tax incentives have relatively high capacity to absorb liquidity risks, search-for-yield introduces a range of new risks, including leverage, liquidity imbalances, and currency mismatches, especially if pension investments reflect herding behavior.¹² Search-for-yield over the prolonged low interest rate environment might have changed the liquidity profile of pension funds in some countries, as they invested into illiquid assets with leverage in order to increase returns. The interconnectedness of pension funds with other financial institutions through asset-based financial linkages and derivatives contracts further amplifies these risks. Since 2020, DB pension funds in Canada, the Netherlands, and the United Kingdom have been facing significant margin calls from derivative contracts, which triggered contagion to other parts of the financial sector, such as money-market funds, repo borrowing, and equity markets. These episodes underscore the importance of robust liquidity management and systemic risk oversight.

Vulnerabilities of Pension Funds

Pension funds remain exposed to traditional risks even as newer, emerging risks are amplifying systemic vulnerabilities. Traditionally, pension funds (mainly in DB plans) have been exposed to structural and cyclical vulnerabilities such as the presence of guarantees, longevity, duration mismatches and associated interest rate risks, and inflation indexing. In addition, the search-for-yield during the era of prolonged low interest rates have accentuated new risks—liquidity imbalances, leverage, currency mismatches, concentrated investments, interconnectedness, and herding.

⁹ Hybrid plans continue to provide reduced level of guarantees to the members.

¹⁰ The Netherlands is an exception wherein, during the ongoing transition, even accumulated benefits have been shifted into the new DC plan.

¹¹ See Chapter 2 of April 2024 *Global Financial Stability Report* for further discussion.

¹² Herding can be pronounced in volatile markets and be observed in rebalancing strategies, reactions to external shocks, and strategic asset allocation. See Broeders and others (2021).

Traditional Risks

Guarantees

A DB pension plan guarantees a certain stream of benefits at retirement and at other predefined events, such as disability. This benefit stream is actuarially determined and considers a plan member's salary and length of membership in the plan. Globally, over 40 percent of pension fund assets were within DB plans across advanced countries at the end of 2023.¹³

Pension plans in several jurisdictions have been moving from DB plans toward DC plans over the past two decades. The share of DB plans has dropped from more than 40 percent to less than 30 percent, even in countries with a historically significant proportion of assets in such plans like the United States, and the decrease has been especially steep over the past two decades in countries such as Israel (91 percent to 43 percent) and Italy (40 percent to 2 percent). The shift helped to reduce the major traditional risks (such as guarantees and interest rates) significantly, although it might have created different type of risks (such as conduct and liquidity—see the Emerging/New Risks section).¹⁴

This trend shifts investment risks to beneficiaries, does not eliminate all risks to the plans arising from guarantees or the need to reduce long-term risks, and increases the importance of strengthening conduct oversight. Pension arrangements must still continue providing guarantees on benefits that correspond to existing members' past contributions and, hence, must continue to manage the risks arising from legacy portfolios far into the future. During the shift from DB to DC, several different types of hybrid plans that combine features of both regimes have been introduced to address members' concerns. In such hybrid plans, pension plans and plan sponsors still provide a reduced level of guarantees to members. For example, the Netherlands is currently transitioning from DB to DC plans mainly with a hybrid form, with a law adopted in 2023 and requiring the conversion of DB plans into DC plans by 2028. The hybrid plan is providing 50 percent of the guaranteed benefits. At the same time, the transfer of investment risks to beneficiaries puts greater and more urgent onus on enhancing members' financial literacy, on disclosures, and conduct regulation.

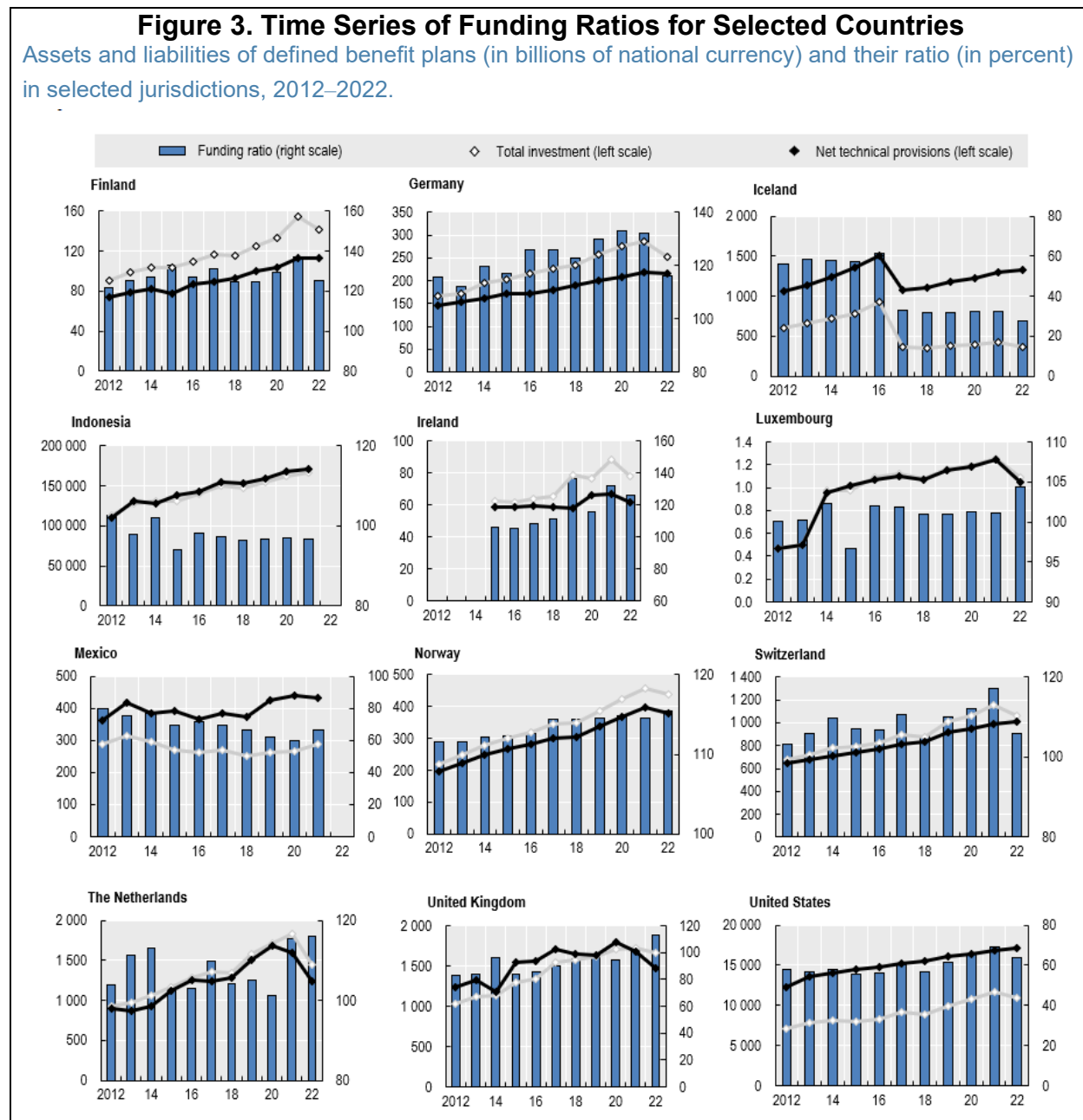
Interest Rates

Prolonged low rates affected the pension sector adversely as the duration of liabilities is longer than that of assets. Low interest rates increase the economic and accounting value of pension liabilities. In many countries, in particular emerging economies, it is typically not possible for fund managers to structure a safe asset portfolio to have a duration that can closely match the long duration of pension liabilities. Asset–liability mismatches are, therefore, common with pension fund liabilities having longer duration than assets, which make it difficult for DB pension funds to maintain funding ratios (usually defined as the value of the total assets divided by its total liabilities) above the regulatory minimum in a low-interest-rate environment. In the aftermath of the global financial crisis, with persistently declining and very low interest

¹³ Those countries include Australia, Canada, Japan, the Netherlands, Switzerland, the United Kingdom, and the United States.

¹⁴ While the investments of DC plans have been made mainly into transparent and plain vanilla instruments (such as mutual funds of listed equities and public bonds), DC plans are increasing their asset allocations into illiquid and risky investments, including crypto Exchange-Traded Funds. See Chapter 1 of October 2024 *Global Financial Stability Report* and *Financial Times* article on January 17, 2025, titled "Pension funds dabble in tokens after bitcoin's surge."

rates in advanced economies, the funding ratios of DB plans deteriorated and have started to recover only recently because of higher interest rates (Figure 3).¹⁵



¹⁵ While asset–liability mismatch is a critical issue for DB pension plans, it is also important for DC pension plans to have investments to achieve adequate returns over a long-term investment horizon (Mantilla-Garcia and others 2024).

Excessive search-for-yield during periods of prolonged low interest rates and safe asset returns could result in a build-up of systemic risks that can amplify the adverse impact of exogenous shocks. Such shocks can trigger abrupt increases in asset price volatility; fire sales of investment assets into falling markets, if pension funds seek to limit asset–liability duration mismatches or meet abrupt spikes in margin/collateral calls (FSB 2023); and, in the extreme, result in episodes of currency and sovereign debt crises. Operational factors can delay responses to exogenous shocks and further exaggerate systemic implications, for example, operational bottlenecks coming from delegated management, pooled investments, or cross-border interconnectedness.

