CHAPTER 3

INSTITUTIONAL INVESTORS

FALLING RATES, RISING RISKS

Lower-for-longer yields may prompt institutional investors to seek riskier and more illiquid investments to earn their targeted return. This increased risk-taking may lead to a further buildup of vulnerabilities among investment funds, pension funds, and life insurers, with grim implications for financial stability. Furthermore, institutional investors' strategies to search for yield may introduce additional risks. Low yields promote an increase in portfolio similarities among investment funds, which may amplify market sell-offs in the event of adverse shocks. The need to satisfy contingent calls arising from pension funds' illiquid investments could constrain the traditional role they play in stabilizing markets during periods of stress. High-return guarantees and duration mismatches are driving an increase in cross-border investments by some life insurers, which could facilitate the spillover of shocks across borders. The underlying vulnerabilities could amplify shocks and should therefore be closely monitored and carefully managed.

Falling Interest Rates Encourage Greater Risk-Taking by Institutional Investors

A prolonged period of even lower interest rates may promote a further buildup of vulnerabilities.[1] The monetary policy cycle may have reached a turning point in major advanced economies (Chapter 1), and the amount of global bonds with negative yields has reached almost $15 trillion (Figure 3.1, panel 1).[2] Persistently low and declining yields on fixed-income instruments have continued to drive institutional investors—especially those with nominal return targets or investment mandate constraints—to boost returns by using leverage and investing in riskier and less liquid assets.

Fixed-income investment funds have reacted to declines in interest rates by shifting the composition of their portfolios toward riskier and less liquid investments. These funds have invested in assets of lower or even unrated credit quality (Figure 3.1, panel 2) and increased their effective average portfolio maturities (Figure 3.1, panel 3).[3] Funds have also decreased their liquidity buffers and may face greater pressure than in the past to sell their less liquid holdings in the event of increased investor redemptions (Box 3.1 shows that these risks are notably higher for smaller funds and for fixed-income funds based in the euro area).[4] Meanwhile, funds based in major currency areas have concentrated investments in assets denominated in their base currencies. Although it has alleviated risks stemming from currency mismatches, the increased home currency bias has contributed to more concentrated exposures and greater similarity in portfolios.

Defined-benefit pension funds are also under pressure to take on more risk. Liabilities to pension beneficiaries typically have a longer duration than pension assets, so declines in interest rates disproportionately increase the present value of liabilities, weakening the long-term solvency of pension funds. Among defined-benefit pension funds in the Netherlands, United Kingdom, and United States that report mark-to-market liabilities, the value of future obligations has increased sharply when long-term interest rates have fallen (Figure 3.1, panel 4). To better match their liabilities, pension funds have increased their exposure to long-duration assets, taking greater illiquidity risk in exchange for higher returns. As a result, they have increased investments in alternative asset classes

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[1]This chapter does not attempt to assess the appropriate monetary policy stance in each jurisdiction. Instead, taking policy as given, the chapter explores changes in investors' risk-taking and their potential implications for financial stability.

[2]Besides accommodative monetary policies, aging trends and low productivity in most advanced economies are adding further downward pressure on interest rates. Older populations will likely alter the future general equilibrium profile of credit demand and risk aversion.

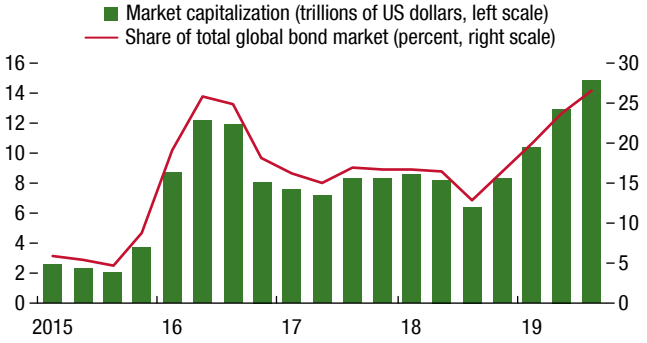
[3]Fund samples include fixed-income funds domiciled in all major economies, with shares denominated in all major currencies and with assets of at least $1 billion. They represent some 60 percent of the global bond fund industry's assets of $10.5 trillion (as of March 2019). Funds are denominated in US dollars (70 percent), euros (10 percent), and other currencies (20 percent).

[4]Similar effects have been reported in Di Maggio and Kacpercyk (2017), highlighting money market fund managers' reaction to the low-yield environment by increasing the riskiness of portfolios or even shifting their business from the management of money market funds to the management of fixed-income funds with riskier portfolios.

Figure 3.1. Institutional Investors' Increased Risk-Taking in a Persistently Low-Interest-Rate Environment

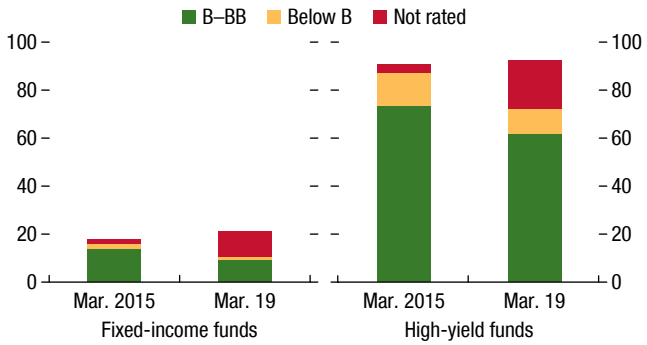
Expected monetary easing has led to a new peak in global bonds outstanding with negative yields ...

1. Market Capitalization and Share of Negative Yielding Global Bonds (US dollars; percent)



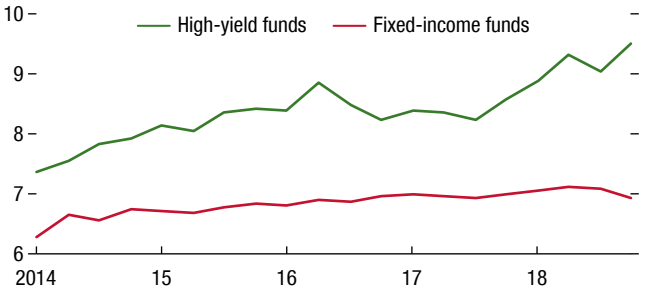
... leading fixed-income funds to search for yield by increasing their holdings of lower-credit-quality debt ...

