Reaching for Duration

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Abstract

Using novel long-run historical data on U.S. bank balance sheets, we show that banks' maturity mismatch has risen nearly four-fold since the mid-1980s, moving in close lockstep with declining interest rates and term premia. In this paper, we argue that these trends are related and rationalize them in a model of bank portfolio choice. When term premia or short-term rates decline, banks increase their investments in long-term assets to remain profitable. This "reaching for duration" effect is convex in the degree of term premium compression. The resulting maturity mismatch renders banks increasingly vulnerable to self-fulfilling runs by uninsured depositors. Banks can partially offset the duration pressure by expanding lending, but this channel is weak when credit markets are saturated. Our findings show that quantitative easing, which compresses term premia and removes duration risk from the private sector, may paradoxically concentrate it on bank balance sheets and make the financial system more vulnerable to depositor runs.

Keywords: Term premium, maturity mismatch, net interest margin, quantitative easing, financial stability.
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1 Introduction

Banks' maturity mismatch—the fact that bank liabilities have a shorter duration than their assets—creates an inherent instability of the financial system. When a bank takes on redeemable deposits and invests in long-term assets, a sudden increase in interest rates lowers the market value of bank assets and can lead to a rapid withdrawal of deposits. Such risks have materialized in the past and resulted in failures of financial institutions, as during the U.S. Savings and Loan Crisis in the late 1980s and the more recent regional banking stress in 2023 around the failure of Silicon Valley Bank.

In this paper, we document new empirical evidence on the maturity structure of U.S. commercial bank balance sheets. Using historical Call Report vintages dating back to 1959, we show that banks' maturity mismatch has widened significantly over the past decades. We measure this mismatch by the *maturity gap*: the difference between the value-weighted average maturity of bank assets and the value-weighted average maturity of bank liabilities. Over our sample, this gap has moved in close lockstep with the general level of interest rates and term premia. In the mid-1980s, when the federal funds rate exceeded 10 percent and term premia were at historical highs, the maturity gap stood at roughly 2 years. As both short- and long-term yields declined over subsequent decades—and as term premia compressed alongside them—banks steadily extended the duration of their assets. The maturity gap rose to about 5 years around the Global Financial Crisis and continued to widen through the prolonged period of near-zero policy rates and successive rounds of Federal Reserve quantitative easing (QE), which aimed to reduce term premia further. During the most recent zero-lower-bound episode and the pandemic-era QE of 2020–2021, banks sharply increased both the overall size of their balance sheets and the duration of their loans and securities, pushing the maturity gap to a peak of approximately 7.5 years in mid-2022—close to a four-fold increase relative to its trough in the mid-1980s.

These empirical patterns raise a number of salient questions. First, why do banks tend to *increase* the duration of their assets precisely when interest rates decline and term premia compress—an environment in which the compensation for bearing duration risk is smallest? Second, do banks optimally engage in such behavior, knowing that it increases their exposure to a potential rise in interest rates and the associated risk of deposit outflows and bank runs? Third, why do we not observe a decline in bank maturity mismatch during periods of quantitative easing, as these policies are intended to remove duration risk from the private sector?

To answer these questions, we develop a model of bank portfolio choice with profitability concerns. We consider a bank that is endowed with equity and deposits, which together fund a portfolio of short-term and long-term assets. The short-term asset pays the prevailing policy rate. The long-term asset is a bond which earns a return that de-

composes into expected future short rates and a term premium—the compensation for bearing duration risk. The bank possesses deposit market power: it passes through only a fraction of changes in market rates to depositors, generating a valuable deposit franchise. After the bank chooses its portfolio allocation, the short rate is subject to a shock. Shareholders are risk-averse and seek to stabilize the bank's profits by choosing the share invested in the long-term bond.

Within this environment, we show that banks can perfectly insulate their profit margins from interest rate shocks by choosing a "hedging portfolio" allocation. This portfolio matches the duration of assets to the duration of non-repricing liabilities, that is, the bank's funding whose costs does not adjust with market rates. This result generalizes the central finding of Drechsler, Savov, and Schnabl (2021) to a setting with a more general capital structure. However, banks may choose to deviate from the hedging portfolio and allocate a larger share toward the long-term asset to earn the term premium. The optimal portfolio trades off additional return against variance in profits, and the higher the term premium, the more the bank invests in the long-term bond. Thus, without additional frictions, this model cannot explain the empirical pattern of rising maturity gaps at times when rates are low and term premia are compressed.

We therefore take profitability concerns of banks into account. When choosing the optimal portfolio, the bank faces the constraint that its costs have to be covered by current earnings, that is, its profit margins cannot turn negative. In practice, banks face several operating costs: for branches, personnel, compliance, and technology. We document that such noninterest expenses are substantial in the data, accounting for around 2.5% of total assets for the aggregate U.S. banking sector.

The profitability constraint gives rise to a *reaching-for-duration* effect. For the constraint to remain slack, the bank has to generate sufficient interest income. However, when short-term interest rates or term premia are low enough, the bank's unconstrained portfolio allocation no longer generates sufficient income to satisfy the profitability constraint. Beyond this threshold, the bank is forced to increase its expected return on assets by investing more in the high-yielding asset and thus extending the duration of its investments.

One prominent reason for a decline in the term premium is quantitative easing. When a central bank conducts QE, it purchases long-term securities from the banking system and credits banks' reserve accounts in return. Because reserves carry zero maturity, a natural first-order view of QE is that it removes duration risk from bank balance sheets. Under this view, banks' maturity mismatch—and hence their exposure to interest rate risk—should decline during periods of large-scale asset purchases. When banks generate sufficient interest income such that the profitability constraint is not binding, asset purchases by the central bank incentivize banks to lower their long-term bond holdings, as the compensation for duration risk is reduced.

However, beyond the critical profitability threshold, QE has the opposite effect: Since banks need to reach for duration to achieve a sufficiently high expected return on their investments, QE *increases* bank maturity mismatch. Thus, a policy that intends to remove duration risk from private portfolios ends up concentrating such risk within the banking sector. We further show that this effect is convex: The more the term premium is compressed, the larger the incremental increase in duration required to cover costs.

The reach-for-duration effect is more likely to arise in low-interest-rate environments, where returns to short-term assets and bank deposit franchise values are diminished, leaving little room to absorb bank operating costs. Our model thus provides a unified explanation for the empirical patterns we document: The secular rise in bank maturity mismatch as yields and term premia have fallen, and the acceleration of this trend during QE episodes.

Next, we introduce bank runs into our framework, building on recent work by Drechsler, Savov, Schnabl, and Wang (2025) and Jiang, Matvos, Piskorski, and Seru (2024). A central premise of these papers is that runs need not rely on the illiquidity of bank assets, as in Diamond and Dybvig (1983). Instead, a run equilibrium can arise even when assets are perfectly liquid—as the bonds in our model—since the withdrawal of uninsured depositors implies a loss of a bank's valuable deposit franchise, which can render a bank insolvent. Importantly, a larger maturity mismatch implies a greater exposure to a rise in interest rates, which erodes a bank's value and, hence, increases the likelihood of a self-fulfilling run. Thus, when banks reach for duration due to profitability concerns, they also raise their exposure to a withdrawal of uninsured depositors. Banks optimally engage in such risk exposure since they need to generate sufficient income to remain solvent. Quantitative easing can therefore sow the seeds of financial instability: by compressing term premia, it pushes banks into portfolios that are increasingly vulnerable to an interest rate reversal that an eventual policy tightening would bring.

Thus far, we limit the bank's investment opportunities to two assets: a short-term asset paying the market rate and a long-term bond. In an extension, we allow the bank to issue loans and explore how this additional margin affects the bank's portfolio and its need to reach for duration. Loans pay the same return as the long-term bond plus a credit spread, which provides further spread income and therefore an additional buffer before profitability concerns arise. We assume that two frictions limit bank lending: a downward-sloping demand curve for credit, which implies that the credit spread decreases with the volume of lending, and credit risk, which exposes the bank to potential loan losses. We show that the strength of these two frictions determines whether banks extend their bond or their loan portfolios when they face profitability pressure. When credit risk is the dominant friction and credit spreads are largely insensitive to volume, banks actively substitute loans for bonds as term premia compress. In contrast, when diminishing returns to lending dominate, the loan book is approximately fixed and all adjustment

flows through the bond portfolio. Whether banks also *reach for credit risk* therefore depends on the nature of the credit market frictions they face.

Our findings resonate with the experience of Silicon Valley Bank (SVB) and the regional banking crisis of 2023. During 2020–2021, SVB experienced a large inflow of uninsured deposits and invested much of the additional funds in long-term securities, as the bank faced limited lending opportunities in the technology sector. When interest rates rose sharply in 2022, the market value of these securities plummeted, generating unrealized losses that are widely believed to have triggered the run on SVB in March 2023. Through the lens of our model, SVB's decision to take on substantial interest rate risk may have been optimal from an ex-ante perspective rather than a failure of risk management. The bank operated in an environment of historically low term premia—driven in part by the Federal Reserve's asset purchase programs—policy rates near the zero lower bound, and a strained regional lending market. Facing these conditions, the model predicts that a bank would invest heavily in long-term securities, even taking into account that doing so raises its vulnerability to a run by uninsured depositors. From an ex-post perspective, this investment strategy appears imprudent, but it may nonetheless have been the bank's best available response given the investment opportunities it faced.

Finally, we return to the baseline model without runs or loans and allow the term premium to respond endogenously to banks' collective demand for long-term assets. This extension is motivated by evidence in Haddad and Sraer (2020) that banks actively influence the pricing of interest rate risk. We show that an amplification mechanism emerges when banks are under solvency pressure: as the term premium declines, banks increase their holdings of long-term securities, which in turn compresses the term premium further. This additional compression tightens the solvency constraint, requiring yet more duration exposure. Beyond a critical threshold, the feedback between bank demand for duration and term premium compression becomes self-reinforcing and a doom loop emerges, such that no equilibrium with solvent banks exists.

Literature. Our paper contributes to several strands of literature. First, a large literature studies, both empirically and theoretically, how different interest rate environments affect banks' profitability and their portfolio decisions, which can be traced back to Flannery (1981) and Flannery (1983). The main findings from this line of research are that low rates depress bank profitability, incentivizing them to take more risks, through a variety of theoretical mechanisms that range from changes in banks' capital structure to banks' deposit market power, among others, see Maddaloni and Peydró (2011), Dell'Ariccia et al. (2014), English et al. (2018), Claessens et al. (2018), Drechsler et al. (2018), Gomez et al. (2020), Di Tella and Kurlat (2021), Wang et al. (2022), and Begenau et al. (2025). Within this literature, several papers have studied the implications of low rates for the transmission of conventional monetary policy to the economy (see, for example, Abadi

et al. (2023), Ulate (2021), and Wang (2025), among others). Relative to this literature, our contribution is to underscore the effects of the term premium, together with the level of interest rates, and their consequences on bank profitability, creating incentives for duration risk-taking—which we label as "reaching for duration."[1] In doing so, we emphasize the consequences of reaching for duration for understanding the effects of QE, which is designed to lower the term premium. According to our mechanism, QE policies—which have the intention to remove duration from the private sector—can, paradoxically, create the incentives to concentrate duration risk in banks.

Another strand of literature investigates banks' concerns for profitability. This literature establishes a more aggressive credit extension of banks when interest rates are low and banks target higher earnings (for example, see Borio and Zhu (2012), Diamond and Rajan (2012), Jimenez et al. (2014), Hansen and Stein (2015), Dell'Ariccia et al. (2017), Granja et al. (2022), among others). Relative to this literature, we show that profitability concerns manifest themselves as banks reaching for duration when interest rates are low. We also show that changes in the term premium lead to a similar outcome. Our analysis therefore highlights the reallocation of interest rate risk as a result quantitative easing.

Our paper also has implications for understanding banks' vulnerability to runs, contributing to a recent literature motivated by the March 2023 events in particular (Haddad et al. (2024); Jiang et al. (2024); Nagel et al. (2024); Drechsler et al. (2025)), and to the literature relating financial stability and monetary policy more broadly (Stein (2012); Boyarchenko et al. (2022); Ajello et al. (2022)). We contribute to this strand of literature by showing that QE policies, designed to depress the term premium, incentivize banks to reach for duration, exposing them to the risk of depositor runs. Thus, our results highlight a trade-off between unconventional monetary policy and financial stability risks: while QE can potentially stabilize markets in the short run, it may end up exposing banks to excessive duration risks, triggering depositors to run following an interest rate reversal after a period of monetary easing.

The remainder of the paper is organized as follows. Section 2 presents the empirical evidence on bank maturity mismatch. Section 3 develops the baseline model and derives the reaching-for-duration mechanism. Section 4 introduces deposit franchise runs. Section 5 extends the model to include bank lending and credit risk. Section 6 analyzes the endogenous term premium and the feedback loop. Section 7 concludes.

[1] Bauer and Rudebusch (2020) show that incorporating the secular decline in the level of interest rates improves the estimates of the term premium, highlighting the importance of understanding both concepts in a unified framework. Our paper is consistent with this insight but focuses on its implications for understanding banks' portfolios.

2 Empirical Evidence

This section documents new empirical evidence on the maturity structure of U.S. commercial bank balance sheets. We construct a long time series of the average maturity of bank assets and liabilities using data from the Federal Financial Institutions Examination Council (FFIEC) Consolidated Reports of Condition and Income ("Call Reports"), covering the period from 1959 to the present. While the existing literature has relied on the maturity and repricing schedules available in modern Call Reports—typically from the late 1990s onward (see, e.g., Paul, 2023)—a contribution of this paper is to extend the series back to 1959 using older reporting forms whose maturity data have not previously been utilized.

2.1 Data

Our data are drawn from the Call Reports filed by all commercial banks operating in the United States and regulated by the Federal Reserve System (FRS), the FDIC, and the OCC. These data provide bi-annual and since 1974 quarterly information on balance sheets on a consolidated basis. The data are digitally available at the Federal Reserve.

The reporting forms have undergone several major revisions since the late 1950s, with substantial changes in the maturity and repricing categories reported. We identify seven distinct reporting regimes and map the relevant variables across each transition. Tables A.2–A.10 in the appendix provide a complete description of all variables used, including their variable codes, the corresponding maturity or repricing buckets, and the time periods over which each variable is available.

Reporting forms. We construct the data using several FFIEC reporting forms that have evolved over time (see Table A.1 for a summary and the appendix for detailed descriptions of each form): the FFIEC 010 (domestic banks with less than $100M in assets, 1959–1983), the FFIEC 012 (domestic offices only, 1978–1983), the FFIEC 014 (banks with foreign offices, 1969–1983), the FFIEC 015 (large banks supplement, 1976–1983), the FFIEC 031 (banks with foreign offices, 1984–present), the FFIEC 032–034 (domestic-only banks by size, 1984–2000), and the FFIEC 041 (all domestic-only banks, 2001–present).

Asset maturity data. On the asset side, we collect data on the maturity or repricing distribution of securities (Treasury notes and bonds, agency obligations, municipal bonds, and other debt securities), loans and leases (broken down by type where available), and other interest-bearing assets. Cash assets and federal funds sold are assigned zero maturity. For each maturity bucket, we assign a representative maturity weight equal to the

midpoint of the bucket, if available (see Tables A.2–A.6 for all weights used).[2]

The data coverage on the asset side begins in 1959:Q2, although the earliest periods provide only limited detail on securities maturities. From 1974:Q2 onward, the reporting becomes substantially richer, with separate maturity breakdowns for different security types and—from large banks via the FFIEC 015—for different loan categories. The 1984 revision introduced a unified maturity/repricing schedule covering loans, securities, and other interest-bearing assets. From 1988 onward, fixed-rate and floating-rate positions are reported separately. The post-1997 schedule adds finer maturity bins (up to six buckets per asset class) and separates mortgage pass-throughs, other MBS, closed-end loans, and other loans.

Liability maturity data. On the liability side, we collect maturity and repricing information on time deposits (broken down by size threshold), non-deposit interest-bearing liabilities, subordinated debt, and limited-life preferred stock where available. Demand deposits, transaction deposits, and nontransaction savings deposits are assigned a repricing frequency of zero. Liability maturity data begins later than asset data—the FFIEC 015 large-bank supplement first reported time deposit maturities starting in 1976:Q1.

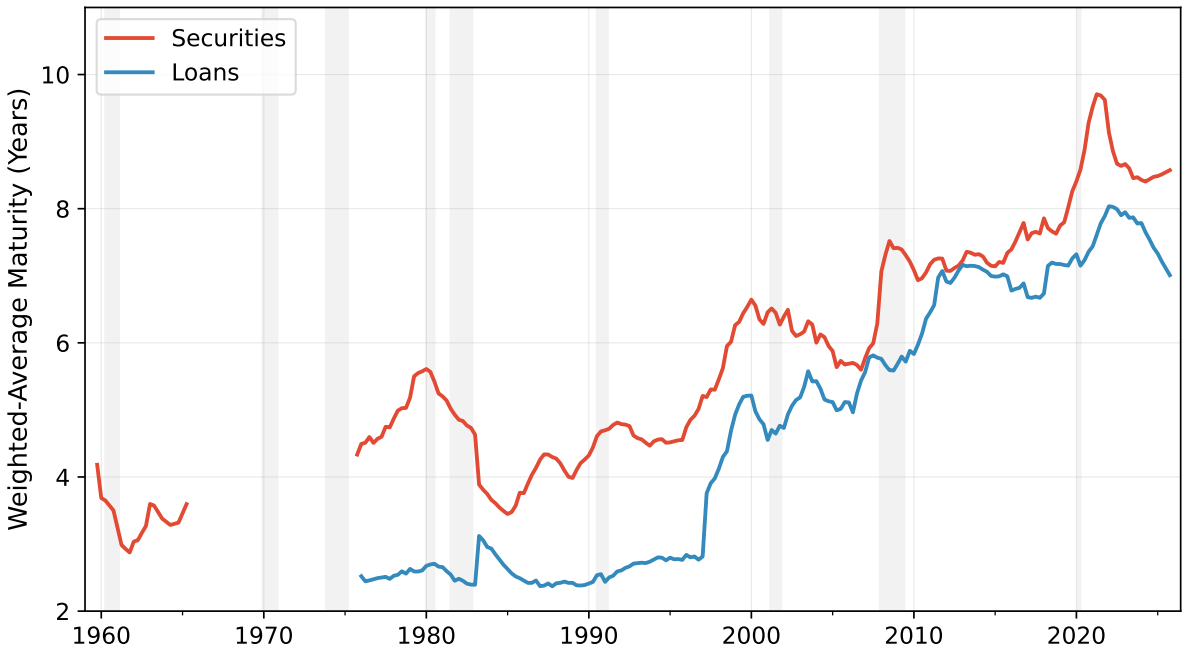
The liability reporting also evolves over time. From 1984 to 1987, time deposits are split into those above and below $100,000, with a fine repricing grid that also covers nondeposit interest-bearing liabilities, subordinated notes and debentures, and limited-life preferred stock. From 1988 onward, the split between fixed-rate and floating-rate time deposits becomes available. In 1997, a revised set of maturity bins was introduced. In 2017, the size threshold for large time deposits shifted from $100,000 to $250,000, reflecting the change in the FDIC insurance limit. Tables A.7–A.10 document all liability variables across reporting regimes.