Empirical evidence shows that search-for-yield by institutional investors increases significantly when the fixed-income asset returns are low. Konradt (2023) shows that, for a sample of 105 pension funds from 14 countries, between 2008 and 2018 the share of risky assets such as public equities, loans, and alternative investments increased by 4.3 percentage points, from 56.3 to 60.6 percent. Konradt estimated that a one percentage point decrease in the risk-free rate was associated with a 0.66 percentage point increase in the exposure of pension funds to risky assets, after accounting for valuation effects (Figure 4). Whereas European pension funds mainly increased their equity exposure, funds based outside of Europe favored alternative assets. In general, search-for-yield tends to be more pronounced for pension funds that have more capacity to take risks, because of either higher funding ratios or lower incumbent holdings of risky assets, although this is by no means universally true.

The pension fund sector has been recently affected by the rise in interest rates and accordingly lower values of fixed-income assets in those markets where assets are valued at fair value. Private pension savings had almost doubled from 2012 to 2021, but given their sensitivity to bond and equity prices, pension plans in most countries were hit by the simultaneous fall in bond and equity markets in 2022. Beyond equities and bonds, pension plans incurred losses on other financial instruments, such as interest-rate swaps which are used as a hedging instrument against declining interest rates, for example, in the Netherlands and the United Kingdom—both countries recorded the lowest nominal investment rates of return among all reporting jurisdictions (–21.1 and –18.5 percent, respectively). High inflation rates added to the problem by making nominal losses even larger in real terms.

In some markets, such as the Netherlands, pension funds use interest rate swaps to reduce the duration gap between assets and liabilities. Being on aggregate fix-receivers (most of the bonds invested by pension funds generate fixed coupons), the market value of these swap positions has been massively declining since 2020, turning negative in early 2022. As of mid-2023, the market value amounted to around –€80 billion, corresponding to more than 5 percent of total assets (Figure 4, panel 3).

Inflation

As benefits of DB pensions are often linked to wages or consumer prices, higher inflation poses a risk if investments do not yield the necessary returns. The limited availability of inflation-linked bonds (with sufficiently long duration) poses an additional challenge. A failure to index pension benefits regularly can lead to a significant loss of trust. In the Netherlands, pension funds grant an indexation of pension

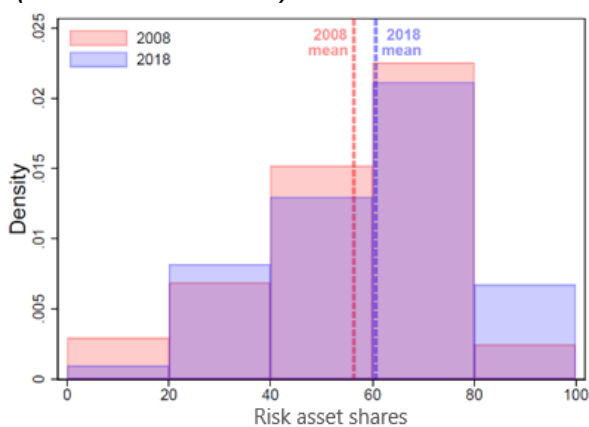
benefits only when the funding position¹⁶ allows so. This has resulted in most pension funds not indexing pensions between 2009 and 2022, leading to a loss in the purchasing power of about 25 percent and a significant loss of trust in the pension system. Only with rising interest rates and improving funding ratios, indexation became possible again in 2022/2023.

Figure 4. Search-for-Yield

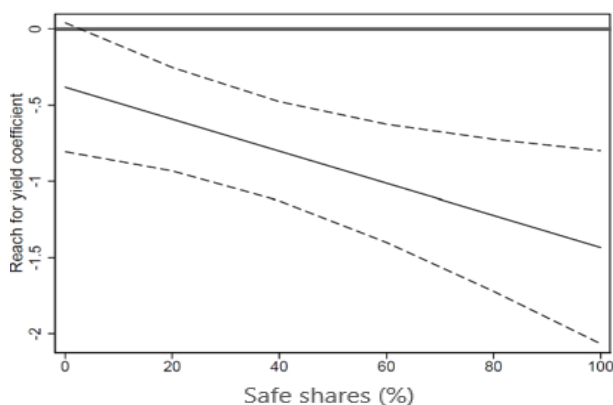
The average fund in the sample saw a 4.3 percentage point increase in its risky asset share, from 56.3 percent in 2008 to 60.6 percent in 2018.

Search-for-yield is most pronounced for funds with more capacity to take risks, either less underfunded or holding fewer risky assets initially.

1. Risky Asset Share (Percent of total assets)

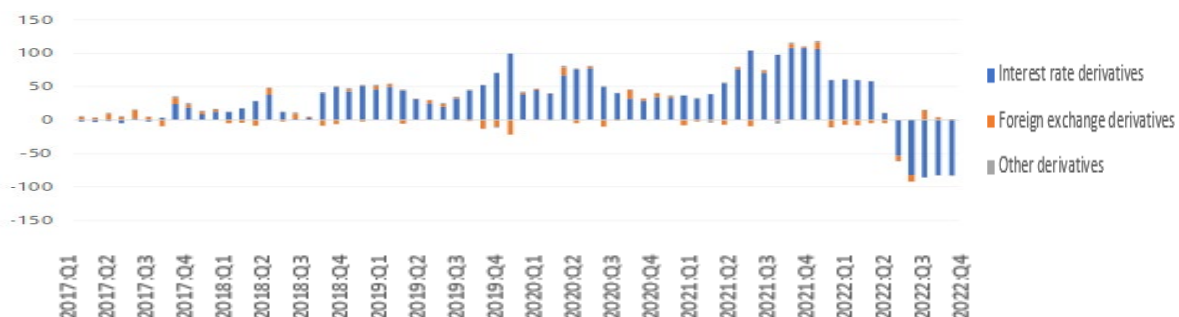


2. Interaction between Search for Yield and Initial Balance Sheet



The recent rise in interest rates has turned the market value of Dutch pension funds' interest rate swap holdings highly negative. While at the end of 2020, these had a market value of around €100 billion, already by mid-2022, the market value was -€80 billion.

3. Dutch Pension Funds: Market Value of Derivatives (EUR billions)



Source: Konradt (2023).

Notes: Risky assets in panel 1 comprise any asset which is not a government bond or cash (equivalent). Panel 2 shows the reach for yield coefficient for different levels of the initial share of safe assets, including 95 percent confidence bands (dotted lines). For instance, a pension fund holding 80 percent safe assets actively increases its risky asset exposure by two times more compared to a fund with 20 percent safe assets. For pension funds with very risky balance sheets (safe share below 10 percent), the reach for yield coefficient loses statistical significance.

Longevity

Longevity can be a material source of risk if mortality tables are not up to date, are “imported” from other countries without proper modification, or fail to account for expected future improvements in mortality.

¹⁶ The minimum funding position is where a funding ratio, that is a ratio of assets to pension liabilities and other liabilities, remain above 100 percent.

Pension funds use mortality assumptions, that is, age-specific probabilities of dying, to determine how much can pensioners be paid out given contributions received and assets accumulated. For DB plans, there is a risk that future pension payments turn out higher than expected, if average life expectancy has risen and is expected to rise further.¹⁷ Research conducted by the OECD's Insurance and Private Pension Committee on mortality assumption and longevity risk revealed that failure to account for further improvements in mortality can expose pension funds and annuity providers to an expected shortfall of provisions of well over 10 percent of their liabilities (OECD 2014).¹⁸

Other Factors

Pension funds such as other financial institutions are exposed to other risks such as operational and cyber risks. They could be affected by cyber-attacks which: (1) target personal information of members; (2) aim at a system outage which could delay benefit payments; and (3) aim at retrieving insider information about upcoming investment deals, all of which can dent the reputation of the plan. In the case of DC Funds, market conduct risk, related to inappropriate actions and conflicting behavior among fund managers, advisors, and administrators, is another factor. One example of heightened operational risk is the ongoing transition from a DB to a DC plan in the Netherlands which requires extraordinary efforts in terms of data quality on each individual pension contract.

Emerging/New Risks

Leverage

In some jurisdictions, most notably the United Kingdom, DB pension funds make use of leverage through liability-driven investment vehicles. Financial liabilities of pension funds through loans and repos typically amount to less than 1 percent of their balance sheet.¹⁹ A study by the FSB (2023) noted that insurers, pension, and investment funds held two-thirds of Non-Bank Financial Intermediation (NBF) assets. However, more than 90 percent of the sector's on-balance sheet financial leverage belonged to broker-dealers, hedge funds, finance companies, holding companies, and securitization vehicles. Leverage can have significant implications in some stress episodes such as the 2022 gilt crisis, wherein DB pension funds had taken off-balance sheet leverage through liability-driven investment vehicles borrowing in repo markets and synthetically in the form of derivatives.²⁰ These types of strategies could affect financial stability through the liquidation of positions (asset fire sales) during times of highly volatile price movements, when leverage leads to abrupt and large margin and collateral calls which can be amplified through concentrated positions held by a small number of institutional investors (pension funds and life insurers) within particular market segments (such as long-dated gilt markets).

Interconnectedness and Concentration Risk

¹⁷ As an example, the life expectancy of Icelandic men and women rose by 8.7 and 6 years, respectively, between the years 1966–1970 and 2007–2011. Four-yearly updates to mortality tables based on historical data resulted in an increase of liabilities between 1 and 2 percent for each new release. Only recently have forward-looking mortality tables been introduced in Iceland.

