FEDERAL RESERVE BANK *of* ATLANTA **WORKING PAPER SERIES**

Why Does the Yield Curve Predict GDP Growth? The Role of Banks

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Working Paper 2025-5
July 2025

Abstract: We show that the slope of the yield curve affects bank lending and economic activity through an "expected bank profitability channel." Using detailed banking data and term premium shocks identified via instrumental variables or event studies, we show that a steeper yield curve–when driven by higher term premiums rather than higher expected short rates–increases bank profits and loan supply. Intuitively, a higher term premium raises the expected returns from maturity transformation–a core banking activity–thereby incentivizing bank lending. This effect is more pronounced for banks with higher leverage. We interpret these findings using a simple bank portfolio model.

JEL classification: E44, E52, E58, G2

Key words: predictive power of the yield curve; term spread; term premium; bank lending; bank profitability; interest rate risk

https://doi.org/10.29338/wp2025-5

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1 Introduction

While the slope of the yield curve reliably predicts future economic activity, its underlying mechanism remains debated.[1] The traditional view holds that long-term rates simply aggregate investor expectations about future economic conditions: foreseeing a slowdown in the economy, investors would expect the central bank to respond by lowering the short rate in the future. Such expectations would, all else equal, reduce long-term rates and flatten the yield curve. This makes the slope of the yield curve a passive predictor that reflects future economic conditions without causing them. However, there is evidence suggesting that the slope contains information beyond investor expectations, raising the possibility that the slope actively influences future economic outcomes through channels that the literature has not yet been fully explored.[2]

In this paper, we argue that the slope of the yield curve influences banks' lending decisions through an *expected profitability channel* that operates as follows. Banks' core business model consists of maturity transformation, whereby they fund longer-term assets (securities and loans) with short-term liabilities (bank deposits and wholesale borrowing). The term premium—the difference between the long rate and the average expected future short rates—represents the excess returns banks expect to earn for bearing the interest rate risks associated with this maturity mismatch. All else equal, higher term premiums would increase the expected profits from lending activities funded by shorter-term borrowing, incentivizing banks to expand their longer-term asset holdings, including loans. This increased bank credit supply can be expected to stimulate economic growth through the well-documented "credit channel," whereby bank-dependent firms are better able to invest and grow (Bernanke and Gertler, 1995).

We provide extensive empirical evidence supporting the expected profitability channel, which we motivate with a banking model following Gertler and Kiyotaki (2015). Using aggregate time-series data, we start by showing that higher term premiums predict higher subsequent bank profits and loan growth, after controlling for short rate changes and expected future economic growth. Building on this evidence, we develop a dynamic portfolio model in which banks face financing constraints, charge a spread on deposits, and respond to exogenous interest rate and term premium shocks. In equilibrium, as in Di Tella and Kurlat (2021), banks' ability to charge deposit spreads

[1] Early studies documenting the predictive power of the yield curve include, among others, Harvey (1989, 1993); Estrella and Hardouvelis (1991); Stock and Watson (1989); Hamilton and Kim (2002a), and Ang et al. (2006).

[2] Previous studies show that the slope of the yield curve contains more information about future economic activity than either short rate expectations (Hamilton and Kim, 2002a; Wright, 2006; Jardet et al., 2013) or median survey forecasts (Rudebusch and Williams, 2009), but do not elaborate on the source of such information.

incentivizes them to hold a leveraged exposure to long-term loans. A positive term premium shock increases expected returns to maturity transformation, raising expected bank profitability, relaxing the financing constraint, and boosting bank lending in subsequent periods. This effect is stronger for more leveraged banks, as higher leverage amplifies how term premium variations affect banks' expected return on wealth.

Taking the model's predictions to the data presents a critical identification challenge: long-term yields are forward looking and contain information about the future economic outlook, potentially confounding the effects of term premium variations. A stronger economic outlook could simultaneously steepen the yield curve today and increase bank lending in the future, creating omitted variable bias if the economic outlook correlates with the term premium. We address this identification challenge using two main strategies.