2. Fixed-Income Funds: Low-Rated Portfolios by Credit Quality (Percent of fixed-income portfolio)



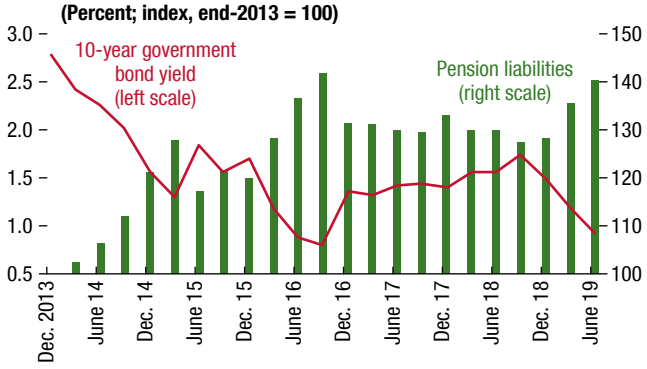
... and lengthening the average effective maturities of fixed-income funds holdings.

3. Fixed-Income Funds: Effective Maturity (Years)



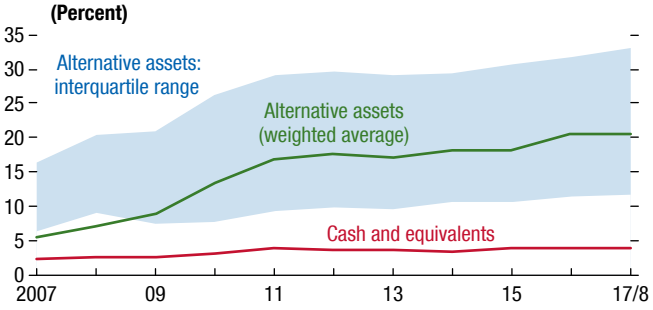
Pension funds' liabilities have increased as yields have declined ...

4. Pension Funds: Long-Term Interest Rates and Defined-Benefit Pension Liabilities (Percent; index, end-2013 = 100)



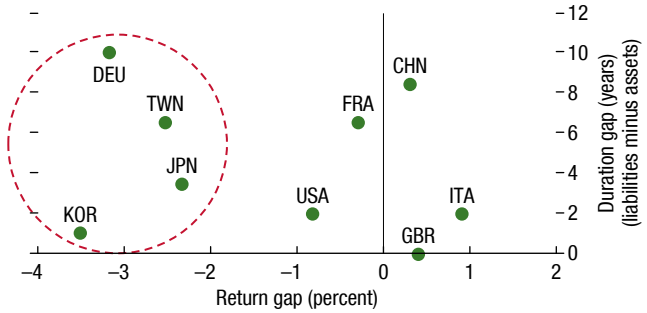
.... prompting them to increase exposure to illiquid, often highly leveraged alternative investments.

5. Large Pension Funds: Alternative Asset and Cash Allocations (Percent)



Return guarantees add to insurers' pressures.

6. Life Insurers: Guaranteed Return Spreads and Duration Mismatches



Sources: Bloomberg Finance L.P.; Haver Analytics; ICE Bond Indices; JPMorgan Chase & Co; Korea Life Insurance Association; Life Insurance Association of Japan; Milliman; Moody's; Morningstar; SNL Financial; Swiss Re; Taiwan Insurance Institute; US National Association of Insurance Companies; and IMF staff calculations.
Note: Panels 2 and 3 use available data for funds with assets of at least $1 billion reported in Morningstar. Series are constructed as balanced panels. For panel 4, pension liabilities are drawn from a sample of Dutch, UK, and US defined-benefit pensions with $5.5 trillion in assets as of 2019:Q1. Dutch pension data are from national balance sheet data; UK pension data reflect Pension Protection Fund data; US pension data consist of the market value of liabilities for the 100 largest private pensions, as calculated by the actuarial firm Milliman. Interest rate shown is simple average of Dutch, UK, and US 10-year government bond yields at the end of the quarter. Panel 5 is based on asset allocation data of 700 of the largest pension funds, representing $13 trillion in assets. For panel 6, the nine countries are the largest life insurance jurisdictions, accounting for 73 percent of the world's life insurance premiums (Source: Swiss Re). Data labels in panel 6 use International Organization for Standardization (ISO) country codes. The data for duration gap and return guarantees in panel 6 are obtained from Moody's.

such as private equity, real estate, and infrastructure, which often involve long-term lockup periods and significant embedded leverage (Figure 3.1, panel 5).

Life insurers face similar pressures to achieve the guaranteed returns on the insurance policies they have offered. Gaps between guaranteed returns and domestic sovereign bond yields, as well as duration mismatches between assets and liabilities, remain wide, most notably for some European countries (including Germany) and major Asian insurers (Figure 3.1, panel 6). This has prompted life insurers to increase their holdings of lower-rated and long-duration bond investments (see the October 2017 *Global Financial Stability Report*) and, in some cases, of foreign investments.

The Renewed Search for Yield May Have Implications for Financial Stability

Higher demand for risky assets from institutional investors may further boost asset prices and could encourage more borrowing by nonfinancial firms (see Chapter 2). In addition, rising balance sheet vulnerabilities may force institutional investors to react to shocks in a way that could amplify their impact on markets and on the broader economy given the growing importance of institutional investors as a source of funding.

As institutional investors increase duration and credit risks, they become more susceptible to a repricing of risks. With rising mismatches between illiquid asset holdings and the promise of daily liquidity to investors, *investment funds* may be facing increasing pressure to sell into an illiquid market in response to investor redemptions, which could exacerbate declines in asset prices. An increase in similarities across investment funds' portfolios raises the potential for their actions to amplify a sell-off. Contingent calls from the illiquid investments of *pension funds* could reduce their liquidity, limiting their ability to play a stabilizing role during market stress. The cross-border portfolio allocation of some *insurers* could contribute to the propagation of shocks across markets, even if sell-offs were driven by seemingly unrelated factors.

Increasing Portfolio Similarities of Investment Funds Raise the Potential to Transmit Shocks

The low-yield environment appears conducive to higher conformity in investment strategies, exacerbating a structural trend driven by benchmarking and compensation (see the April 2019 *Global Financial Stability Report*). The returns between the top and bottom deciles of fixed-income funds are becoming more correlated. This correlation appears to have increased as sovereign yields declined and reversed when yields rose, suggesting a greater similarity in fund investment strategies—with stronger home currency biases and lower cash positions—when yields are low (Figure 3.2, panels 1 and 2).

Growing portfolio similarities, combined with low cash buffers, raise the potential for rapid transmission of shocks to other investment funds, amplifying market stress. Higher exposures to home currencies also intensify the local fund industry's vulnerability to domestic asset price movements through similar exposures across funds.

Expectations of further monetary easing provide incentives for funds to increase their holdings of illiquid assets. The sensitivity of fixed-income funds' returns to proxies for market illiquidity tends to rise as sovereign yields fall, indicating a greater willingness of funds to hold more illiquid assets (Figure 3.2, panel 3).[5] Should the need arise to sell some of these illiquid assets, the similarity in portfolios and rapidly falling prices could transmit the shock quickly through the financial system. This could, for instance, amplify a widening in credit spreads in the US corporate bond market if funds were to reduce their considerable exposures abruptly (Figure 3.2, panel 4).