2.2 Results

Using the data described above, we construct four quarterly time series of weighted-average maturity (in years): (i) total assets, (ii) total liabilities, (iii) securities only, and (iv) loans only. Each series is computed as a value-weighted average across the universe of reporting banks in a given quarter. Because earlier reporting regimes include fewer balance-sheet categories, the level of the series should be interpreted with some caution around transition dates; however, within each regime, the series provide a consistent measure of the maturity structure.

[2]For open-ended maturity/repricing buckets (e.g., >5 years), we either assume a specific maturity or match the weighted maturity of subsequent years for the same asset types and maturity spectrum at a point where there is a transition between reporting periods, which reduces possible biases for earlier periods.

Figure 1: Weighted-Average Maturity of Securities and Loans



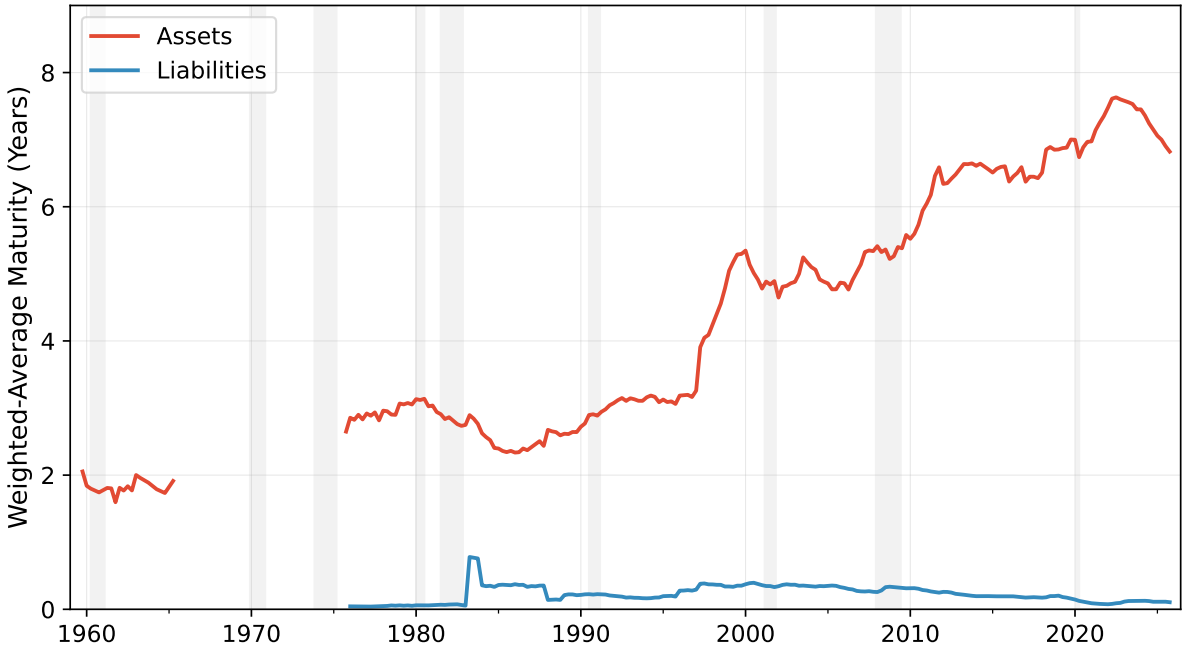
Notes: This figure plots the value-weighted average maturity (in years) of bank securities and loan portfolios. Securities maturity is available from 1959:Q4; loan maturity from 1976:Q1. Shaded areas denote NBER recession dates.

Securities and loan maturities. We begin with the maturity of securities and loans separately, as these are the two main interest-bearing asset classes on bank balance sheets. Figure 1 plots the two time series. Securities maturity is available from 1959:Q4 onward; loan maturity begins in 1976:Q1, when the FFIEC 015 large-bank supplement first provided maturity breakdowns by loan type.

Several patterns stand out. In the early 1960s, the average maturity of bank securities portfolios was between 3 and 4 years. Maturity rose during the 1970s, reaching roughly 5.5 years around 1980, before declining to about 4 years by the late 1980s. From the mid-1990s onward, securities maturity increased markedly—surpassing 6 years by 2000 and continuing to climb. The series peaked near 9.7 years in 2021.

Loan maturities display a broadly similar upward trend, but start from a lower level. In the late 1970s, the average loan maturity was approximately 2.5 years, reflecting the prevalence of short-term commercial lending. The series remained relatively flat through the early 1990s at around 2.4–3 years, then began a sustained increase that brought it to roughly 8 years by 2020. By the end of our sample, loan maturity stands at about 7 years.

Figure 2: Weighted-Average Maturity of Assets and Liabilities



Notes: This figure plots the value-weighted average maturity (in years) of total bank assets and liabilities. Asset maturity is available from 1959:Q4; liability maturity from 1976:Q1. Shaded areas denote NBER recession dates.

Asset and liability maturities. We next turn to the maturity of total assets and total liabilities. Total asset maturity combines the securities and loan components documented above with cash, federal funds, and other interest-bearing assets, all aggregated using the same value-weighted methodology. Total liability maturity aggregates time deposits (broken down by size), nondeposit interest-bearing liabilities, subordinated debt, and limited-life preferred stock where available. Demand deposits, transaction deposits, and nontransaction savings deposits are assigned a repricing frequency of zero, which pulls the liability average substantially below the asset average.

Figure 2 shows that the average maturity of assets begins at around 2 years in the early 1960s and rises gradually over time, reaching about 3 years in the early 1980s. A pronounced upward shift occurs in the late 1990s as loans and securities both lengthen, and asset maturity climbs past 5 years by the early 2000s. In recent years, the average has exceeded 7 years, peaking at 7.6 years in 2022.

By contrast, liability maturity is an order of magnitude smaller. The series begins in 1976:Q1 and peaked at roughly 9 months in 1984, when high interest rates incentivized depositors to lock in longer-term time deposits. Since then, liability maturity has trended downward to about 1–2 months in recent years, reflecting the growing dominance of demand and savings deposits in bank funding.

The maturity gap. The maturity gap—defined as the difference between the weighted-average maturity of assets and liabilities—is a summary measure of the duration mismatch on bank balance sheets. Figure 3 plots this series from 1976:Q1, the first quarter for which both components are available.

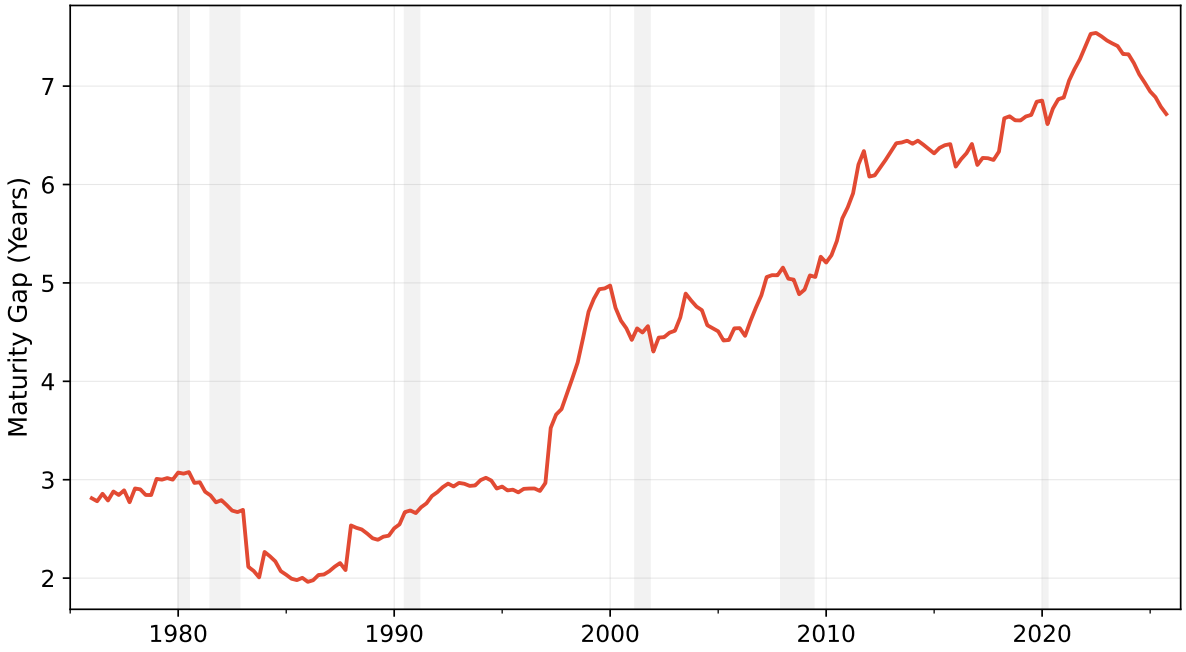
The most striking feature of Figure 3 is the secular increase in the maturity gap over the past five decades. In the early part of the sample, the gap hovered around 2.5–3 years, reaching a low of about 2 years in 1986. This trough coincided with the peak of the Volcker disinflation, when the federal funds rate exceeded 10 percent and long-term yields were similarly elevated, as shown in Figure 4. From the mid-1990s onward, the maturity gap widened dramatically as interest rates embarked on a long decline. The gap surpassed 5 years around the time of the Global Financial Crisis and continued to increase through the subsequent period of near-zero policy rates and large-scale Federal Reserve asset purchases (QE1 in 2008–2010, QE2 in 2010–2011, QE3 in 2012–2014). During the most recent zero-lower-bound episode and the pandemic-era quantitative easing of 2020–2021, the gap reached a peak of approximately 7.5 years in mid-2022. By the end of our sample, it stands at about 6.7 years.

The comovement between the maturity gap and the general level of interest rates suggests that banks systematically extend duration when rates are low. This pattern is also consistent with the behavior of term premia: estimates from Adrian, Crump, and Moench (2013), plotted in Figure 4, show that term premia at various maturities peaked in the early 1980s and have since declined to historically low levels. A lower term premium reduces the compensation banks receive for bearing duration risk and, paradoxically, may encourage further reaching for duration as banks seek to maintain net interest margins. Taken together, the evidence points to an environment in which both the low level of interest rates and compressed term premia have contributed to a historically large maturity mismatch in the U.S. banking sector. Motivated by these historical patterns, we develop a model that formalizes such mechanisms in what follows.

3 Baseline Model

This section develops a model of bank portfolio choice in which banks reach for duration. The model has the following key ingredients: deposit market power, a term premium on long-term assets, stochastic short-term interest rates, risk-averse shareholders, and bank operating costs. We introduce each in turn, derive the bank's optimal portfolio, and show how a decline in term premia—which could be caused, among other forces, by the implementation of QE—push the bank into a region in which it has incentives to reach for duration.

Figure 3: The Maturity Gap



Notes: This figure plots the maturity gap, defined as the difference between the value-weighted average maturity of total assets and total liabilities (in years). The series begins in 1976:Q1, the first quarter for which both asset and liability maturity data are available. Shaded areas denote NBER recession dates.

3.1 Environment

Consider a three-period economy ($t = 0, 1, 2$) with a continuum of identical banks. We describe the problem for a representative bank.

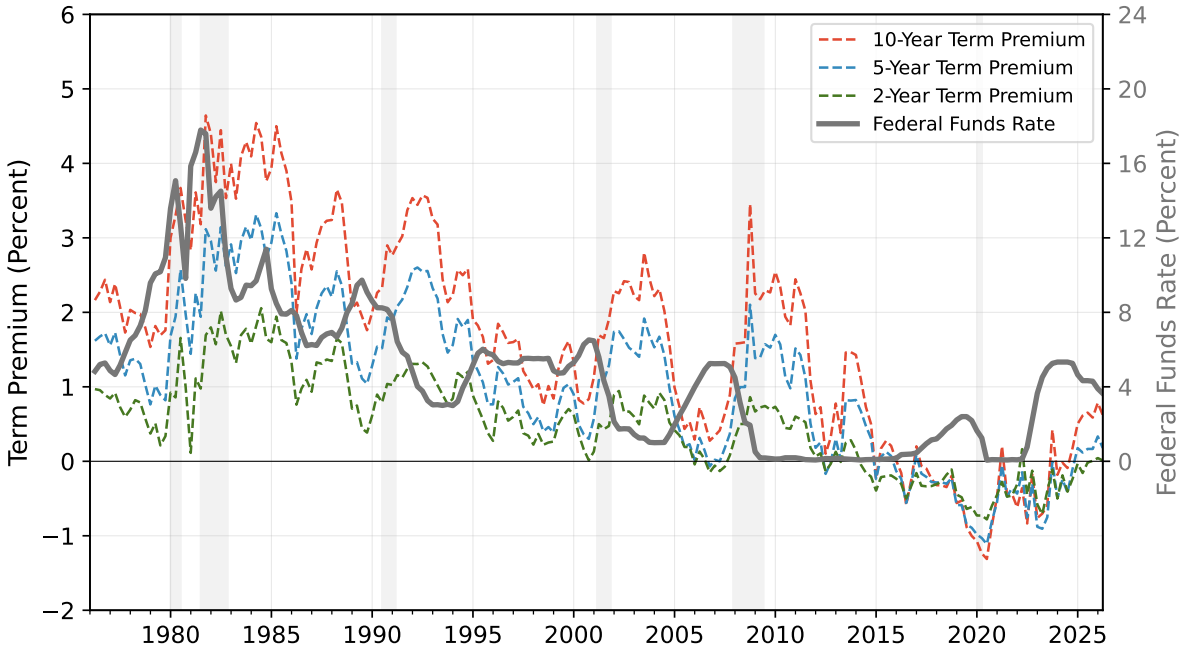
Balance sheet. The bank has total assets normalized to one, funded by deposits $1 - e$ and equity $e \geq 0$:

$$\underbrace{\alpha}_{\text{long bond}} + \underbrace{(1-\alpha)}_{\text{short asset}} = \underbrace{(1-e)}_{\text{deposits}} + \underbrace{e}_{\text{equity}}.$$

The portfolio share $\alpha \in [0, 1]$ is the bank's choice variable.

Assets. The bank chooses between two assets at $t = 0$, a short-term and a long-term asset. The short-term asset is a one-period bond yielding r_S per period, rolled over at $t = 1$. The long-term asset is a two-period bond yielding $r_B = \frac{1}{2}(r_S + \mathbb{E}[r'_S]) + \tau$, that is, the average expected yield on the short term asset plus a term premium $\tau > 0$. The term premium compensates the bank for bearing duration risk. We specify the stochastic process for r_S below.

Figure 4: Term Premia and Federal Funds Rate



Notes: This figure plots the effective Federal Funds rate and term premia estimates for the 2-, 5-, and 10-year maturities from Adrian, Crump, and Moench (2013). Shaded areas denote NBER recession dates.

Deposit market power. The bank pays a below-market deposit rate $r_D = \beta\, r_S$, where $\beta \in [0, 1]$ is the *deposit beta*. This parameter measures how much of a change in market rates is passed through to depositors: $\beta = 1$ means full pass-through (no market power), while $\beta = 0$ implies the bank pays no interest on deposits regardless of market rates. We define the *effective repricing share*:

$$B \equiv (1 - e)\beta,$$

which captures the fraction of the bank's total funding that reprices with market rates. It combines the deposit beta, β, with the deposit share, $1 - e$.

Interest rate shock. At $t = 1$, after period-1 cash flows are realized, the short rate shifts from r_S to $r_S + \varepsilon$, where ε has mean zero ($\mathbb{E}[\varepsilon] = 0$) and variance σ_ε^2. The shock affects the reinvestment rate on short-term assets and the deposit rate in period 2 (since $r'_D = \beta(r_S + \varepsilon)$). The long bond is unaffected: it matures at $t = 2$ and pays $(1 + r_B)$ regardless of ε. The bank therefore faces *reinvestment risk*, not mark-to-market risk.

Shareholders. Shareholders have mean-variance preferences over terminal profits Π_2 at $t = 2$:

$$U(\alpha) = \mathbb{E}[\Pi_2] - \frac{\rho}{2}\,\mathrm{Var}[\Pi_2], \tag{1}$$

where $\rho > 0$ represents shareholders' coefficient of risk aversion.

Operating costs. The bank pays a fixed operating cost $c > 0$ per period. We assume $c > (1 - B)r_S$, so that the non-repricing income alone is insufficient to cover costs: the bank must earn the term premium to survive.

3.2 Net Interest Margin and Terminal Profits

Period 1. The bank earns income on its assets, pays interest on deposits, and faces per period operating costs. In what follows, we term the combined profit margin the bank's net interest margin (NIM). Bank accounting typically does not include operating costs into bank's net interest margins. For the lack of a better label, we use net interest margin in what follows, though one could alternatively call the profit margin "net operating income" or simply "net income." At $t = 1$, the bank's NIM is given by:

$$\mathrm{NIM}_1 = \underbrace{r_S + \alpha\tau}_{\text{asset income}} - \underbrace{(1-e)\beta\, r_S}_{\text{deposit cost}} - \underbrace{c}_{\text{operating costs}} = s + \alpha\tau - c,$$

where

$$s \equiv (1 - B)\, r_S$$

is the bank's *non-repricing income*: the return on total assets (r_S) minus the repricing cost of deposits ($(1-e)\beta\, r_S$). It includes both the deposit franchise $(1-\beta)r_S$ per unit of deposits and the return $e\, r_S$ on equity-funded assets.

