Board of Governors of the Federal Reserve System

International Finance Discussion Papers

ISSN 1073-2500 (Print)
ISSN 2767-4509 (Online)

Number 1425

October 2025

The case for supporting liquidity supply in (some corners of) non-bank intermediation

Sirio Aramonte

Please cite this paper as:
Aramonte, Sirio (2025). "The case for supporting liquidity supply in (some corners of) non-bank intermediation," International Finance Discussion Papers 1425. Washington: Board of Governors of the Federal Reserve System, https://doi.org/10.17016/IFDP.2025.1425.

The case for supporting liquidity supply in (some corners of) non-bank intermediation

Sirio Aramonte

Federal Reserve Board

September 26, 2025

Abstract

After the Global Financial Crisis, the liquidity-supply ecosystem that underpins non-bank intermediation shifted away from traditional dealers. Instead, it started to rely more on intermediaries with fragile funding structures and opportunistic investment strategies. Over the years, stress episodes saw the sudden retrenchment of these intermediaries, which amplified liquidity imbalances and market malfunction. Efforts to reduce the risk and magnitude of liquidity imbalances have mostly focused on reducing liquidity transformation and on constraining liquidity demand. This paper highlights the importance of strengthening liquidity supply in certain non-bank segments, particularly those that allow households to conduct long-term consumption smoothing. The main argument is that the rise of non-bank intermediation, and the ensuing risk of spikes in liquidity demand, partly reflects structural changes in how households can meet fundamental financial needs. In addition, the risk-taking channel of monetary policy can affect liquidity-demand dynamics, including for some intermediaries that facilitate household consumption smoothing.

Keywords: Drivers of liquidity demand; Liquidity supply; NBFIs

JEL classification: G14; G28; G38

Sirio.aramonte@frb.gov. I would like to thank Daniel Beltran, Stephanie Curcuru, Torsten Ehlers, Falko Fecht, Linda Goldberg, Luca Guerrieri, Juan Londono-Yarce, Maria Perozek, Viktors Stebunovs, and seminar participants at the International Banking Research Network and Investment Company Institute for comments and suggestions. This article represents the views of the author and not those of the Federal Reserve Board, Federal Reserve System, their principals, or other members of their staff.

1 Introduction

The growth of non-bank financial intermediaries (NBFIs) has led to rising liquidity demand across financial markets. In fact, the business models of non-banks are often predicated on investing in marketable securities that trade relatively often. These trading flows, which can be amplified by forced deleveraging or disruptions in liquidity transformation, need reliable liquidity supply, including at times of market distress.

The liquidity-provision ecosystem on which NBFIs rely experienced significant structural changes over time. In particular, the traditional dealer-centric model that emerged in the 1980s became more diffuse after the Global Financial Crisis (GFC). It now depends on intermediaries that often have fragile funding structures and can exhibit opportunistic behavior. Given the broad-based effects of liquidity imbalances, which propagate shocks through price externalities, academics and policymakers have extensively studied how to assess the risk of liquidity disruptions and what remedial actions are feasible.

This paper reviews structural developments that have shaped the size and composition of the NBFI sector in the United States over the past fifty years. It then highlights how some of these developments are useful to devise strategies for containing liquidity imbalances. Specifically, the paper discusses (i) how long-term consumption smoothing is increasingly the sole responsibility of individuals, which boosts demand for delegated asset management and for liquidity; and (ii) how search for yield can generate portfolio reallocation—and liquidity demand—including by intermediaries that support household consumption smoothing.

The paper comprises three parts, in addition to a concluding section that reviews the key considerations. Section 2 includes a shorty summary of how NBFIs evolved over time, of what factors drove non-banks growth, and of how these developments affected key features of the financial system. Section 3 is a deeper dive that emphasizes certain changes in how households can achieve long-term consumption smoothing, including their implications for non-bank intermediation and liquidity demand. Section 4 studies the effect of selected macroeconomic factors on asset reallocation within the NBFI sector, which naturally generates liquidity demand. Search for yield, as a manifestation of the risk-taking channel

of monetary policy, is especially relevant, including for select intermediaries that facilitate household consumption smoothing. In particular, a shift toward riskier and less liquid securities may generate heightened liquidity demand when the policy stance changes and investors re-optimize their portfolios.

The concluding section highlights that, since market liquidity is instrumental to meeting fundamental financial needs and sometimes reflects how investors adjusted to certain policies, tackling liquidity imbalances primarily with demand restrictions may be suboptimal compared to a framework that also includes fostering supply.

2 The rise of NBFIs and its implications

The share of bank-held assets in the U.S. financial system declined steadily between the late 1970s and the mid-1990s (Figure 1). This drop coincided with sustained growth in mortgage-backed securities issued by government-sponsored enterprises (or GSEs; teal area) and pooled investment vehicles, such as mutual funds and exchange-traded funds (ETFs) (yellow and purple areas). Over time, the share of defined-benefit (DB) pension funds declined in favor of defined-contribution (DC) funds (light blue and dark red areas), while the footprint of insurance companies contracted slightly (orange area). In addition, large non-financial firms also progressively increased their holdings of financial assets (Figure 2, shaded area), including relatively illiquid securities such as corporate bonds (red line; see Duchin et al., 2017 and Mota and Darmouni, 2023). The overall shift toward marketable securities raised the need for liquidity supply, which dealers met by expanding their balance sheets (Figure 1, red area).

After the 2008 financial crisis, dealer assets shrank due to changes in business models and regulation. The corresponding decline in stable dealer-provided liquidity (see, among others, Bao, O'Hara, and Zhou, 2018 and Bessembinder et al., 2018) opened the door to more opportunistic liquidity supply by other non-banks, such as mutual funds (Anand et al., 2013 and Wang et al., 2020) and insurance companies (Aramonte and Mano, 2022), especially at times of market stress (O'Hara et al., 2025). In relatively deep markets, such as those for U.S. Treasuries, certain intermediaries that provide significant amount of liquidity, including

principal trading firms, tend to focus on trading speed and have short holding periods and high turnover (Eren and Wooldridge, 2021), heightening the fragility of liquidity supply.

2.1 Drivers of NBFI growth

Many factors contributed to the expansion of non-bank intermediation. Besides changes to how investors conduct consumptions smoothing, which are the focus of Section 3, here I review three broad driving forces: regulation, evolving bank business models, and shifts in corporate governance.

Starting with regulation, certain policy actions had the stated intent of developing selected non-bank intermediation channels. Government-sponsored enterprises (GSEs) are a prime example, starting with the Farm Credit System and culminating with Fannie Mae and Freddie Mac, which were established to support residential mortgage finance. The GSEs were pivotal to the growth of debt securitizations.[1] In other instances, regulation only played an indirect role. For many years starting in 1933, for instance, Regulation Q limited the interests that banks could pay to depositors. As short-term market rates rose above interest-rate ceilings in the late 1960s (Gilbert, 1986), savers had an incentive to invest in money-market mutual funds (MMFs), which have since grown to manage about $7 trillion in assets. As a more recent example, adjustments to securities regulations in the mid-1990s improved the ability of late-stage start-ups to raise private capital (Ewens and Farre-Mensa, 2020), which has contributed to the declining relative size of public markets.

Turning to evolving bank business models, the early rise of NBFIs put pressure on banks' balance sheets, both on the asset side (eg, firms could issue bonds instead of taking loans) and on the liability side (eg, MMF shares were an alternative to deposits); see Berger, Kashyap, and Scalise (1995) and Gorton and Metrick (2013). The rollback of restrictions on the ability of banks to expand geographically increased competition within the sector, leading to consolidation (Berger, Demsetz, and Strahan, 1999 and Jayaratne and Strahan,

[1] GSE-sponsored mortgage-backed securities (MBS) are perceived as relatively close substitutes to Treasuries in terms of credit risk, and grew rapidly in the 15 years prior to the Great Financial Crisis. Between 1992 and 2007, mortgages guaranteed by Fannie Mae and Freddie Mac rose from about $700 billion to roughly $3.5 trillion (Richardson et al., 2017). At present, outstanding agency MBS amount to nearly $9 trillion (Ginnie Mae, "Global Markets Analysis Report," April 2024) and are widely held by fixed-income investment funds.

1998). In turn, consolidation allowed banks to raise efficiency as demanded by shareholders (G10, 2001), both by improving operations (Hughes et al., 1996) and by enhancing their risk profiles through portfolio diversification (McAllister and McManus, 1993). Balance-sheet efficiency was also facilitated by loan securitizations and by the development of the originate-to-distribute model (Berger, Kashyap, and Scalise, 1995 and Buchak et al., 2024). Furthermore, advances in data processing paved the way for automated credit scoring and, at the margin, reduced credit flows to smaller firms (G10, 2001 and Berger, Kashyap, and Scalise, 1995), which are less easily scored using quantitative models.

Switching to corporate governance, the rise of institutional investors lowered coordination costs among shareholders, allowing them to be more assertive in seeking improvements that would boost stock prices (Donaldson, 1994). Investors used leverage, also through corporate-bond issuance, to align the incentives of corporate managers with their own, given that debt absorbs free cash flows and reduces the scope for wasteful spending (see Grossman and Hart, 1982 and Jensen, 1986 for early contributions, and Shleifer and Vishny, 1997b for a review).[2]

2.2 Effects of NBFI growth

Besides re-routing capital flows through a variety of non-bank channels, the rise of NBFIs had significant implications for the breadth of available funding sources, for the cyclicality of credit, and for financial stability.

Starting with broader funding availability, the presence of NBFIs can increase the number and types of available lenders. In practice, NBFIs can act as a "spare tire" that makes the economy and the financial system more resilient to unexpected shocks (Greenspan, 1999a,b). Fischer (2015) notes that long-term investors, such as mutual funds and insurance companies, normally tend to offset changes in credit extended by banks. For instance, firms can use corporate bonds to replace syndicated loans when the supply of bank credit contracts (Benveniste, Singh, and Wilhelm, 1993 and Becker and Ivashina, 2014).

[2] As a percent of GDP, corporate bonds nearly doubled between the early 1980s and the late 1990s; see: Federal Reserve's Financial Accounts of the United States (https://www.federalreserve.gov/releases/z1/dataviz/z1/nonfinancial_debt/chart/#series:corporate;units:percent-of-gdp).

Turning to cyclicality in capital availability, investor flows into NBFIs affect the amount of funds that non-banks can deploy. Indeed, inflows are a key determinant of the participation of non-bank lenders to loan syndicates (Fleckenstein et al., 2024). Flows into mutual funds are also important drivers of financial conditions for companies that issue bonds widely held by mutual funds (Zhu, 2021). Among various NBFIs, DC pension plans are particularly sensitive to macroeconomic conditions in their allocation to equities and bonds (Sialm, Starks, and Zhang, 2015).