Pension Fund Risk-Taking May Increase the Potential for Market Procyclicality

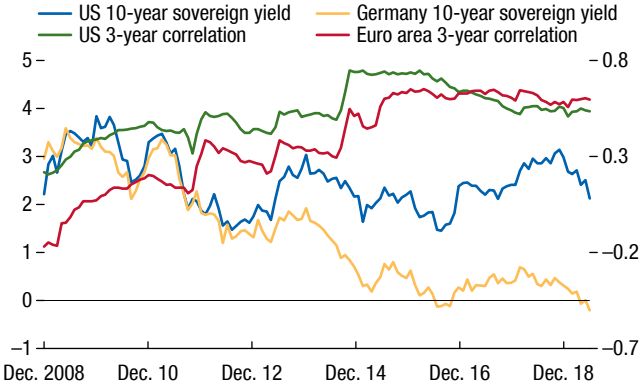
Pension funds' increased risk-taking raises their exposure to credit, market, and liquidity risks. In addition to the increase in alternative, illiquid investments (Figure 3.1, panel 5), the largest pension funds' notional derivatives positions have risen to 155 percent of net assets, on average, from 95 percent in 2011 (Figure 3.3, panel 1). Use of direct on-balance-sheet

[5]Return sensitivities are estimated with bivariate models regressing contemporaneous fund flows and fund returns on two lags and a set of contemporaneous illiquidity factors (based on a principal component analysis of spreads between overnight interest swaps and risk-free rates; turnover ratios in US bond markets; the spread between 30-year on-the-run and off-the-run US Treasuries; the Bloomberg US government securities liquidity index; and 10-year US swap spreads). Fund-specific sensitivities are aggregated and weighted by assets. Sector averages for sensitivities to individual illiquidity factors are aggregated across all available principal components using respective shares in total group variance as weights. Note that the 2016 decrease in the sensitivity follows expectations of a change in US monetary policy to a less accommodative stance.

Figure 3.2. Fixed-Income Fund Risks and Increasing Portfolio Similarities

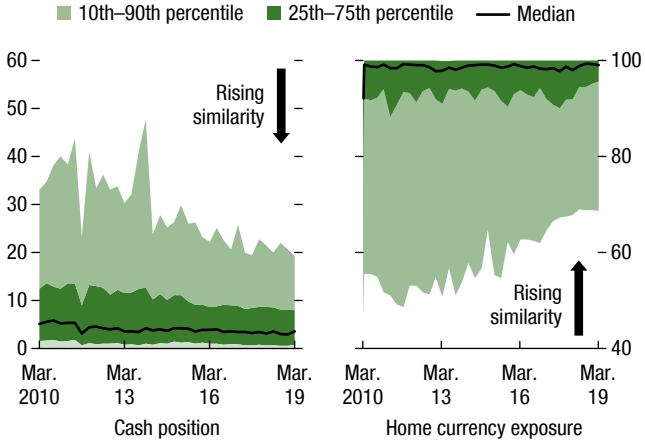
Return correlations of fixed-income funds have increased with lower interest rates ...

1. Correlation of Top and Bottom Return Deciles of Fixed-Income Funds (Yield in percent, left scale; correlation, right scale)



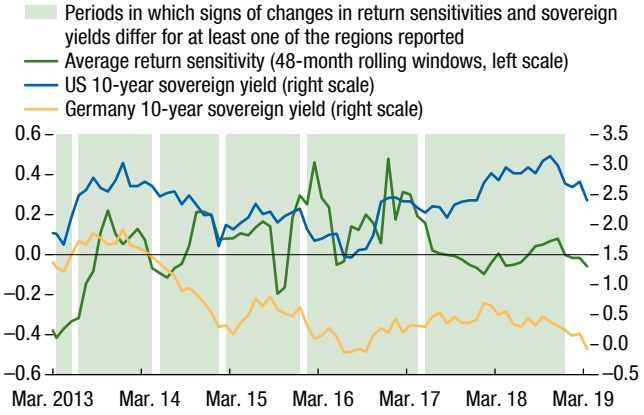
... reflecting rising similarities in home currency exposures and cash positions across fund portfolios.

2. Fund Positions in Cash and Major Currencies (Percent of assets)



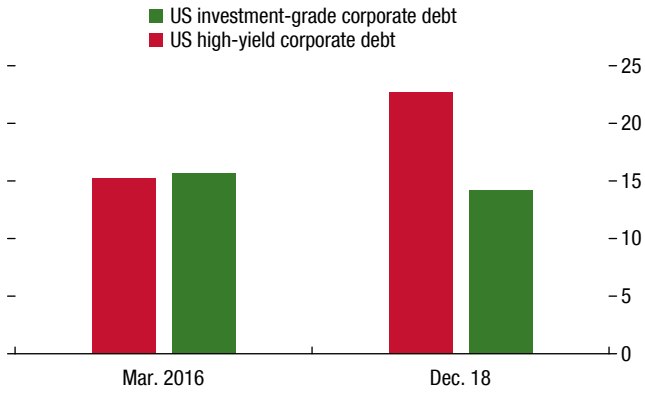
With declining interest rates fund returns became more sensitive to illiquidity factors ...

3. Sensitivity of Fund Returns to Illiquidity Proxies (Coefficients, left scale; percent, right scale)



... as fixed-income funds continued to increase their share in riskier US corporate credit markets.

4. Holdings of US Corporate Credit by Global Fixed-Income Funds (Percent of US corporate credit markets)



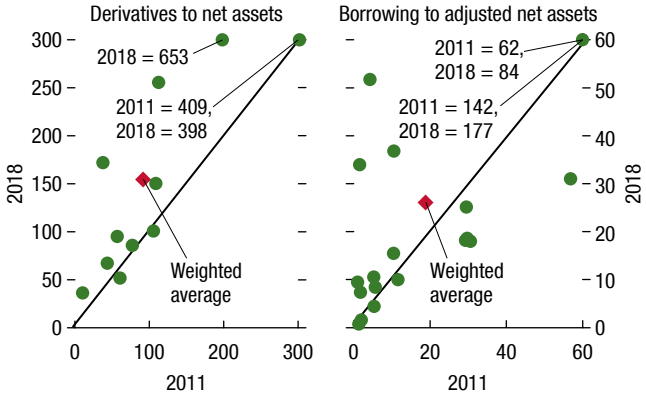
Sources: Bank for International Settlements; Bloomberg Finance L.P.; Haver Analytics; International Investment Funds Association; MarketAxxess; Morningstar; Refinitiv Datastream; and IMF staff calculations.