Period 2. At $t = 1$, after the shock ε is realized, the bank reinvests its cash at $r_S + \varepsilon$ and the long bond matures at par. Terminal profits are:

$$\Pi_2 = \big[(1-\alpha) + \mathrm{NIM}_1\big](1 + r_S + \varepsilon) + \alpha(1 + r_B) - (1-e)\big[1 + \beta(r_S + \varepsilon)\big] - c.$$

In the small-rate approximation ($r_S, \tau \ll 1$), this simplifies to:

$$\Pi_2(\varepsilon, \alpha) = \underbrace{e + 2(s + \alpha\tau - c)}_{\equiv\, a(\alpha)} + \underbrace{\big[(1-B) - \alpha\big]}_{\equiv\, b(\alpha)} \cdot \varepsilon. \tag{2}$$

Terminal profits are linear in the rate shock ε, with intercept a (equity plus cumulative NIM over both periods) and slope b (the bank's interest rate exposure).

Interest rate exposure. The bank's exposure to the rate shock is:

$$\frac{\partial \Pi_2}{\partial \varepsilon} = b(\alpha) = (1 - B) - \alpha. \tag{3}$$

When rates rise, $\varepsilon > 0$, two forces operate. First, the bank's non-repricing income appreciates: it earns more on reinvested cash and the spread over repricing deposits widens. Second, the duration position loses: the long bond earns only the fixed coupon r_B while the short rate has risen. The net exposure is zero when α equals the non-repricing share $1 - B$.

The hedging portfolio. Setting the exposure (3) to zero gives the hedging portfolio:

$$\alpha^{\text{hedge}} = 1 - B = (1 - \beta) + e\beta. \tag{4}$$

Equation (4) generalizes the central result of Drechsler, Savov, and Schnabl (2021) to a more generic liability structure: *the bank should match the duration of its assets to the duration of its non-repricing liabilities.* When $e = 0$, the hedge reduces to $1 - \beta$—the deposit franchise. With $e > 0$, the hedge increases by $e\beta$, because equity-funded assets create additional non-repricing income that must be hedged with duration.

When banks choose the hedge portfolio, their terminal profits are deterministic: $\Pi_2 = a(\alpha^{\text{hedge}})$ regardless of ε. Any deviation from the hedge—in either direction—introduces variance.

3.3 The Bank's Problem

Expected utility. Computing the moments of (2), we have

$$\mathbb{E}[\Pi_2] = a(\alpha) = e + 2(s + \alpha\tau - c), \tag{5}$$

$$\text{Var}[\Pi_2] = b(\alpha)^2 \sigma_\varepsilon^2 = \big[(1 - B) - \alpha\big]^2 \sigma_\varepsilon^2. \tag{6}$$

Substituting (5) and (6) into the mean-variance objective (1), we obtain

$$U(\alpha) = e + 2(s + \alpha\tau - c) - \frac{\rho\sigma_\varepsilon^2}{2}\big[(1 - B) - \alpha\big]^2. \tag{7}$$

The first term in (7) is the expected NIM over both periods, plus the equity from the first period. The second term is the risk cost, whose minimum value is at the hedge portfolio, $\alpha = 1 - B$.

Per-period equivalent. Since the bank's per-period problem is the natural unit of comparison, we work with $U(\alpha)/2$. Expanding the quadratic, we obtain

$$\frac{U(\alpha)}{2} = \text{const} + \tilde{\tau}\,\alpha - \frac{\gamma}{2}\,\alpha^2,$$

where we define

$$\begin{aligned} \gamma &\equiv \tfrac{1}{2}\,\rho\sigma_\varepsilon^2 \\ \tilde{\tau} &\equiv \tau + \gamma(1-B). \end{aligned} \tag{8}$$

The expression (8), $\tilde{\tau}$, is the *effective return to duration* and has two components. The first, τ, is the term premium: bank earns a higher yield by holding long-term assets. The second term, $\gamma(1-B)$, is the *hedging benefit*: the first $1-B$ units of duration *reduce* the bank's variance, and the risk-averse bank values this variance reduction at rate γ per unit. Both components make duration attractive for banks, but for different reasons.

Profitability constraint. We posit the bank faces a profitability constraint in $t=1$, which demands that its net interest margin must be non-negative:

$$s + \alpha\tau - c \geq 0 \quad \Longleftrightarrow \quad \alpha \geq \frac{c-s}{\tau} \equiv \underline{\alpha}(\tau). \tag{9}$$

Note that this constraint also holds for period 2 in expectation since $\mathbb{E}[\text{NIM}_2] = \text{NIM}_1$ (as $\mathbb{E}[\varepsilon] = 0$). While NIM_1 is deterministic, NIM_2 can deviate from its expected value due to non-zero realizations of ε.[3] The profitability constraint can be motivated by empirical evidence showing that the ratio of banks' net income to assets (return on assets) is relatively stable over time at around 1 percent, as shown in Appendix Figure 12. While we assume a non-zero net income requirement, we could equally demand that banks have a positive required net income target, without changing any of our following results. The profitability constraint (9) implies a minimum required duration $\underline{\alpha}(\tau)$ which is a decreasing, convex function of the term premium: as τ falls, the bank needs progressively more duration exposure just to cover its costs.

Note that the bank cannot circumvent the profitability constraint by liquidating long-term assets at $t=1$. At that point, the shock ε has been realized and the long bond trades at its fair value $p = (1+r_S+\tau)/(1+r_S+\varepsilon)$. Selling Δ units at this price and reinvesting the proceeds at the short rate $r_S+\varepsilon$ leaves terminal profits Π_2 unchanged for every realization of ε: the sale is a zero-net-present-value transaction. Since NIM_1 is determined by the portfolio chosen at $t=0$ and is likewise unaffected by the sale,

[3] For any given realization of ε, the period-2 NIM is $\text{NIM}_2(\varepsilon) = \text{NIM}_1 + [(1-B)-\alpha]\,\varepsilon$. When $\alpha > 1-B$ (the bank overshoots the hedge to earn the term premium), rate increases reduce period-2 NIM. This downside risk is what the variance term in the mean-variance objective penalizes.

liquidation cannot relax the period-1 profitability constraint.

Optimal Portfolio. The first-order condition of (3.3) gives the interior optimum:

$$\alpha^*_{\text{int}} = \frac{\tilde{\tau}}{\gamma} = (1 - B) + \frac{\tau}{\gamma}. \tag{10}$$

The optimal portfolio has two components:

1. A *hedging component*, $1 - B$, which eliminates interest rate risk entirely, as shown above.
2. A *myopic component*, τ/γ, which earns the term premium at the cost of additional variance.

As τ falls, the myopic component shrinks and α^* converges to the hedge portfolio: the bank still holds substantial duration (to hedge), but the myopic component vanishes.

When does the profitability constraint bind? The profitability constraint binds when $\alpha^*_{\text{int}} < \underline{\alpha}(\tau)$:

$$(1 - B) + \frac{\tau}{\gamma} < \frac{c - s}{\tau} \quad \Longleftrightarrow \quad \tau^2 + \gamma(1 - B)\tau < \gamma(c - s). \tag{11}$$

This holds for τ below the threshold:

$$\tilde{\tau} = \frac{-\gamma(1 - B) + \sqrt{\gamma^2(1 - B)^2 + 4\gamma(c - s)}}{2}. \tag{12}$$

When $e = 0$ and $\beta = 1$ (no deposit market power, no equity), $B = 1$ and this simplifies to $\tilde{\tau} = \sqrt{\gamma c}$.

3.4 Exogenous term premium

We close the model by assuming an exogenous process for the term premium. This process can be motivated, for example, as a sequence of exogenous shocks to central bank's purchases of long-term bonds that compresses the term premium. We extend the analysis to an endogenous term premium in Section 6.

We assume,

$$\tau(Q) = \bar{\tau} - \delta Q, \tag{13}$$

where $Q \geq 0$ follows some exogenous process. One possible interpretation for Q is that it captures the scale of QE, while $\bar{\tau}$ is the pre-QE term premium, and $\delta > 0$ is the sensitivity of the term premium to central bank purchases. Equation (13) can be interpreted as a reduced-form specification that captures the main channel emphasized in the literature: by absorbing duration from the market, QE reduces the compensation investors require

for holding long-term bonds. Alternatively, Q can be interpreted as capturing structural forces in the economy that banks take as given.

The effect of Q on the bank's portfolio decisions depends on the regime. When $\tau(Q) > \tilde{\tau}$ (the profitability constraint is slack), the bank's response is straightforward: it reduces its myopic demand as the term premium falls, since the reward for bearing duration risk has declined. When $\tau(Q) \leq \tilde{\tau}$ (the profitability constraint binds), banks are forced to increase their duration exposure to cover costs—i.e., banks reach for duration.

3.5 Equilibrium

Combining the optimal portfolio with (13) gives the equilibrium:

$$\alpha^*(Q) = \max\left\{(1-B) + \frac{\tau(Q)}{\gamma}, \quad \frac{c-s}{\tau(Q)}\right\}. \tag{14}$$

Proposition 1 (Reach for Duration)**.** *There exists a threshold $\hat{Q} = (\bar{\tau} - \tilde{\tau})/\delta$ such that:*

1. *For $Q < \hat{Q}$ (unconstrained regime): the profitability constraint is slack and*

$$\alpha^* = (1-B) + \frac{\bar{\tau} - \delta Q}{\gamma}. \tag{15}$$

   The bank overshoots the hedge to earn the term premium. The myopic component, τ/γ, is decreasing in Q.

2. *For $Q \geq \hat{Q}$ (constrained regime): the profitability constraint binds and*

$$\alpha^* = \frac{c-s}{\bar{\tau} - \delta Q}. \tag{16}$$

   The bank reaches for duration: α^* is increasing in Q, with

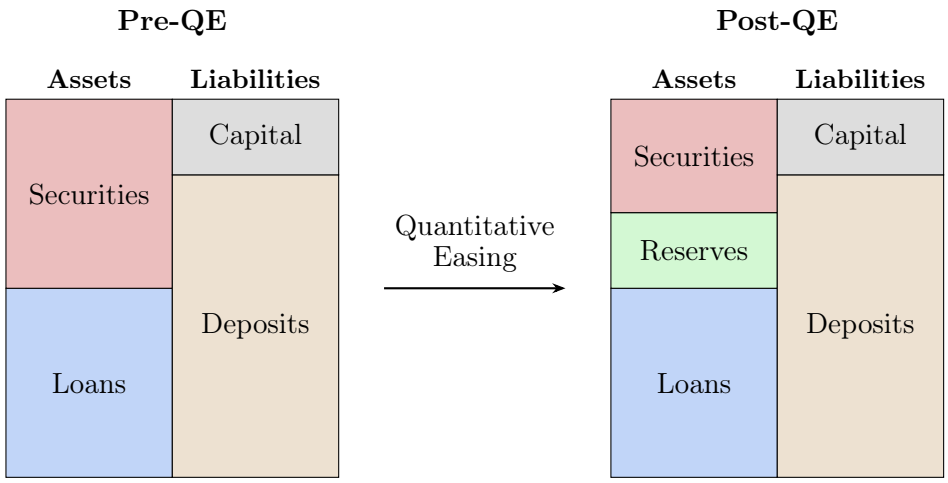
$$\frac{d\alpha^*}{dQ} = \frac{\delta(c-s)}{(\bar{\tau} - \delta Q)^2} > 0. \tag{17}$$

   Moreover, α^* is convex in Q: the marginal effect of Q on maturity mismatch is increasing.

Banks are unprofitable when $\tau(Q) < c - s$, i.e., when $Q > (\bar{\tau} - c + s)/\delta$.

Intuition. When the term premium is high, banks voluntarily overshoot their hedge to earn the term premium. A decline in τ reduces this overshoot. However, once τ falls below $\tilde{\tau}$, banks are squeezed: the only way to generate enough NIM to cover operating costs is to load up on long-term assets. The flatter the yield curve becomes, the more duration the bank needs, creating a "reach for duration." Note that this effect is convex: when the term premium is small, a further compression in τ would incentivize banks to reach for duration at an even stronger pace.

Figure 5: The Effect of Quantitative Easing on Bank Balance Sheets



Notes: This figure illustrates the effect of quantitative easing on a stylized bank balance sheet. A central bank purchases securities from banks and credits their reserve accounts, replacing long-duration securities with zero-duration reserves while leaving loans, deposits, and capital unchanged.

One potential reason for a fall in the term premium is quantitative easing. In such a program, securities are replaced by reserves, while loans, deposits, capital, and the overall size of the balance sheet remain unchanged, all else equal (see Figure 5 for a stylized impact on the bank's balance sheet). Because reserves carry zero maturity, a natural first-order view of QE is that it removes duration risk from bank balance sheets. Under this view, banks' maturity mismatch—and hence their exposure to interest rate risk—should decline during periods of large-scale asset purchases. In our model, when banks generate sufficient interest income, asset purchases by the central bank would incentivize banks to lower their long-term bond holdings, as the compensation for duration risk is reduced.

However, beyond the critical profitability threshold, QE has the opposite effect: it *increases* bank maturity mismatch rather than decreasing it. Thus, a policy that intends to remove duration risk from private portfolios ends up concentrating such risk within the banking sector, in contrast to the simple view based on Figure 5. Proposition 1 further shows that this effect is convex: the more the term premium is compressed, the larger the incremental increase in duration required to cover costs. The reach-for-duration effect is more likely to arise in low-interest-rate environments, where returns to short-term assets and bank deposit franchise values are diminished, leaving little room to absorb bank operating costs.

3.6 Graphical Illustration and Comparative Statics

Figure 6 illustrates the equilibrium in (τ, α) space for a calibration motivated by U.S. banking data. We set the deposit beta to $\beta = 0.44$, which is the asset-weighted average across U.S. commercial banks, following calculations based on Drechsler, Savov, and Schnabl (2021).[4] The operating cost is set to $c = 0.025$, matching approximately the ratio of aggregate non-interest expenses to total assets reported in the FDIC's Quarterly Banking Profile.[5] The equity ratio is calibrated to $e = 0.06$, corresponding to the minimum Tier 1 capital ratio under Basel III. We set $r_S = 0$, and hence $s = 0$, to capture the zero lower bound, where the non-repricing income $s = (1 - B)r_S$ vanishes. The risk-cost parameter $\gamma = 0.5$ is chosen for illustration. This calibration implies $B = (1 - e)\beta = 0.414$, a hedge portfolio of $1 - B = 0.586$, and a threshold $\tilde{\tau} \approx 0.038$.

The blue line in Figure 6 is the FOC curve $\alpha^*_{\text{int}} = (1 - B) + \tau/\gamma$, which is linear with intercept $1 - B$ (the hedge portfolio). The orange line is the survival curve $\alpha^*_{\text{bind}} = (c - s)/\tau$, which is a decreasing convex function. They cross at $\tilde{\tau}$. The equilibrium path (thick line) follows the FOC for $\tau > \tilde{\tau}$ and switches to the survival curve for $\tau < \tilde{\tau}$.

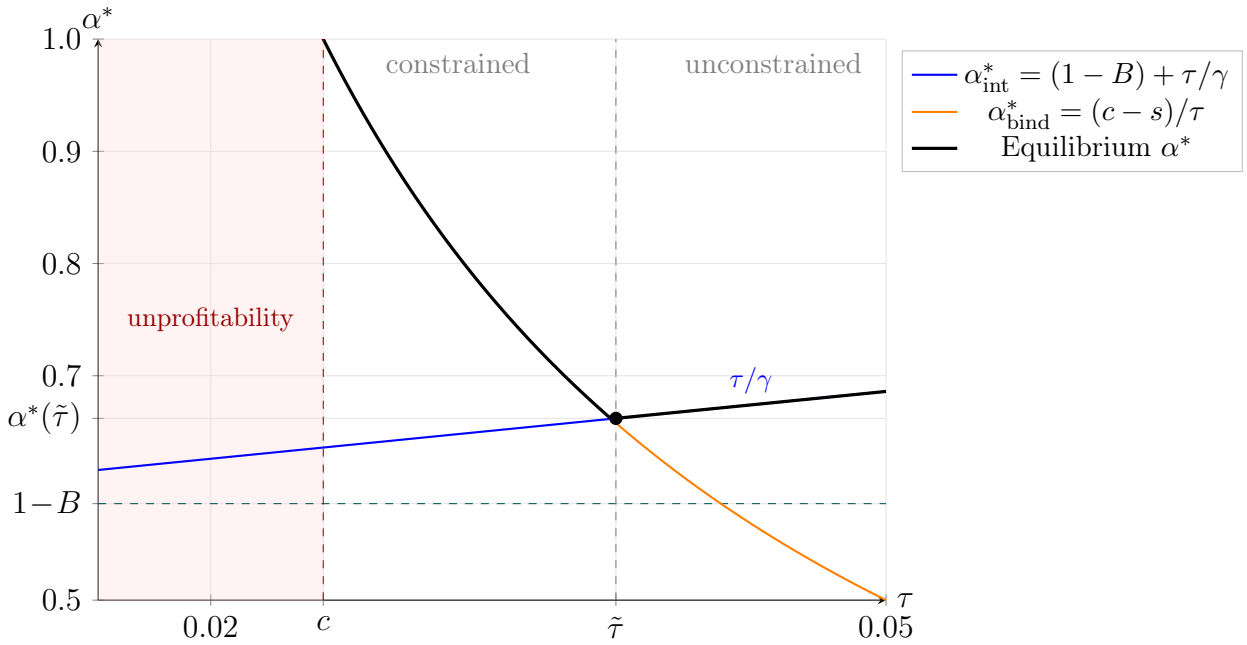


Figure 6: Equilibrium maturity mismatch at the zero lower bound ($s = 0$). Parameters: $\beta = 0.44$, $e = 0.06$, $c = 0.025$, $\gamma = 0.5$ (so $B = 0.414$, $1 - B = 0.586$, $\tilde{\tau} \approx 0.038$).