In terms of financial stability, structural features of the NBFI sector – chiefly, leverage and liquidity transformation – create vulnerabilities that generate systemic risk, as summarized by Erel and Inozemtsev (2024). The effects of these vulnerabilities can be amplified by the intrinsic dependence of NBFIs on reliable market liquidity; see Aramonte, Schrimpf, and Shin (2023) for an overview of the implications of liquidity imbalances. As a consequence, it becomes crucial to understand the factors that could make liquidity supply insufficient to match demand. The balance-sheet capacity of key intermediaries, such as dealers and market makers, is a paramount driver of liquidity supply (see, for instance, Comerton-Forde et al., 2010 and Goldberg and Nozawa, 2021) and can generate liquidity co-movement across asset classes (Aramonte and Szerszen, 2020). Besides capital shortages, risk-management strategies can be a key source of constrained balance sheets and reduced liquidity supply (Shin, 2010). Intermediary leverage is also a very important driver of liquidity supply (Adrian and Shin, 2010 and Adrian and Shin, 2014), including when taken through margins in cleared markets (Aramonte, Schrimpf, and Shin, 2023).

The financial-market volatility that characterized the onset of the Covid-19 pandemic is a prime example of how a rapid contraction in the balance-sheet capacity of key intermediaries can lead to severe liquidity disruptions. Most notably, hedge funds active in Treasury markets retrenched quickly (Kruttli et al., 2023) and the resulting illiquidity spiral (Schrimpf et al., 2020) was so pronounced that it led to calls for changes in the trading architecture of Treasury markets (Duffie, 2020). Corporate-bond markets also faced unusually poor liquidity during the Covid-19 crisis (Kargar et al., 2021 and O'Hara and Zhou, 2021), partly due to interruptions in liquidity transformation by mutual funds, which hold large amounts of

bonds (Ma et al., 2022). Lack of liquidity became so detrimental to market functioning that policymakers were forced to intervene as liquidity providers of last resort (Gilchrist et al., 2024, Boyarchenko, Kovner, and Shachar, 2022, and Haddad, Moreira, and Muir, 2021).

3 The shifting burden of consumption smoothing

Over the past fifty years, the funding of certain large life-cycle expenses, such as retirement, has increasingly become the responsibility of individuals, contributing to the accumulation of households savings. Income risk, which is a key driver of precautionary savings, has also inched up over the same period. How households invest these savings has helped shape some corners of non-bank intermediation, in particular facilitating the rise of investment vehicles—like fixed-income mutual funds—that have been at the center of the academic and policy discussion on liquidity disruptions (Chen et al., 2010, Choi et al., 2020, Goldstein et al., 2017, and FSB, 2023).

This section starts be reviewing changes to how individuals provide for their retirement, before considering healthcare expenses and income risk.[3] To the extent possible, the section also reviews how households invest their savings, which are typically entrusted to asset managers. The section concludes with a discussion of why potential conflicts of interests in delegated portfolio management generate a deep-seated preference for liquidity.

3.1 Retirement savings

In the United States, individuals fund their retirement with a mix of Social Security benefits, corporate pensions, and personal savings, including those accumulated in tax-advantaged accounts.

The share of old-age income provided by Social Security and corporate pensions has generally declined over the past 50 years. For Social Security, earnings replacement rates

[3] Rising costs for higher education are not discussed in this section, but they also shift consumption smoothing to individuals in a similar way as changes to pension availability and income replacement rates do. Assets held in tax-advantaged 529 education savings accounts increased together with tuition costs (Hannon et al., 2016) and amounted to about $500 billion (ICI, 2025) in 2024.

(benefits received at 65 as a percent of career-average earnings) trended up after the program was established and peaked for those retiring in 1980 at 67.5% (low earners) and 48.5% (high earners). For those retiring in 2020, the figures were 53.0% and 32.5%, respectively (Burkhalter and Rose, 2025, Table D). At the same time, normal retirement age increased to 67 years. These changes aimed at stabilizing the overall cost of the program, which had roughly doubled to 5% of GDP between the early 1960s and the early 1980s (Martin and Weaver, 2005). There is also perceived uncertainty about the future path of benefits, which, should the Social Security Trust Funds continue to deplete at current trends, could decline to 81% of scheduled benefits (Social Security Trustees, 2025).

Turning to corporate pensions, and focusing on workers covered by a retirement plan, the share of employees with access only to DC options—without DB pensions—rose from about 12% in 1983 to roughly 73% in 2019 (CRR, 2024). Headline coverage numbers can overestimate the significance of DB-plan availability for retirement income, because employers may have an incentive to fire workers just before vesting (Schiller and Weiss, 1979) and inflation may erode the value of vested participation after job separation. Still, legislation sets statutory vesting periods (Ippolito, 1988) and, after vesting, workers often have the option to cash out pensions (Burman et al., 1999 and Hurd and Panis, 2006) and roll them into accounts that offer investments able to hedge inflation.

Declining eligibility for DB corporate pensions coincided with rapid growth in DC plans, including employer-sponsored tax-deferred accounts (Salisbury, 1990). These changes partly reflected demand for portable retirement savings in industries with high employee turnover (Aaronson and Coronado, 2005), but also offered meaningful cost reductions to employers (Cocco, 2014 and Rauh, Stefanescu, and Zeldes, 2020). Reliance on DC plans increases uncertainty about future income, since these plans can provide higher wealth accumulation but also raise the risk of poor outcomes (Poterba et al., 2007).

Understanding how changes in retirement-funding options can affect non-bank intermediation hinges on gauging their impact on savings rates. Researchers generally conclude that public pensions reduce private savings (Bernheim and Levin, 1989 and Gokhale, Kotlikoff, and Sebelhaus, 1996; see Feldstein and Liebman, 2002 for a comprehensive summary). Based

on the literature, CBO (1998) reckons that private savings decline by about 25% to 50% of the payouts of public pensions. These estimates imply that declining income replacement rates from public and corporate pensions have meaningfully increased private savings rates, which are also boosted by uncertainty about future pension benefits (Jappelli et al., 2021).

While most research focuses on the United States, international evidence also points to a significant inverse link between government-provided DB pensions and savings rates. This is the case for country-specific studies that use data from the United Kingdom (Attanasio and Rohwedder, 2003) and Italy (Attanasio and Brugiavini, 2003), as well as for research based on cross-country comparisons (Samwick, 2000).

3.2 Health expenses

Healthcare costs paid for by patients—even those with insurance—are known as out-of-pocket expenses. In the United States, these costs averaged $1,400 in 2022.[4] Considerable asymmetry in their distribution highlights the risk that patients may shoulder high costs: in 2021, about 70% of the population spent less than $500, while 9% spent more than $2,500. Expenses differ markedly across age (2.6 times higher for patients older than 65 compared to those in the 19-34 bracket) and health conditions (3.3 times higher for patients in poor rather than excellent conditions). In advanced old age, expenses increase exponentially into the tens of thousands of dollars, especially for higher-income households (De Nardi et al., 2016).

Out-of-pocket expenses tend to grow more rapidly than inflation. For instance, they increased by 1.1% per year between 1996 and 2016, adjusted for inflation and for the size and age composition of the population (Dieleman, Cao, and Chapin, 2020).

Healthcare-driven precautionary savings are a meaningful fraction of overall household savings, and shift asset allocation toward safer assets (Guiso et al., 1996). Capatina (2015) finds that the need to cover medical expenses in old age increases savings by about 25% for

[4] Unless otherwise noted, the statistics reported in this section are from the Peterson-KFF Health System Tracker (www.healthsystemtracker.org/indicator/access-affordability/out-of-pocket-spending).

people in or close to retirement, and by approximately 10% for younger cohorts.[5] By itself, the risk of out-of-pocket expenses for nursing homes accounts for 3% of aggregate wealth, and it slows savings drawdown in old age (Kopecky and Koreshkova, 2014).

3.3 Income risk

The risk that labor income may fluctuate can increase savings rates, as individuals hedge against possible future earnings shortfalls. Income risk has increased over time for male workers, especially when considering transitory shocks rather than permanent changes to income (Gottschalk and Moffitt, 2009 and Moffitt and Zhang, 2018). The possibility of very large income drops is an important component of income risk (Moffitt et al., 2022) and it is key for explaining its cyclical variation (Guvenen et al., 2014).

Theoretical research that built on life-cycle models indicated that precautionary motives linked to income risk could potentially explain up to about half of household savings (Skinner, 1988 and Caballero, 1991). However, establishing the causal effect of income risk on consumption and savings is not straightforward, chiefly because measures of income variability are often noisy and career choices are endogenous (Lusardi, 1998), meaning that workers with higher risk tolerance can self-select into professions with more volatile earnings. Indeed, the early empirical literature found conflicting results (see the discussion in Carroll, Dynan, and Krane, 2003 and Lugilde et al., 2019).

Over time, consensus emerged that income risk affects consumption (Carroll, 1994 and Hahm and Steigerwald, 1999) and savings, and that the possibility of very large income declines has a particularly persistent effect on savings (Malmendier and Shen, 2024). Notably, Carroll and Samwick (1998) find that differences in exposure to income risk across households can explain between 30% an 50% of wealth accumulation. Engen and Gruber (2001) use changes in unemployment insurance for identification, and find that halving the income replacement rate offered by insurance raises household financial assets by about 15%. Besides increasing savings rates, income risk pushes households towards safer assets (Guiso, Jappelli,

[5] The figures are within-age group averages of estimates reported on line "Medical expenditures=0, ages>65" of Table 8 in Capatina (2015).

and Terlizzese, 1996), especially if their income falls when stocks experience negative returns (Viceira, 2001 and Bonaparte et al., 2014).

The strength of precautionary motives arising from income risk varies across individuals. Kazarosian (1997) studies differences across professions and reports that those in managerial positions tend to save more for a given level of income uncertainty. Across income levels, Carroll, Dynan, and Krane (2003) note that higher-income households are more sensitive to increases in the probability of job loss.

3.4 How are savings invested?

The need to save for retirement facilitates the development of non-bank capital markets and increases the size of the overall financial sector (Scharfstein, 2018). As Viceira (2008, pg. 3) writes, "*one of the major beneficiaries of this change* [the shift from DB to DC plans] *has been the mutual fund industry.*" In the United States, DC plans invest through mutual funds more often than DB ones do (Broadbent, Palumbo, and Woodman, 2006), partly because mutual funds offer cost advantages (Hubbard et al., 2010). Globally, the mutual funds industry is more developed in countries with a larger share of DC plans (Khorana, Servaes, and Tufano, 2005).

Of total U.S. retirement assets, 64% are held in 401(k) accounts, individual retirement accounts (IRAs), and annuities (up from 41% in 1995; these figures are from ICI, 2025, as are those reported below unless noted otherwise). Of 401(k) assets, 60% are invested in mutual funds, as are 38% of IRA assets. Within 401(k) plans, savers change asset allocation with age. Exposure to equities is 90% for individuals in their 20s, and declines to 57% for those in their 60s. At this age, bonds-only funds represent 10% of assets, while target-date and balanced funds—both of which have significant shares of bonds—represent a combined 37% of assets.[6] On balance, these figures suggest that mutual funds that engage in liquidity transformation hold a meaningful share of retirement assets for older savers.