First, we employ an instrumental variable (IV) strategy to isolate term premium variations driven by foreign official demand, which are unlikely to reflect shifts in the domestic economic outlook. Our instrument is foreign official holdings of U.S. Treasury securities normalized by U.S. GDP. This approach is motivated by the preferred habitat theory of the term structure, which posits that when risk bearing capacity is limited, exogenous shifts in Treasury demand and supply alter the compensation arbitrageurs require for bearing interest rate risks, thereby driving fluctuations in the term premium (Vayanos and Vila, 2021; Greenwood and Vayanos, 2014). The identifying assumption is that changes in foreign official holdings of Treasuries are driven primarily by foreign central banks' reserve management and foreign exchange intervention needs rather than the U.S. economic outlook or other factors driving the supply of U.S. government debt. Consistent with this assumption, we show that this instrument is uncorrelated with GDP growth expectations or U.S. recession probabilities, yet strongly predicts term premiums after controlling for short rates and other macro variables.

Second, we conduct an event-study analysis during a period of an unexpected surge in the term premium and test whether bank lending responses varied systematically with banks' leverage. In particular, we study the "Taper Tantrum" episode following Chair Ben Bernanke's May 22, 2013 congressional testimony, during which he stated in the Q&A that the Federal Reserve might begin tapering asset purchases under its quantitative easing program—a statement that was followed by a steep and persistent rise in the term premium. At the time, market commentaries generally did not attribute the announcement to an improving economic outlook but instead interpreted it as the Fed's reaction function being less accommodative than expected. Nonetheless, we account for the possibility that the decision to reduce the pace of asset purchases reflected expectations of an improving economic outlook by controlling for banks' forecasts of GDP growth both before and after the start of the Taper Tantrum.

Our findings can be summarized as follows. Consistent with the implications of the model, we show that (i) banks experience higher loan growth and higher profits, on average, following an exogenous increase in the term premium; and (ii) banks with higher leverage (i.e., lower capital ratios) increase lending by relatively more in response to such an increase.[3] Focusing on the Taper Tantrum episode, we show that the rise in the term premium is associated with an increase in loan supply: lower-capital banks increase loan volumes and reduce spreads more than other banks. These credit effects propagate to the real economy: nonfinancial firms borrowing from more leveraged banks exhibit higher investment rates and asset growth following the episode. Similarly, counties with more leveraged banks experience relatively higher economic growth after the rise in the term premium. Importantly, this pattern of bank lending behavior generalizes to the longer 2012–2019 time period, based on observed variations in the term premium.

Our estimates of both the level and differential effects of the term premium on banks' lending behavior and the real economy are economically meaningful. A one standard deviation increase in the term premium—equivalent to 50 basis points (bps)—is associated with bank loan growth and return on equity (ROE) that are higher by 1.5 percentage points (ppts) and 28 bps, respectively, over the next 4 quarters. For comparison, average loan growth and ROE over the sample period were 4.8% and approximately zero, respectively. In the four quarters following the start of the Taper Tantrum, a bank with higher leverage (capital ratio at the 25th percentile of the distribution) originated loans that were 11% larger and 70 bps cheaper than those of a bank with lower leverage (capital ratio at the 75th percentile). Over the two years following the Taper Tantrum, firms borrowing from more leveraged banks (25th percentile) had investment rates that were 2 ppts higher than those borrowing from less leveraged banks (75th percentile), relative to an average investment rate of 5.8%.

The empirical analysis brings together two primary data sources: (a) a long-run panel dataset on bank balance sheets spanning 1994–2019 and (b) a shorter micro-level dataset with detailed information on bank-firm lending contracts over 2012–2019. The latter dataset helps mitigate a key identification concern: that observed bank lending responses to term premium fluctuations may reflect changes in firms' credit demand rather than changes in banks' credit supply, as these

[3] Our main analysis uses the term premium series from the Kim and Wright (2005) term structure model but are invariant to term premium estimates from alternative models such as Adrian et al. (2013) and Kim and Priebsch (2024).

quantities are jointly determined and may be driven by common macroeconomic shocks. To disentangle credit supply from credit demand forces, we follow Khwaja and Mian (2008) and Jiménez et al. (2020) and include firm×time fixed effects, which control for time-varying credit demand shocks at the firm level. This strategy allows us to compare the lending behavior of banks with different ex-ante capital ratios that lend to the same firm in the same quarter. Our regressions also control for standard bank-level determinants, including bank size, core deposits, securities, and reserves. Securities holdings are included to account for valuation effects from fluctuations in long-term interest rates, which may affect bank net worth (Chakraborty et al., 2020; Rodnyansky and Darmouni, 2017).[4] Controlling for securities holdings additionally captures potential portfolio rebalancing strategies from short- to long-term assets associated with declining term premiums under quantitative easing (Bottero et al., 2022).