Note: Samples include fixed-income funds with assets over $1 billion, representing some 60 percent of the global bond fund industry's assets. Panel 1 reports correlations between the 10th and the 90th percentile of the cross-sectional return distribution. Panel 2 is constructed using balanced panels. Major net asset value currencies in panel 2 include the US dollar, the euro, and the British pound. Panel 3 reports, for fixed-income funds with assets of at least $5 billion, sensitivities of returns to illiquidity factors estimated in bivariate vector autoregression models, which regress fund returns and fund flows on their lags, a set of illiquidity factors, and euro and British pound exchange rates against the US dollar. Illiquidity factors include principal components derived from a group of illiquidity indicators comprising spreads between three-month Treasuries and three-month overnight index swaps for the euro area, the United Kingdom, and the United States, turnover ratios in high-yield and investment-grade US debt markets, the spread between 30-year on-the-run and off-the-run US Treasuries, the Bloomberg US government securities liquidity index, and the 10-year US swap spread. Return sensitivities, evaluated at the 5 percent significance level, for respective principal components, are aggregated across funds on an asset-weighted base and subsequently combined to one metric using the weights of individual principal components within the group's variation. Estimated models are rolled over the period between March 2009 and March 2019 using 48-month windows for each estimation. Panel 4 is constructed using unbalanced panels.

Figure 3.3. Pension Fund Risk-Taking and Countercyclical Investment Capacity

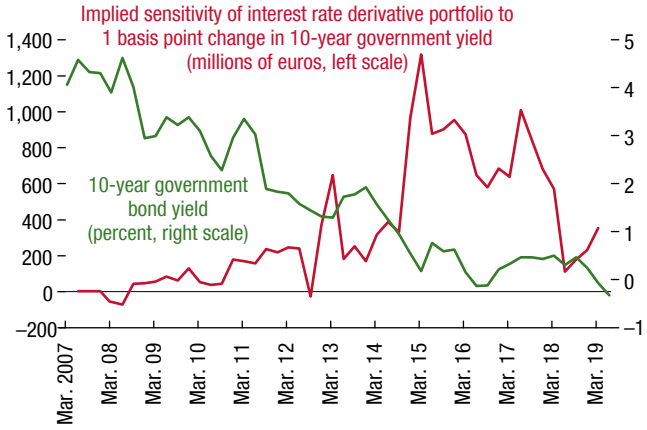
Use of derivative- and leverage-based strategies has grown, increasing market and liquidity risk related to margin calls ...

1. Pension Funds: Notional Derivatives to Net Assets and Borrowing, 2011 and 2018 (Percent)



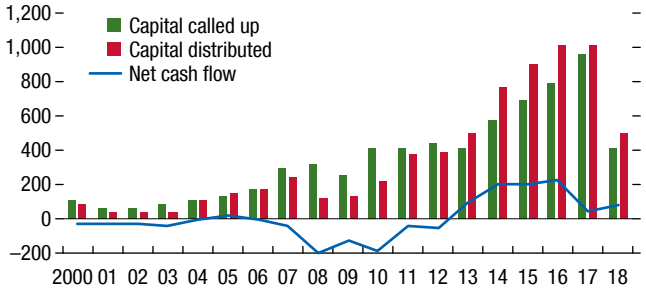
... as suggested by the changing interest rate hedge sensitivity of Dutch pension funds.

2. Netherlands: Pension Sector Interest Rate Hedge Sensitivity and 10-Year German Government Bond Yield



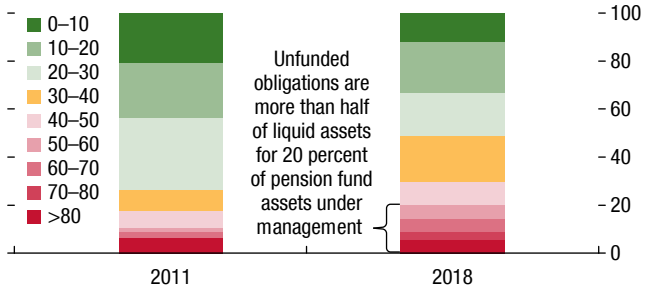
Rising exposures to illiquid assets carry unfunded commitments that could be called on in a severe downturn, increasing liquidity outflows ...

3. Private Capital Markets: Total Investor Capital Calls and Capital Distributions (Billions of US dollars)



... posing a risk particularly for the growing segment, with contingent liquidity demands that are more than half of liquidity buffers.

4. Global Pension Funds: Estimated Contingent Obligations as a Percentage of Cash and Fixed-Income Assets, by Total Assets under Management (Percent)



Sources: Bloomberg Finance L.P.; De Nederlandsche Bank; pension fund annual reports; Preqin, and IMF staff calculations.
Note: For panel 1, each green dot in left box represents one of 11 of world's 50 largest defined-benefit pension funds with available data, representing $2 trillion in assets; the right box has the same sample plus nine funds with an additional $1 trillion in assets. Adjusted net assets are net assets less the higher assets classified as illiquid or difficult-to-value or private equity and real estate investments. For panel 2, the red line is a rolling four-quarter beta of changes in the net fair value of the interest rate derivatives portfolio and changes in the 10-year German government bond yield. For panel 3, data for 2018 are through the first half of the year. For panel 4, fixed income, cash, and estimated unfunded obligations to external fund managers are based on a balanced panel of 273 defined-benefit pension funds with about $8 trillion in assets. Unfunded obligations are estimated as one-third of alternative investments.

financial leverage has also grown, particularly when net assets are adjusted for illiquid assets that are typically not available to repay borrowing and have separate and undisclosed embedded leverage (Figure 3.3, panel 1).

Although derivatives-based positions are used to reduce duration mismatches, many funds dynamically adjust these hedges in anticipation of changes in interest rates. In the Netherlands, the sensitivity of the interest rate derivatives portfolio to changes in interest rates increased when rates fell and declined when rates were expected to rise (Figure 3.3, panel 2). This active management magnifies gains when rates fall and limits losses when rates rise but can contribute to procyclicality in interest rate markets (Domanski, Shin, and Sushko 2017; Greenwood and Vissing-Jorgensen 2018; Klingler and Sundaresan 2018). Alternative investments also typically entail leveraged exposures to assets that in many cases have stretched valuations, such as corporate equity and debt in leveraged buyout deals (Chapter 2, Figure 2.3, panel 5).

Even when used as a hedge, in stress periods margin calls on derivative positions can create sizable contingent liquidity demands that can be met only by selling or lending other assets or by closing out the position.[6] Similarly, capital commitments on alternative asset investments may be more likely to be drawn on a net basis following periods of severe market stress when opportunities abound as a result of lower valuations—or due to the use of credit lines collateralized with these capital commitments—and could thus create liquidity outflows. For instance, during the global financial crisis, investors experienced net liquidity outflows as managers called in capital commitments to take advantage of attractive investment opportunities at the same time as distributions from previously drawn commitments fell (Figure 3.3, panel 3).[7]

These potential liquidity needs have grown relative to liquid assets. Liquidity buffers have declined relative to alternative investments in many pension funds. For approximately 20 percent of pension fund assets under management, estimated capital commitments related to alternative investments are more than half of their liquid assets (Figure 3.3, panel 4). Of note, drawdowns of alternative asset capital commitments following market stress would be in addition to potential liquidity requirements related to derivative and leveraged positions, for which there are insufficient data.