¹⁸ Accurate measurement faces several challenges. For example, pension fund members are likely to have different mortality experience than the general population often because of better access to health care and healthier lifestyles.

¹⁹ One percent in the euro area, and even less in Japan, the United Kingdom, and the United States (FSB 2023).

²⁰ A detailed analysis is contained in Case Study 1 of Chapter 2 of April 2023 *Global Financial Stability Report*.

Interconnectedness can arise from asset-based financial linkages or through derivative contracts. The notional value of derivatives transactions of a sample of pension funds rose to 80 percent of total assets in 2022 from 67 percent in 2016. Some pension funds also actively engage in repurchase agreements, increasing both their leverage and intra-financial system interconnectedness.²¹ The use of common services, of trustees, actuaries, and asset managers, can also increase interconnectedness.²²

In some countries, the pension sector is an important player in the domestic financial market (Figure 5, panel 2). In jurisdictions with less developed domestic capital markets, pension funds can be large investors holding concentrated positions in the equity and bond markets (especially long-term sovereign bonds), investment plans, and bank deposits. Pension systems, in particular DCs, can contribute to capital market development, depth, and liquidity, which would help to improve financial stability in the long term. However, depending on the level of pension sector development, this can make them vulnerable to counterparty default risk, limit their ability to swiftly liquidate large amounts of assets without material price impact, and potentially entail destabilizing effects of rapid portfolio rebalancing for financial markets and institutions.

The interaction of tactical and strategic asset allocation of pension funds makes it difficult to clearly anticipate the sector's aggregate investment behavior and its amplifying or attenuative impact during times of stress. Such differences can be explained by different investment horizons (typically much longer for pension funds), different liability characteristics (such as member rights to withdraw funds at short notice in case of disability), and for foreign investors, exchange rate movements.²³ The sector is seen as a stable and opportunistic buyer, reflecting positive net asset purchases during stressed periods, and has also sold assets to support portfolio rebalancing during and after market turbulence. For example, cash flow data reveals that Dutch pension funds sold large amounts of stocks in 2022:Q4, while at the same time, they have bought investment fund units of similar value (Figure 5, panel 3).

The pension risk transfer market is growing in some advanced economies, including Ireland, the Netherlands, United Kingdom, and the United States. DB funds transfer pension obligations and risks to insurers, with these liabilities often being reinsured offshore. This would increase cross-border and cross-sectoral interconnectedness among pension funds, insurers, and reinsurers.

The investment behavior of pension funds can show different patterns of herding which is widespread in some markets. Even under normal financial market conditions, the cyclical nature of pension funds' investment behavior, including herding, could contribute to the build-up of systemic risks. While the literature hints at common factors for countercyclical behavior, the actual evidence is less clear-cut and potentially more dependent on country and market-specific parameters (Appendix 1).

²¹ See also Chapter 2 of April 2024 *Global Financial Stability Report*.

²² In Iceland, the entire pension fund sector uses the services of only two appointed actuaries. In South Africa, the largest private pension fund administrators are also one of the largest life insurers in the market.

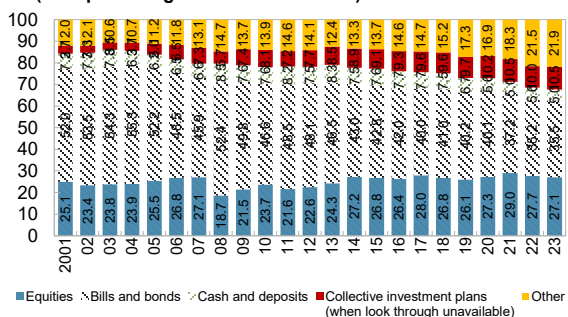
²³ This is the case in Chile, where members can choose among funds with different risk exposure.

Figure 5. Pension Funds as Investors

Pension funds have been increasing their asset allocations toward collective investment plans (which cannot be looked through) and other assets.

In several countries, pension funds are a dominant investor in domestic assets, typically very pronounced in the stock market and the government bond market.

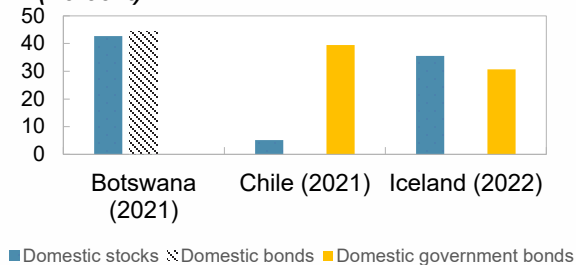
1. Average Asset Allocation of Pension Providers in Selected Asset Classes and Investment Vehicles in a Selection of 15 Jurisdictions, 2001-2023 (As a percentage of total investment)



Source: OECD Pension Statistics.

Notes: The average allocations of pension plan assets have been calculated over 15 jurisdictions: Austria, Czech Republic, Denmark, Germany, Japan, the Netherlands, Norway, Poland, Slovenia (from 2003 onward), Sweden, Türkiye (from 2004 onward) and the United States among OECD countries; and Bulgaria, Hong Kong (China) (from 2002 onward), and Peru among other jurisdictions.

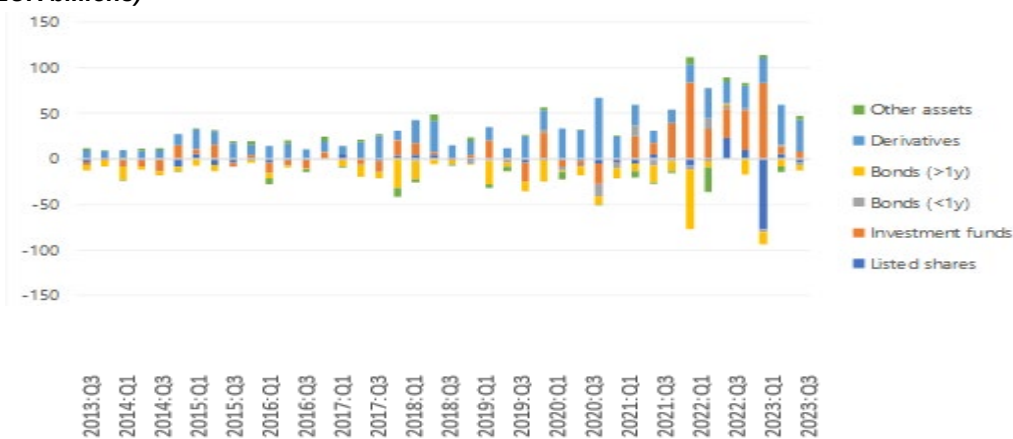
2. Share of Pension Funds Assets in Total Market Size (Percent)



Source: IMF staff calculations based on NBFIRA, Banco Central de Chile, Superintendencia de Pensiones, Bolsa de Santiago, Central Bank of Iceland.

Cash flow data shed a light on the role of pension funds in financial markets: In 2022:Q4, the Dutch pension funds have been large net sellers of stocks but bought significant amounts of investment funds at the same time.

3. Dutch Pension Funds: Net Asset Transactions (EUR billions)



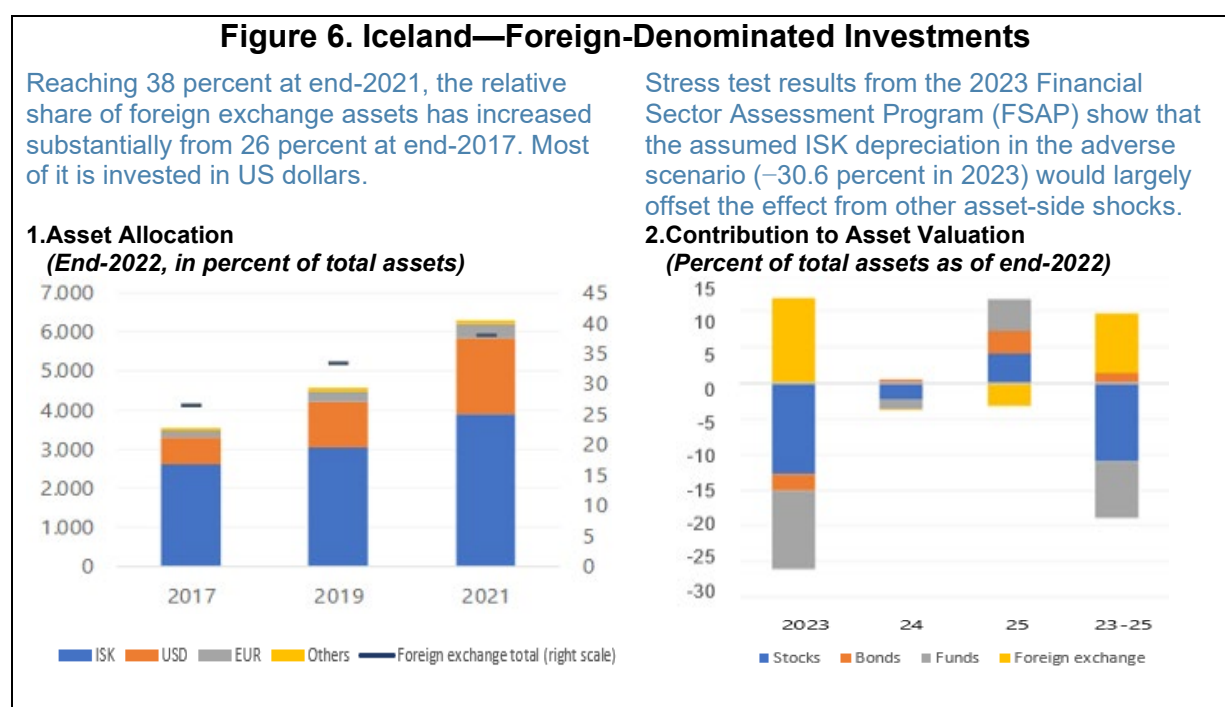
Source: IMF staff calculations based on De Nederlandsche Bank.