The model generates several intuitive comparative statics:

Rate level (r_S). A decline in the short rate reduces the bank's non-repricing income, $s = (1-B)r_S$, which tightens the profitability constraint: the minimum required duration

[4] See https://pages.stern.nyu.edu/~pschnabl/data/data_deposit_beta.htm.
[5] See https://www.fdic.gov/quarterly-banking-profile.

$\underline{\alpha}(\tau) = (c - s)/\tau$ rises, and the reach-for-duration region expands. Lower rates therefore make it more likely that the profitability constraint binds at any given term premium, consistent with the empirical evidence in Section 2. In the limit, at the zero lower bound ($r_S \to 0$), non-repricing income vanishes entirely regardless of B, and the constraint tightens maximally ($c - s \to c$). Since the zero lower bound is also the environment in which central banks resort to unconventional tools like QE, the two forces—low rates squeezing bank income and QE compressing the term premium—reinforce each other in driving banks' maturity choice.

Deposit market power (β). A bank with stickier deposits (lower β, hence lower B) has a larger hedge portfolio $1 - B$ and holds more duration at any τ. It also has a higher non-repricing income $s = (1 - B)r_S$, which relaxes the profitability constraint: $\tilde{\tau}$ is lower, so the reach-for-duration region is smaller. Banks with more deposit market power are therefore *both* more heavily invested in duration *and* less vulnerable to the reach-for-duration pressure.

Equity (e). Higher equity increases $1-B$, because $B = (1-e)\beta$ falls, raising the hedge. It also raises $s = (1 - B)r_S$, relaxing the profitability constraint. Well-capitalized banks hold more duration but are less likely to be squeezed by a decline in the term premium.

Rate volatility (σ_ε^2). Higher volatility increases $\gamma = \frac{1}{2}\rho\sigma_\varepsilon^2$, which reduces the myopic component, τ/γ. That is, the bank is more cautious about exceeding the hedge. Lower interest-rate volatility also raises $\tilde{\tau}$, making the constrained regime more likely. In volatile rate environments, banks stay closer to their hedge but are also more likely to be pushed into the constrained region.

3.7 Discussion of Assumptions

The baseline model makes two simplifying assumptions that merit discussion: the portfolio is restricted to $\alpha \in [0, 1]$, and the deposit base is fixed at $1 - e$. We argue that the first is an innocuous normalization, while the second is important to the mechanism.

Portfolio restriction. If we allow $\alpha \in [0, \bar{\alpha}]$ for some $\bar{\alpha} > 1$—permitting the bank to borrow at the short rate, as in wholesale funding markets, and invest in the long bond—the unconstrained optimum $\alpha^*_{\text{int}} = (1 - B) + \tau/\gamma$ and the survival curve $\underline{\alpha}(\tau) = (c - s)/\tau$ are unchanged, as is the threshold $\tilde{\tau}$. The only difference is the unprofitability condition: the bank becomes unprofitable when $\alpha^* > \bar{\alpha}$, i.e., when $\tau < (c - s)/\bar{\alpha}$. Higher leverage capacity delays unprofitability in term premium space but does not eliminate the profitability constraint or the reach for duration. The restriction $\bar{\alpha} = 1$ is therefore a normalization; in practice, $\bar{\alpha}$ can be interpreted as a leverage constraint.

Fixed deposits. The assumption that the bank's deposit base $1-e$ is fixed is substantive. When deposits are endogenous, the bank can resolve profitability pressure by adjusting its balance sheet size rather than distorting its portfolio. To see this, let total deposits be A (a choice variable) and write the bank's profit as $\Pi = A(s+\alpha\tau) - C(A) - (\gamma/2)(\alpha A)^2$, where $C(A)$ is the total operating cost and further define the total dollar duration exposure $D = \alpha A$.

With *linear* costs $C(A) = cA$, each unit of deposits is a drag on profit when $s < c$, so the bank shrinks to the minimum balance sheet compatible with its desired duration $D^* = \tau/\gamma$. The portfolio share is $\alpha = 1$ everywhere, and the profitability constraint $s + \tau \geq c$ is independent of the portfolio—the reach for duration through portfolio rebalancing disappears.

With *convex* costs $C(A) = (c/2)A^2$, the bank has interior optima for both size ($A^* = s/c$) and duration ($D^* = \tau/\gamma$).[6] The two decisions decouple: the bank adjusts its balance sheet to equate the marginal cost of deposits to the net return s, and adjusts duration to trade off τ against γ. The profitability constraint is always slack, and the reach for duration vanishes entirely.

In either case, the reach-for-duration mechanism requires the deposit base to be outside the bank's short-run control. This can be motivated by evidence that deposit bases are sticky (Bolton, Li, Wang, and Yang, 2025): banks cannot easily shed deposits or attract new ones through rate adjustments, particularly at the effective lower bound where deposit rates are compressed toward zero.

4 Deposit Franchise Runs

In this section, we extend the baseline model with deposit franchise runs. The objective is to understand the extent to which reaching for duration can put banks in a fragile position in which self-fulfilling bank runs are more likely to occur. To this end, we build on Drechsler et al. (2025) and Jiang et al. (2024) who show that runs of uninsured depositors can occur even when bank assets are fully liquid.

4.1 Setup and Run Condition

The setting is identical to Section 3, with two modifications. First, the bank's deposit base $1-e$ is split into *insured* and *uninsured* deposits. A fraction $\varphi \in (0,1)$ of deposits is uninsured and the remainder $1-\varphi$ is insured. Both types pay the same rate βr_S, so all formulas from Section 3—including $B = (1-e)\beta$, the hedge $1-B$, and the profitability

[6] The bank chooses total assets A and dollar duration $D = \alpha A$ to maximize $\Pi = As + D\tau - (c/2)A^2 - (\gamma/2)D^2$. The first-order conditions give $A^* = s/c$ and $D^* = \tau/\gamma$, with portfolio share $\alpha^* = c\tau/(\gamma s)$. Maximized profit is $\Pi^* = s^2/(2c) + \tau^2/(2\gamma) > 0$. The profitability constraint requires $A^*s + D^*\tau \geq (c/2)(A^*)^2$, which simplifies to $s^2/(2c) + \tau^2/\gamma \geq 0$—satisfied for all parameter values.

constraint—carry through unchanged. The distinction between insured and uninsured deposits matters only for the possibility of a run. Second, we assume the interest rate shock is uniformly distributed, $\varepsilon \sim U[-\bar{\varepsilon}, \bar{\varepsilon}]$, so that $\mathbb{E}[\varepsilon] = 0$ and the run probability can be computed in closed form.

Run condition. Following Drechsler et al. (2025), when uninsured depositors withdraw, the bank loses the deposit franchise it would have earned on their deposits in period 2. We assume that the bank meets deposit withdrawals by borrowing in the short-term funding market at rate $r_S + \varepsilon$. The lost franchise value, in present-value terms at $t = 1$, is therefore:

$$\Delta_V(\varepsilon) = \frac{\varphi(1-e)(1-\beta)(r_S+\varepsilon)}{1+r_S+\varepsilon}. \tag{18}$$

A run is self-fulfilling if, after losing the uninsured franchise, the bank's market value at $t = 1$ turns negative.[7] Equivalently, in terminal-wealth terms: $\Pi_2(\varepsilon, \alpha) < \Delta_W(\varepsilon)$, where $\Delta_W = (1 + r_S + \varepsilon)\,\Delta_V$. Using (2) and dropping the small constant $\varphi(1-e)(1-\beta)r_S$ relative to equity e, the run condition reduces to $\varepsilon > \varepsilon^*(\alpha)$, where:[8]

$$\varepsilon^*(\alpha) = \frac{a(\alpha)}{\alpha - \tilde{B}}, \qquad \tilde{B} \equiv e + (1-e)(1-\varphi)(1-\beta). \tag{19}$$

The threshold ε^* has a clear interpretation. The numerator $a(\alpha) = e + 2(s + \alpha\tau - c)$ is the bank's buffer (equity plus cumulative NIM). The denominator $\alpha - \tilde{B}$ is the bank's net duration exposure beyond the *insured franchise hedge* $\tilde{B}$: the portion of income that survives a run because it comes from equity-funded assets and insured deposits. More duration (higher α) or a smaller buffer (lower a) reduces ε^* and makes runs more likely.

We impose two assumptions. First, when a self-fulfilling run is possible ($\varepsilon > \varepsilon^*$), it occurs (worst-case equilibrium selection). Second, the bank has sufficient equity that fundamental unprofitability—defined as $\Pi_2 < 0$ absent any run—does not occur within the shock's support $[-\bar{\varepsilon}, \bar{\varepsilon}]$.[9]

[7] The market value at $t = 1$ is $V_1 = \Pi_2/(1 + r_S + \varepsilon)$, since the bank's only remaining cash flow is terminal wealth Π_2 at $t = 2$. The run condition $V_1 < \Delta_V$ is therefore equivalent to $\Pi_2 < \Delta_W$, where $\Delta_W(\varepsilon) = \varphi(1-e)(1-\beta)(r_S+\varepsilon)$ is the franchise loss in terminal-wealth units. We state the condition in market-value terms to align with Drechsler et al. (2025), but work with terminal wealth Π_2 for algebraic convenience.

[8] Retaining the constant term would shift ε^* slightly without changing the qualitative results. To derive the threshold, note that $\Pi_2 < \Delta_W$ becomes $a + b\varepsilon < \varphi(1-e)(1-\beta)\varepsilon$, where $b = (1-B) - \alpha$. Rearranging: $a < [\varphi(1-e)(1-\beta) - b]\varepsilon = [\varphi(1-e)(1-\beta) - (1-B) + \alpha]\varepsilon$. Since $1 - B = e + (1-e)(1-\beta)$, the bracket simplifies to $\alpha - [e + (1-e)(1-\varphi)(1-\beta)] = \alpha - \tilde{B}$.

[9] Fundamental unprofitability requires $\varepsilon > a/(\alpha - (1-B))$, which exceeds ε^* since $\tilde{B} < 1 - B$. The assumption therefore requires $a/(\alpha - (1-B)) > \bar{\varepsilon}$ for all relevant α, ensuring that the only source of bank failure is a self-fulfilling run.

4.2 Run Onset and the Three Regimes

At the constrained portfolio $\alpha^* = (c-s)/\tau$, the profitability constraint binds with $\text{NIM}_1 = 0$, so the buffer reduces to equity alone: $a = e$. The run threshold becomes:

$$\varepsilon^*(\tau) = \frac{e\,\tau}{c - s - \tilde{B}\,\tau}, \tag{20}$$

which is increasing in τ: as the term premium falls, the bank is more fragile. Since $\varepsilon \sim U[-\bar{\varepsilon}, \bar{\varepsilon}]$, runs are possible when $\varepsilon^*(\tau) < \bar{\varepsilon}$, which defines the *run onset threshold*:

$$\tau_{\text{run}} = \frac{\bar{\varepsilon}\,(c-s)}{e + \bar{\varepsilon}\,\tilde{B}}. \tag{21}$$

For $\tau < \tau_{\text{run}}$, the constrained bank faces a positive probability of a self-fulfilling run, with run probability $q(\tau) = (\bar{\varepsilon} - \varepsilon^*(\tau))/(2\bar{\varepsilon})$ increasing as τ falls.

We assume that the parameters are such $\tau_{\text{run}} < \tilde{\tau}$. The equilibrium therefore has three regimes:

1. **Unconstrained, no runs** ($\tau > \tilde{\tau}$): The profitability constraint is slack, $\alpha^* = (1-B) + \tau/\gamma$, and $q = 0$.
2. **Constrained, no runs** ($\tau_{\text{run}} < \tau \leq \tilde{\tau}$): The profitability constraint binds, $\alpha^* = (c-s)/\tau$, but the bank's equity buffer keeps $\varepsilon^* > \bar{\varepsilon}$, so $q = 0$.
3. **Constrained, run risk** ($c - s < \tau \leq \tau_{\text{run}}$): The profitability constraint binds and $q(\tau) > 0$, increasing as τ falls.

The run onset threshold τ_{run} is decreasing in equity e (better-capitalized banks tolerate more duration before runs become possible) and increasing in the shock range $\bar{\varepsilon}$ (a more volatile rate environment expands the run-risk region). Indeed, a bank with sufficiently high equity is immune to runs at *any* term premium: since $\varepsilon^*(\tau)$ is lowest at $\tau = c - s$ (where $\alpha = 1$), runs are impossible for all τ whenever $e \geq e^* \equiv \bar{\varepsilon}\,\psi/(1 + \bar{\varepsilon}\,\psi)$, where $\psi = 1 - (1-\varphi)(1-\beta)$.

4.3 Graphical Illustration

Figure 7 illustrates the three regimes using the Section 3 calibration with uninsured deposit share $\varphi = 0.42$ and shock bound $\bar{\varepsilon} = 0.14$. The uninsured share is consistent with FDIC data: uninsured deposits accounted for approximately 42 percent of domestic deposits in the U.S. banking sector as of the fourth quarter of 2024.[10] The shock bound is chosen so that fundamental unprofitability—i.e. $\Pi_2 < 0$ absent any run—never occurs: this requires $\bar{\varepsilon} < e/B \approx 0.145$.[11] The blue and orange curves are identical to Figure 6.

[10] The 42 percent share is computed from estimated uninsured deposits and total domestic deposits reported in Table II-A of the FDIC *Quarterly Banking Profile*, Fourth Quarter 2024; see FDIC (2025).

[11] At the most stressed constrained portfolio $\alpha = 1$ (equivalently $\tau = c - s$), the unprofitability threshold is $\tilde{\varepsilon} = e/(1-(1-B)) = e/B \approx 0.145$. Setting $\bar{\varepsilon} = 0.14 < 0.145$ ensures that fundamental unprofitability

The vertical dashed line at $\tau_{\text{run}} \approx 0.032$ separates the constrained region into two zones: to its right, the bank's equity buffer keeps $\varepsilon^* > \bar{\varepsilon}$ and runs are impossible; to its left (shaded gray), the reach for duration has pushed α high enough that self-fulfilling runs become possible. The mechanism is *not* that the bank's assets lose value—its long bond is held to maturity—but that the elevated duration means a rate increase would destroy the franchise value of uninsured deposits, triggering a rational run.

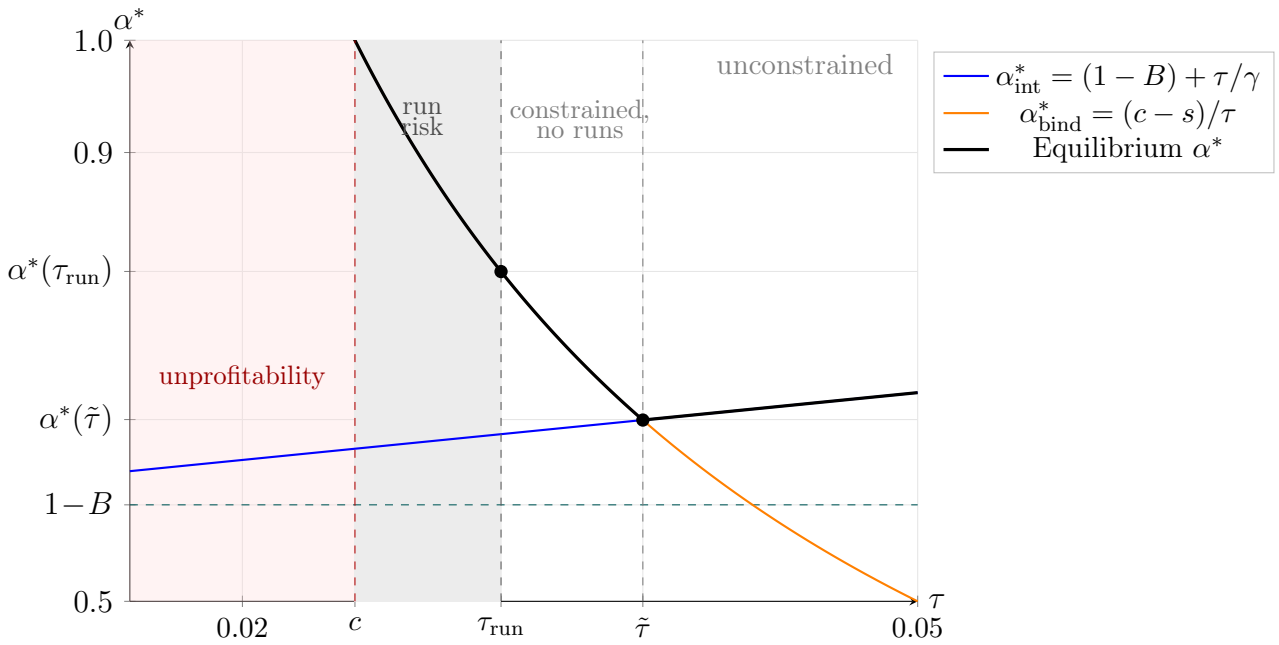


Figure 7: Equilibrium maturity mismatch with deposit franchise run risk. The blue and orange curves are as in Figure 6. To the left of τ_{run} (shaded gray), the constrained bank faces a positive probability of a self-fulfilling run by uninsured depositors. Parameters: $\varphi = 0.42$, $\bar{\varepsilon} = 0.14$; all others as in Figure 6.

5 Reaching for Credit Risk

This section extends the baseline model of Section 3 by allowing the bank to invest in risky loans alongside long-term bonds. Loans earn a credit spread above bonds but expose the bank to credit losses. The central question is how a decline in the term premium—for example, driven by QE—affects the bank's allocation between bonds and loans.