[6] At the time of writing, two of the largest target-date funds for investors approaching retirement (2030 target-date funds managed by Fidelity and Vanguard) reported a 39% average allocation to fixed income securities. In turn, this allocation consisted of government bonds (about half on average), corporate bonds (15%), securitizations (14%) and other instruments, including derivatives.

Households wishing to save for retirement can indirectly hold registered funds through accounts at life insurers that issue annuities, in particular variable annuities. About 6% of U.S. retirement assets are in the form of annuities. Savers make recurring deposits that are invested in financial assets, which are eventually used to back a stream of periodic payments made by the insurer. Strong demand for annuities has turned them into the main business line of life insurers (Ellul et al., 2022). About 75% of the assets held in annuity accounts are invested in stocks, often through mutual funds (Drexler et al., 2017).

Mutual funds and other registered funds, including ETFs and closed-end funds, represent a large share of U.S. household wealth outside tax-advantaged retirement accounts. Overall, households held 24% of their financial wealth in registered funds.[7] For comparison, 10% of their financial wealth is in registered funds held in retirement accounts. Conversely, households are the largest investor type in mutual funds, holding 88% of U.S. mutual funds net assets and 68% of MMF assets.

These observations are important for two reasons. First, households savings outside of retirement assets are bound to support the growth of registered funds.[8] Second, liquidity disruptions, together with provisions that constrain liquidity demand, directly affect households' ability to achieve the desired portfolio allocation.

3.5 A deep-seated preference for liquidity

Delegated portfolio management is typically characterized by potential agency conflicts (Bebchuk, Cohen, and Hirst, 2017), which arise from portfolio managers' incentives to maximize their own expected benefits at the expense of value accrued to investors. These incentives typically pertain to compensation or job security. For instance, managers tend to take more

[7] ETFs are increasingly the investment vehicle of choice for households. The share creation/redemption mechanism of ETFs reduces the risk of liquidity disruptions because traded share prices internalize liquidity costs. However, ETFs can still transmit significant selling pressure to the reference assets, depending on certain characteristics of the intermediaries involved in creations and redemptions (Shim and Todorov, 2023).

[8] Savings for healthcare reasons are also likely to increase assets held in registered funds. For instance, tax-advantaged savings accounts for healthcare expenses offer similar investment options as retirement accounts. However, relatively low statutory contribution limits mean that assets in health-savings accounts are unlikely to cover more than a fraction of expected out-of-pocket health costs (Fronstin, 2010). As a result, healthcare-related savings are bound to be held in general-purpose accounts that likely invest in registered funds, including mutual funds.

risk to compensate for poor returns—unless employment risk is high, in which case they reduce portfolio risk to avoid trailing peers by wide margins (Kempf, Ruenzi, and Thiele, 2009). In general, researchers have long highlighted that, even in the relatively standardized mutual fund industry, compensation packages can be more directly tied to the profitability of the asset management company than to investor returns (Farnsworth and Taylor, 2006).

Besides well designed fund governance (Clifford, Ellis, and Gerken, 2018), the threat of capital withdrawal is the main disciplining device that investors can use to align the incentives of portfolio managers with their own. Such threat is so powerful that portfolio managers may forgo profitable arbitrage if it encumbers capital for too long (Shleifer and Vishny, 1997a). Consistent with investors' preference for capital redeemability, the discount of closed-end funds' prices to the underlying investments is partly driven by measures of agency conflicts, and turning these funds into open-ended vehicles substantially reduces discounts (Bradley, Brav, Goldstein, and Jiang, 2010).

Given that agency conflicts are intrinsic to delegated portfolio management, demand for open-ended vehicles is an ingrained feature of non-bank intermediation. The structural nature of investors' preferences for liquidity does not subtract from the vulnerabilities that arise from liquidity transformation and spikes in liquidity demand. Rather, it emphasizes that promoting market stability by suppressing access to liquidity is costly for investors.

4 The effect of macroeconomic and financial conditions

Thus far, the discussion has covered key structural factors that underpinned the long-term growth of non-bank intermediation. I now take a different perspective, focusing on cyclical asset reallocation in response to changing macroeconomic and financial conditions. Naturally, reallocation creates liquidity demand. I first consider possible reallocation between banks and non-banks, before studying reallocation across certain non-banks (Section 4.1). I then characterize how certain intermediaries with search-for-yield incentives invest in corporate bonds—an example of illiquid securities at the center of the discussion on liquidity transformation—when interest rates rates are low, and when market stress spikes (Section

4.2).

The results indicate that macroeconomic variables have little explanatory power, with the exception of interest rates: *changes* in rates anticipate growth in MMFs relative to longer-duration investment funds, and rate *levels* anticipate corporate-bond investments by intermediaries with known search-for-yield incentives. In turn, these intermediaries retrench quickly at times of stress.

Search for yield is particularly significant when discussing the risk of liquidity disruptions, for two main reasons. First, it facilitates the accumulation of risky and illiquid positions that, as noted above, can be unwound rapidly and overwhelm liquidity provision (similar to the reversals mechanism outlined in Feroli et al., 2014). Second, search for yield is a reflection of the risk-taking channel of monetary policy (Borio and Zhu, 2012), meaning that surges in liquidity demand from rapid derisking can, to some extent, be an aftereffect of policy choices.

4.1 The macroeconomic cycle

This section starts by investigating whether selected macroeconomic variables have explanatory power for differences in the growth rate of the banking sector vs. the growth rate of non-banks as a whole. Growth rates are computed from annual transactions (net of valuation effects) and year-end assets, as reported in the Financial Accounts of the United States. The explanatory variables are lagged annual changes in 10-year Treasury yields (ΔTreas_{y-1}), percent growth in gross domestic product (ΔGDP) and in the consumer price index (ΔCPI), changes in the private non-financial credit-to-GDP gap (ΔGap), and changes in the personal savings rate (ΔSavings). These data are from the FRED database of the Federal Reserve Bank of St. Louis, except for the credit-to-GDP gap, which is from the Bank for International Settlements. All variables are standardized, so that regression coefficients can be interpreted as the effect of a one-standard deviation change in the independent variable in terms of standard deviations of the dependent variable.

As shown in Table 1, there is little evidence that changes macroeconomic variables, including interest rates, anticipate growth differences between banks and non-banks. Indeed,

not one of the fifteen coefficients is statistically significant at the 10% level. Furthermore, R^2s are in the mid to low single digits, indicating poor fit.

In contrast, interest rates do affect the composition of the non-bank sector, as proxied by differences in the growth rates of assets held by various NBFIs. I consider NBFIs that, ex-ante, should be relatively more or less attractive to yield-focused investors depending on the evolution of interest rates. In particular, MMFs lose allure as rates decline, while Treasuries become relatively more appealing due to the higher yields that come from longer duration. The positive coefficient in the first column in Panel A of Table 2 indicates that, following rate declines, MMFs grow less than Treasuries held by mutual funds. Similarly, as shown by the coefficient in the second column, falling rates anticipate lower MMF growth compared to mortgage real-estate investment trusts (mREITs), which are funds that largely invest in mortgage-backed securities and employ high leverage to boost yields. There is also some evidence that MMFs grow less relative to equities held by mutual funds (third column), but the coefficient is marginally statistically insignificant. Within assets held by mutual funds, falling rates anticipate faster growth for equities compared to Treasuries (fourth column), while there is no appreciable effect for corporate bonds relative to Treasuries (fifth column).

Like changes in interest rates, inflation also anticipates growth-rate differences between certain NBFI types. As shown in Panel B of Table 2, the effect of inflation is limited to MMF growth vs. growth in (i) Treasuries and (ii) equities held by mutual funds (first and third columns), and it is generally weaker in terms of both economic and statistical significance.

4.2 Search for yield

There is ample evidence that many NBFIs tend to invest, within the limits of their mandates, in relatively higher-yielding and riskier securities, especially when interest rates are low. Researcher have studied MMFs (Di Maggio and Kacperczyk, 2017 and La Spada, 2018), pension funds (Andonov et al., 2017), insurers (Becker and Ivashina, 2015), in addition to mutual funds and securitizations (Choi and Kronlund, 2018 and Aramonte et al., 2022).

In this section, I focus on intermediaries that can invest in a broad array of assets

and analyze their holdings of corporate bonds,[9] which are relatively illiquid and are often at the center of concerns about the fragility of liquidity transformation (see, among others, Goldstein et al., 2017). The intermediaries in question, which also help support household consumption smoothing, are life insurers and DB and DC pension funds. Figure 3 provides insights into their balance sheets. Corporate bonds represent the largest asset class held by life insurers. Their investments in mutual funds, which have risen sharply since the 1980s, also include corporate bond funds.[10] Turning to pension funds, DB funds hold mostly equities, although the share of corporate bonds has increased since the 2008 financial crisis. As for DC funds, the large majority of their assets consists of mutual funds, which have progressively crowded out direct holdings of equities and especially of corporate bonds. Just as for life insurers, DC funds' holdings of mutual funds likely add significant indirect investments in corporate bonds.

The search-for-yield incentives of these three NBFI types arise different types of institutional frictions and behavioral traits. In general, life insurers tend to "*attempt to increase the yield in their bond portfolio by taking on extra priced risk, while leaving capital requirements unaffected*" (Becker and Ivashina, 2015, p.1865). Furthermore, Garavito et al. (2024) and Kaufmann, Leyva, and Storz (2024) find evidence of search for yield by life insurers after monetary policy loosening. As for DB funds, they have nominal liabilities that must be met by investing contributions, and underfunding can lead to a shift toward riskier investments (Giesecke and Rauh, 2023). Turning to DC funds, individual investors—who often self-direct their investments in these plans—tend to search for yield, especially if young and less wealthy (Lian et al., 2019 and Gomes et al., 2025). In addition, the investment funds included in DC plans also can engage in search for yield, for instance due to career concerns faced by fund managers (Guerrieri and Kondor, 2012).

[9] The Financial Accounts of the United States group together corporate and foreign bonds. For brevity, I will refer to this category as "corporate bonds." At the end of 2022, the Financial Accounts of the United States recorded holdings of $15.11 trillion in corporate and foreign bonds (https://www.federalreserve.gov/releases/z1/20250612/html/l208.htm). In the same time period, the U.S. Treasury reported that U.S. residents held $3.24 trillion in long-term foreign-government and foreign-corporate bonds (https://ticdata.treasury.gov/resource-center/data-chart-center/tic/Documents/slt_table2.html).

[10] The share of corporate bonds in mutual-fund assets has increased over time, roughly doubling between the 1950s and the 2020s to about 13%.