Currency Mismatch

In jurisdictions with small domestic financial markets, pension funds might be exposed to high currency mismatch risk. Pension fund liabilities are typically denominated entirely in domestic currency, and they have no significant incentive to invest in foreign currency denominated assets, especially DB funds. However, in countries with small onshore financial markets, pension funds may not be able to find an

adequate amount of domestic long-term assets with stable values to invest into (see Figure 6). In other countries, prolonged periods of low interest rates may, for DB funds with large, guaranteed portfolio of liabilities, generate substantial search-for-yield incentive which can, in part, be addressed by increasing overseas investments. In both cases, the feasibility and cost of hedging currency risks becomes a critical consideration and, in many emerging economies, is a significant issue as there is no liquid market for swaps and other hedging instruments.²⁴

Even if the currency risk is hedged, rollover risk can be significant if pension funds use short-term foreign exchange swaps. For example, the Dutch pension sector had an outstanding notional exposure in foreign exchange swaps of almost €400 billion at the end of 2022, down from almost €460 billion two years earlier. While the underlying investment portfolio is of long maturity, hedge positions are typically rolled over on a monthly or quarterly basis, creating a maturity mismatch (BIS 2022b).



Source: IMF staff calculations based on the data from the Central Bank of Iceland.

Liquidity Mismatch and Systemic Risks

Historically, pension fund liquidity was strongly supported by well-diversified and continuous cash inflows from member contributions. Such contributions tend to exceed benefit payouts (cash outflows) in “younger” pension systems, implying a low risk of negative cash flows. This situation allows younger

²⁴ Icelandic pension funds invest about 36 percent of their portfolio in foreign currency denominated assets and do not hedge the currency risk as they consider these assets as an implicit hedge against domestic inflation. For example, a depreciation of the domestic currency (ISK) would likely be accompanied by an increase in inflation (given the high weight of imports in the consumption and production basket) which would be associated with a depreciation in the market value of domestic assets (equities, bonds, and funds). However, this would be cushioned by an increase in the ISK-measured value of foreign currency assets of pension funds. This was the finding of the stress tests of the 2023 Iceland Financial Sector Assessment Program (FSAP) (Figure 9).

systems to buy and hold capital market instruments even during market stress. As a result, pension funds play the role of a stabilizer in such capital markets, for example, Chile and Malaysia.

Once pension systems mature, net cash flows gradually shift down and eventually turn negative as benefits payouts to retirees exceed contributions from active members. Such imbalances can persist for years, potentially even decades. Moreover, it should be noted that even in those countries with a lower average population age, political and social needs often result in sudden changes in redemptions, which could create liquidity pressures for pension funds and potential contagion to capital markets.

Consequently, for more mature pension systems, especially in aging societies, careful liquidity risk management is paramount. This challenge is especially pertinent for individual pension funds that are closed to new members; for single-employer-to-industry-wide pension funds in shrinking economic sectors; and for pension funds in an aging country with a high old-age dependency ratio. In fact, some of the large Canadian pension funds have already reached their decumulation stage, wherein benefits payouts are, and will for the foreseeable future, be higher than contributions.

Pension funds in countries with younger populations and structurally positive cash flows may also experience liquidity stress if members can withdraw their funds for purposes other than retirement.

- This can happen as a consequence of exogenous shocks with large, adverse economic effects, such as the COVID-19 pandemic, for example, as seen in Namibia (Figure 7). In such circumstances, pension funds' liquidity can be significantly affected by political measures aimed at providing crisis relief to households. Some countries, for example, Chile and Iceland, have allowed temporary withdrawals during the COVID-19 pandemic and the global financial crisis. In other countries, permanent measures allowed for payouts unrelated to retirement.²⁵ While this type of liquidity risk has been limited to few countries, future economic crises or abrupt increases in households' liquidity needs could create social pressures for pension funds to allow premature redemption of accumulated retirement savings.
- Events not driven by macrofinancial developments, such as mortgage repayments or payment of medical bills, can also drive liquidity stress. Occasionally, withdrawals are allowed in case of dismissals or other loss of employment and may be linked to the business cycle. The recent Botswana Financial Sector Assessment Program (FSAP) highlighted risks that may arise from changes to pension legislation. In Botswana, the scope for members to withdraw funds was expanded (for example, upon dismissal, to repay mortgage loans, and to pay for medical bills), and to receive a larger part of their pension in the form of a lump sum, effectively resulting in a transfer of liquidity from the pension fund sector to the household sector.²⁶

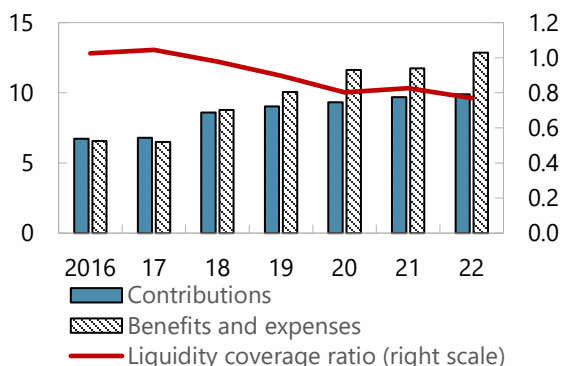
²⁵ A further example of withdrawals would be Malawi: A legislative amendment allowed pensioners within five years before retirement to access up to 50 percent of their pension entitlements. To meet the liquidity needs caused by a surge in pension benefit claims in the early days of implementation, pension funds were permitted to use repurchase agreements (Oh and Staňko 2023).

²⁶ There are other cases where redemption options are provided in case of specific events such as terminal illness, housing, or marriage.

Figure 7. Structural Liquidity Risks

In Namibia, pension funds experienced an abrupt shift since 2018 with contributions falling below benefits and expenses.

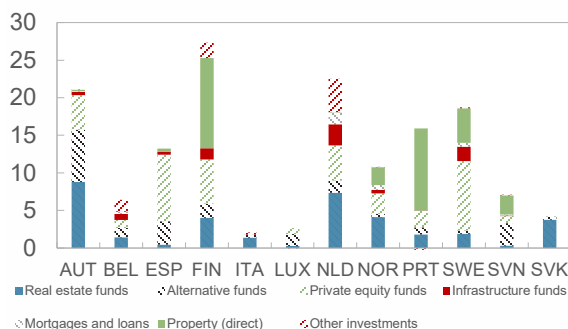
1. Namibia: Pension Fund Contributions and Benefits (NAD billions)



Source: IMF staff calculations based on Namibia Financial Institutions Supervisory Authority (NAMFISA) data.

Illiquid assets account for 22 percent of DB assets in EU countries, up from 17 percent in 2021. Real estate investment funds (7 percent) are the most relevant class.

3. EU Pension Funds: Illiquid Assets (2023:Q3, in percent of total assets)

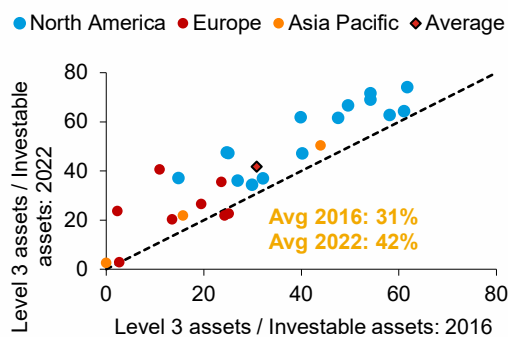


Source: IMF staff calculations based on EIOPA data.

Note: Data labels in the figure use International Organization for Standardization (ISO) country codes.

The assets of a sample of pension funds with derivatives have significantly increased their share of illiquid investments.

2. Share of Level 3 Assets over Investable Assets



Sources: Chapter 2 of April 2024 *Global Financial Stability Report*, Individual annual reports of selected pension funds and IMF staff calculations.

The share of illiquid assets (real estate investment funds, alternative investment funds, private equity funds, infrastructure funds, (mortgage) loans, direct property) varies between 2 and 27 percent among different EU member states.