The answer depends on the nature of the friction that limits lending. When the bank expands its loan portfolio, it may face a downward-sloping demand curve for credit, requiring it to lower lending rates and accept a smaller spread to attract additional

lies outside the shock support for all $\alpha \leq 1$, so the only source of bank failure is a self-fulfilling run. This assumption also rules out risk-shifting incentives: under limited liability the bank's payoff would be $\max(\Pi_2, 0)$, which exceeds Π_2 in unprofitability states and creates a "put option" whose value is increasing in duration α. By ensuring $\Pi_2 > 0$ for all $\varepsilon \in [-\bar{\varepsilon}, \bar{\varepsilon}]$, the put is worthless and the bank has no incentive to gamble on duration.

borrowers or raise loan volumes of previous borrowers. Alternatively, the bank may be able to sustain previous spreads but must extend credit to borrowers with higher default risk, taking on additional credit risk. We model both margins and show that the strength of the loan portfolio response to a decline in the term premium depends on their relative importance. When credit risk is the dominant friction, the bank actively substitutes loans for bonds as τ falls; when diminishing spreads dominate, the loan book is approximately fixed and all adjustment flows through the bond portfolio.

5.1 Environment

The setting is identical to Section 3, except that the bank now chooses between three assets at $t = 0$: a short-term asset (share $1 - \alpha$), a long-term bond (share α_B), and a risky loan (share α_L), with

$$\alpha_B + \alpha_L = \alpha, \qquad \alpha_B, \alpha_L \geq 0. \tag{22}$$

Bonds. As before, long-term bonds yield $r_B = \frac{1}{2}(r_S + \mathbb{E}[r'_S]) + \tau$ per period and are held to maturity.

Loans. Loans yield $r_L = \frac{1}{2}(r_S + \mathbb{E}[r'_S]) + \tau + \sigma(\alpha_L)$ per period, where $\sigma(\alpha_L) \geq 0$ is the credit spread above the bond rate. The spread is decreasing in the volume of lending:

$$\sigma(\alpha_L) = \sigma_0 - \frac{\kappa}{2}\,\alpha_L, \qquad \kappa > 0. \tag{23}$$

The parameter $\sigma_0 > 0$ is the marginal spread on the first unit of lending, and κ captures the slope of the credit demand curve: the bank faces a downward-sloping demand for credit and must lower lending rates to attract additional borrowers, compressing the marginal spread. Total spread income is $S(\alpha_L) \equiv \alpha_L\,\sigma(\alpha_L) = \alpha_L(\sigma_0 - \frac{\kappa}{2}\,\alpha_L)$, which is maximized at $\alpha_L = \sigma_0/\kappa$.

Credit risk. In period 2, after the interest rate shock ε is realized, loans suffer a credit loss $\alpha_L\,\eta$, where η is a mean-zero random variable with variance σ_η^2, independent of ε. The shock η captures aggregate credit risk—defaults and recovery shortfalls—that is orthogonal to interest rate movements.

5.2 The Bank's Problem

The bank earns the term premium on all long assets and the credit spread on loans. Following the same small-rate approximation as in Section 3, terminal profits are:

$$\Pi_2 = \underbrace{e + 2\big[s + \alpha\tau + S(\alpha_L) - c\big]}_{\text{expected profits}} + \underbrace{\big[(1-B) - \alpha\big]\,\varepsilon}_{\text{interest rate risk}} - \underbrace{\alpha_L\,\eta}_{\text{credit risk}}. \tag{24}$$

The first term is the deterministic component: equity plus cumulative NIM over both periods, now augmented by spread income $S(\alpha_L)$. The second is interest rate risk, exactly as in the baseline: the bank's exposure to ε depends on total duration $\alpha = \alpha_B + \alpha_L$, with both bonds and loans contributing equally. The third is credit risk, which loads only on the loan portfolio.

Since ε and η are independent, the variance decomposes as:

$$\mathrm{Var}(\Pi_2) = \underbrace{\big[(1-B) - \alpha\big]^2\,\sigma_\varepsilon^2}_{\text{interest rate variance}} + \underbrace{\alpha_L^2\,\sigma_\eta^2}_{\text{credit variance}}. \tag{25}$$

The two risk factors enter additively and are controlled by different portfolio choices: interest rate variance depends on total duration α, while credit variance depends only on the loan share α_L.

The bank maximizes mean-variance utility $U = \mathbb{E}[\Pi_2] - (\rho/2)\,\mathrm{Var}(\Pi_2)$ subject to the profitability constraint $\mathrm{NIM}_1 \geq 0$ and non-negative portfolio shares. Using the per-period convention from Section 3.3, define the risk-cost parameters:

$$\gamma \equiv \tfrac{1}{2}\,\rho\,\sigma_\varepsilon^2, \qquad \gamma_\eta \equiv \tfrac{1}{2}\,\rho\,\sigma_\eta^2. \tag{26}$$

The parameter γ prices interest rate risk (as in the baseline), and γ_η prices credit risk. Per-period expected utility is:

$$\frac{U}{2} = \text{const} + \tilde{\tau}\,\alpha - \frac{\gamma}{2}\,\alpha^2 + S(\alpha_L) - \frac{\gamma_\eta}{2}\,\alpha_L^2, \tag{27}$$

where $\tilde{\tau} = \tau + \gamma(1-B)$ is the effective return to duration from Section 3. The first three terms are identical to the baseline objective: expected NIM from duration net of interest rate risk. The last two are the credit extension: spread income net of credit risk.

5.3 Unconstrained Regime

When the profitability constraint is slack, the bank optimizes freely over α and α_L (with $\alpha_B = \alpha - \alpha_L$). The first-order conditions are:

$$\frac{\partial(U/2)}{\partial \alpha} = \tau + \gamma\big[(1-B) - \alpha\big] = 0, \tag{28}$$

$$\frac{\partial(U/2)}{\partial \alpha_L} = \sigma_0 - \kappa\,\alpha_L - \gamma_\eta\,\alpha_L = 0. \tag{29}$$

The first condition—identical to the baseline—pins down total duration:

$$\alpha^* = (1-B) + \frac{\tau}{\gamma}. \tag{30}$$

The second directly determines the loan portfolio:

$$\alpha_L^* = \frac{\sigma_0}{\kappa + \gamma_\eta}. \tag{31}$$

Proposition 2 (Portfolio Separation)**.** *In the unconstrained regime, the bank's portfolio separates into a duration decision and a lending decision:*

$$\alpha^* = (1-B) + \frac{\tau}{\gamma}, \qquad \alpha_L^* = \frac{\sigma_0}{\kappa + \gamma_\eta}. \tag{32}$$

Total duration is the same as in the baseline (hedge plus overshoot), while the loan portfolio balances the marginal spread income $S'(\alpha_L) = \sigma_0 - \kappa\,\alpha_L$ against the marginal credit risk cost:

$$\underbrace{\sigma_0 - \kappa\,\alpha_L^*}_{S'(\alpha_L^*)} = \underbrace{\gamma_\eta\,\alpha_L^*}_{\textit{marginal credit risk cost}}. \tag{33}$$

The bond allocation absorbs all duration adjustment: $\alpha_B^* = \alpha^* - \alpha_L^*$.

The two frictions contribute additively to pinning down the loan portfolio. When $\kappa \to 0$ (constant spread), the loan allocation $\alpha_L^* = \sigma_0/\gamma_\eta$ is determined entirely by the credit-risk Sharpe ratio. When $\gamma_\eta \to 0$ (no credit risk), $\alpha_L^* = \sigma_0/\kappa$ is determined entirely by the diminishing-returns technology.

The key observation is that α_L^* is *independent of* τ. The term premium governs total duration through the myopic component τ/γ. As the term premium falls, the bank's loan book is unaffected; only the bond portfolio shrinks.

5.4 Constrained Regime

When the term premium falls below a threshold, the profitability constraint binds:

$$s + \alpha\tau + S(\alpha_L) = c \qquad \Longrightarrow \qquad \alpha = \frac{c - s - S(\alpha_L)}{\tau}. \tag{34}$$

Compared to the baseline (where $\alpha = (c-s)/\tau$), spread income $S(\alpha_L)$ partially substitutes for duration income. Loans relax the profitability constraint: each dollar of spread income reduces the required duration by $1/\tau$.

With the constraint binding, expected profits are pinned at $\mathbb{E}[\Pi_2] = e$, and the bank's objective reduces to minimizing variance. The bank's single free variable is α_L, with α determined by (34) and $\alpha_B = \alpha - \alpha_L$. Define the *excess duration* as:

$$D(\alpha_L) \equiv \alpha - (1 - B) = \frac{c - s - S(\alpha_L)}{\tau} - (1 - B), \tag{35}$$

which measures how far the bank overshoots its interest rate hedge. In the baseline with $\alpha_L = 0$, $D_0 = (c - s)/\tau - (1 - B) > 0$: the constrained bank necessarily overshoots (see, for example, Figure 6). With loans, $D < D_0$ because spread income reduces required duration.

The bank solves:

$$\min_{\alpha_L} \; V(\alpha_L) = D(\alpha_L)^2 \, \sigma_\varepsilon^2 + \alpha_L^2 \, \sigma_\eta^2. \tag{36}$$

The first-order condition equates the marginal reduction in interest rate variance to the marginal increase in credit variance:

$$\underbrace{D \cdot \frac{S'(\alpha_L)}{\tau} \cdot \sigma_\varepsilon^2}_{\text{interest rate variance reduction}} \quad = \quad \underbrace{\alpha_L \cdot \sigma_\eta^2}_{\text{credit variance increase}} \quad , \tag{37}$$

where $S'(\alpha_L) = \sigma_0 - \kappa\,\alpha_L$ is the marginal spread income. The left side captures the benefit of substituting loans for bonds: each unit of loans generates $S'(\alpha_L)$ in additional spread income, which reduces required total duration by S'/τ and therefore lowers excess duration D by the same amount. Since interest rate variance is $D^2\sigma_\varepsilon^2$, each unit reduction in D lowers it at rate $2D\,\sigma_\varepsilon^2$, giving a total marginal benefit of $2D\,(S'/\tau)\,\sigma_\varepsilon^2$ per unit of loans. The right side is the direct credit variance cost of expanding the loan book: since credit variance is $\alpha_L^2\sigma_\eta^2$, the marginal cost is $2\alpha_L\sigma_\eta^2$. The factors of two cancel, yielding (37).[12]

Limiting cases. The FOC (37) nests the two pure-friction models as special cases. When $\kappa = 0$ (pure credit risk), $S' = \sigma_0$ is constant and the FOC gives α_L in closed form

[12]The second-order condition is satisfied: $d^2V/d\alpha_L^2 = (S')^2\,\sigma_\varepsilon^2/\tau^2 + \kappa D\,\sigma_\varepsilon^2/\tau + \sigma_\eta^2 > 0$, where positivity follows from $D > 0$ and $S' > 0$ at the interior optimum.

as a function of D; the loan book responds actively to τ because D depends on τ. When $\sigma_\eta^2 = 0$ (pure diminishing returns), the right side vanishes, forcing $S'(\alpha_L) = 0$ and hence $\alpha_L = \sigma_0/\kappa$—the same as the unconstrained solution, independent of τ.

5.5 Loan Share Dynamics

How does a decline in the term premium affect the composition of the bank's long-asset portfolio? As τ falls, both loans and total duration respond, and the direction of the loan share $\lambda \equiv \alpha_L/\alpha$ depends on which adjusts faster. We derive the comparative statics for total duration and the loan portfolio, then combine them to characterize the loan share response.

Total duration. Differentiating the profitability constraint (34) with respect to τ gives:

$$\frac{d\alpha}{d\tau} = -\frac{\alpha + S'\, d\alpha_L/d\tau}{\tau}. \tag{38}$$

The first term, $-\alpha/\tau$, is the *mechanical effect*: holding loans fixed, a fall in τ forces the bank to hold more total duration to cover operating costs (this is the bonds-only response from the baseline, where $d\alpha/d\tau = -(c-s)/\tau^2$). The second term, $-S'(d\alpha_L/d\tau)/\tau$, is the *offset from loan expansion*: since $d\alpha_L/d\tau \leq 0$ (as we show next), more loans generate additional spread income, partially substituting for duration income and attenuating the required increase in α. In general, the mechanical effect dominates and $d\alpha/d\tau < 0$: total duration rises as τ falls.[13] A reversal ($d\alpha/d\tau > 0$) is theoretically possible only if the loan expansion is strong enough that the additional spread income more than compensates for the fall in τ, allowing the bank to reduce total duration.

When the loan market is deep enough that spread income can fully cover operating costs ($S(\sigma_0/\kappa) = \sigma_0^2/(2\kappa) \geq c - s$), total duration remains bounded even as $\tau \to 0$. The profitability constraint still binds in this region—the bank earns zero expected profit above equity—but it no longer forces $\alpha \to \infty$. Instead, at the extreme ($\tau = 0$), the bank holds only loans with $\alpha_B = 0$ and $S(\alpha_L) = c - s$, which pins α_L at a finite level.[14]

Loan portfolio response. Applying the implicit function theorem to the FOC (37) gives:

$$\frac{d\alpha_L}{d\tau} = -\frac{S'\,\sigma_\varepsilon^2\,(D+\alpha)}{(S')^2\,\sigma_\varepsilon^2 \;+\; \kappa\, D\,\sigma_\varepsilon^2\,\tau \;+\; \sigma_\eta^2\,\tau^2}, \tag{39}$$

[13] This holds in both limiting cases ($\kappa = 0$ and $\sigma_\eta^2 = 0$).

[14] At the loans-only corner ($\alpha_B = 0$), the constraint $\alpha_L(\tau + \sigma_0 - (\kappa/2)\alpha_L) = c - s$ has a solution for all $\tau \geq 0$ provided $\sigma_0^2 \geq 2\kappa(c-s)$. As $\tau \to 0$, $\alpha_L \to [\sigma_0 - \sqrt{\sigma_0^2 - 2\kappa(c-s)}]/\kappa$, which is finite.

where $D+\alpha = 2D+(1-B) > 0$, $S' > 0$, and $D > 0$ at any interior constrained solution, so $d\alpha_L/d\tau < 0$: the bank expands its loan portfolio as the term premium falls.[15] The mechanism is as follows. As τ falls, the profitability constraint forces more total duration, which raises excess duration D and increases the marginal benefit of substituting loans for bonds (the left side of the FOC (37) grows). The bank expands lending until the marginal credit variance cost ($\alpha_L\sigma_\eta^2$) catches up.

The three terms in the denominator govern how aggressively the bank expands. The first, $(S')^2\sigma_\varepsilon^2$, is a base term reflecting the curvature of spread income. The second, $\kappa D\sigma_\varepsilon^2\tau$, is the diminishing-returns channel (proportional to κ). The third, $\sigma_\eta^2\tau^2$, is the credit-risk channel (proportional to σ_η^2). When $\sigma_\eta^2 = 0$, the FOC forces $S'(\alpha_L) = 0$, pinning $\alpha_L = \sigma_0/\kappa$ regardless of τ, so the loan portfolio does not respond: $d\alpha_L/d\tau = 0$.

Loan share. The loan share $\lambda = \alpha_L/\alpha$ depends on both the loan and total duration responses derived above. Differentiating and substituting (38) yields:[16]

$$\frac{d\lambda}{d\tau} = \frac{\lambda}{\tau}\big(1-\Psi\big), \tag{40}$$

where the *substitution ratio* is

$$\Psi \equiv \left|\frac{d\alpha_L}{d\tau}\right| \cdot \frac{\tau + \lambda\, S'}{\alpha_L}. \tag{41}$$

Since $\lambda/\tau > 0$, the sign of $d\lambda/d\tau$ is determined entirely by $1-\Psi$. When τ falls ($d\tau < 0$): if $\Psi > 1$ then $d\lambda/d\tau < 0$, so λ rises; if $\Psi < 1$, λ falls. The substitution ratio compares the loan growth rate ($|d\alpha_L/d\tau|/\alpha_L$) to the total portfolio growth rate, with the factor $\tau+\lambda S'$ measuring the effective marginal income per unit of total duration (bonds contribute τ, while loans contribute an additional $\lambda S'$ through the credit spread).

Limiting cases and the combined model. Whether Ψ exceeds one depends on the parameters κ and σ_η^2.

Case 1: $\kappa = 0$ (pure credit risk). Here $S' = \sigma_0$ is constant. From (39), the denominator reduces to $\sigma_0^2\sigma_\varepsilon^2 + \sigma_\eta^2\tau^2$, and the FOC (37) gives $\sigma_\eta^2\tau^2 = D\sigma_0\sigma_\varepsilon^2\tau/\alpha_L$. Substituting into the definition of Ψ:

$$\Psi = \frac{(D+\alpha)(\tau+\lambda\sigma_0)}{\alpha_L\sigma_0 + D\tau}.$$

[15] The numerator follows from $\partial D/\partial\tau = -\alpha/\tau$ and the product rule on $D\cdot S'/\tau$, using $\alpha + D = 2D + (1-B)$. The denominator collects $-\partial f/\partial\alpha_L$ where $f = DS'\sigma_\varepsilon^2/\tau - \alpha_L\sigma_\eta^2$.

[16] Differentiating $\lambda = \alpha_L/\alpha$: $d\lambda/d\tau = (1/\alpha)(d\alpha_L/d\tau) - (\alpha_L/\alpha^2)(d\alpha/d\tau)$. Substituting (38) for $d\alpha/d\tau$ and collecting terms gives $d\lambda/d\tau = (d\alpha_L/d\tau)(\tau+\lambda S')/(\alpha\tau) + \lambda/\tau$. Writing $d\alpha_L/d\tau = -|d\alpha_L/d\tau|$ and using $\lambda\alpha = \alpha_L$ yields $d\lambda/d\tau = (\lambda/\tau)(1-\Psi)$.

To verify $\Psi > 1$, expand the numerator using $\alpha\lambda = \alpha_L$:

$$(D + \alpha)(\tau + \lambda\sigma_0) = D\tau + D\lambda\sigma_0 + \alpha\tau + \alpha_L\sigma_0 > \alpha_L\sigma_0 + D\tau,$$

where the inequality holds because $D\lambda\sigma_0 + \alpha\tau > 0$. Hence $\Psi > 1$ and the loan share rises as τ falls. The bank substitutes aggressively into loans because the credit variance cost $\alpha_L^2\sigma_\eta^2$ weakens as τ falls (through the FOC link between $\sigma_\eta^2\tau$ and D), while each additional loan still generates constant spread income σ_0.