Given higher liquidity risks, pension funds will likely have to set aside more of their liquid assets to cover potential outflows during and after periods of stress, especially if market funding becomes more expensive. This would make it more difficult for them to buy assets traded at distressed price levels, limiting their ability to invest countercyclically and thus play a stabilizing role during periods of market stress. Limited portfolio rebalancing capacity could also exacerbate pension fund losses, transmitting stress to sponsoring governments and firms by increasing contingent liabilities. Pension funds' dynamic adjustment of leverage-based strategies could also increase volatility during periods of rapid increases in interest rates.

[6]The magnitude of market losses and margin calls depends on the size, directionality, and asset composition of pension funds' unfunded derivative positions.

[7]Alternatively, capital calls could be lower than expected following periods of severe stress if weak debt-raising conditions hinder deal making, or if alternative asset managers agreed to limit capital calls at the request of important investor clients.

Increased Cross-Border Portfolio Allocation by Life Insurers Could Create New Risk Transmission Channels

Larger-than-average spreads between return guarantees and local yields as well as duration mismatches (Figure 3.1, panel 6) have driven Asian life insurers (Japan, Korea, Taiwan Province of China) to search for yield, increasing their foreign assets to nearly $1.5 trillion, almost double the amount five years ago (Figure 3.4, panel 1).[8] Given relatively small domestic corporate bond markets (Figure 3.4, panel 2), foreign corporate bonds represent an attractive investment for these insurers (Figure 3.4, panel 3). A significant share of such investments has been in US dollar credit—the largest credit market globally[9]—where the Asian insurers' combined share of the market has risen to 11 percent from 8 percent over the past five years. This increase has been driven mainly by life insurers from Taiwan Province of China, which added $0.25 trillion in new investment in US dollar–denominated credit during 2013–18, equivalent to almost 15 percent of the increase in market capitalization over the period.

Life insurers from Taiwan Province of China may be vulnerable because of their large concentrated foreign exposures and relatively weak capital buffers:

- *Foreign exposures* have grown rapidly to more than two-thirds of their assets over the past five years, significantly above the levels of their peers (Figure 3.4, panel 4).[10] Although these insurers are selling more US dollar–denominated policies, this is not keeping pace with the rise in their foreign investments, widening currency mismatches between assets and liabilities.[11]
- The *capital adequacy* of Taiwanese insurers is weaker relative to peers (Figure 3.4, panel 4), which could reduce their ability to absorb adverse shocks.

[8]These three jurisdictions are among the eight largest globally, accounting for almost 20 percent of all global life insurance premium volumes.

[9]As of December 2018, the US dollar J.P. Morgan US Liquid index had a market capitalization of more than $6 trillion, compared with $2.5 trillion for the ICE Bank of America Merrill Lynch Euro Corporate index and less than $0.2 trillion for the ICE Bank of America Merrill Lynch Japan Corporate index.

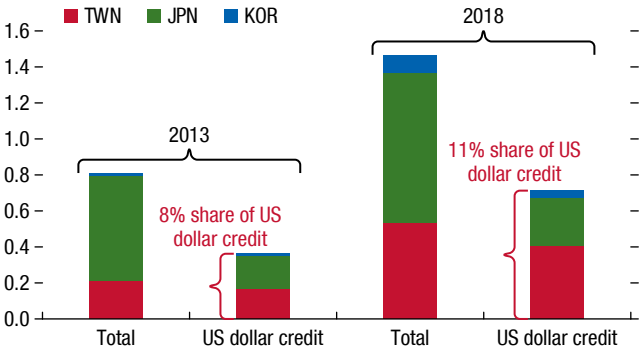
[10]The foreign exposure of other major Asian jurisdictions has also grown, but to a lesser extent. Japanese and Korean life insurers have increased their foreign investments to 24 percent and 14 percent of their assets, from 17 percent and 5 percent, respectively, five years ago.

[11]About one-quarter of their foreign currency investments are unhedged.

Figure 3.4. Asian Life Insurers and Increased Cross-Border Portfolio Allocation

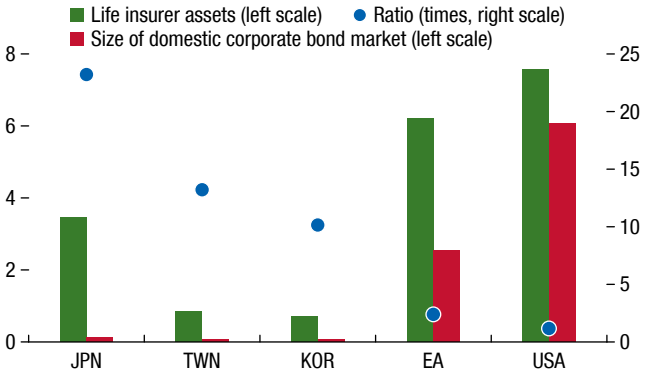
Low domestic yields have led to a sharp increase in the foreign investments of major Asian jurisdictions ...

1. Foreign Cross-Border and US Dollar Credit Investment (Trillions of US dollars)



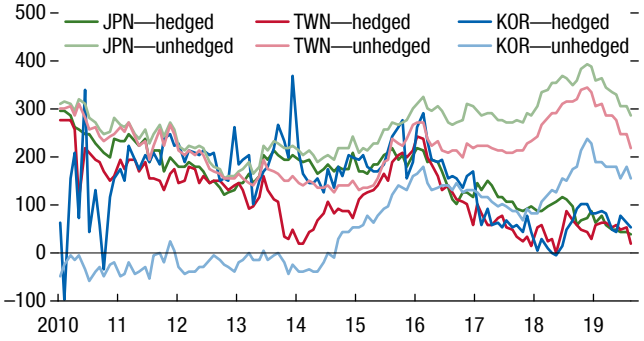
... partly due to the small size of their domestic corporate bond markets ...

2. Life Insurers' Assets and Size of Domestic Corporate Bond Markets (Trillions of US dollars)



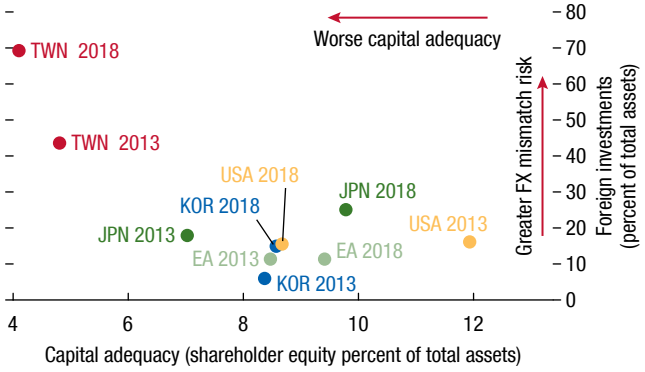
... as well as the attractiveness of foreign corporate bond excess returns, particularly when unhedged.