4. EU Pension Funds: Illiquid Assets (Defined benefit, in percent of total assets)

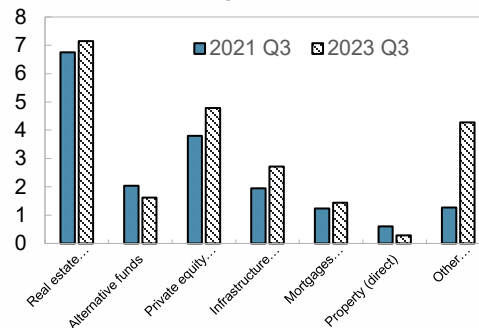


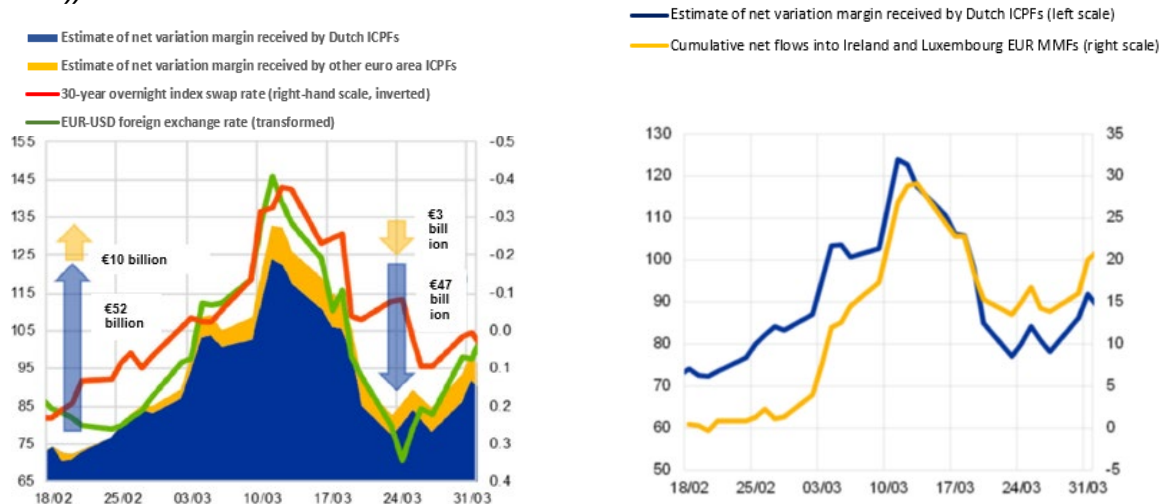
Figure 7. (continued)

Variation margins of euro area insurers and pension funds moved with interest and exchange rates during the March 2020 “dash-for-cash” episode.

At the same time, net flows of Irish and Luxembourgish Money Market Funds (MMFs) were highly correlated with the variation margin of Dutch insurers and pension funds.

5. Co-movement of Interest and Foreign Exchange Rates with Variation Margin Paid/Received by ICPFs (EUR billions (left scale), in percentages (right scale))

6. Co-movement of ICPF Variation Margin and Euro-Denominated MMF Flows (EUR billions)



Notes: In the left axis, the overnight interest swap rate and exchange rate are lagged by two days since ICPF’s variation margin is typically to be paid with a one or two-day lag. The arrows show increase in the (net) variation margin received between February 20 and March 11, 2020, and subsequent (net) variation margin posted until March 23, 2020. ICPF = insurance companies and pension funds.

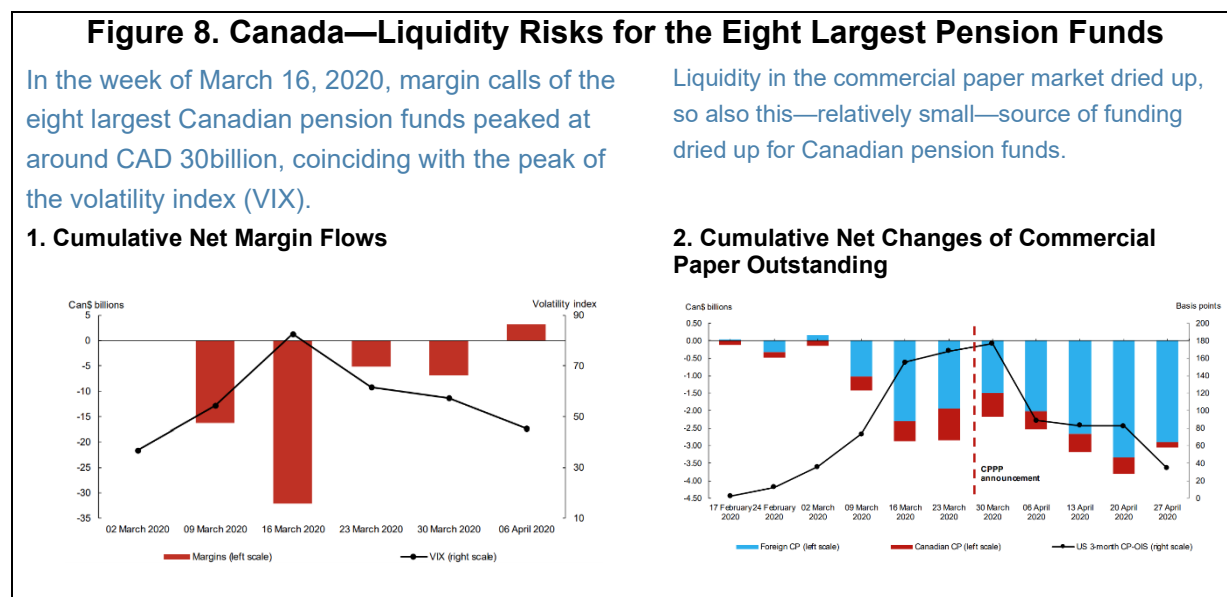
Source: Rousová and others (2020) in ECB Financial Stability Review, November 2020.
Note: ICPF = insurance companies and pension funds.

Recently, some pension funds have faced acute liquidity needs in times of financial stress. A concentration in illiquid investments, investment strategies, and collateral that could result in large margin calls create material sources of vulnerabilities as was shown in the liability-driven investments of DB pension funds in the United Kingdom. A comprehensive view of flows between pension funds and other segments of the financial system is vital to early warning risk surveillance. Rousová and others (2020) analyze the interconnectedness of insurance companies and pension funds (ICPFs) with other parts of the financial sector through derivatives and money market funds during the “dash-for-cash” episode in March 2020 (Figure 7, panels 5 and 6). Acute liquidity risks can be triggered by exogenous shocks in financial markets, for example, resulting in margin calls or the dry-up of certain market segments, and as a result of political or regulatory drivers, such as allowing extraordinary withdrawals by pension plan members.

Another structural component of liquidity risk is the tendency of pension funds to invest in less liquid assets such as private equity and mortgage loans. Such an investment strategy is salient for a long-term investor with predictable cash flows who can earn the illiquidity premium, but when combined with

guarantees and unpredictable cash flows, liquidity risks can be material and would need to be managed prudently. Some of the world’s largest pension funds, with assets in excess of \$7 trillion, have significantly increased their allocations to illiquid investments while actively using derivatives and other forms of leverage. For a sample of 12 EU countries, the share of illiquid assets accounts for 22 percent of total assets in DB plans, but only 6 percent in DC plans as of 2023:Q3. Whereas in DB plans, the share of illiquid assets has increased by almost 30 percent over the past two years, in DC plans, this share came down by 25 percent over the same period. Among illiquid assets, certain types of investments dominate, such as real estate funds, alternative investment funds, private equity funds, and infrastructure funds. In a few countries, directly held real estate investments are more than 10 percent of total assets according to the data from European Insurance and Occupational Pensions Authority (EIOPA).

The largest Canadian pension funds experienced large increases in need to access liquidity during the dash-for-cash episode in March 2020, mainly because of rapid increases in margin calls on their derivatives positions. Stress in short-term funding markets that also rose in tandem, specifically the inability to roll over US commercial paper, caused concerns regarding the unavailability of other funding markets (Figure 8, panel 2). Pension funds turned out to be generally resilient in meeting their liquidity demands through various strategies, such as raising cash using equities as collateral, increasing term repos, and withdrawing purchases and outright sales of bankers’ acceptances. Pension funds increased their use of long-term repos and total return swaps to reduce the rollover risk and forced equity sales. While dealers initially struggled to meet demand, the Bank of Canada’s interventions helped support the functioning of the repo market, including through the Contingent Term Repo Facility (Figure 8, panel 2). Shares were sold to raise cash while simultaneously taking offsetting derivatives positions through total return swaps to maintain the strategic asset allocation toward the equity market.



Sources: Bédard-Pagé and others (2021) based on proprietary data, Federal Reserve Economic Data, and Bloomberg Finance L.P.
 Notes: CPPP refers to the Bank of Canada’s Commercial Paper Purchase Program announced on March 27, 2020. The United States’ three-month commercial paper-OIS spread is a measure of funding costs in the commercial paper market. The sample of pension funds comprises the Canada Pension Plan Investment Board, Caisse de dépôt et placement du Québec, the Ontario Teachers’ Pension Plan, the British Columbia Investment Management Corporation, the Public Sector Pension Investment Board, the Alberta Investment Management Corporation, the Ontario Municipal Employees Retirement System, and the Healthcare of Ontario Pension Plan.

According to a recent survey by the International Organization of Pension Supervisors (IOPS), very few pension fund supervisors have identified liquidity issues related to margin calls (Oh and Staňko 2023). Thirty-seven IOPS members responded to the survey, representing almost half of the membership. In 14 jurisdictions, pension funds use derivatives and repos and therefore have collateral requirements; in eight other jurisdictions, the use of such instruments is allowed but no active use is made. Of the overall sample, 34 authorities have—by April/May 2023—not seen any liquidity issues associated with margin calls; while the remaining three reported liquidity issues but did not experience liquidity shortages. It was noted that jurisdictions such as Australia and Colombia already use supervisory liquidity stress tests for pensions, and in the latter, even reverse stress testing.