I characterize the search for yield of life insurers and DB and DC pension funds by analyzing the link between their investment in corporate bonds and lagged interest rates. The analysis focuses on the low interest-rate period that followed the GFC, when rates remained low for extended periods. The dependent variable is the difference between the growth rate of corporate-bond holdings and the growth rate of safe-assets holdings (Treasury and Agencies securities), to which I refer as the *growth spread*. Both growth rates are computed from valuation-unadjusted quarterly holdings in the Financial Accounts of the United States, but I include the contemporaneous changes in the BAA spread control for changes in valuations. The main independent variable is the lagged level of 10-year Treasury rates. Other explanatory variables are lagged values of: GDP growth, four quarter-ahead GDP-growth expectations (from the Survey of Professional Forecasters), and the VIX implied volatility index. Some specifications also include lagged values of the dependent variable. Controls are mostly lagged twice, in an effort to avoid potential endogeneity with once-lagged interest rates.

Starting with life insurers, the negative coefficients on lagged Treasury rates reported in Table 3 indicate that lower interest rates anticipate a wider growth spread between corporate bonds and safe securities. Since regressions are based on standardized variables, the coefficients imply that one-standard deviation lower rates correspond to growth spreads wider by about 0.3 standard deviation. When including lagged growth spreads as controls, the standard errors are adjusted for persistence with the Newey-West correction (last three columns), and the results are broadly unchanged.

Rates also correlate with wider future growth spreads for DB pension funds. The coefficients imply a roughly 0.45-standard deviation increase in the growth spread for one-standard deviation lower Treasury yields. The results are quite similar for DC funds, as shown in Table 5: the coefficients are smaller in absolute value than for DB funds, but are larger than for life insurers.

The sample analyzed so far includes the Covid-19 pandemic, which caused widespread turmoil in financial markets and might have upended normal investment patterns, possibly influencing the results. To gauge the possible effects of these disruptions, Table 6 shows

regression coefficients on Treasury rates for the 2010-2019 period. The main difference relative to the full sample is that, for life insurers, the coefficients are both economically and statistically insignificant. In contrast, the coefficients are broadly similar for DB pension funds, and larger for DC funds. The outsize effect exerted by the pandemic on life insurers' corporate-bond investments is consistent with the findings in Aramonte and Mano (2022). In early 2020, these intermediaries were unusually active in the investment-grade segment of corporate bond markets, providing liquidity in the face of large bond sales by other market participants. The combination of low rates and large purchases by life insurers during the pandemic likely contributed to the statistically significant coefficients reported in Table 3.

While the incentives to search for yield are different for life insurers and pension funds, the results in Tables 3 to 5 indicate that the effect of Treasury rates on risk taking is relatively similar. Indeed, formal tests show that, between 2010 and 2023, the coefficients on Treasury yields are statistically indistinguishable across intermediaries (Table 7, left panel). Over the shorter sample (right panel), the coefficients for DB and DC funds are statistically the same, but they are different than those on life insurers—recall that, when excluding the pandemic, there is no evidence that life insurers replace safer securities with corporate bonds (Table 6).

4.3 The effect of market distress on corporate-bond holdings

A portfolio tilt in favor of riskier securities can unwind rapidly when market stress spikes, possibly straining the liquidity-provision ecosystem. In general, periods of elevated volatility tend to coincide with portfolio rebalancing toward safe assets (see Vayanos, 2004, among others) and with liquidity disruptions (Nagel, 2012). The accumulation of riskier securities that comes from prolonged search for yield can amplify these dynamics, in line with the risk-taking reversal described in Feroli et al. (2014).

In line with these considerations, the investments patterns of life insures and pension funds point to their rapid retrenchment from corporate bond markets during periods of stress. I define episodes of market stress as quarters in which the highest VIX value is in the top quintile of the distribution across all quarters. As shown in the upper panel of Table 8, the corporate-bond positions of life insurers and pension funds tend to grow by about 1.5% to 2%

on a quarterly basis, gross of valuation effects. During episodes of market stress, the growth rate becomes slightly negative for life insurers and stalls for both DB and DC pension funds. On balance, the decline in growth rates is quite sizable, and turns these intermediaries from liquidity providers to liquidity demanders or neutral market participants. Valuation effects do not drive the results, which change little when growth rates are orthogonalized with respect to changes in BAA corporate-bond yields (bottom panel).

5 How to avoid liquidity disruptions?

Imbalances between liquidity demand and liquidity supply can unsettle financial markets by hindering portfolio reallocation and by rapidly transmitting shocks via price externalities (Morris and Shin, 2008). These disruptions can result from surges in liquidity demand, as was the case at the onset of the Covid-19 pandemic, or from rapid declines in liquidity supply, which typically arise when key financial intermediaries face binding balance-sheet constraints (Morris and Shin, 2004 and Adrian and Shin, 2010, among others). The risk and severity of disruptions can be reduced by curbing liquidity demand or by supporting liquidity supply.

Demand can be curbed after imbalances emerged, for instance by halting redemptions or by forcing redeeming investors to pay for liquidity costs through swing pricing, thus reducing the externalities imposed on non-redeemers.[11] Demand can also be constrained pre-emptively, by reducing liquidity transformation through holdings of liquidity buffers (see, for instance, Aramonte, Scotti, and Zer, 2020 and Chernenko and Sunderam, 2020), or by promoting structures that better embed liquidity costs in traded prices (like ETFs, see Pan and Zeng, 2019 and Shim and Todorov, 2023).

[11] Provisions meant to internalize the liquidity costs can be difficult to calibrate. Lewrick and Schanz (2023) find that swing pricing did not prevent outflows from fixed-income funds during the 2013 Taper Tantrum, and conclude that the size of the swing factor did not fully reflect the externalities created by running on funds. In addition, the non-linearity of liquidity restrictions based on preset thresholds can catalyze runs when these thresholds are approached (Fecht and Wedow, 2014 and Li et al., 2021). Even arrangements that fully internalize liquidity costs, such as redemptions in kind (RIK) may have unintended consequences. About 40% of U.S. mutual funds reserve the right to use RIK, and, of these, more than 10% have used RIK in practice (Agarwal et al., 2023). RIK shift the burden of liquidation on investors, who may have poorer market access than funds. Furthermore, funds may behave strategically and deliver the most illiquid securities among those eligible.

As for supporting supply, broadening market participation lowers the risk that many liquidity providers retrench simultaneously. Specific options include facilitating central clearing and optimizing liquidity regulations (Duffie, 2020 and Liang and Parkinson, 2020), improving risk management (King et al., 2023), and reducing pro-cyclicality in regulatory requirements (Murphy and Vause, 2021). In addition, during episodes of widespread market stress such as the Covid-19 crisis, the use of central-bank balance sheets has proved instrumental to restoring market functioning (Gilchrist et al., 2024, Boyarchenko, Kovner, and Shachar, 2022, and Haddad, Moreira, and Muir, 2021). As standard, codified recourse to public resources would entail regulatory oversight to limit moral hazard (see, among others, Tucker, 2014, Adrian and Boyarchenko, 2015, and Metrick and Tarullo, 2021).

Devising an encompassing strategy to manage liquidity disruptions is ultimately a trade off between constraining demand and bolstering supply. The optimal balance—and, notably, to what extent public resources should be made available—partly depends on the drivers behind the growth of NBFIs and of the attending demand for liquidity. This paper highlights that certain non-bank segments—including investment funds and especially mutual funds—expanded as a result of structural changes to how households can achieve long-term consumption smoothing. In addition, the paper highlights how certain intermediaries that support household consumption smoothing tend to accumulate riskier securities when interest rates are low, and also rapidly reduce purchases of riskier securities, or outright sell them, when market stress is elevated. That is, rapid portfolio rebalancing by these intermediaries, and the potential associated shifts in liquidity, can be the reflection of policy choices that investors had to adapt to.

References

Aaronson, S. and J. Coronado (2005): "Are firms or workers behind the shift away from DB pension plans?" *Finance and Economics Discussion Papers, Federal Reserve Board*.

Adrian, T. and N. Boyarchenko (2015): "Intermediary Leverage Cycles and Financial Stability," Tech. rep.

Adrian, T. and H. Shin (2010): "Liquidity and Leverage," *Journal of Financial Intermediation*, 19, 418–437.

——— (2014): "Procyclical Leverage and Value-at-Risk," *Review of Financial Studies*, 27, 373–403.

Agarwal, V., H. Ren, K. Shen, and H. Zhao (2023): "Redemption in Kind and Mutual Fund Liquidity Management," *Review of Financial Studies*, 36, 2274–2318.

Anand, A., P. Irvine, A. Puckett, and K. Venkataraman (2013): "Institutional trading and stock resiliency: Evidence from the 2007-2009 financial crisis," *Journal of Financial Economics*, 108, 773–797.

Andonov, A., R. Bauer, and M. Cremers (2017): "Pension funds asset allocation and liability discount rates," *Review of Financial Studies*, 30, 2555–2595.

Aramonte, S., S. Lee, and V. Stebunovs (2022): "Risk taking and low longer-term interest rates: Evidence from the U.S. syndicated term loan market," *Journal of Banking & Finance*, 138.

Aramonte, S. and N. Mano (2022): "Insurance companies as liquidity providers: The case of corporate-bond mutual funds," *Working paper*.

Aramonte, S., A. Schrimpf, and H. Shin (2023): "Non-bank financial intermediaries and financial stability," in *Research Handbook of Financial Markets*, ed. by R. Gürkaynak and J. Wright, Cheltenham, United Kingdom: Edward Edgar, chap. 7, 147–170.

Aramonte, S., C. Scotti, and I. Zer (2020): "Measuring the Liquidity Profile of Mutual Funds," *International Journal of Central Banking*, 16, 143–178.

Aramonte, S. and P. Szerszen (2020): "Cross-market liquidity and dealer profitability: Evidence from the bond and CDS markets," *Journal of Financial Markets*, 51.

Attanasio, O. and A. Brugiavini (2003): "Social Security and Households' Saving," *Quarterly Journal of Economics*, 118, 1075–1119.

Attanasio, O. and S. Rohwedder (2003): "Pension Wealth and Household Saving: Evidence from Pension Reforms in the United Kingdom," *American Economic Review*, 93, 1499–1521.

Bao, J., M. O'Hara, and X. Zhou (2018): "The Volcker Rule and Corporate Bond Market Making in times of Stress," *Journal of Financial Economics*, 130, 95–113.

Bebchuk, L., A. Cohen, and S. Hirst (2017): "The Agency Problems of Institutional Investors," *Journal of Economic Perspectives*, 31, 89–102.

Becker, B. and V. Ivashina (2014): "Cyclicality of Credit Supply: Firm Level Evidence," *Journal of Monetary Economics*, 62, 76–93.

——— (2015): "Reaching for yield in the bond market," *Journal of Finance*, 70, 1863–1902.