3. Excess Returns on US Investment-Grade Corporate Bonds over Domestic Sovereign Bonds (Basis points)



Life insurers from Taiwan Province of China have the largest foreign currency exposures and the weakest capital adequacy.

4. Shareholders Equity and Foreign Investment (Percent of assets)



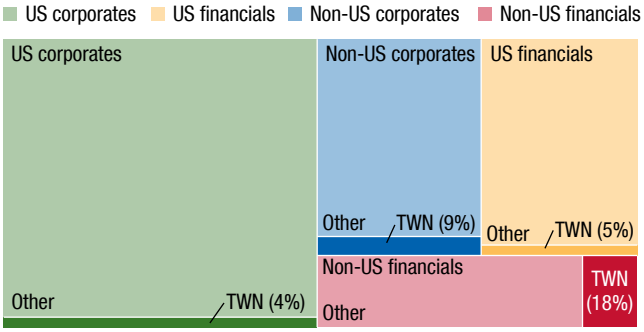
Sources: Bloomberg Finance L.P.; European Insurance and Occupational Pensions Authority; Haver Analytics; ICE Bond Indices; Individual Life Insurer Annual Reports; JPMorgan Chase & Co; Korea Life Insurance Association; Life Insurance Association of Japan; National Association of Insurance Commissioners; Taiwan Insurance Institute; and IMF staff calculations.

Note: For panel 1, the US dollar corporate bond holdings for life insurers in each jurisdiction uses individual annual reports and investor presentations for selected life insurers—from Japan, Republic of Korea, and Taiwan Province of China—to calculate their holdings of US dollar corporate bonds. The share of US dollar credit is calculated using as a proxy the sum of the market capitalization of the US dollar J.P. Morgan US Liquid Index (JULI) and of all US dollar–denominated Formosa bonds outstanding. Formosa bonds are securities issued in Taiwan Province of China but denominated in a currency other than the new Taiwan dollar. For panel 3, hedged yields assume a rolling three-month forward exchange hedge. For panel 4, the latest available foreign investment data for the United States is as of 2017, whereas the 2013 data for the euro area are as of 2016. The relationship between foreign investment and foreign currency mismatches varies by jurisdiction. For example, for Taiwan Province of China, the majority of its foreign investment is denominated in US dollars, and about a quarter of this investment is unhedged. However, for the largest jurisdictions, such as the United States, the majority of foreign investments can be in the domestic currency, which minimizes currency mismatches. Data labels in the figure use International Organization for Standardization (ISO) country codes. EA = euro area; FX = foreign exchange; TWN = Taiwan Province of China.

Figure 3.5. Life Insurers from Taiwan Province of China: Increased Presence in US Dollar Credit and Rate Volatility Markets

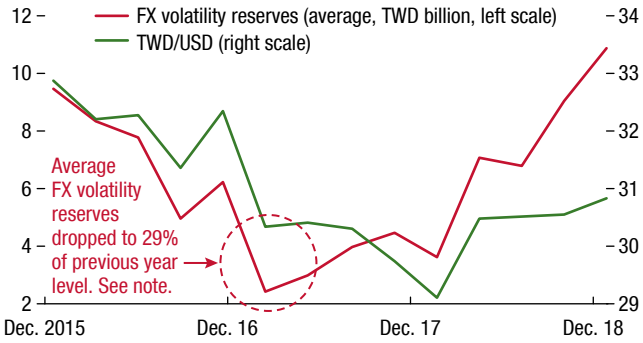
Life insurers from Taiwan Province of China own a growing share of US dollar credit from non-US banks issuers.

1. Life Insurers from Taiwan Province of China: Share of Sectors of US Dollar Credit (Percent)



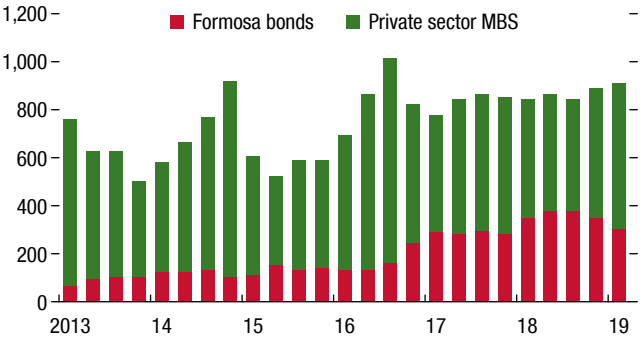
Life insurers from Taiwan Province of China are also vulnerable to a sharp depreciation of the US dollar versus the new Taiwan dollar.

2. Life Insurers from Taiwan Province of China: Foreign Currency Volatility Reserves and New Taiwan Dollar/US Dollar Exchange Rate



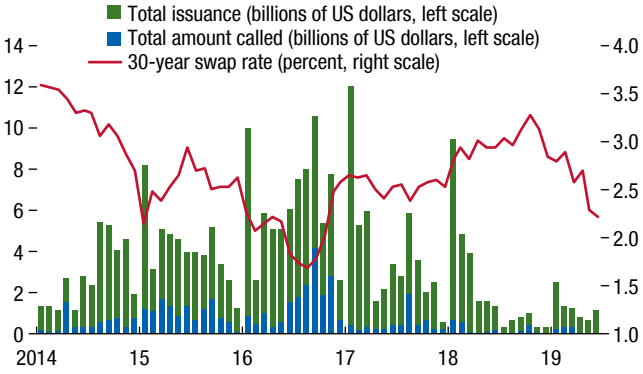
Their large holdings of US dollar callable bonds are associated with large dealer short option exposures ...

3. Estimated Dollar Vega for US Agency Mortgage-Backed Securities versus Formosa Callable Bonds (Billions of US dollars per basis point change in annualized volatility)



... with lower rates increasing the risk of these bonds being called, triggering the unwinding of hedging positions and a volatility spike.