The shift from DB to DC plans could create additional liquidity risk, depending on the investment flexibilities provided to the members. As the members of DC plans bear any profits and losses of the underlying investments, such plans often provide them frequent opportunities to enter or exit investments. This flexibility may exacerbate liquidity mismatches between the underlying assets—especially illiquid assets, such as private equity and credit—and plan liabilities because the effective duration of the liabilities has been reduced. For example, Australian superannuation funds are required to allow clients to switch between different investment options generally within three business days, even though these funds hold, on average, illiquid exposures exceeding 20 percent of their total assets.^{27,28}

Climate Related Risks

Similar to other institutional investors, pension funds are also likely to be exposed to both physical and transitional risks from their long-term investments. The EIOPA's stress test on the occupational pensions sector, focused on climate risks, showed that European pension funds have material exposure to transitional risks, with more than 12 percent asset valuation loss at the stress scenario. The exercise also found that more than 90 percent of pension funds consider Environmental, Social and Governance factors when determining their investment policy, although only 14 percent of pension funds reported using environmental stress testing in their own risk management.

Data and Tools for Systemic Risk Analysis

Data on pension funds is rather patchy and difficult to compare across jurisdictions. The OECD has made good progress with their Global Pension Statistics, which by now also includes more than 50 non-OECD countries, following a joint initiative with the IOPS and the World Bank. Data still lacks full comparability, and critical data for financial stability analysis is often not available publicly and even for the supervisory authorities.

²⁷ See more detail analysis in the Chapter 1 of October 2024 *Global Financial Stability Report*.

²⁸ DC pension fund designs which allow for members' decisions on the investment allocation can vary substantially, leading to different degrees of liquidity risks. Illiquid level 3 assets in five of the largest Australian superannuation funds, with assets under management exceeding \$0.5 trillion, are estimated to account for almost one-quarter of total assets (Bradley 2023). Note that prudential regulations in Australia require super funds to determine sufficient liquidity levels within each investment option to manage client switching

Systemic risk analysis covering the pension fund sector would require detailed data on investments, liquidity, and leverage (IMF 2023b). However, many pension regulators do not collect granular data on individual investment positions. Oh and Staňko (2023) report that out of 22 jurisdictions where pension funds are allowed to hold derivatives, only 12 require periodic reporting on these positions (of which three have such data only semi-annually or annually). While EIOPA has established statistics compiled by international organizations (including the OECD) and regional supervisory bodies, it lacks granularity and completeness.

Valuation rules can vary considerably across countries, with significant implications for the interpretation and comparability of market statistics as well as systemic risk analysis. Assets can be accounted for either at fair value, historic cost, or amortized cost. On the liability side, pension liabilities of DB plans can be valued with market-based discount rates or with a constant reference rate.²⁹ Some countries use fixed discount rates, whereas others use market rates as discount rates (Appendix 2). Due to the long duration of pension liabilities, small differences in discount rates have a significant impact on the valuation of liabilities and statistics derived from them. In some countries, for example, in Iceland, the framework is further complicated by a parallel regime of accounting valuation and actuarial valuation.

Tools for Quantitative Risk Analysis

The toolkit for quantitative risk analysis in the pension fund sector is still evolving. Recent FSAPs have included solvency stress tests for DB plans, projections of future pension values for DC plans, liquidity analysis, and interconnectedness and contagion analysis. It could also include reverse stress testing based on individual risk factors, for example, on equity prices or interest rates.

Solvency Stress Tests of DB Plans

The 2024 Netherlands FSAP conducted a top-down stress test for the ten largest pension funds, covering 70 percent of sector assets. Higher interest rates lowered the value of pension fund liabilities by 27 percent on average, compensating for the decline in asset values (Figure 9, panel 1). As a result, funding ratios improved for most of the pension funds. On average, the ratio increased by 7 percentage points, to 122 percent, while for funds with a larger duration gap between assets and liabilities, the improvements were greater than 10 percentage points (Figure 9, panel 2).

EIOPA performs regular solvency stress tests for the occupational pension fund sector. The latest stress test covering an adverse macrofinancial scenario for the DB sector was conducted in 2019. It covered 99 DB plans in 19 European countries. EIOPA found a substantial aggregate shortfall in the adverse scenario, of €180 billion according to national methodologies and €216 billion according to the stress test's common methodology. Under the assumptions of the common methodology, the shortfalls would

²⁹ In DC plans, the value of liabilities is typically determined by the value of investment assets. However, even for DC plans, a valuation of the liabilities with actuarial standards and a discounting of projected future benefits can be required as, for example, in Iceland.

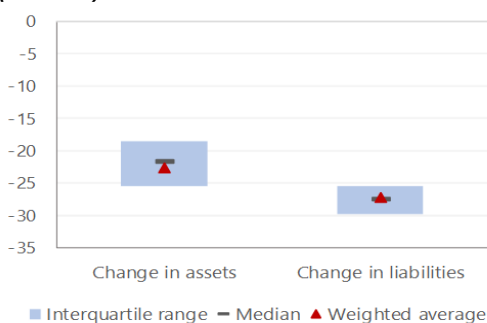
have triggered aggregate benefit reductions of €173 billion and financial support from pension plan sponsors of €49 billion.^{30,31}

Figure 9. Quantitative Risk Analysis—Solvency Stress Tests in Financial Sector Assessment Program

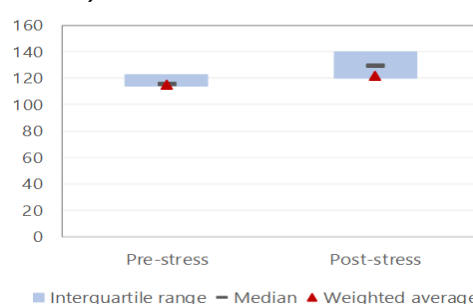
Asset values of the Netherlands pension funds decline by 23 percent (–€235 billion for the sample), overcompensated by a decline in liabilities by €245 billion.

The average funding ratio of Netherlands pension funds increases from 115 to 122 percent, with more outliers toward the upper end of the dispersion.

1. Change in the Value of Assets and Liabilities (Percent)



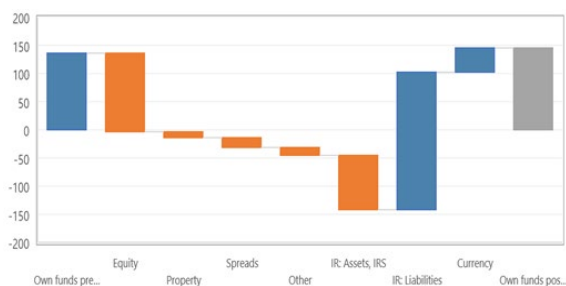
2. Funding Ratios (Percent)



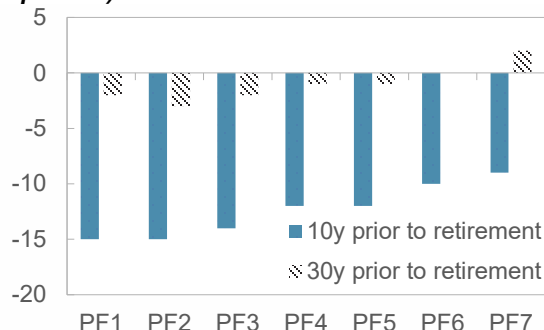
The effect of the interest rate shock on liability values compensates almost all asset-side shock effects, especially those on stocks and fixed-income assets in the Netherlands.

For a representative member with 10 years prior to retirement, the pension value in the median fund declines by 13 percent, but results vary between pension funds from –9 to –15 percent in Iceland.

3. Contribution of Individual Shocks (EUR billions)



4. Reduction in Future Pension Values (Difference between baseline and adverse, in percent)



Source: IMF staff calculations.

Source: IMF staff calculations based on the data from the Central Bank of Iceland.

³⁰ Another stress test exercise in 2022, covering 187 DB and DC plans in 18 European countries (market coverage of 65 percent), tested a climate transition risk scenario (EIOPA 2022).

³¹ The scenarios applied to the Netherlands stress tests of FSAP and European Insurance and Occupational Pensions Authority (EIOPA) are different in the following attributes: (1) sovereign spread shocks were larger in the EIOPA stress test: +81 base points (bps) and +140 bps for EU and US sovereigns, while the FSAP had +60 bps for both the Euro Area and the US; (2) property valuation shocks were also more pronounced in the EIOPA stress test: –38 percent for EU real estate, while the NLD FSAP used –15 percent for domestic commercial real estate and –12 for foreign commercial real estate.

Projection of Future Pension Values for DC Plans

For DC plans, which are not subject to a funding level requirement, risk analysis typically takes on the perspective of a pension plan member, for example, through the projection of future pension values.³² Such a projection is not primarily designed as a systemic risk analysis tool, since risks are fully borne by pension plan members, but touches upon potential market conduct issues, informing about potential future fiscal needs in case of Pillar I pensions and about other subsistence payments to compensate for lower Pillar II payouts.³³ Members are also facing conversion risk from accumulated pension savings at retirement age to the income stream after retirement.

The 2023 Iceland FSAP projected the future pension value for representative members with 10 or 30 years to retirement, both in baseline and adverse FSAP scenarios.³⁴ Their accrued pension benefit is shocked with the market risk stresses in each of the first three years of the projection horizon, while afterward annual investment returns would again be in line with the baseline scenario. In the adverse scenario, assets of pension funds would decline considerably in the first two years of the projection, also reducing future pension values materially.