Benveniste, L., M. Singh, and W. Wilhelm (1993): "The failure of Drexel Burnham Lambert: Evidence on the implications for commercial banks," *Journal of Financial Intermediation*, 3, 104–137.

Berger, A., R. Demsetz, and P. Strahan (1999): "The consolidation of the financial services industry: Causes, consequences, and implications for the future," *Journal of Banking & Finance*, 23, 135–194.

Berger, A., A. Kashyap, and J. Scalise (1995): "THe transformation of the U.S. banking industry: What a long, strange trip it's been," *Brookings Papers on Economic Activity*, 1995, 55–201.

Bernheim, B. and L. Levin (1989): "Social security and personal savings: An analysis of expectations," *American Economic Review*, 79, 97–102.

Bessembinder, H., S. Jacobsen, W. Maxwell, and K. Venkataraman (2018): "Capital commitment and illiqudity in corporate bonds," *Journal of Finance*, 73, 1615–1661.

Bonaparte, Y., G. Korniotis, and A. Kumar (2014): "Income hedging and portfolio decisions," *Jornal of Financial Economics*, 113, 300–324.

Borio, C. and H. Zhu (2012): "Capital regulation, risk-taking and monetar," *Journal of Financial Stability*, 8, 236–251.

Boyarchenko, N., A. Kovner, and O. Shachar (2022): "It's what you say and what you buy: A holistic evaluation of the corporate credit facilities," *Journal of Financial Economics*, 144, 695–731.

Bradley, M., A. Brav, I. Goldstein, and W. Jiang (2010): "Activist arbitrage: A study of open-ending attempts of closed-end funds," *Journal of Financial Economics*, 95, 1–19.

Broadbent, J., M. Palumbo, and E. Woodman (2006): "The shift from defined benefit to defined contribution pension plans – Implications for asset allocation and risk management," *Working paper prepared for the CGFS working group on "Institutional investors, global savings and asset allocation"*.

Buchak, G., G. Matvos, T. Poskorski, and A. Seru (2024): "The secular decline of bank balance sheet lending," *NBER Working Paper 32176*.

Burkhalter, K. and K. Rose (2025): "Replacement rates for hypothetical retired workers," *Social Security Administration, Actuarial Note*, 9.

Burman, L., N. Coe, and W. Gale (1999): "Lump sum distributions from pension plans: Recent evidence and issues for policy and research," *National Tax Journal*, 52, 553–562.

Caballero, R. (1991): "1991," *American Economic Review*, 81, 859–871.

Capatina, E. (2015): "Life-cycle effects of health risk," *Journal of Monetary Economics*, 74, 67–88.

Carroll, C. (1994): "How does future income affect current consumption," *Quarterly Journal of Economics*, 109, 111–147.

Carroll, C., K. Dynan, and S. Krane (2003): "Unemployment risk and precautionary wealth: Evidence from households' balance sheets," *Review of Economics and Statistics*, 85, 586–604.

Carroll, C. and A. Samwick (1998): "How important is precautionary savings?" *Review of Economics and Statistics*, 80, 410–419.

CBO (1998): "Social Security and private savings: A review of empirical evidence," *Congressional Budget Office*.

Chen, Q., I. Goldstein, and W. Jiang (2010): "Payoff complementarities and financial fragility: Evidence from mutual fund outflows," *Journal of Financial Economics*, 97, 239–262.

Chernenko, S. and A. Sunderam (2020): "Measuring the perceived liquidity of the corporate bond market," *NBER Working Paper 27092*.

Choi, J., S. Hoseinzade, S. Shin, and H. Tehranian (2020): "Corporate bond mutual funds and asset fire sales," *Journal of Financial Economics*, 138, 432–457.

Choi, J. and M. Kronlund (2018): "Reaching for Yield in corporate bond mutual funds," *Review of Financial Studies*, 31, 1930–1965.

Clifford, C., J. Ellis, and W. Gerken (2018): "Hedge Fund Boards and the Market for Independed Directors," *Journal of Financial and Quantitative Analysis*, 53, 2067–2101.

Cocco, J. (2014): "Corporate pension plans," *Annual Review of Financial Economics*, 6, 163–184.

Comerton-Forde, C., T. Hendershott, C. Jones, P. Moulton, and M. Seasholes (2010): "Time Variation in liquidity: The role of market-maker inventories and revenues," *Journal of Finance*, 65, 295–331.

CRR (2024): "Workers with pension coverage by type of plan, 1983, 1998, and 2019," *Center for Retirement Research of Boston College*.

Darmouni, O. and L. Mota (2023): "The savings of corporate giants," *Working paper*.

De Nardi, M., E. French, and J. Jones (2016): "Savings after retirement: A survey," *Annual Review of Economics*, 8, 177–204.

Di Maggio, M. and M. Kacperczyk (2017): "The unintended consequences of the zero lower bound," *Journal of Financial Economics*, 123, 59–80.

Dieleman, J., J. Cao, and A. Chapin (2020): "US health care spending by payer and health condition, 1996-2016," *Journal of the American Medical Association*, 323, 863–884.

Donaldson, G. (1994): "Corporate restructuring," *Harvard University Press*.

Drexler, A., T. Plesits, and R. Rosen (2017): "How much risk do variable annuity guarantees pose to life insurers?" *Chicago Fed Letter*, 384.

Duchin, R., T. Gilbert, J. Harford, and C. Hrdlicka (2017): "Precautionary savings with risky assets: When cash is not cash," *Journal of Finance*, 72, 793–852.

Duffie, D. (2020): "Still the Worldâs Safe Haven?" *Hutchins Center Working Paper #62*.

Ellul, A., C. Jotikasthira, A. Kartasheva, C. Lundblad, and W. Wagner (2022): "Insurers as Asset Managers and Systemic Risk," *Review of Financial Studies*, 35, 5483–5534.

Engen, E. and J. Gruber (2001): "Unemployment insurance and precautionary saving," *Journal of Monetary Economics*, 47, 545–579.

Erel, I. and E. Inozemtsev (2024): "Evolution of debt financing toward less-regulated financial intermediaries in the United States," *Journal of Financial and Quantitative Analysis*, 1–38.

Eren, E. and P. Wooldridge (2021): "Non-bank Financial Institutions and the Functioning of Government Bond Markets," *BIS Papers*, 119.

Ewens, M. and J. Farre-Mensa (2020): "The deregulation of the private equity markets and the decline in IPOs," *The Review of Financial Studies*, 33, 5463–5509.

Farnsworth, H. and J. Taylor (2006): "Evidence on the compensation of portfolio managers," *Journal of Financial Research*, 29, 305–324.

Fecht, F. and M. Wedow (2014): "The Dark and the Bright Side of Liquidity Risks: Evidence from Open-End Real Estate Funds in Germany," *Journal of Financial Intermediation*, 23, 376–399.

Feldstein, M. and J. Liebman (2002): "Social Security," *Handbook of Public Economics, Chapter 32*, 4, 2245–2324.

Feroli, M., A. Kashyap, K. Schoenholtz, and H. Shin (2014): "Market tantrums and monetary policy," *Chicago Booth Paper*, 14.

Fischer, S. (2015): "Macroprudential policy in the U.S. economy," *Speech at the 59th Economic Conference of the Federal Reserve of Boston*, October 2.

Fleckenstein, Q., M. Gopal, G. Gutiérrez, and Hillenbrand (2024): "Nonbank lending and credit cyclicality," *Working paper*.

Fronstin, P. (2010): "The use of health savings accounts for health care in retirement," *Employee Benefit Research Institute Notes*, 31, 2–6.

FSB (2023): "Revised policy recommendations to adddress structural vulnerabilities from liquidity mismatch in open-ended funds," *Financial Stability Board*.

G10 (2001): "Report on Consolidation in the Financial Sector," *Group of Ten*.

Garavito, F., U. Lewrick, T. Stastny, and K. Todorov (2024): "Shifting landscapes: life insurance and financial stability," *BIS Quarterly Review*, September, 21–34.

Giesecke, O. and J. Rauh (2023): "Trends in state and local pension funds," *Annual Review of Financial Economics*, 15, 221–238.

Gilbert, A. (1986): "Requiem for Regulation Q: What it did and why it passed away," *Federal Reserve Bank of St. Louis Review*, 22–37.

Gilchrist, S., B. Wei, V. Yue, and E. Zakrajšek (2024): "The Fed takes on corporate credit risk: An analysis of the efficacy of the SMCCF," *Journal of Monetary Economics*, 146.

Gokhale, J., L. Kotlikoff, and J. Sebelhaus (1996): "Understanding the postwar decline in U.S. saving: A cohort analysis," *Brookings Papers on Economic Activity*, 1, 315–390.

Goldberg, J. and Y. Nozawa (2021): "Liquidity Supply in the Corporate Bond Market," *Journal of Finance*, 76, 755–796.

Goldstein, I., H. Jiang, and D. Ng (2017): "Investor flows and fragility in corporate bond funds," *Journal of Financial Economics*, 126, 592–613.

Gomes, F., C. Peng, O. Smirnova, and N. Zhu (2025): "Reaching for yield: Evidence from households," *Journal of Financial Economics*, 168.

Gorton, G. and A. Metrick (2013): "Chapter 1 – Securitization," *Handbook of the Economics of Finance*, 2, 1–70.

Gottschalk, P. and R. Moffitt (2009): "The rising instability of U.S. earnings," *Journal of Economic Perspectives*, 23, 3–24.

Greenspan, A. (1999a): "Do efficient financial markets mitigate financial crises?" *Speech at the 1999 Financial Markets Conference of the Federal Reserve Bank of Atlanta*, October 19.

——— (1999b): "Lessons from the global crises," *Speech at World Bank Group and International Monetary Fund*, September 27.

Grossman, S. and O. Hart (1982): "Corporate financial structure and managerial incentives," in *The economics of information and uncertainty*, ed. by J. McCall, Chicago University Press, chap. 4.

Guerrieri, V. and P. Kondor (2012): "Fund managers, career concerns, and asset price volatility," *American Economic Review*, 102, 1986–2017.

Guiso, L., T. Jappelli, and D. Terlizzese (1996): "Income risk, borrowing constraints, and portfolio choice," *American Economic Review*, 86, 158–172.

Guvenen, F., S. Ozkan, and J. Song (2014): "The nature of countercyclical income risk," *Journal of Political Economy*, 122, 621–660.

Haddad, V., A. Moreira, and T. Muir (2021): "When selling becomes viral: Disruptions in debt markets in the COVID-19 crisis and the Fedâs response," *Review of Financial Studies*, 34, 5309–5351.

Hahm, J. and D. Steigerwald (1999): "Consumption adjustment under time-varying income uncertainty," *Review of Economics and Statistics*, 81, 32–40.

Hannon, S., K. Moore, I. Stefanescu, and M. Schmeiser (2016): "Saving for College and Section 529 Plans," *FEDS Notes*, February 3.