4. Amount of US Dollar Corporate Bonds Called and 30-Year US Dollar Swap Rate (Billions of US dollars; percent)



Sources: Bloomberg Finance L.P.; Individual Life Insurer Annual Reports; JPMorgan Chase Co; Taiwan Insurance Institute; and IMF staff calculations.
Note: Panel 1 adds US dollar Formosa bonds to the different sectors of the US dollar JP Morgan US Liquid Index (JULI) as the proxy for the US dollar credit market as of December 2018. Formosa bonds are securities issued in Taiwan Province of China but denominated in a currency other than the new Taiwan dollar. The US corporates and non-US corporates categories exclude financials. In panel 2, life insurers from Taiwan Province of China set aside foreign exchange reserves to help them weather periods of strong new Taiwan dollar appreciation. However, there is a withdrawal floor where they are stopped from using reserves and therefore currency losses from their US dollar holdings could have an impact on earnings. This floor is the higher of either 20 percent of the previous year-end foreign exchange volatility reserves or 20 percent of their average year-end reserves since 2012. In panel 3, vega is defined as the change in the price of the option given a 1 basis point change in the volatility of the underlying instrument. FX = foreign exchange; MBS = mortgage-backed securities; TWD = new Taiwan dollar; TWN = Taiwan Province of China; USD = US dollar.

For example, further declines in US interest rates or a weaker US dollar vis-à-vis the Taiwan dollar[12] could put pressure on Taiwanese life insurers and potentially lead to broader market spillovers:

- Taiwanese insurers' investment has risen to more than $400 billion, or 7 percent of all corporate and bank bonds outstanding denominated in US dollars. This exposure is concentrated in dollar bonds of non-US issuers, where they hold an estimated 18 percent of bank debt and 9 percent of corporate bonds (Figure 3.5, panel 1). These concentrated holdings make them increasingly vulnerable to

[12]These are examples of specific shocks that could lead to losses. It should be noted that during periods of global risk aversion, the US dollar is likely to appreciate against the Taiwan dollar, which would serve as a natural hedge for Taiwanese life insurers.

losses due to a sharp depreciation of the US dollar (Figure 3.5, panel 2).[13] Currency losses could reduce their demand for new investments or, in the extreme, force them to sell securities to raise capital.

- A further decline in US rates could amplify interest rate volatility, as well as losses for Taiwan Province of China life insurers through their large holdings of US dollar callable bonds. Callable bonds carry an option that allows the issuer to redeem the bond early, which is more likely when interest rates decline. If US interest rates fall to a level that triggers bonds being called, the unwinding of related hedges could further increase interest rate volatility. This, in turn, could induce large losses on the unhedged callable bond holdings, further raising the prospect of spillovers to US dollar credit markets. It is estimated that exposures related to the embedded options in US dollar callable bond holdings amounts to $300 billion, roughly equivalent to half of the exposures from hedging privately held mortgage-backed securities[14] (Figure 3.5, panels 3 and 4).

Policy Action Can Reduce the Buildup of Vulnerabilities

Policymakers can help mitigate the buildup of vulnerabilities through appropriate incentives, minimum solvency or liquidity standards, and enhanced disclosures. In the current lower-for-longer environment the priorities are as follows:

- *Investment funds:* Minimum eligibility criteria (based on credit quality and liquidity) for the inclusion of assets in fixed-income funds' portfolios could be introduced to help lessen credit risks and liquidity mismatches.[15] Requiring funds to better match redemption periods to the liquidity profiles of their portfolios would mitigate the potential for fire sales.[16] Enhanced guidance for frequent and rigorous stress testing and appropriate disclosures of risks would also help ensure a minimum standard for funds' liquidity risk management. For example, appropriate labeling of funds would provide additional transparency on liquidity risks. Harmonized standards for the measurement of leverage would help identify and mitigate related vulnerabilities (see International Organization of Securities Commissions 2018b).
- *Pension funds'* regulation, governance, and disclosure should more explicitly consider risk from illiquid assets and synthetic leverage, for instance by requiring reporting of detailed and standardized calculations of projected liquidity inflows and outflows during periods of stress, as well as exposure to market risks. Authorities should consider limiting risks associated with guaranteed benefits by adopting cost-sharing arrangements that link a portion of pension payouts to market performance.
- *Life insurance companies:* A globally harmonized minimum solvency standard would help reduce vulnerabilities and the potential for weaknesses in one jurisdiction from spilling over to others through international capital markets.[17] The implementation of capital requirements for insurance groups globally is important as it may help prevent regulatory arbitrage (see Chapter 1, Table 1.1). Policies serving as a disincentive to new life insurance products offering guaranteed returns should be considered.

[13]Taiwanese life insurers set aside foreign exchange volatility reserves to help them weather periods of strong Taiwan dollar appreciation. However, there is a withdrawal floor at which they are stopped from using further reserves. This floor is the higher of either 20 percent of the previous year-end foreign exchange volatility reserves or 20 percent of their average year-end reserves since 2012.

[14]Hedging activity of refinancing risk for mortgage-backed securities is known as a major driver of US fixed income markets. For example, Malkhozov and others (2015) find that mortgage duration increases bond excess returns and that mortgage convexity is positively related to increases in bond yield volatility. Cortes (2003) finds that mortgage prepayment hedging is a major driver of US dollar swap spreads.

[15]In the separate case of money market funds, rules on credit quality and liquidity of portfolio assets have been introduced in recent years in the United States (Securities and Exchange Commission's money market funds reform) and Europe (EU regulation on money market funds). See also Table 1.1 in Chapter 1 for the number of macroprudential policy tools in use in various jurisdictions.

[16]Such proposals follow closely the spirit of respective recommendations laid out in International Organization of Securities Commissions (2018a).

[17]Risk assessment in the insurance sector suffers from opaque and heterogeneous financial disclosure and deficiencies in the accounting and regulatory regimes. See the October 2017 *Global Financial Stability Report*.

Box 3.1. Are Fixed-Income Funds Well Prepared to Meet Investor Redemptions?

In the event that investment funds are unable to meet investor redemptions with available liquid assets, the risk of fire sales could increase and this could amplify asset price volatility. Open-ended investment funds tend to offer daily share redemptions for cash. However, during periods of market stress, when investors have more incentives to redeem their shares ahead of others, a fund may not always be able to cover redemption requests with available liquid assets, cash reserves, or credit lines.[1] Such runs could force fund managers to engage in fire sales, further depressing asset prices, inflicting losses on other market participants, and, in the extreme case, increasing the risk for the financial system.

Declines in holdings of liquid assets (Figure 3.1.1, panel 1) raise questions about fixed-income funds' ability to absorb redemption shocks. The liquidity stress scenario presented in this box assesses the resilience of investment funds by comparing their liquid assets with sufficiently severe redemption shocks. Here liquid assets include cash and assets that can be sold quickly, following the principles of the Basel III standard for high-quality liquid assets.[2] The exercise assumes that redemption shocks are equivalent to the worst percentile of funds' monthly asset outflows during 2000–19. If these shocks cannot be absorbed, funds suffer liquidity shortfalls.