Case 2: $\sigma_\eta^2 = 0$ (pure diminishing returns). The FOC forces $S'(\alpha_L) = 0$, so $\alpha_L = \sigma_0/\kappa$ is fixed independently of τ. Since $d\alpha_L/d\tau = 0$, we have $\Psi = 0 < 1$, and the loan share falls as τ falls: the loan book is pinned at the spread-maximizing level and cannot absorb any of the duration pressure, so all additional duration flows through bonds and $\lambda \to 0$ as $\tau \to 0$.

Since all equilibrium quantities are continuous functions of κ and σ_η^2, and $\Psi > 1$ when $\kappa = 0$ while $\Psi = 0$ when $\sigma_\eta^2 = 0$, by continuity there exists a boundary in (κ, σ_η^2) space separating the two regimes.

Proposition 3 (Loan Share Response)**.** *In the constrained regime:*

1. *The bank expands its loan portfolio as the term premium falls: $d\alpha_L/d\tau < 0$. When $\sigma_\eta^2 = 0$, loans are pinned at $\alpha_L = \sigma_0/\kappa$ and do not respond: $d\alpha_L/d\tau = 0$.*
2. *When $\kappa = 0$ (credit risk is the only friction), the loan share λ rises as τ falls. When $\sigma_\eta^2 = 0$ (diminishing returns is the only friction), the loan share falls as τ falls.*
3. *In the combined model ($\kappa > 0$, $\sigma_\eta^2 > 0$), there exists a threshold in (κ, σ_η^2) space such that the loan share rises when credit risk is relatively more important and falls when diminishing returns are relatively more important.*

The credit risk extension delivers two main results. First, in the unconstrained regime the bank's portfolio separates: total duration is determined by the term premium (as in the baseline model), while the loan allocation is pinned by the balance of credit spreads against credit risk and diminishing returns. Loans do not respond to changes in term premia (such as a QE shock). Second, once the profitability constraint binds, loans become a tool for managing the NIM shortfall. The bank expands lending as τ falls because loans generate spread income that reduces the required duration overshoot. A shallow credit demand curve (κ small) and volatile credit outcomes (σ_η^2 large) favor reallocation toward loans; a steep demand curve (κ large) and low credit risk (σ_η^2 small) favor reallocation toward bonds.

5.6 Graphical Illustration

Figures 8 and 9 illustrate the two polar cases, using the same baseline calibration as Figure 6, augmented with a credit spread $\sigma_0 = 0.01$. Both figures decompose the bank's

long-asset portfolio into its loan component (teal shading) and bond component (blue shading), alongside total duration ($\alpha = \alpha_L + \alpha_B$, black line).

Pure credit risk ($\kappa = 0$). Figure 8 shows the equilibrium when only credit risk disciplines lending ($\gamma_\eta = 0.05$, $\kappa = 0$). In the unconstrained regime ($\tau > \tilde{\tau}$), the bank holds $\alpha_L = \sigma_0/\gamma_\eta = 0.20$ in loans, independent of τ, with bonds absorbing all duration adjustment. Once the profitability constraint binds, the bank actively substitutes bonds for loans: α_L rises steeply while α_B falls. By $\tau = 0.025$, loans account for over 60 percent of the portfolio. Total duration grows as the term premium falls (the profitability constraint still tightens), but more slowly than in the bonds-only baseline because spread income absorbs part of the NIM shortfall.

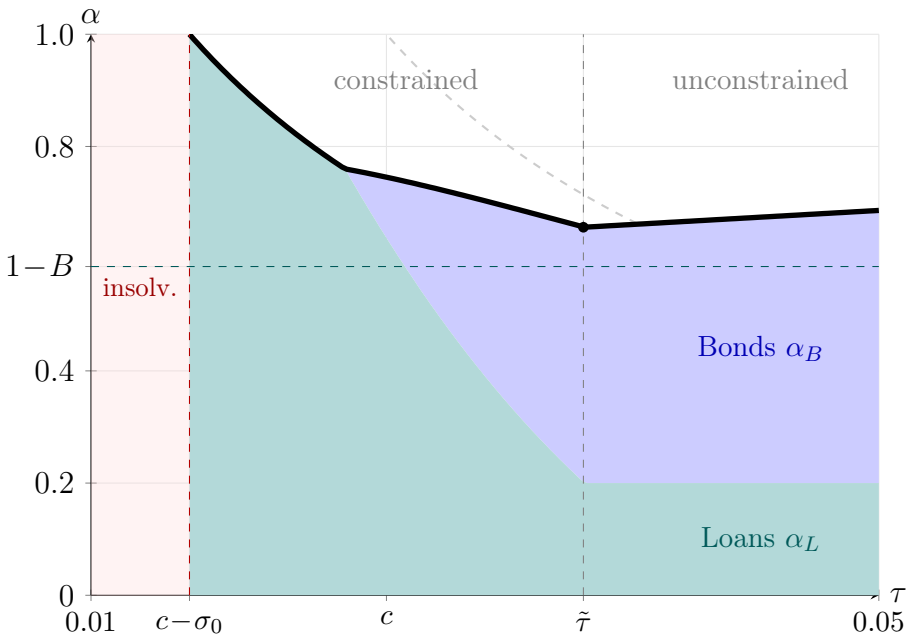


Figure 8: Portfolio composition with pure credit risk ($\kappa = 0$). As τ falls below $\tilde{\tau}$, the bank substitutes bonds for loans, and the loan share rises. Total duration (black) grows more slowly than in the bonds-only baseline (gray dashed) because spread income partially offsets the NIM shortfall. Parameters: $\sigma_0 = 0.01$, $\gamma_\eta = 0.05$, $\kappa = 0$; all others as in Figure 6.

Pure diminishing returns ($\sigma_\eta^2 = 0$). Figure 9 shows the equilibrium when only the downward-sloping credit demand curve limits lending ($\kappa = 0.05$, $\sigma_\eta^2 = 0$). The loan portfolio is fixed at $\alpha_L = \sigma_0/\kappa = 0.20$ in both regimes: the bank maximizes spread income regardless of τ. All duration adjustment flows through bonds. In the constrained regime, α_B rises steeply as τ falls—the pure reach for duration of the baseline model, attenuated only by the constant contribution of spread income.

The contrast between the two figures is sharp. A constrained bank facing primarily credit risk (Figure 8) responds to QE by shifting from bonds to loans—a portfolio com-

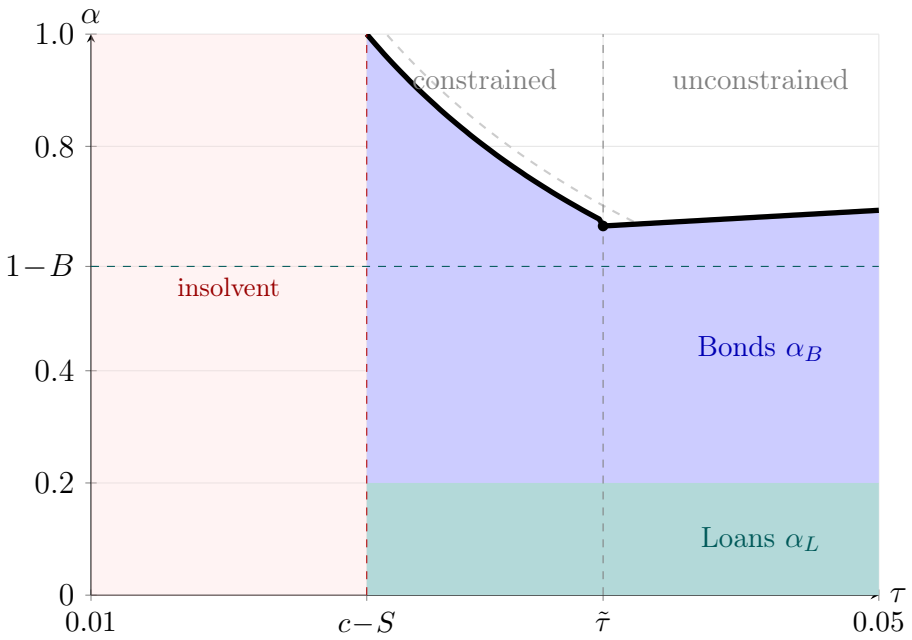


Figure 9: Portfolio composition with pure diminishing returns ($\sigma_\eta^2 = 0$). The loan portfolio is constant at $\alpha_L = \sigma_0/\kappa$ in both regimes. All duration adjustment as τ falls flows through bonds. Total duration (black) lies below the bonds-only baseline (gray dashed) by the constant spread income, but follows the same convex shape. Parameters: $\sigma_0 = 0.01$, $\kappa = 0.05$, $\sigma_\eta^2 = 0$; all others as in Figure 6.

position effect. A constrained bank facing primarily a downward-sloping demand curve (Figure 9) responds by extending the duration of its bond portfolio—the pure reach for duration of the baseline. Thus, the model can explain why constrained banks facing concentrated or saturated lending opportunities should exhibit rising bond duration with stable loan shares. This finding resonates with the experience of Silicon Valley Bank which faced limited lending opportunities in the tech sector in the run-up to its failure, incentivizing the bank to increase its security holdings.

In the combined model ($\kappa > 0$ and $\sigma_\eta^2 > 0$), the portfolio response is intermediate. The loan share rises or falls depending on the relative importance of credit risk versus diminishing returns, as characterized in Proposition 3. The key empirical object is whether the bank's lending technology exhibits more concavity in the spread (κ large, demand curve steep) or more variance in credit outcomes (σ_η^2 large, credit risk dominant). The model provides a structural framework for distinguishing the two.

5.7 Discussion

Sections 5.4–5.5 model two frictions that limit lending: a downward-sloping credit demand curve (parameterized by κ) and credit risk (parameterized by σ_η^2). This subsection considers alternative modeling choices and whether they would generate different predictions.

Alternatives within the existing framework. Several natural frictions produce predictions that are qualitatively equivalent to one of the two channels already in the model.

Regulatory or capacity constraints. If the bank faces a hard lending cap $\alpha_L \leq \bar{\alpha}_L$—due to regulatory limits, balance-sheet capacity, or a finite pool of eligible borrowers—the loan portfolio is fixed once the cap binds. All duration adjustment then flows through bonds, exactly as in the pure diminishing-returns case ($\sigma_\eta^2 = 0$).

Monitoring costs. If the bank must pay a convex monitoring cost $m(\alpha_L)$ to manage its loan portfolio, net spread income becomes $S(\alpha_L) - m(\alpha_L)$. This effectively steepens the declining marginal spread, increasing the curvature of the profitability constraint in α_L without introducing a qualitatively new channel. The prediction is again that of the diminishing-returns case: lending is limited by the flattening of net spread income.

Adverse selection and concentration risk. When the bank expands lending, it may attract riskier borrowers (adverse selection) or concentrate exposure in correlated sectors (concentration risk). Both frictions imply that credit risk scales more than proportionally with α_L—for instance, replacing $\alpha_L^2\sigma_\eta^2$ in (36) with a convex function $g(\alpha_L)$ satisfying $g'' > 2\sigma_\eta^2$. At the same time, adverse selection may raise ex-ante spreads (since riskier borrowers pay higher rates), so $S'(\alpha_L)$ need not be decreasing as our diminishing-returns specification assumes. This combination—rising spreads but accelerating risk—does not map cleanly into either polar case. However, the qualitative prediction is similar to the credit risk channel: the bank expands lending as τ falls, but the convexity of g provides stronger damping at high α_L, limiting the expansion more than in the linear-risk case.

Alternatives with different predictions. Two extensions would generate predictions not nested by the current model.

Correlated credit and interest rate risk. The model assumes $\eta \perp \varepsilon$, so the bank's variance decomposes as $D^2\sigma_\varepsilon^2 + \alpha_L^2\sigma_\eta^2$. If credit losses are positively correlated with rate increases ($\mathrm{Cov}(\varepsilon, \eta) > 0$)—as is plausible if rising rates trigger defaults—the variance includes a cross term $2D\alpha_L \,\mathrm{Cov}(\varepsilon, \eta)$. This term penalizes loans more heavily when excess duration D is large, precisely the region where the profitability constraint is most binding. The FOC (37) would acquire an additional positive term on the right side, damping the loan expansion relative to the independent case. Negative correlation (credit losses fall when rates rise) would have the opposite effect, making loans a partial hedge against interest rate risk and strengthening the substitution toward loans.

Heterogeneous loan duration. The model assumes loans and bonds contribute equally to total duration ($\alpha = \alpha_B + \alpha_L$). In practice, loans often have shorter effective duration than long-term bonds. If loans carry duration weight $\delta < 1$, so that $\alpha = \alpha_B + \delta\alpha_L$, the profitability constraint becomes $(\alpha_B + \delta\alpha_L)\tau + S(\alpha_L) = c - s$. Because each unit of loans generates less duration income ($\delta\tau$ instead of τ), the bank must hold more total assets to cover costs, weakening loans as a substitute for bonds. Moreover, if term premia are

increasing in duration, the relevant spread for loans would be $\delta\tau + \sigma(\alpha_L)$ rather than $\tau + \sigma(\alpha_L)$, further reducing the attractiveness of lending relative to bond holdings. The prediction is that shorter loan duration reduces the substitution toward loans in the constrained regime, pushing the model closer to the diminishing-returns case even when credit risk is the dominant friction.

6 Endogenous Term Premium

In this section, we extend the baseline model to allow the term premium to respond endogenously to banks' aggregate demand for long-term assets. This extension is motivated by recent evidence that banks actively influence the pricing of interest rate risk. In particular, Haddad and Sraer (2020) show that the aggregate interest rate exposure of the banking sector is a strong predictor of excess Treasury bond returns, suggesting that banks' portfolio choices partly determine the term premium.

6.1 Setup and Equilibrium

The term premium now has two components:

$$\tau(\alpha, Q) = \underbrace{\bar{\tau} - \delta Q}_{\equiv\, \hat{\tau}} - \mu\alpha, \tag{42}$$

where $\mu > 0$ measures the price impact of bank demand on the long-term bond market. When banks collectively tilt toward long-term assets (higher α), they bid up long-bond prices and compress the term premium further. The microfoundation follows standard preferred-habitat logic: long-term bonds are held by price-sensitive arbitrageurs (here, banks) and price-insensitive preferred-habitat investors. When banks increase demand, the market-clearing yield on the long bond falls. We define the exogenous component as $\hat{\tau} \equiv \bar{\tau} - \delta Q$ and write $\tau = \hat{\tau} - \mu\alpha$.

Each bank is small and takes τ as given. A **symmetric equilibrium** is a pair (α^*, τ^*) such that (i) α^* solves the bank's problem given τ^*, and (ii) $\tau^* = \hat{\tau} - \mu\alpha^*$.

Unconstrained regime. When the profitability constraint is slack, the first-order condition from Section 3 gives $\alpha = (1 - B) + \tau/\gamma$. Substituting $\tau = \hat{\tau} - \mu\alpha$:

$$\alpha = (1 - B) + \frac{\hat{\tau} - \mu\alpha}{\gamma} \quad \Longrightarrow \quad \alpha^*_{\text{int}} = \frac{(1 - B)\gamma + \hat{\tau}}{\gamma + \mu}. \tag{43}$$

The equilibrium term premium is:

$$\tau^*_{\text{int}} = \frac{\gamma[\hat{\tau} - \mu(1 - B)]}{\gamma + \mu}. \tag{44}$$

Compared to the exogenous model (where $\alpha^*_{\text{int}} = (1-B) + \hat{\tau}/\gamma$ and $\tau^* = \hat{\tau}$), the endogenous feedback rotates the FOC curve downward and compresses the equilibrium term premium to a fraction $\gamma/(\gamma+\mu)$ of the exogenous premium, net of a correction for the hedge. When $\mu = 0$, we recover the exogenous model.

Constrained regime. When the profitability constraint binds, $s + \alpha\tau = c$ and thus $\alpha = (c-s)/\tau$. Substituting $\tau = \hat{\tau} - \mu\alpha$:

$$\alpha = \frac{c-s}{\hat{\tau} - \mu\alpha} \quad \Longrightarrow \quad \mu\alpha^2 - \hat{\tau}\,\alpha + (c-s) = 0. \tag{45}$$

By the quadratic formula, this has two roots:

$$\alpha_\pm = \frac{\hat{\tau} \pm \sqrt{\hat{\tau}^2 - 4\mu(c-s)}}{2\mu}, \tag{46}$$

with $\alpha_- \leq \alpha_+$. Both roots satisfy the profitability constraint with equality, so the equilibrium-relevant root must be selected by an additional criterion.

Root selection. The regime boundary $\hat{\tau}^*$ is defined as the value of $\hat{\tau}$ at which the unconstrained solution first violates the profitability constraint as the exogenous term premium falls. That is, $\hat{\tau}^*$ is the largest $\hat{\tau}$ solving $\alpha^*_{\text{int}}(\hat{\tau}) \cdot \tau^*_{\text{int}}(\hat{\tau}) = c - s$, where α^*_{int} and τ^*_{int} are the unconstrained solutions from (43)–(44).[17] The constrained solution must connect continuously to the unconstrained solution at this boundary, which pins down the root: at $\hat{\tau} = \hat{\tau}^*$, exactly one of $\alpha_\pm$ equals $\alpha^*_{\text{int}}(\hat{\tau}^*)$. We focus on the case $\mu < \mu_{\text{crit}}$ where the price impact is moderate.[18] The equilibrium-relevant (smaller) root is:

$$\alpha^*_{\text{bind}} = \alpha_- = \frac{\hat{\tau} - \sqrt{\hat{\tau}^2 - 4\mu(c-s)}}{2\mu}, \tag{47}$$

with corresponding equilibrium term premium $\tau^*_{\text{bind}} = \hat{\tau} - \mu\alpha^*_{\text{bind}}$, which simplifies to:

$$\tau^*_{\text{bind}} = \frac{\hat{\tau} + \sqrt{\hat{\tau}^2 - 4\mu(c-s)}}{2}. \tag{48}$$

[17] Since α^*_{int} and τ^*_{int} are both linear in $\hat{\tau}$, their product is a quadratic in $\hat{\tau}$. The equation $\alpha^*_{\text{int}} \cdot \tau^*_{\text{int}} = c - s$ therefore has at most two solutions. For all economically relevant parameter values, only one solution is positive, so $\hat{\tau}^*$ is uniquely determined.