Liquidity Risk Analysis

The Netherlands FSAP 2024 reviewed the results of De Nederlandsche Bank's bottom-up analysis of the resilience of pension funds to liquidity risks from margin calls. The shocks used for this analysis covered assumptions implying limited access to repo markets and adverse foreign exchange valuation changes adding an extra layer of prudence.³⁵ In the scenario, the five largest pension funds had to meet a cash collateral call of €18.4 billion and repo markets remained an important source of liquidity for them. Smaller pension funds which were exempted from the clearing obligations use bilateral swaps which allow for settlement-in-kind that lowered liquidity risks (Figure 10, panel 1).

Other FSAPs have conducted liquidity risk analysis. The 2019 Canada FSAP 2019 reported that large Canadian pension funds conducted liquidity stress tests based on a modified liquidity coverage ratio framework. A staff analytical note issued by the Bank of Canada also noted that the eight largest Canadian public pension funds apply the liquidity coverage ratio framework with some adjustments depending on their legal structure, asset allocation, leverage, derivative exposures, liability structure and risk tolerance. The Finland FSAP discussed liquidity risks of pension funds, including an option for members to borrow up to their past contributions, and recommended developing a liquidity regulation for pension funds.

³² EIOPA performed such an exercise in 2017, measuring also the impact on replacement rates for representative members with 5, 20, and 35 years prior to retirement.

³³ See, for example, Finanstilsynet (2017). However, some DC plans have hybrid features where partial guarantees are provided to the pension plan members. In such a case, analysis similar to DB plans is useful to be conducted.

³⁴ A similar exercise was conducted in the 2023 Botswana FSAP. In the Iceland FSAP's analysis, most of the valuation impact stemmed from lower stock prices. In the first year, the depreciation of the Krona assumed by the scenario counterbalanced the decline in domestic equity value by the increase in the value of foreign exchange-denominated investments. Future pension values were estimated to decline under the scenario by between 9 and 15 percent for a member with 10 years prior to retirement, while being almost unaffected for a member with 30 years prior to retirement (a maximum of -2 percent).

³⁵ About 36 bps increase of EUR interest rates, combined with a 4.4 percent EUR appreciation against USD.

Figure 10. Quantitative Risk Analysis—In the Netherlands Financial Sector Assessment Program 2024

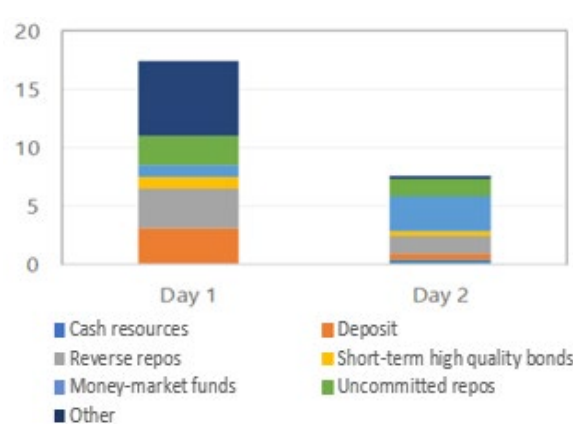
Cash collateral calls close to €20 billion could be met by tapping different sources, even when assuming limited repo market access.

1. Collateral Calls (EUR billions)



Cash collateral calls close to €20 billion could be met by tapping different sources, even when assuming limited repo market access.

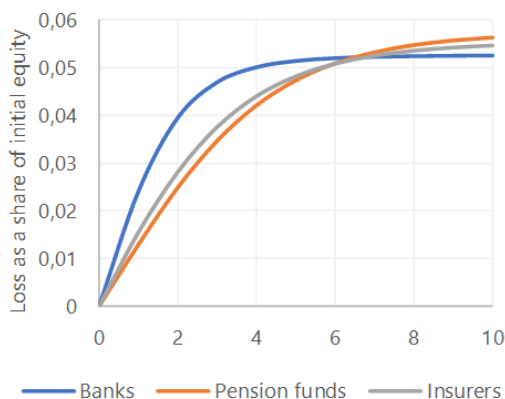
2. Sources of Liquidity (EUR billions)



Source: IMF staff calculations.

In early rounds, losses are concentrated in the banking sector, but they spread to the insurance and pension sectors in later rounds.

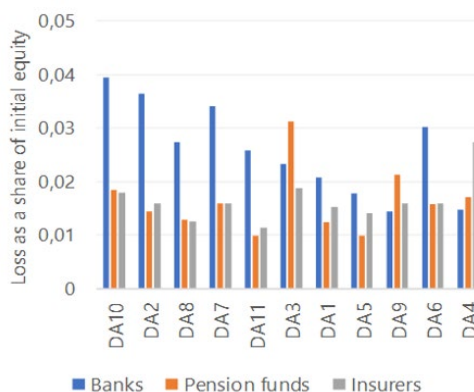
3. Sectoral Losses from Bank Solvency Shock (Cumulative by round)



Source: IMF staff calculations.

Banks suffer the highest total loss as a share of initial equity following the defaults of securities-issuing agents.

4. Losses from Defaulting Agents



Interconnectedness and Contagion Analysis

A fire-sale systemic stress test, conducted as part of the 2024 Netherlands FSAP, assessed the contagion effects of balance sheet shocks in banks, insurers, and pension funds. The stress test starts by having one or more agents experience a balance sheet loss. Agents are assumed to want to keep their leverage ratio constant, so that balance sheet losses translate into sales of securities, proportionate to their market value. Two types of initial balance-sheet losses were considered. The first set of balance sheet losses were those of the six significant banks in the adverse scenario of the bank solvency stress

test (which are considered jointly). The second set of balance sheet losses are the ones generated when each securities-issuing agent defaults in turn.

Losses from the bank solvency stress-test exercise led to fire-sale induced losses of about 5 percent of initial equity. In early rounds, the losses are concentrated in the banking sector, but they spread to the insurance and pension sectors in later rounds (Figure 10, panel 3). Individual-agent defaults can cause substantial losses that are amplified through fire-sale channels, but no single agent's default triggered defaults of other agents. Banks suffered the highest total loss as a share of initial equity following the defaults of securities-issuing agents (Figure 10, panel 4). Contagion can be caused by the default of relatively small agents.

Regulatory Environment and Supervision

Organization of Pension Fund Supervision

The regulatory framework for pension funds is rather fragmented. Supervisory authorities can be fully integrated, cover only the nonbank sector, be part of a twin-peaks model, or be separate authorities solely in charge of pension fund supervision. Organization of pension fund supervision tends to be more fragmented than regulation of other financial sectors, with multiple pension fund supervisors at the national level. In some countries, pension fund supervision is organized at a provincial level, for example, in Canada (with some pension plans also being supervised at the federal level) or in Switzerland (with an additional coordinating body at the federal level). Even at a regional level, such as in the EU, the level of harmonization is significantly lower than in the insurance, banking, or securities sector partly because of different social security system in each jurisdiction.³⁶

Lack of clear, or conflicting, supervisory objectives on financial stability presents further complications. Occasionally, supervisory objectives are driven by social policy considerations which might not be aligned with financial stability considerations and policies. For example, some authorities impose minimum requirements for pension funds to invest into sub-segment of the domestic assets and sectors. Not all pension fund supervisors have a financial stability as its explicit objective, and thus there is often no representation of the pension regulator in the financial stability committee.

Pension fund regulators may not have formal arrangements with other financial authorities. They are often not represented in financial stability committees or macroprudential decision bodies. As an example, the Pension Regulator in the United Kingdom does not have any formal arrangements with the Bank of England to discuss financial stability matters. This could hinder appropriate information and data sharing, and prompt actions to address systemic risks arising from pension funds.

³⁶ Not all occupational pension funds in the EU fall under the scope of the IORP II Directive, in force since 2017, which focus on administrative and governance requirements, internal control functions, fit & proper, transparency toward (prospective) members and beneficiaries, and cross-border activities.

Principles of Pension Fund Regulation

The IOPS has issued standards on supervision and the OECD on regulation. Pension supervisors from 79 jurisdictions are IOPS members. Its Principles of Private Pension Supervision were issued in 2006 and reviewed in 2010. The recently revised version (2024) is under public consultation process.³⁷ As they focus primarily on the role of the supervisory authority, they are typically considered in combination with the more comprehensive OECD Core Principles of Private Pension Regulation, issued in 2009, revised in 2016, and currently under revision. The Financial Stability Board lists the IOPS Principles in its Compendium of Standards, though not as part of the key standards.

International standards on governance, internal control function, and risk management are not aligned with those of other financial sectors. As compared to the Insurance Core Principles issued by the International Association of Insurance Supervisors, the OECD Core Principles and the IOPS Principles may benefit from more detail descriptions especially with regard to corporate governance (for example, board members' independence and objectivity, regular assessments of board effectiveness, remuneration), internal controls (for example, establishment of a risk management or compliance function), and risk management (for example, definition of risk appetite, use of stress testing and scenario analyses). Moreover, lack of detail standards for international coordination and information exchange complicates the monitoring framework of key risk indicators in the pension fund sector, for example the degree of leverage and interlinkages with other financial sectors.