Staff liquidity stress scenarios confirm that fixed-income funds are vulnerable to liquidity shocks:

- The total liquidity shortfall of fixed-income funds with $10.5 trillion in assets under management is estimated at $160 billion (as of March 2019). Funds with estimated liquidity shortfalls account for almost one-sixth of all fixed income fund assets and nearly half of all high-yield fund assets (Figure 3.1.1, panel 2).[3]
- Global fixed-income funds have become more vulnerable to liquidity stress in recent years. The average shortfall (calculated as a share of assets of all fixed-income funds) has increased by about one-third over the past two years to about 1.5 percent. In terms of the assets of funds with liquidity shortfalls, however, the average shortfall has remained stable at 10 percent (Figure 3.1.1, panel 3). Moreover, for a weak tail of one-fifth of these funds, the shortfalls exceed 20 percent of assets (Figure 3.1.1, panel 4).
- Larger funds typically face lower redemption stress, allowing them to hold less cash, whereas diversified portfolios provide them with more ample liquidity (Figure 3.1.1, panel 5). Shortfalls of funds in the euro area are higher than those of US-based funds (Figure 3.1.1, panel 6).

This box was prepared by Frank Hespeler.

[1]Alternative means to mitigate redemption pressure can provide relief as well. These include the use of pricing to discourage or delay redemptions and stops or restrictions on redemption, such as the gating of redemptions.

[2]Besides the high-quality liquid assets metric, the test employs an adjusted variant of high-quality liquid assets, the alternative high-quality liquid assets. This metric balances short positions and long positions, which exceed the volume of total assets, by the residual assets available in the portfolio, allowing funds to preserve such positions as long as possible and to thereby maintain their preferred allocation. This is done by liquidity category, starting with the most liquid positions and keeping track of the assets already used for balancing of more liquid positions. Cash positions—which include cash on hand, deposits, and money market assets—are cleaned in the same way. Details on the definition of metrics and the data used are presented in Section 3 of Online Annex 1.1.

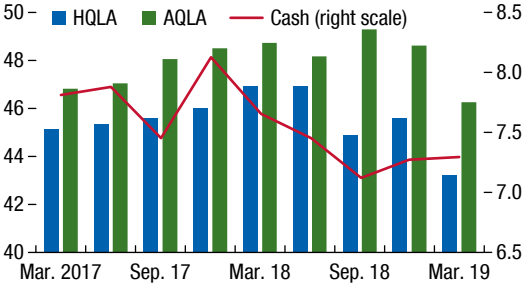
[3]Fixed-income funds include all funds with an explicit investment focus on debt markets, except money market funds. High-yield funds are hence a subset of fixed-income funds.

Box 3.1 *(continued)*

Figure 3.1.1. Liquidity Stress Scenarios for Fixed-Income Funds

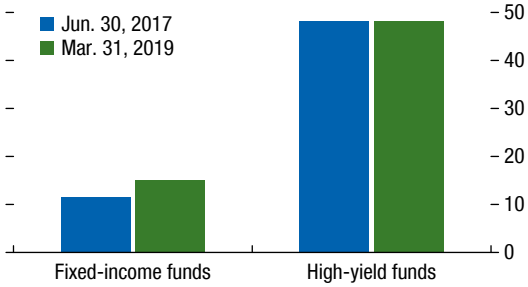
The liquid assets held by fixed-income funds have declined ...

1. Fund Liquidity Indicators
(Percent of assets, both axes)



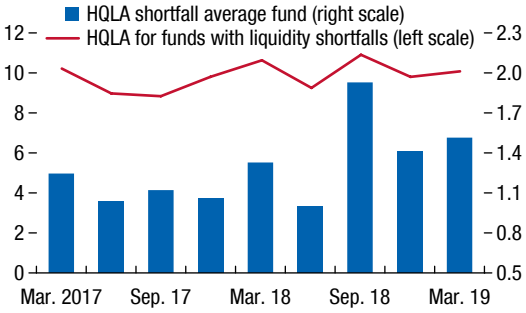
... exposing a larger share of funds to potential liquidity shortfalls in the event of investor redemptions.

2. Asset Share of Funds with HQLA Shortfalls
(Percent of sector's assets)



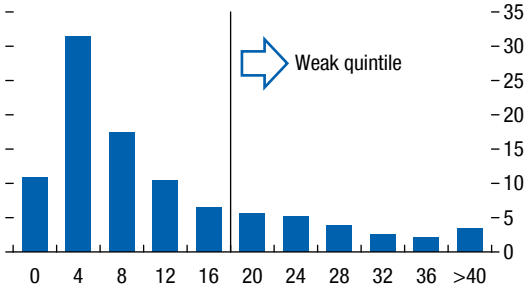
Funds' vulnerabilities have increased over time ...

3. Average Liquidity Shortfalls
(Percent of assets, both axes)



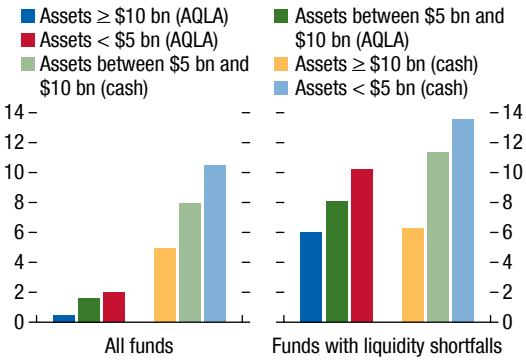
... and some funds are particularly exposed to liquidity shortfalls.

4. Frequency of HQLA Shortfalls
(Shortfall in percent of assets on horizontal axis; percent of assets on vertical axis, as of Mar. 2019)



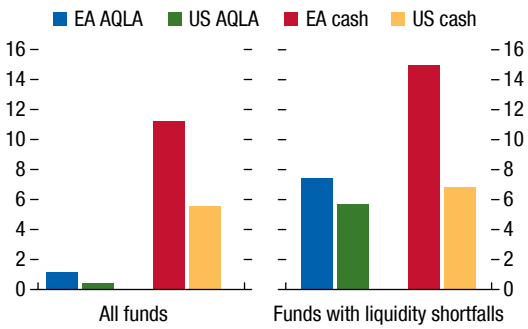
Larger funds are less susceptible to liquidity shortfalls and tend to face smaller shortfalls than smaller funds.

5. Liquidity Shortfalls by Fund Sizes
(Percent of assets, as of March 2019)



Euro area funds are more susceptible to liquidity shortfalls and tend to face larger shortfalls than US funds.

6. Liquidity Shortfalls by Region
(Percent of assets, as of March 2019)



Sources: Morningstar; and IMF staff calculations.
Note: The sample includes fixed-income funds, excluding money market funds, with assets of more than $1 billion. High-yield funds include funds with an investment focus on sovereign, corporate, and/or municipal high-yield debt. The various versions of liquidity buffers (HQLA, AQLA, and cash) are defined in Online Annex 1.1. AQLA = alternative high-quality liquid assets; bn = billion; EA = euro area; HQLA = high-quality liquid assets.

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