Hubbard, G., M. Koehn, S. Ornstein, M. Van Audenrode, and J. Royer (2010): "Mutual fund industry growth and importance in retirement plans," in *The mutual fund industry – Competition and investor welfare*, Columbia Business School Publishing, chap. 1.

Hughes, J., W. Lang, L. Mester, and C. Moon (1996): "Efficient banking under interstate branching," *Journal of Money, Credit, and Banking*, 28, 1043–1071.

Hurd, M. and C. Panis (2006): "The choice to cash out pension rights at job change or retirement," *Journal of Public Economics*, 2213-2227, 12.

ICI (2025): "Investment Company Factbook," *Investment Company Institute*.

Ippolito, R. (1988): "A study of the regulatory effet of the Employee Retirement Income Security Act," *Journal of Law and Economics*, 31, 85–125.

Jappelli, T., I. Marino, and M. Padula (2021): "Social security uncertainty and demand for retirement savings," *Review of Income and Wealth*, 67, 810–834.

Jayaratne, J. and P. Strahan (1998): "Entry restrictions, industrial evolution and dyncamic efficiency: Evidence from commercial banking," *Journal of Law and Economics*, 49, 239–274.

Jensen, M. (1986): "Agency costs of free cash flow, corporate finance, and takeovers," *American Economic Review, Papers and Proceedings*, 76, 323–329.

Kargar, M., B. Lester, D. Lindsay, S. Liu, P. Weil, and D. Zúñiga (2021): "Corporate bond liquidity during the COVID-19 crisis," *Review of Financial Studies*, 34, 5352–5401.

Kaufmann, C., J. Leyva, and M. Storz (2024): "Insurance corporations' balance sheets, financial stability and monetary policy," *Working paper*.

Kazarosian, M. (1997): "Precautionary savings – A panel study," *Review of Economics and Statistics*, 79, 241–247.

Kempf, A., S. Ruenzi, and T. Thiele (2009): "Employment risk, compensation incentives, and managerial risk taking: Evidence from the mutual fund industry," *Journal of Financial Economics*, 92, 92–108.

Khorana, A., H. Servaes, and P. Tufano (2005): "Explaining the Size of the Mutual Fund Industry around the World," *Journal of Financial Economics*, 78, 145–185.

King, T., T. Nesmith, A. Paulson, and T. Prono (2023): "Central Clearing and Systemic Liquidity Risk," *International Journal of Central Banking*, October, 85–142.

Kopecky, K. and T. Koreshkova (2014): "THe impact of medical and nursing home expenses on savings," *American Economic Journal: Macroeconomics*, 6, 29–72.

Kruttli, M., P. Monin, L. Petrasek, and S. Watugala (2023): "LTCM redux? Hedge fund Treasury trading and funding fragility," *Journal of Financial Economics*, Forthcoming.

La Spada, G. (2018): "Competition, Reach for Yield, and Money Market Funds," *Journal of Financial Economics*, 129, 87–110.

Lewrick, U. and J. Schanz (2023): "Towards a Macroprudential Framework for Investment Funds: Swing Pricing and Investor Redemptions," *International Journal of Central Banking*, 19, 229–267.

Li, L., Y. Li, M. Macchiavelli, and A. Zhou (2021): "Liquidity restrictions, runs, and central bank interventions: Evidence from money market funds," *Review of Financial Studies*, 34, 5402–5437.

Lian, C., Y. Ma, and C. Wang (2019): "Low interest rates and risk-taking: Evidence from individual investment decisions," *Review of Financial Studies*, 32, 2107–2148.

Liang, N. and P. Parkinson (2020): "Enhancing Liquidity of the U.S. Treasury Market Under Stress," *Hutchins Center Working Paper #72*.

Lugilde, A., R. Bande, and D. Riveiro (2019): "Precautionary saving: A review of the empirical literature," *Journal of Economic Surveys*, 33, 481–515.

Lusardi, A. (1998): "On the importance of the precautionary savings motive," *American Economic Review, Papers and Proceedings*, 88, 449–453.

Ma, Y., K. Xiao, and Y. Zeng (2022): "Mutual Fund Liquidity Transformation and Reverse Flight to Liquidity," *Review of Financial Studies*, 35, 4674–4711.

Malmendier, U. and L. Shen (2024): "Scarred consumption," *American Economic Journal*, 16, 322–355.

Martin, P. and D. Weaver (2005): "Social Security: A program and policy history," *Social Security Bulletin*, 66.

McAllister, P. and D. McManus (1993): "Resolving the scale efficiency puzzle in banking," *Journal of Banking and Finance*, 7.

Metrick, A. and D. Tarullo (2021): "Congruent Financial Regulation," *Brookings Papers on Economic Activity*, Spring.

Moffitt, R., J. Abowd, C. Bollinger, M. Carr, C. Hokayem, K. McKinney, E. Wiemers, S. Zhang, and J. Ziliak (2022): "Reconciling trends in U.S. male earnings volatility: Results from survey and administrative data," *Journal of Business & Economic Statistics*, 41, 1–11.

Moffitt, R. and S. Zhang (2018): "Income volatility and the PSID: Past research and new results," *AEA Papers and Proceedings*, 108, 277–280.

Morris, S. and HS. Shin (2004): "Liquidity Black Holes," *Review of Finance*, 8, 1–18.

——— (2008): "Financial Regulation in a Systemic Context," *Brookings Papers on Economic Activity*, Fall, 229–261.

Mota, L. and O. Darmouni (2023): "The savings of corporate giants," *Review of Financial Studies*, Forthcoming.

Murphy, D. and N. Vause (2021): "A CBA of APC – Analysing Approaches to Procyclicality Reduction in CCP Initial Margin Models," *Working paper*.

Nagel, S. (2012): "Evaporating liquidity," *Review of Financial Studies*, 25, 2005–2039.

O'Hara, M., A. Rapp, and X. Zhou (2025): "Bond market resiliency: The role of insurers," *Review of Financial Studies*, Forthcoming.

O'Hara, M. and A. Zhou (2021): "Anatomy of a liquidity crisis: Corporate bonds in the COVID-19 crisis," *Journal of Financial Economics*, 142, 46–68.

Pan, K. and Y. Zeng (2019): "ETF arbitrage under liquidity mismatch," *Working paper*.

Poterba, J., J. Rauh, S. Venti, and D. Wise (2007): "Defined contribution plans, defined benefit plans, and the accumulation of retirement wealth," *Journal of Public Economics*, 91, 2062–2086.

Rauh, J., I. Stefanescu, and S. Zeldes (2020): "Cost saving and the freezing of corporate pension plans," *Journal of Public Economics*, 188.

Richardson, M., S. Van Nieuwerburgh, and L. White (2017): "What to do about GSEs?" *Annual Review of Financial Economics*, 9, 21–41.

Salisbury, D. (1990): "Statement before the Subcommittee on Private Retirement Plans and Oversight of the Internal Revenue Service of the Senate Committee on Finance," *Hearing of pension plan complexity*.

Samwick, A. (2000): "Is pension reform conducive to higher saving?" *Review of Economics and Statistics*, 82, 264–272.

Scharfstein, D. (2018): "Presidential address: Pension policy and the financial system," *Journal of Finance*, 73, 1463–1512.

Schiller, B. and R. Weiss (1979): "The impact of private pensions on firm attachment," *Review of Economics and Statistics*, 61, 369–380.

Schrimpf, A., HS. Shin, and V. Sushko (2020): "Leverage and Margin Spirals in Fixed Income Markets during the Covid-19 Crisis," *BIS Bulletin*, 2.

Shim, J. and K. Todorov (2023): "ETFs, illiquid assets, and fire sales," *Working paper*.

Shin, HS. (2010): *Risk and Liquidity*, Clarendon Lectures in Finance, Oxford University Press.

Shleifer, A. and R. Vishny (1997a): "The limits of arbitrage," *Journal of Finance*, 52, 35–55.

——— (1997b): "A survey of corporate governance," *Journal of Finance*, 52, 737–783.

Sialm, C., L. Starks, and H. Zhang (2015): "Defined Contribution Pension Plans: Mutual Fund Asset Allocation Changes," *American Economic Review*, 105, 432–436.

Skinner, J. (1988): "Risky income, life cycle consumption, and precautionary savings," *Journal of Monetary Economics*, 22, 237–255.

Social Security Trustees (2025): "The 2025 annual report of the Board of Trustees of the federal old-age and surivors insurance and federal disability insurance trust funds," .

Tucker, P. (2014): "The Lender of Last Resort and Modern Central Banking: Principles and Reconstruction," in *Re-thinking the Lender of Last Resort, BIS Papers 79*.

Vayanos, D. (2004): "Flight to quality, flight to liquidity, and the pricing of risk," *NBER Working Paper 10327*.

Viceira, L. (2001): "Optimal portfolio choice for long-horizon investors with nontradable labor income," *Journal of Finance*, 56, 433–470.

——— (2008): "Life-cycle funds," in *Overcoming the savings slump: How to increase the effectiveness of financial education and saving programs*, ed. by A. Lusardi, University of Chicago Press, chap. 5.

Wang, Z., H. Zhang, and X. Zhang (2020): "Fire sales and impediments to liquidity provision in the corporate bond market," *Journal of Financial and Quantitative Analysis*, 55, 2613–2640.

Weesie, J. (1999): "Seemingly unrelated estimation and the cluster-adjusted sandwich estimator." *Stata Technical Bulletin*, 52, 34–47.

Zhu, Q. (2021): "Capital supply and corporate bond issuances: Evidence from mutual fund flows," *Journal of Financial Economics*, 141, 551–572.

Figure 1: Composition of the U.S. financial system over time.

The chart shows the share of financial assets held by various types of intermediaries. The data are from the Financial Accounts of the United States. The sample covers 1952 to 2022. For defined-benefit pension funds, the chart shows total financial assets minus claims on sponsors (unfunded pension entitlements). The acronyms shown in the legend stand for: real-estate investment trusts (REITs), asset-backed securities (ABS), government-sponsored enterprises (GSEs), agency pools (Ag. Pools), defined-contribution and defined-benefit pension funds (DC and DB pensions), exchange-traded funds (ETFs), mutual funds (MFs), closed-end funds (CEFs), and money-market mutual funds (MMFs).