[18] The constrained region spans $\hat{\tau} \in [\hat{\tau}_{\text{crit}}, \hat{\tau}^*]$ (where $\hat{\tau}_{\text{crit}}$ is defined in Section 6.2 below) and shrinks as μ increases. At $\mu = \mu_{\text{crit}}$, the region vanishes: $\hat{\tau}^* = \hat{\tau}_{\text{crit}}$ and the two roots merge at $\alpha_{\text{merge}} = \hat{\tau}_{\text{crit}}/(2\mu)$. Requiring this merged point to also satisfy the unconstrained FOC yields, after substitution, $u^2 + \gamma(1-B)u - \gamma(c-s) = 0$ with $u = \sqrt{\mu(c-s)}$—the same quadratic that defines $\tilde{\tau}$ in Section 3. Hence $\mu_{\text{crit}} = \tilde{\tau}^2/(c-s)$. When $\mu < \mu_{\text{crit}}$, continuity selects α_- and α_+ is infeasible ($\alpha_+ > 1$); the bank reaches for duration as $\hat{\tau}$ falls. When $\mu > \mu_{\text{crit}}$, both roots are feasible and continuity selects α_+, which *decreases* as $\hat{\tau}$ falls—the opposite of the reach-for-duration mechanism.

Note the sign flip: the smaller root for α gives the *larger* equilibrium term premium, since less duration exposure means less demand compression. As the exogenous component $\hat{\tau}$ falls (due to QE), the discriminant shrinks and α^*_{bind} increases: the bank reaches for duration, just as in the exogenous model, but the feedback loop amplifies the effect. The equilibrium term premium τ^*_{bind} falls, reflecting the additional compression from banks' own demand.

6.2 Instability and Amplification

The constrained equilibrium exists if and only if the discriminant in (45) is non-negative:

$$\hat{\tau}^2 \geq 4\mu(c-s) \quad \Longleftrightarrow \quad \hat{\tau} \geq 2\sqrt{\mu(c-s)} \equiv \hat{\tau}_{\text{crit}}. \tag{49}$$

Proposition 4 (Financial Instability Threshold)**.** *There exists a critical level of the exogenous term premium component*

$$\hat{\tau}_{\text{crit}} = 2\sqrt{\mu(c-s)}, \tag{50}$$

below which no equilibrium with solvent banks exists. At this threshold, the feedback between bank demand for duration and term premium compression becomes self-reinforcing.

Intuition. Below $\hat{\tau}_{\text{crit}}$, a feedback loop emerges: banks need duration income to survive $\rightarrow$ their demand compresses the term premium $\rightarrow$ which tightens the profitability constraint further $\rightarrow$ requiring yet more duration, and so on without bound. The two roots of the quadratic merge at $\hat{\tau}_{\text{crit}}$, and below it no real solution exists.

Amplification. In the constrained regime, the endogenous α^*_{bind} exceeds the exogenous benchmark $(c-s)/\hat{\tau}$ at every $\hat{\tau}$, and the amplification factor grows as $\hat{\tau}$ approaches $\hat{\tau}_{\text{crit}}$. The sensitivity of α^* to QE also diverges near the instability threshold. Differentiating (47) with respect to $\hat{\tau}$:

$$\frac{d\alpha^*_{\text{bind}}}{d\hat{\tau}} = \frac{1}{2\mu}\left(1 - \frac{\hat{\tau}}{\sqrt{\hat{\tau}^2 - 4\mu(c-s)}}\right) < 0, \tag{51}$$

so α^* increases as $\hat{\tau}$ falls (i.e., as QE increases). Since $\hat{\tau} = \bar{\tau} - \delta Q$, the sensitivity to QE is $d\alpha^*/dQ = -\delta \cdot d\alpha^*/d\hat{\tau} > 0$, which diverges as $\hat{\tau} \to \hat{\tau}_{\text{crit}}$.

Regime characterization. The three regimes are summarized in Table 1. The boundary $\hat{\tau}^*$ between the unconstrained and constrained regimes is defined by the condition that the unconstrained α^*_{int} just satisfies the profitability constraint with equality (see Section 3).

Table 1: Three regimes of the endogenous term premium model.

Regime	**Condition**	**Behavior**
Unconstrained	$\hat{\tau} > \hat{\tau}^*$	α^* given by (43), decreasing in Q
Constrained (stable)	$\hat{\tau}_{\text{crit}} \leq \hat{\tau} \leq \hat{\tau}^*$	α^* given by (47), increasing and convex in Q, with feedback amplification
No equilibrium	$\hat{\tau} < \hat{\tau}_{\text{crit}}$	Feedback loop: profitability constraint infeasible

6.3 Graphical Illustration and Discussion

6.3.1 Equilibrium Maturity Mismatch

Figure 10 compares the equilibrium α^* in the exogenous and endogenous models, both plotted against the exogenous component $\hat{\tau}$. The price impact parameter is $\mu = 0.026$; all other parameters are as in Figure 6. The endogenous feedback rotates the FOC curve downward from $\alpha = (1-B) + \hat{\tau}/\gamma$ to $\alpha = [(1-B)\gamma + \hat{\tau}]/(\gamma + \mu)$ (blue vs. gray solid). In the constrained regime, the endogenous solvency curve (orange) lies above the exogenous one (gray dashed): the bank must hold *more* duration in the endogenous model because its own demand compresses the very term premium it is trying to earn. An instability threshold $\hat{\tau}_{\text{crit}} \approx 0.051$ emerges, well to the right of the exogenous unprofitability threshold at $c = 0.025$: the feedback loop causes failure at a much higher $\hat{\tau}$ than simple unprofitability would.

6.3.2 Equilibrium Term Premium

Figure 11 plots the equilibrium term premium τ^* against the exogenous component $\hat{\tau}$. The dashed 45-degree line represents the exogenous benchmark ($\tau^* = \hat{\tau}$ when $\mu = 0$). With the feedback, τ^* falls below the 45-degree line. The shaded wedge between the two represents the additional compression caused by banks' collective demand for duration.

In the *unconstrained regime* (right of $\hat{\tau}^*$), the equilibrium term premium is a linear function of $\hat{\tau}$ with slope $\gamma/(\gamma + \mu) < 1$—the wedge is proportionally constant. In the *constrained regime* (between $\hat{\tau}_{\text{crit}}$ and $\hat{\tau}^*$), τ^*_{bind} given by (48) falls as $\hat{\tau}$ decreases, reflecting the additional compression from the feedback loop. At $\hat{\tau}_{\text{crit}}$, the equilibrium term premium is $\tau^*_{\text{crit}} = \hat{\tau}_{\text{crit}}/2 = \sqrt{\mu(c-s)}$.

Discussion. The model delivers a feedback loop that links term premium compression to bank fragility. A decline in the term premium squeezes banks' NIMs until the profitability constraint eventually binds. Banks respond by reaching for duration—increasing α—which further compresses the term premium through the demand channel ($\mu\alpha$). This additional compression tightens the profitability constraint further, requiring yet more

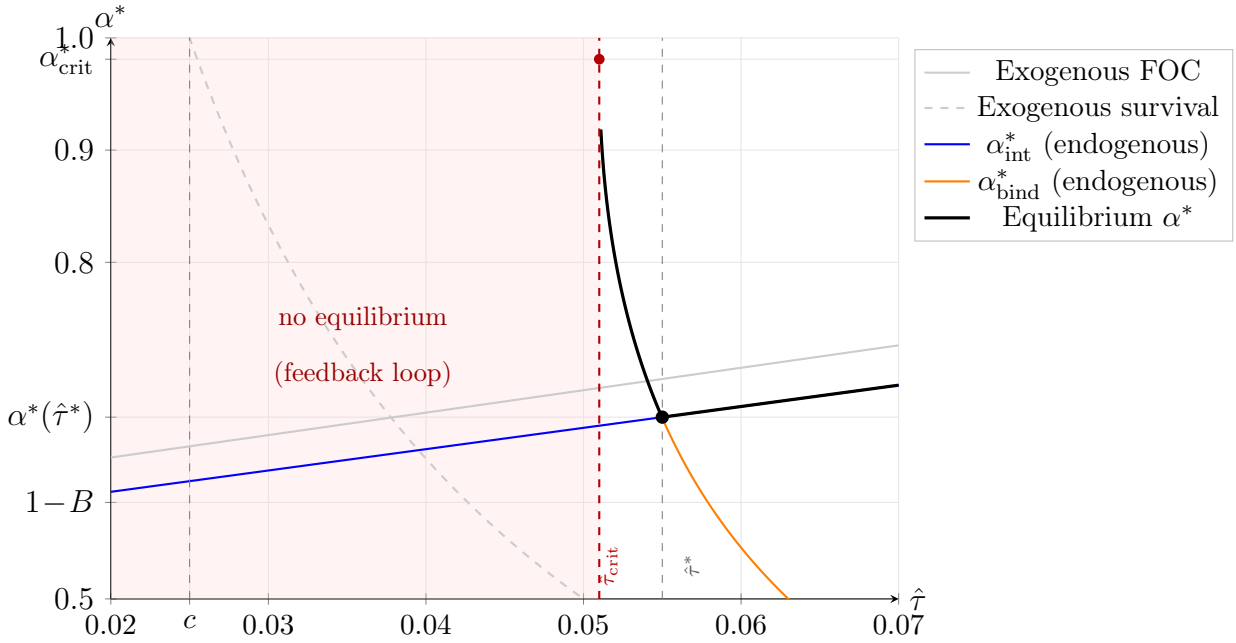


Figure 10: Equilibrium maturity mismatch: exogenous vs. endogenous term premium. The endogenous feedback ($\mu > 0$) rotates the FOC curve downward (blue vs. gray solid) and shifts the solvency curve upward and to the right (orange vs. gray dashed), amplifying the reach for duration. An instability threshold $\hat{\tau}_{\text{crit}}$ emerges well to the right of the exogenous unprofitability threshold c. Parameters: $\mu = 0.026$; all others as in Figure 6.

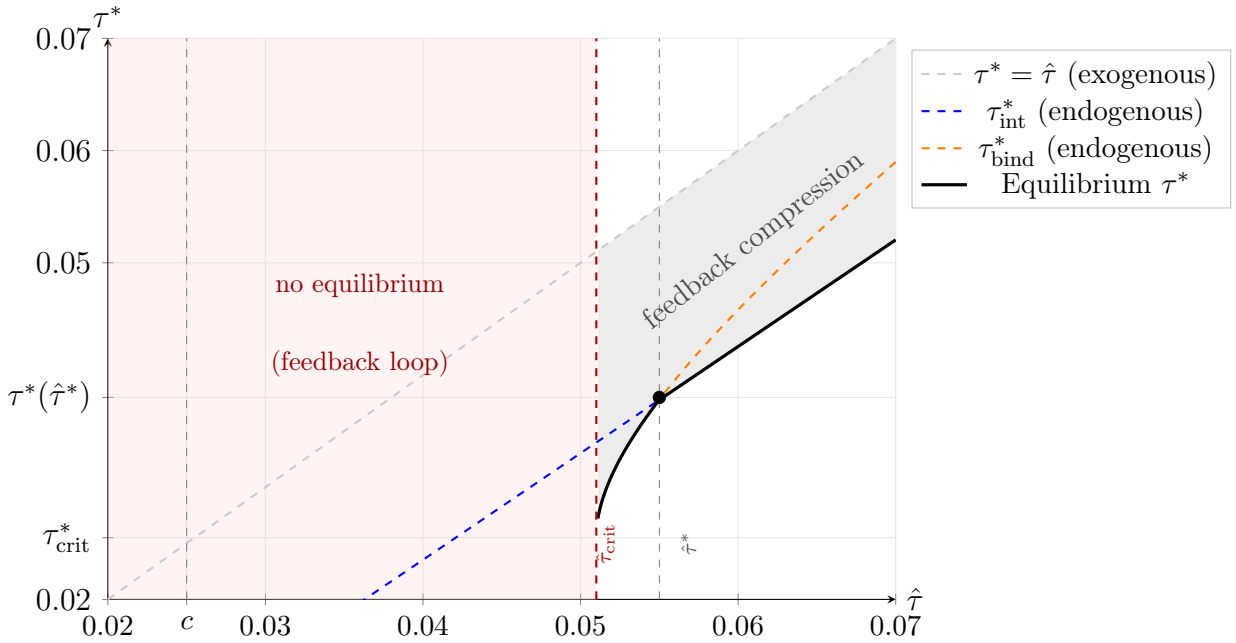


Figure 11: Equilibrium term premium with endogenous feedback. The shaded wedge between the 45-degree line and the equilibrium path represents the additional term premium compression caused by banks' collective demand for duration. The wedge widens as $\hat{\tau}$ falls toward $\hat{\tau}_{\text{crit}}$. Parameters: $\mu = 0.026$; all others as in Figure 6.

duration exposure. Near the instability threshold, the system becomes fragile: small additional term premium compression triggers large increases in maturity mismatch and, ultimately, the possibility of bank failure.

This amplification mechanism is analogous to fire-sale spirals but operates through the *asset side* of the balance sheet via duration risk rather than through leverage and margin constraints (Brunnermeier and Pedersen, 2009). The implication is that term premium changes, possibly driven by QE, have a non-linear, potentially destabilizing effect on the banking sector that is absent from models with exogenous term premia.

7 Conclusion

This paper documents a pronounced increase in banks' maturity mismatch over the past four decades and provides a novel explanation for this phenomenon. Using historical data on U.S. commercial bank balance sheets, we show that the maturity gap between assets and liabilities has risen nearly four-fold since the mid-1980s, tracking the secular decline in interest rates and term premia. We develop a model in which banks face profitability constraints from substantial noninterest expenses that must be covered by current earnings. When term premia fall below a critical threshold—whether through market forces or quantitative easing—banks extend the duration of their assets to generate sufficient income to maintain profitability, a mechanism we term "reaching for duration." This portfolio adjustment increases banks' vulnerability to interest rate reversals and can lead to self-fulfilling runs by uninsured depositors. When the term premium responds endogenously to banks' demand for long-term securities, a feedback can emerge in which no equilibrium with sufficiently profitable banks exists.

Our analysis opens several avenues for future work. First, the model is deliberately kept to two periods, which allows for analytical tractability but precludes an analysis of transition dynamics and optimal portfolio adjustments over time. Extending the framework to a dynamic setting would permit a richer characterization of how banks adjust their portfolios as monetary policy and quantitative easing evolve. Second, the model generates sharp cross-sectional predictions—for instance, that banks with higher operating costs, lower deposit franchise values, or more limited lending opportunities should exhibit a stronger reach for duration—that can be tested using bank-level data. Third, the tension between the intended macroeconomic effects of QE and its unintended consequences for bank stability raises natural questions about optimal policy design: how large-scale asset purchases might be structured to achieve their stimulus objectives while limiting the buildup of duration risk in the banking sector, and how macroprudential tools could complement monetary policy in addressing this trade-off.

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Appendix: Data Documentation

Table A.1: Historical Call Report Reporting Forms

Form	Filing Period	Frequency	Coverage
FFIEC 010	1959:Q2–1983:Q4	SA/Q	Domestic Report of Condition (<$100M)
FFIEC 012	1978:Q4–1983:Q4	Q	Domestic offices only
FFIEC 014	1969:Q2–1983:Q4	Q	Domestic & foreign subsidiaries
FFIEC 015	1976:Q1–1983:Q1	Q	Large banks supplement
FFIEC 031	1984:Q1–present	Q	Domestic & foreign offices
FFIEC 032	1984:Q1–2000:Q4	Q	Domestic only, assets ≥$300M
FFIEC 033	1984:Q1–2000:Q4	Q	Domestic only, $100M–$300M
FFIEC 034	1984:Q1–2000:Q4	Q	Domestic only, <$100M
FFIEC 041	2001:Q1–present	Q	Domestic only (replaces 032–034)

Notes: This table lists the FFIEC reporting forms used to construct the maturity data. "SA" denotes semiannual reporting (FFIEC 010 from 1964 to 1972); "Q" denotes quarterly. The data are digitally available at the Federal Reserve. Historical reporting forms can be accessed via the FFIEC website and the Micro Data Reference Manual at the Federal Reserve.

Reporting Form Details

The following provides detailed descriptions of the FFIEC reporting forms used to construct the maturity data.

- **FFIEC 010** — Domestic Report of Condition. Filed from June 10, 1959 to December 31, 1983. Prior to December 31, 1960, it was reported by FRS member banks and a handful of nonmember banks; afterwards, by all insured commercial banks, savings banks, nondeposit trust companies, and industrial banks with domestic offices only. From December 31, 1978, coverage was restricted to banks with domestic offices only and with less than $100 million in total assets. From 1964 to 1972, data are reported semiannually; otherwise, quarterly.

- **FFIEC 012** — Consolidated Report of Condition for a Bank and its Domestic Subsidiaries (Domestic Offices Only). Filed from December 31, 1978 to December 31, 1983, by all insured commercial banks, savings banks, nondeposit trust companies, and industrial banks with domestic offices only.

- **FFIEC 014** — Consolidated Report of Condition for a Bank and its Domestic and Foreign Subsidiaries. Filed from June 30, 1969 to December 31, 1983, by all insured commercial banks with domestic offices and foreign branches, foreign subsidiaries, Edge Act and agreement subsidiaries, and/or branches in Puerto Rico or U.S. territories and possessions.

- **FFIEC 015** — Large Banks Supplement. Provided additional detail on maturity breakdowns for large banks, including time deposit maturities on the liability side starting in 1976:Q1.

- **FFIEC 031** — Consolidated Reports of Condition and Income for a Bank with Domestic and Foreign Offices. Filed from March 31, 1984 to the present by all national banks, state member banks, insured state nonmember banks, and savings associations with branches or consolidated subsidiaries in a foreign country or with international banking facilities.