Typically, there are no capital requirements for pension funds. Some DB plans are subject to funding requirements where a funding ratio should remain above 100 percent. However, pension plans for the public sector are often exempted from the funding requirement, resulting in funding ratios considerably below 100 percent. Funding rules can differ considerably across countries. In the Netherlands, a 12-month average of the "market funding ratio" is used for regulatory purposes, thereby allowing for some smoothing. Further differences exist on the recovery period in case of an under-funding, for example, in Iceland pension funds have to permanently maintain a funding ratio between 90 and 110 percent and not outside 95 and 105 percent for five consecutive years.

Recent FSAPs over the past five years have highlighted shortcomings in pension fund oversight. As shown in the recent Iceland FSAP (IMF 2023a), governance of pension funds can be impaired by several factors: Board members can face conflicts of interest, especially when nominated by the government (in the case of public sector funds) or trade unions, and internal control functions are not specified in detail (for example, regarding the actuarial function). The Netherlands FSAP (IMF 2024b) recommended a further clarification in the Pension Fund Act on the requirement to have independent supervisory board members.

Macroprudential and climate risk supervision are reflected in neither the OECD Core Principles nor the IOPS Principles. The International Association of Insurance Supervisors recently adopted the Application

³⁷ The IOPS issued public consultation on the draft Revised IOPS Principles of Private Pension Supervision. <https://www.iopsweb.org/public-consultation-draft-revised-iops-principles-of-private-pension-supervision.htm>.

Papers on Macroprudential Supervision and on Climate Risk Supervision that could be relevant for pension fund supervision (IAIS 2021a, 2021b).

Policy Considerations

Where pension funds become significant, supervisors should consider their objectives and their role in the financial sector. The pension sector is significant and growing globally with greater interconnectedness with the rest of the financial system in several jurisdictions. Pension supervisors should have an explicit financial stability objective and be represented in inter-institutional financial stability and macroprudential committees in countries where pension funds are significant.

Pension supervisory authorities should enhance their reporting requirements proportionate to the major risks and complexities. Data gaps and cross-country heterogeneity in the industry make it challenging to perform a comprehensive analysis of risks and vulnerabilities in the sector globally. Reporting requirements should be enhanced to a level that allows supervisors to conduct comprehensive systemic risk analysis. A granular reporting of the material on- and off-balance sheet exposures (ideally detailed asset-by-asset and derivatives data) would be needed where the sector has grown and become an important capital market player. Together with cash flow data, supervisory authorities should be able to derive suitable indicators on counterparty/sectoral concentration, liquidity, and leverage (including through derivatives and securities financing transactions).³⁸ Data should be available at an adequately high frequency, and authorities should have legal powers to increase reporting frequency in times of crisis. In designing new reporting requirements, the principle of proportionality should be borne in mind.

Pension fund supervisors should establish close coordination with the central banks and other financial authorities for data sharing and addressing financial stability concerns with regard to the pension fund sector.³⁹ The regulatory and supervisory frameworks for pension funds are often fragmented. Lack of coordination between pension and other financial supervisors may have hindered proper monitoring and timely action against systemic risks. With enhanced reporting requirements, pension fund supervisors should be able to perform and contribute to systemic risk analysis covering pension funds. Pension fund supervisors should be able to share the detailed data and information with the central bank and other financial authorities to conduct system wide analysis jointly. A recent survey conducted by the IOPS on enhancing the resilience of pension supervision (forthcoming) shows that among 37 Members who have participated in the survey, 23 Members stated having established formal arrangements with other financial authorities, for example, Council of Financial Regulators or Financial Stability Committee/Commission gathering senior representatives from key financial sector authorities, including pension supervisory authorities.

³⁸ This needs to include accumulated exposures across different asset classes. In Botswana, there are counterparty concentration limits and corresponding reporting requirements, but only in individual asset classes.

³⁹ Close coordination with foreign central banks and other financial authorities can also go beyond data sharing. For example, to respond to the risks caused by GBP-denominated liability-driven investment funds, the Central Bank of Ireland and Commission de Surveillance du Secteur Financier, Luxembourg have implemented measures to improve liability-driven investment resilience, such as leverage limit which require liability-driven investment funds to maintain resilience to a minimum 300 bps increase in UK yields.

Pension supervisory authorities should enhance their corporate governance, internal controls, and risk management requirements. Recent FSAPs have highlighted shortcomings in pension fund oversight on governance of pension funds. As demonstrated in this note, there is room for improvement for the IOPS Principles regarding corporate governance, internal controls, and risk management. This can be achieved by providing more detail on the requirements and aligning those with other financial sector's international standards, such as Basel Core Principles, Insurance Core Principles, and International Organization of Securities Commissions Principles of Securities Regulation.

Pension supervisors with large DB plans should develop a risk-based capital regime tailored to these pension funds. As described in this note, pension funds are facing significant and complex challenges, which cannot be captured appropriately by simple metrics such as the funding ratio. Except for a few countries, pension funds are not subject to risk-based capital requirements and funding rules differ considerably across countries. The risk-based capital regime is one of the most effective ways to reflect the numerous complex risks faced by a specific type of pension fund (especially DB plans). Pension supervisors with large DB plans should develop a risk-based capital regime, with due consideration of such regimes applicable to the banking and insurance sectors, thereby also helping to mitigate excessive regulatory arbitrages across the financial sectors. This transition to a risk-based capital requirement for pension funds would not only assist supervisors in identifying the risks and vulnerabilities in the sector, but also assist in allocating scarce resources.

Pension supervisors should monitor the liquidity risk of pension funds and should enhance liquidity risk management practices of the pension fund sector. Search for yield has created liquidity mismatches both from the asset and liability sides. The asset side liquidity has been reduced through higher illiquid asset investment, while liquidity needs from the liability side have been increased through derivatives, short-term securities financing transactions, associated margin calls, and flexibilities around redemption and switching of the investment portfolio. This trend warrants robust monitoring and appropriate supervisory actions. When the pension supervisors identify high liquidity risk in the pension sector, they should address the risk by improving liquidity risk management practices.

Pension fund supervisor should enhance their toolkits for quantitative risk analysis. A toolkit for quantitative risk analysis in the pension fund sector can be developed and can include solvency stress tests for DB plans, projections of future pension values for DC plans, liquidity analysis, and interconnectedness and contagion analysis to the wider financial sector. It could include reverse stress testing based on individual risk factors, for example, on equity prices or interest rates. These exercises should be best achieved through close coordination with the central bank and other financial sector authorities, which would help the authorities analyze interconnectedness and contagion analysis between pension funds and the wider financial sectors.

Appendix Table 1.1 Research on Herding Behavior of Pension Sector

Paper	Jurisdiction	Herding Behavior
Raddatz and Schmukler (2011)	Chile	Herding investment behaviors were observed among Chilean pension funds in asset classes where market information is scarce and when risk increases and often among funds that narrowly compete.
Blake and others (2016)	UK	DB funds with similar size and sponsor type tend to move in and out of different asset classes. A systematic switch was observed from equities to bonds as liabilities mature and the mechanical rebalancing of portfolios occurs in the short term.
Broeders and others (2016)	The Netherlands	The authors distinguished three types of herding behaviors. Weak herding describes similar rebalancing strategies, semi-strong herding is a similar reaction to external shocks or regulatory changes, and strong herding is the intentional replication of other pension funds' strategic asset allocation. For a sample of large pension funds in the Netherlands, the authors found evidence for the latter two types of herding behaviors, whereas they acted countercyclically in the case of weak herding category, where the pension funds offset more than 20 percent of the passive changes in their equity allocation and 25 percent for their bond allocation through active changes within the month.
Bauer and others (2018)	The Netherlands	Pension funds tend to change their strategic asset allocation in the same direction if they are connected through actuaries or dominant asset managers, particularly prevalent regarding allocations into alternative asset classes.
Papaioannou and others (2013)	Multiple jurisdictions	Pension funds' investment decisions were largely driven by regulatory constraints for DB plans. For DC plans, the investment decisions were influenced by the use of similar benchmarks, which could contribute to herding behavior.
Han and others (2021)	Multiple jurisdictions	Pension funds in different countries behave procyclically (in Poland and Italy) or countercyclically (in Chile, although it is less than statistically significant). Procyclicality could potentially be driven by the regulatory or institutional framework.

Appendix Table 2.1 Discount Rates in the Liability Valuation

Use of Discount Rates in the Liability Valuation of European Pension Funds						
	Market Swap Rate or Yield on High-Quality Bonds (Uniform Rate)	Risk-Free Term Structure, Excluding UFR	Risk-Free Term Structure, Including UFR	Expected Return on Assets – Market Rate + Risk Premium	Expected Return on Assets – Long-Term Estimate	Other
BEL	X			x	x	x
CYP				x	x	x
DEU				x	x	x
DNK			x			
ESP					x	x
FIN						x
GBR	X	x		x		
IRL	X					x
ITA					x	
LUX					x	x
NLD			x			
NOR						x
PRT	X					
SVN				x		x
SWE			x			

Sources: ESRB (2020)

Notes: The proportion of liabilities measured under each discount rate varies significantly across countries. Data labels in the table use International Organization for Standardization (ISO) country codes. UFR = ultimate forward rate (EIOPA publishes the ultimate forward rate (UFR) for 2025—European Union (europa.eu)). BEL = Belgium; CYP = Cyprus; DEU = Germany; DNK = Denmark; ESP = Spain; FIN = Finland; GBR = United Kingdom; IRL = Ireland; ITA = Italy; LUX = Luxembourg; NLD = Netherlands; NOR = Norway; PRT = Portugal; SVN = Slovenia; SWE = Sweden.

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