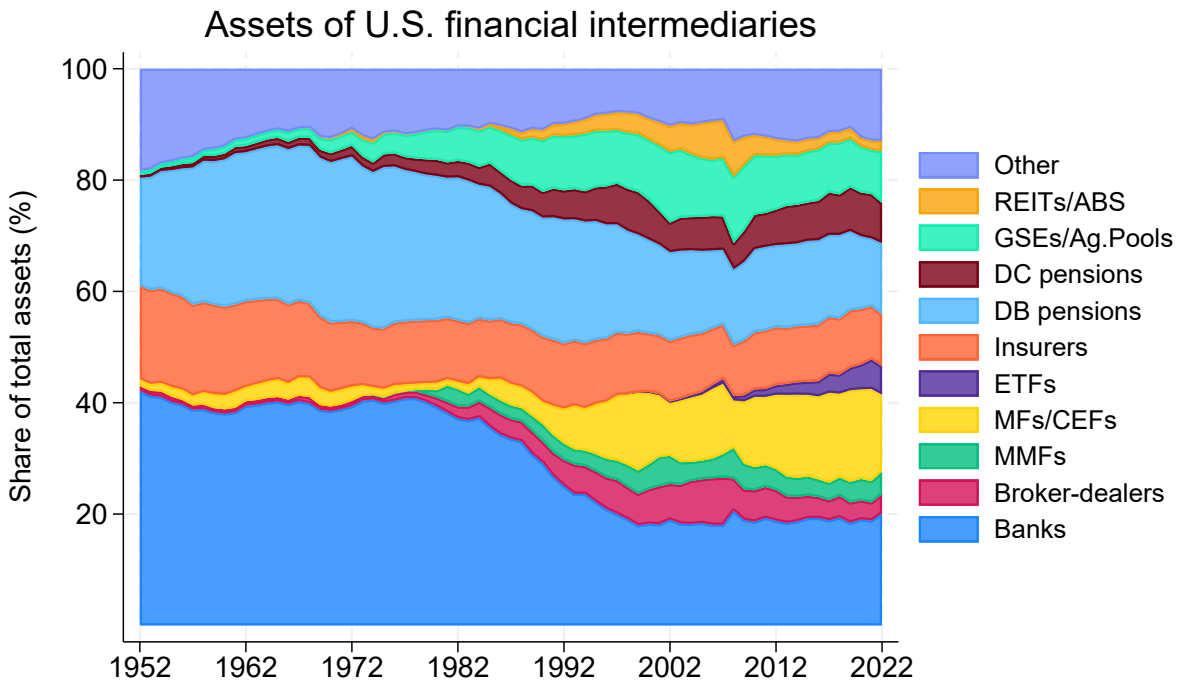

Figure 2: Financial assets held by large non-financial corporations.

The shaded area shows financial assets held by a selection of large U.S. non-financial corporations, as defined by Darmouni and Mota (2023). The red line represents the share of financial assets invested in corporate bonds. The sample covers 2000 to 2021.

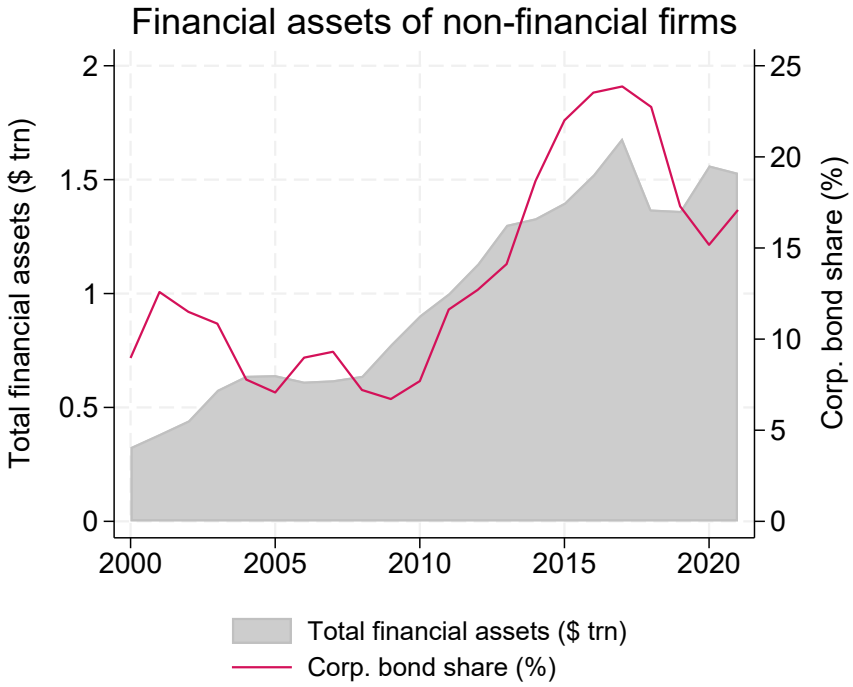

Figure 3: The asset mix of select types of U.S. financial intermediaries.

The three charts report the composition of the balance sheets of three types of U.S. financial intermediaries: life insurers (top), defined-benefit (DB) pension funds (middle) and defined-contribution (DC) pension funds (bottom). MMFs and CP stands for money-market mutual funds and commercial paper, respectively. The data are from the Financial Accounts of the United States. The sample covers 1952 to 2022.

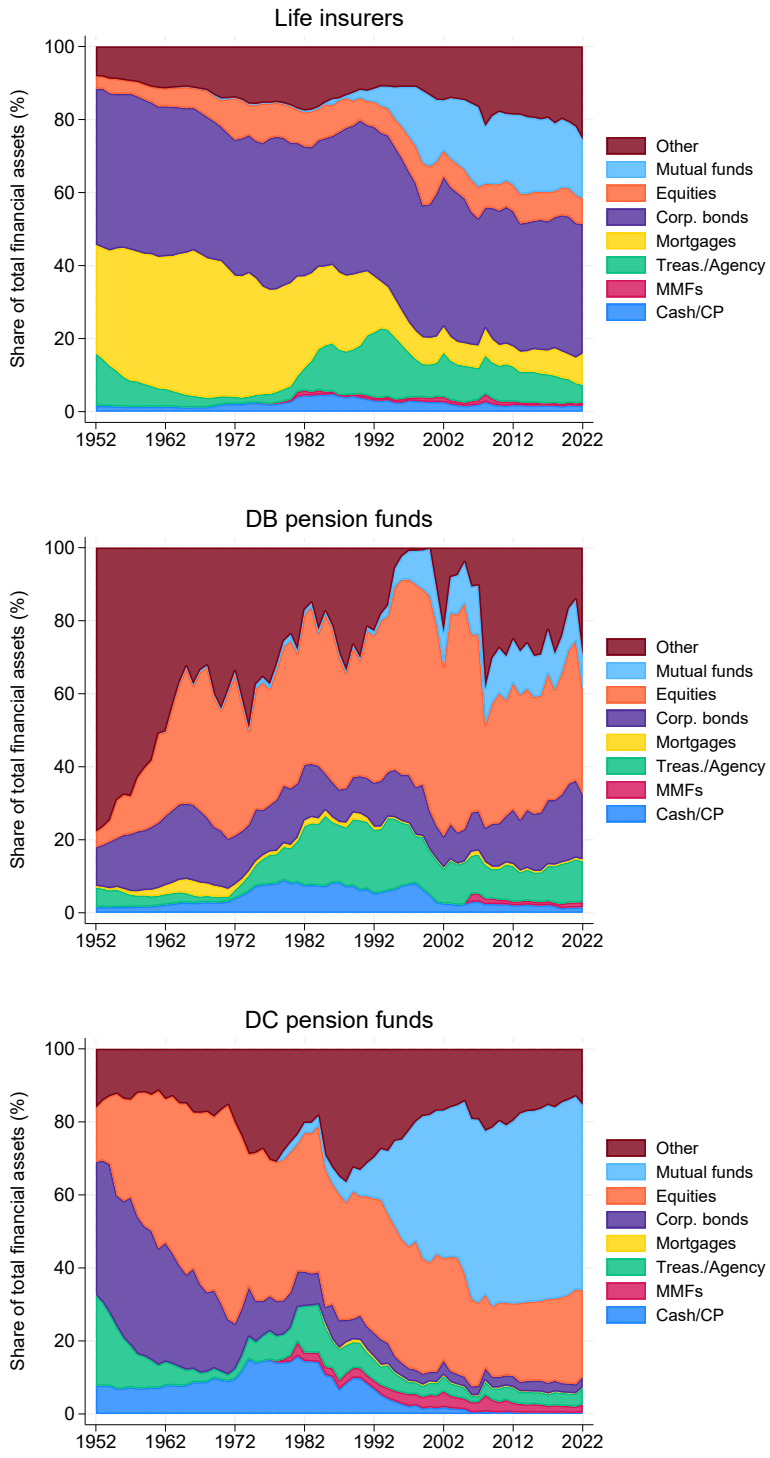

Table 1: Macro drivers of growth-rate differences between banks and non-banks.

The table shows the link between lagged changes in various macroeconomic variables and growth-rate differences (net of valuation effects) between assets held by banks and non-banks. The macroeconomic variables are changes in 10-year Treasury yields (ΔTreas), percent growth in gross domestic product (ΔGDP) and in the consumer price index (ΔCPI), changes in the private non-financial credit-to-GDP gap (ΔGap), and changes in the personal savings rate (ΔSavings). *t*-statistics are shown in parentheses. The data are annual and are from the Financial Accounts of the United States, the FRED database of the Federal Reserve Bank of St. Louis, and the Bank for International Settlements. The sample covers 1965 (or later, based on data availability) to 2022. All variables are standardized, hence the coefficients can be interpreted as the effect of a one-standard deviation change in the independent variables in terms of standard deviations of the dependent variable.

Dep. Var.:	Growth-rate differences				
Predictor:	ΔTreas	ΔGDP	ΔCPI	ΔGap	ΔSavings
Lag 1	-0.025	0.074	-0.164	0.246	0.012
	(-0.20)	(0.51)	(-1.05)	(1.58)	(0.09)
Lag 2	-0.125	-0.196	-0.110	0.067	0.155
	(-1.01)	(-1.32)	(-0.46)	(0.49)	(0.93)
Lag 3	0.133	-0.167	0.031	-0.236	0.180
	(1.05)	(-1.06)	(0.17)	(-1.33)	(0.88)
Obs.	54	55	55	54	54
R^2	0.035	0.080	0.056	0.072	0.029

Table 2: Drivers of growth-rate differences across select investment funds.

The table shows the link between growth-rate differences across various types of investment funds and lagged interest rates (Panel A) or lagged inflation (Panel B). MMFs are money-market mutual funds and mREITs are mortgage real-estate investment trusts. The variables "Treas. in MFs," "Eq. in MFs," and "Corp. Bonds in MFs" refer to the growth rates of Treasuries, equities, and corporate and foreign bonds held by mutual funds. *t*-statistics are shown in parentheses. The data are annual and are from the Financial Accounts of the United States. The sample covers 1965 (or later, based on data availability) to 2022. All variables are standardized, and the coefficients can be interpreted as the effect of a one-standard deviation change in the independent variables in terms of standard deviations of the dependent variable.