- **FFIEC 032–034** — Consolidated Reports of Condition and Income for banks with domestic offices only, stratified by asset size. The FFIEC 032 covered banks with total assets of $300 million or more; the FFIEC 033 covered those with total assets of $100 million or more but less than $300 million; the FFIEC 034 covered those with total assets less than $100 million. All three were filed from March 31, 1984 to December 31, 2000.

- **FFIEC 041** — Consolidated Reports of Condition and Income for a Bank with Domestic Offices Only. Since March 31, 2001, the FFIEC 041 replaced the FFIEC 032, 033, and 034 forms. It is filed by all national banks, state member banks, insured state nonmember banks, and savings associations with domestic offices only.

Table A.2: Asset Maturity Variables: 1959:Q2–1965:Q2

Variable	Code	Maturity/Repr. Bucket	Weight (Mo.)	Period
Treasury Notes				
	RCON 0294	<12 months	6	1959:Q4–1965:Q2
	RCON 0304	>12 months	24	1959:Q4–1965:Q2
Treasury Bonds (1961:Q1–1965:Q2)				
	RCON 0298	<12 months	6	1961:Q1–1965:Q2
	RCON 0308	12–60 months	36	1961:Q1–1965:Q2
	RCON 0315	60–120 months	90	1961:Q1–1965:Q2
	RCON 0320	>120 months	150	1961:Q1–1965:Q2
Treasury Bonds (1959:Q2–1960:Q4)				
	RCON 0309	<60 months	30	1959:Q2–1960:Q4
	RCON 0315	60–120 months	90	1959:Q2–1960:Q4
	RCON 0324	120–240 months	180	1959:Q2–1960:Q4
	RCON 0328	>240 months	300	1959:Q2–1960:Q4
Cash				
	RCON 0010	0	0	1959:Q4–present

Notes: This table lists the Call Report variables used to measure asset maturity from 1959:Q2 to 1965:Q2. Data are from the FFIEC 010 reporting forms. "Weight" denotes the representative maturity (in months) assigned to each bucket.

Table A.3: Asset Maturity Variables: 1974:Q2–1983:Q1

Variable	Code	Maturity/Repr. Bucket	Weight (Mo.)	Large Only
U.S. Treasuries				
	RCON 0405	<12 months	6	
	RCON 0410	12–60 months	36	
	RCON 0415	60–120 months	90	
	RCON 0420	>120 months	150	
U.S. Agency Obligations				
	RCON 0610	<12 months	6	
	RCON 0615	12–60 months	36	
	RCON 0620	60–120 months	90	
	RCON 0625	>120 months	150	
Municipal Bonds				
	RCON 0910	<12 months	6	
	RCON 0915	12–60 months	36	
	RCON 0920	60–120 months	90	
	RCON 0925	>120 months	150	
Other Bonds, Notes, and Debentures				
	RCON 0960	<12 months	6	
	RCON 0965	12–60 months	36	
	RCON 0970	60–120 months	90	
	RCON 0975	>120 months	150	
Construction & Development Loans				
	RCOS 1416	<12 months	6	✓
	RCOS 1417	12–60 months	36	✓
	RCOS 1418	>60 months	120	✓
Other RE Loans				
	RCOS 1486	<12 months	6	✓
	RCOS 1487	12–60 months	36	✓
	RCOS 1488	>60 months	120	✓
C&I Loans				
	RCOS 1601	<12 months	6	✓
	RCOS 1602	12–60 months	36	✓
	RCOS 1603	>60 months	120	✓
Other Loans				
	RCOS 2086	<12 months	6	✓
	RCOS 2087	12–60 months	36	✓
	RCOS 2088	>60 months	120	✓
Cash				
	RCON 0010	0	0	

Notes: This table lists the Call Report variables used to measure asset maturity from 1974:Q2 to 1983:Q1. Data are from FFIEC 010, 012, 014, and 015 reporting forms. Variables marked "Large Only" are from the FFIEC 015 supplement and are available only for large banks. Loan variables use the RCOS prefix.

Table A.4: Asset Maturity/Repricing Variables: 1984:Q1–1987:Q4

Variable	Code	Maturity/Repr. Bucket	Weight (Mo.)
Loans and Leases			
	RCON 1425	0 (noninterest)	0
	RCON 1426	<3 months	1.5
	RCON 1427	3–6 months	4.5
	RCON 1428	6–12 months	9
	RCON 1429	12–60 months	36
	RCON 1431	>60 months	165
Debt Securities			
	RCON 1546	0 (noninterest)	0
	RCON 1547	<3 months	1.5
	RCON 1548	3–6 months	4.5
	RCON 1549	6–12 months	9
	RCON 1551	12–60 months	36
	RCON 1552	>60 months	130
Other Interest-Bearing Assets			
	RCON 1554	0 (noninterest)	0
	RCON 1556	<3 months	1.5
	RCON 1557	3–6 months	4.5
	RCON 1558	6–12 months	9
	RCON 1559	12–60 months	36
	RCON 1561	>60 months	130
Cash and Fed Funds			
	RCON 0081 + 0071	0	0
	RCON B987	0	0

Notes: This table lists the Call Report variables used to measure asset maturity from 1984:Q1 to 1987:Q4. Data are from FFIEC 031–034 reporting forms. Buckets represent maturity for fixed-rate positions and earliest repricing date for floating-rate positions.

Table A.5: Asset Maturity/Repricing Variables: 1988:Q1–1997:Q1

Variable	Code	Maturity/Repr. Bucket	Weight (Mo.)
Fixed-Rate Debt Securities (Remaining Maturity)			
	RCON 0343	<3 months	1.5
	RCON 0344	3–12 months	7.5
	RCON 0345	12–60 months	36
	RCON 0346	>60 months	130
Floating-Rate Debt Securities (Repricing Frequency)			
	RCON 4544	<3 months	1.5
	RCON 4545	3–12 months	7.5
	RCON 4551	12–60 months	36
	RCON 4552	>60 months	130
Fixed-Rate Loans (Remaining Maturity)			
	RCON 0348	<3 months	1.5
	RCON 0349	3–12 months	7.5
	RCON 0356	12–60 months	36
	RCON 0357	>60 months	165
Floating-Rate Loans (Repricing Frequency)			
	RCON 4554	<3 months	1.5
	RCON 4555	3–12 months	7.5
	RCON 4561	12–60 months	36
	RCON 4564	>60 months	165
Cash and Fed Funds			
	RCON 0081 + 0071	0	0
	RCON B987	0	0

Notes: This table lists the Call Report variables used to measure asset maturity from 1988:Q1 to 1997:Q1. Data are from FFIEC 031–034 reporting forms. Fixed-rate positions are classified by remaining maturity; floating-rate positions by repricing frequency. Additionally, RCON 5519 reports floating-rate debt securities with remaining maturity <12 months (1992:Q1–1996:Q4) and RCON A246 reports floating-rate loans with remaining maturity <12 months (1996:Q1–1997:Q1).

Table A.6: Asset Maturity/Repricing Variables: 1997:Q2–Present

Variable	Code	Maturity/Repr. Bucket	Weight (Mo.)
Debt Securities—Government Agencies			
	RCON A549	<3 months	1.5
	RCON A550	3–12 months	7.5
	RCON A551	12–36 months	24
	RCON A552	36–60 months	48
	RCON A553	60–180 months	120
	RCON A554	>180 months	240
Debt Securities—Mortgage Pass-Throughs			
	RCON A555	<3 months	1.5
	RCON A556	3–12 months	7.5
	RCON A557	12–36 months	24
	RCON A558	36–60 months	48
	RCON A559	60–180 months	120
	RCON A560	>180 months	240
Debt Securities—Other MBS			
	RCON A561	<36 months	18
	RCON A562	>36 months	60
Loans and Leases—Closed-End			
	RCON A564	<3 months	1.5
	RCON A565	3–12 months	7.5
	RCON A566	12–36 months	24
	RCON A567	36–60 months	48
	RCON A568	60–180 months	120
	RCON A569	>180 months	240
Loans and Leases—Excluding Closed-End			
	RCON A570	<3 months	1.5
	RCON A571	3–12 months	7.5
	RCON A572	12–36 months	24
	RCON A573	36–60 months	48
	RCON A574	60–180 months	120
	RCON A575	>180 months	240
Cash and Fed Funds			
	RCON 0081 + 0071	0	0
	RCON B987	0	0

Notes: This table lists the Call Report variables used to measure asset maturity from 1997:Q2 to the present. Data are from FFIEC 031–034 and FFIEC 041 reporting forms.

Table A.7: Liability Maturity Variables: 1976:Q1–1983:Q1

Variable	Code	Maturity/Repr. Bucket	Weight (Mo.)	Large Only
Time CDs ≥$100k				
	RCOS 6637	<3 months	1.5	✓
	RCOS 6639	3–6 months	4.5	✓
	RCOS 6641	6–12 months	9	✓
	RCOS 6643	>12 months	15	✓
Zero-Maturity Liabilities				
	RCON 2220	Demand deposits	0	
	RCON 6650	Savings deposits	0	

Notes: This table lists the Call Report variables used to measure liability maturity from 1976:Q1 to 1983:Q1. Time deposit data are from the FFIEC 015 large-bank supplement (RCOS prefix).

A Historical Bank Income Measures

Table A.8: Liability Maturity/Repricing Variables: 1984:Q1–1987:Q4

Variable	Code	Maturity/Repr. Bucket	Weight (Mo.)
Time Deposits ≥$100k			
	RCON 2459	0 (noninterest)	0
	RCON 2460	<3 months	1.5
	RCON 2461	3–6 months	4.5
	RCON 2462	6–12 months	9
	RCON 2464	12–60 months	36
	RCON 2465	>60 months	90
All Other Time Deposits			
	RCON 2466	0 (noninterest)	0
	RCON 2467	<3 months	1.5
	RCON 2470	3–6 months	4.5
	RCON 2471	6–12 months	9
	RCON 2472	12–60 months	36
	RCON 2473	>60 months	90
Nondeposit Interest-Bearing Liabilities			
	RCON 2492	0 (noninterest)	0
	RCON 2493	<3 months	1.5
	RCON 2495	3–6 months	4.5
	RCON 2497	6–12 months	9
	RCON 2499	12–60 months	36
	RCON 2501	>60 months	90
Subordinated Notes & Debentures (1984:Q1–1985:Q1)			
	RCON 3201	<12 months	6
	RCON 3203	12–24 months	18
	RCON 3204	24–36 months	30
	RCON 3206	36–48 months	42
	RCON 3208	48–60 months	54
	RCON 3209	>60 months	90
Limited-Life Preferred Stock (1984:Q1–1985:Q1)			
	RCON 3276	<12 months	6
	RCON 3277	12–24 months	18
	RCON 3278	24–36 months	30
	RCON 3279	36–48 months	42
	RCON 3280	48–60 months	54
	RCON 3281	>60 months	90
Zero-Maturity Liabilities			
	RCON 2215	Demand & transaction deposits	0
	RCON 2389	Nontransaction savings deposits	0

Notes: This table lists the Call Report variables used to measure liability maturity from 1984:Q1 to 1987:Q4. Data are from FFIEC 031–034 reporting forms.

Table A.9: Liability Maturity/Repricing Variables: 1988:Q1–1997:Q1

Variable	Code	Maturity/Repr. Bucket	Weight (Mo.)
Time Deposits <$100k & Open-Account TDs ≥$100k (1988:Q1–1995:Q4)			
	RCON 0359	<3 months	1.5
	RCON 3644	3–12 months	7.5
Fixed-Rate Time Deposits ≥$100k (1988:Q1–1995:Q4)			
	RCON 2761	<3 months	1.5
	RCON 2762	3–12 months	7.5
	RCON 2763	12–60 months	36
	RCON 2765	>60 months	90
Floating-Rate Time Deposits ≥$100k (1988:Q1–1995:Q4)			
	RCON 4568	<3 months	1.5
	RCON 4569	3–12 months	7.5
	RCON 4571	12–60 months	36
	RCON 4572	>60 months	90
Fixed-Rate Time Deposits <$100k (1996:Q1–1997:Q1)			
	RCON A225	<3 months	1.5
	RCON A226	3–12 months	7.5
	RCON A227	>12 months	16
Floating-Rate Time Deposits <$100k (1996:Q1–1997:Q1)			
	RCON A228	<3 months	1.5
	RCON A229	3–12 months	7.5
	RCON A230	>12 months	16
Fixed-Rate Time Deposits ≥$100k (1996:Q1–1997:Q1)			
	RCON A232	<3 months	1.5
	RCON A233	3–12 months	7.5
	RCON A234	12–60 months	36
	RCON A235	>60 months	90
Floating-Rate Time Deposits ≥$100k (1996:Q1–1997:Q1)			
	RCON A236	<3 months	1.5
	RCON A237	3–12 months	7.5
	RCON A238	12–60 months	36
	RCON A239	>60 months	90
Zero-Maturity Liabilities			
	RCON 2215	Demand & transaction deposits	0
	RCON 2389	Nontransaction savings deposits	0

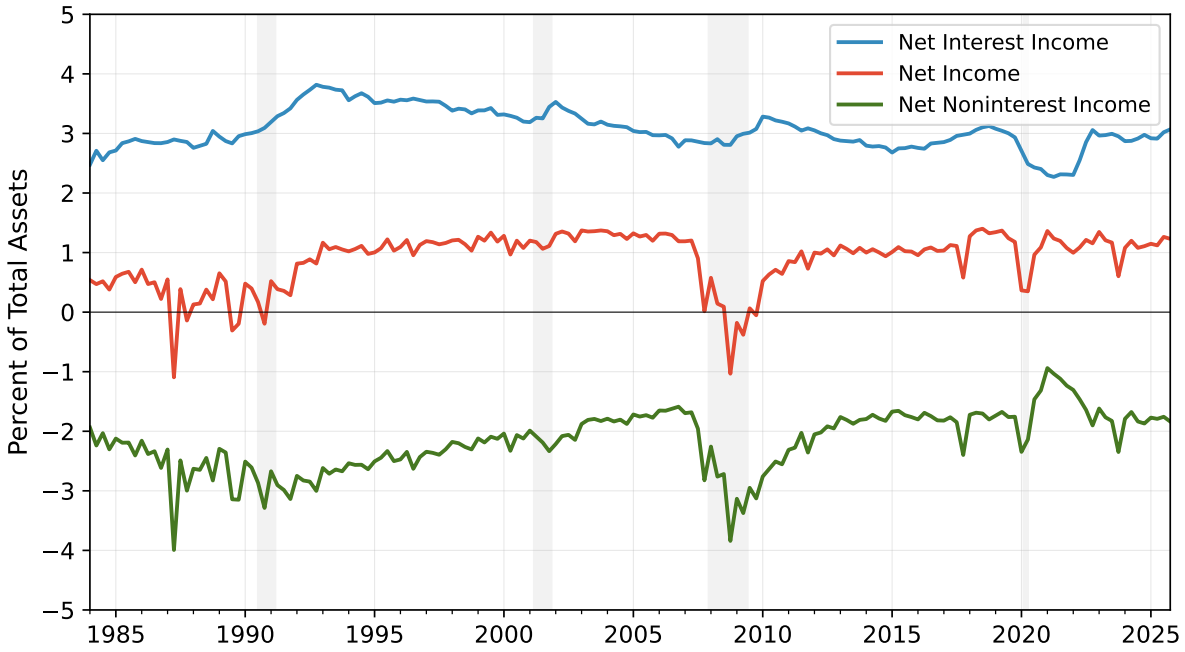
Notes: This table lists the Call Report variables used to measure liability maturity from 1988:Q1 to 1997:Q1, covering two sub-regimes: 1988:Q1–1995:Q4 and 1996:Q1–1997:Q1. Data are from FFIEC 031–034 reporting forms. RCON A231 and RCON A240 report floating-rate time deposits with remaining maturity <12 months (1996:Q1–1997:Q1).

Table A.10: Liability Maturity/Repricing Variables: 1997:Q2–Present

Variable	Code	Maturity/Repr. Bucket	Weight (Mo.)	Period
Time Deposits <$100k (1997:Q2–2016:Q4)				
	RCON A579	<3 months	1.5	1997:Q2–2016:Q4
	RCON A580	3–12 months	7.5	1997:Q2–2016:Q4
	RCON A581	12–36 months	24	1997:Q2–2016:Q4
	RCON A582	>36 months	60	1997:Q2–2016:Q4
Time Deposits ≥$100k (1997:Q2–2016:Q4)				
	RCON A584	<3 months	1.5	1997:Q2–2016:Q4
	RCON A585	3–12 months	7.5	1997:Q2–2016:Q4
	RCON A586	12–36 months	24	1997:Q2–2016:Q4
	RCON A587	>36 months	60	1997:Q2–2016:Q4
Time Deposits <$250k (since 2017:Q1)				
	RCON HK07	<3 months	1.5	2017:Q1–present
	RCON HK08	3–12 months	7.5	2017:Q1–present
	RCON HK09	12–36 months	24	2017:Q1–present
	RCON HK10	>36 months	60	2017:Q1–present
Time Deposits ≥$250k (since 2017:Q1)				
	RCON HK12	<3 months	1.5	2017:Q1–present
	RCON HK13	3–12 months	7.5	2017:Q1–present
	RCON HK14	12–36 months	24	2017:Q1–present
	RCON HK15	>36 months	60	2017:Q1–present
Zero-Maturity Liabilities				
	RCON 2215	Demand & transaction deposits	0	
	RCON 2389	Nontransaction savings deposits	0	

Notes: This table lists the Call Report variables used to measure liability maturity from 1997:Q2 to the present. Data are from FFIEC 031–034 and FFIEC 041 reporting forms. In 2017:Q1, the size threshold for large time deposits changed from $100,000 to $250,000.

Figure 12: Aggregate Bank Income Measures.



Notes: Based on aggregate data for all FDIC-insured institutions, this figure plots net interest income (interest income minus interest expenses), net income, and net noninterest income (noninterest income minus noninterest expenses plus all other net income), all scaled by total assets. Shaded areas denote NBER recession dates.