Growth-rate difference b/w:	MMFs vs. Treas. in MFs	MMFs vs. mREITs	MMFs vs. Eq. in MFs	Eq. in MFs vs. Treas. in MFs	Corp. Bonds in MFs vs. Treas. in MFs
Panel A: Effect of lagged rate changes					
ΔTreas_{y-1}	0.376**	0.345**	0.151	-0.108*	-0.061
	(2.51)	(2.40)	(1.47)	(-1.74)	(-0.46)
Obs.	48	48	48	56	56
R^2	0.145	0.122	0.023	0.011	0.003
Panel B: Effect of lagged inflation					
ΔCPI_{y-1}	0.304**	0.231	0.173*	-0.035	0.132
	(2.01)	(1.62)	(1.70)	(-0.54)	(0.92)
Obs.	48	48	48	56	56
R^2	0.092	0.053	0.030	0.001	0.018

Table 3: Interest rates and the growth rate of corporate-bond holdings: Life insurers.

GrowthSpread is the difference between the growth rate of the holdings (i) of corporate and foreign bonds and (ii) of "safe assets" at life insurers. "Safe assets" include Treasury and Agency securities. Growth rates are calculated using level tables from the Financial Accounts of the United States divided by corresponding lagged values. The set of covariates includes changes in BAA corporate bond spreads, which account for valuation effects. t-statistics are shown in parentheses. Intercepts are not reported. See Section 4 for variable definitions. The three rightmost specifications show results from Newey-West regressions with two lags; other columns are based on OLS regressions with heteroskedasticity-consistent standard errors. The quarterly sample runs from the first quarter of 2010 to the second quarter of 2023. All variables are standardized, hence the coefficients can be interpreted as the effect of a one-standard deviation change in the independent variables in terms of standard deviations of the dependent variable.

Dep. Var.:	$GrowthSpread_q$ for life insurers							
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treas_{q-1}$	-0.278**	-0.284**	-0.304**	-0.215	-0.273*	-0.278**	-0.284**	-0.285*
	(-2.10)	(-2.24)	(-2.12)	(-1.15)	(-1.77)	(-2.06)	(-2.10)	(-1.93)
ΔBAA_q	-0.512**	-0.538***	-0.536**	-0.533***	-0.511**	-0.512**	-0.538**	-0.538**
	(-2.62)	(-2.72)	(-2.59)	(-2.69)	(-2.52)	(-2.11)	(-2.17)	(-2.37)
ΔGDP_{q-1}		0.151***					0.151***	0.151**
		(3.17)					(3.62)	(2.06)
ΔGDP_{q-2}			0.080					
			(0.66)					
$\Delta GDPexp_{q-2}^{q+4}$				0.178				
				(1.09)				
VIX_{q-2}					0.119			
					(1.04)			
$GrowthSpread_{q-1}$								-0.001
								(-0.01)
Obs.	53	53	52	52	52	53	53	53
R^2	0.298	0.320	0.306	0.318	0.314			

Table 4: Interest rates and the growth rate of corporate bond holdings: Defined-benefit pension funds.

GrowthSpread is the difference between the growth rate in the holdings (i) of corporate and foreign bonds and (ii) of "safe assets" at defined-benefit pension funds. "Safe assets" include Treasuries and Agencies securities. Growth rates are calculated using level tables from the Financial Accounts of the United States divided by corresponding lagged values. The set of covariates includes changes in BAA corporate bond spreads, which account for valuation effects. t-statistics are shown in parentheses. Intercepts are not reported. See Section 4 for variable definitions. The three rightmost specifications show results from Newey-West regressions with two lags; other columns are based on OLS regressions with heteroskedasticity-consistent standard errors. The quarterly sample runs from the first quarter of 2010 to the second quarter of 2023. All variables are standardized, hence the coefficients can be interpreted as the effect of a one-standard deviation change in the independent variables in terms of standard deviations of the dependent variable.

Dep. Var.:	$GrowthSpread_q$ for DB pension funds							
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treas_{q-1}$	-0.448***	-0.447***	-0.417***	-0.521***	-0.454***	-0.448***	-0.447***	-0.392**
	(-4.23)	(-4.09)	(-3.82)	(-3.80)	(-3.94)	(-3.73)	(-3.75)	(-2.30)
ΔBAA_q	-0.501***	-0.495***	-0.437**	-0.483***	-0.502***	-0.501**	-0.495**	-0.510**
	(-2.95)	(-2.83)	(-2.24)	(-2.78)	(-2.93)	(-2.41)	(-2.29)	(-2.28)
ΔGDP_{q-1}		-0.036					-0.036	0.012
		(-0.41)					(-0.39)	(0.14)
ΔGDP_{q-2}			-0.229**					
			(-2.67)					
$\Delta GDPexp_{q-2}^{q+4}$				-0.161				
				(-0.91)				
VIX_{q-2}					-0.017			
					(-0.17)			
$GrowthSpread_{q-1}$								0.150
								(0.73)
Obs.	53	53	52	52	52	53	53	53
R^2	0.384	0.385	0.426	0.393	0.378			

Table 5: Interest rates and the growth rate of corporate bond holdings: Defined-contribution pension funds.

GrowthSpread is the difference between the growth rate in the holdings (i) of corporate and foreign bonds and (ii) of "safe assets" at defined-contribution pension funds. "Safe assets" include Treasuries and Agencies securities. Growth rates are calculated using level tables from the Financial Accounts of the United States divided by corresponding lagged values. The set of covariates includes changes in BAA corporate bond spreads, which account for valuation effects. *t*-statistics are shown in parentheses. Intercepts are not reported. See Section 4 for variable definitions. The three rightmost specifications show results from Newey-West regressions with two lags; other columns are based on OLS regressions with heteroskedasticity-consistent standard errors. The quarterly sample runs from the first quarter of 2010 to the second quarter of 2023. All variables are standardized, hence the coefficients can be interpreted as the effect of a one-standard deviation change in the independent variables in terms of standard deviations of the dependent variable.

Dep. Var.:	$GrowthSpread_q$ for DC pension funds							
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Treas_{q-1}$	-0.411***	-0.412***	-0.351***	-0.382**	-0.379***	-0.411***	-0.412***	-0.337***
	(-4.06)	(-4.10)	(-3.48)	(-2.66)	(-3.69)	(-3.80)	(-3.76)	(-2.73)
ΔBAA_q	-0.459**	-0.462**	-0.434**	-0.450**	-0.457**	-0.459**	-0.462**	-0.496**
	(-2.58)	(-2.50)	(-2.19)	(-2.35)	(-2.56)	(-2.25)	(-2.14)	(-2.20)
ΔGDP_{q-1}		0.017					0.017	0.070
		(0.24)					(0.25)	(1.08)
ΔGDP_{q-2}			-0.075					
			(-1.12)					
$\Delta GDPexp_{q-2}^{q+4}$				-0.048				
				(-0.31)				
VIX_{q-2}					-0.104			
					(-1.27)			
$GrowthSpread_{q-1}$								0.203
								(1.06)
Obs.	53	53	52	52	52	53	53	53
R^2	0.345	0.345	0.330	0.326	0.337			

Table 6: Interest rates and the growth rate of corporate-bond holdings: Excluding the Covid-19 pandemic.

The table shows the coefficients on changes in Treasury yields from regressions similar to those in Tables 3, 4, and 5, with the quarterly sample running from 2010 to 2019.

Dep. Var.:	$GrowthSpread_q$							
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Life insurers				
$Treas_{q-1}$	-0.034	-0.010	-0.038	0.036	-0.038	-0.034	-0.010	0.020
	(-0.26)	(-0.07)	(-0.24)	(0.21)	(-0.22)	(-0.20)	(-0.06)	(0.14)
				Defined-benefit pension funds				
$Treas_{q-1}$	-0.424***	-0.422***	-0.396**	-0.451***	-0.396***	-0.424**	-0.422**	-0.170
	(-3.58)	(-3.46)	(-2.63)	(-3.34)	(-2.88)	(-2.65)	(-2.50)	(-1.33)
				Defined-contribution pension funds				
$Treas_{q-1}$	-0.561***	-0.532***	-0.414**	-0.559***	-0.444**	-0.561**	-0.532**	-0.172
	(-3.33)	(-3.01)	(-2.45)	(-3.17)	(-2.65)	(-2.65)	(-2.45)	(-1.63)

Table 7: Differences in search-for-yield coefficients across intermediary types.

The table shows statistical-significance levels for tests that search-for-yield coefficients ($\beta_{Treas_{q-1}}$) are equal for different types of intermediaries. Tests are conducted with the seemingly unrelated estimation of Weesie (1999). Dots indicate that coefficients are not statistically different, while asterisks indicate that coefficients are statistically different at the 1% (***), 5% (**), and 10% (*) levels. The regressions are similar to those in Tables 3 to 6. Rows show results from specifications with different sets of controls. The quarterly sample runs from the first quarter of 2010 to either the second quarter of 2023 (left panel) or the fourth quarter of 2019 (right panel).

	Sample					
	2010-2023			2010-2019		
	Null tested (by column):			Null tested (by column):		
	$\beta^{IC}_{Treas_{q-1}} = \beta^{DB}_{Treas_{q-1}}$	$\beta^{IC}_{Treas_{q-1}} = \beta^{DC}_{Treas_{q-1}}$	$\beta^{DB}_{Treas_{q-1}} = \beta^{DC}_{Treas_{q-1}}$	$\beta^{IC}_{Treas_{q-1}} = \beta^{DB}_{Treas_{q-1}}$	$\beta^{IC}_{Treas_{q-1}} = \beta^{DC}_{Treas_{q-1}}$	$\beta^{DB}_{Treas_{q-1}} = \beta^{DC}_{Treas_{q-1}}$
Controls						
ΔBAA_q	.	.	.	**	**	.
ΔBAA_q; ΔGDP_{q-1}	.	.	.	**	**	.
ΔBAA_q; ΔGDP_{q-2}	.	.	.	*	.	.
ΔBAA_q; $\Delta GDPexp^{q+4}_{q-2}$	**	.	.	**	**	.
ΔBAA_q; VIX_{q-2}	.	.	.	*	.	.

Table 8: Changes in corporate-bond holdings in times of financial-market stress.

Changes are quarter-on-quarter percent growth rates of corporate and foreign bonds held by life insurance companies (IC), defined-benefit pension funds (DB PF) and defined-contribution pension funds (DC PF). Orthogonalized holdings changes are computed with regressions of growth rates on changes in BAA corporate bond yields. Quarters with high stress are those in which the maximum within-quarter value of the implied-volatility index VIX is in the top quintile of its distribution across quarters. Asterisks in the "Difference" rows indicate statistical significance at the 10% (*), 5% (**), or 1% (***) levels, respectively. The quarterly sample runs from the first quarter of 2010 to the second quarter of 2023.

Variable	Sample	IC	DB PF	DC PF
Holdings changes	High-stress quarters	-0.20	0.19	0.14
	Other quarters	1.45	1.89	2.16
	Difference	-1.64*	-1.71*	-2.02**
Holdings changes (orth.)	High-stress quarters	-0.09	0.21	0.62
	Other quarters	1.41	1.89	2.02
	Difference	-1.50*	-1.67*	-1.40*