We subject our empirical results to numerous robustness checks, with particular focus on strengthening our identification methodology. For instance, we construct a measure of high-frequency term premium "shocks" from changes in the Kim and Wright (2005) term premium on FOMC event days. Estimations with these term premium shocks yield similar results. In addition, we show that our main findings are robust to using an alternative instrumental variable, the maturity-weighted debt to GDP, which previous studies have used to study how Treasury supply affects interest rates (Greenwood and Vayanos, 2014). All specifications include controls for future economic outlook, using survey-based forecasts of GDP growth and expectations of future short rates measured either in the aggregate or at the individual bank level. In addition, changes in the short rate are included throughout the analysis to capture the standard bank lending channel.

Our work contributes to three strands of literature. First, we contribute to the literature on the predictive power of the yield curve for future economic growth (Harvey, 1988; Estrella and Hardouvelis, 1991; Hamilton and Kim, 2002b; Favero et al., 2005; Ang et al., 2006; Rudebusch et al., 2006; Jardet et al., 2013). Our contribution is to emphasize the role of financial intermediaries and to document one specific channel through which a higher term premium may boost the economy—an expected profits channel that incentivizes banks to engage in more maturity transformation and increase loan supply. The paper closest to ours is Adrian et al. (2019), who explore a similar channel through which monetary policy tightening at the short end flattens the yield curve and reduces credit supply by compressing net interest margins. Our paper differs from theirs in two

[4] Such valuation changes would, if anything, bias against finding a positive effect of term premium increases on bank lending, as a steeper yield curve would *reduce* the value of longer-duration securities, thereby lowering banks' net worth and lending capacity.

major ways. First, we focus on the role of the term premium as the component of the term spread that drives the expected profits channel. Second, we combine granular data with multiple identification strategies to mitigate endogeneity problems associated with the forward-looking nature of long-term yields and to isolate a causal mechanism for the forecasting power of the term spread.

Second, this paper contributes to the literature on banks' exposure to interest rate risks and the implications for monetary policy transmission (Aksoy and Basso, 2014; Begenau et al., 2015; Di Tella, 2020; Haddad and Sraer, 2020; Drechsler et al., 2021; Gomez et al., 2021; Schneider, 2025). Most studies in this literature focus on the level of the short rate. The few exceptions include Alessandri and Nelson (2015) and Paul (2023), who examine the link between the slope of the yield curve and bank profits, and English et al. (2018), who show that bank equity prices fall following increases in interest rate levels or yield curve steepening. We complement these studies by exploring how changes in the slope of the yield curve affect not only bank profitability but also the supply of bank credit and the investment decisions of bank-dependent firms. Our work further emphasizes the importance of decomposing yields into expectations and term premium components for understanding the channels through which financial intermediaries react to changes in long term rates.

Finally, this paper contributes to the literature on the bank lending channel of monetary policy. Previous studies focus on the short rate policy and document that, following a rate cut, banks increase lending, which amplifies the effect of monetary policy easing on economic activity. In particular, the bank capital channel (Van den Heuvel, 2002) argues that a rate cut lowers banks' funding costs and increases bank profits, which over time leads to higher bank capital, relaxes banks' capital constraints and boosts lending. In this paper, we show that the bank capital channel operates differently under asset purchase policies from that under short rate policies. Rather than amplifying stimulus, bank lending could contract following central bank asset purchases and partially offset the intended stimulative effect. This occurs because asset purchases lower term premiums, which diminishes banks' profits from maturity transformation, and leads them to curtail lending.

Our findings suggest that banks are an important channel through which the entire yield curve, not just the short rate, affects the economy, with important implications for monetary policy. Asset purchases have became a standard tool that global central banks employ to provide monetary accommodation when the short rate is near its effective lower bound, and they are typically thought of as operating by reducing term premiums (Krishnamurthy and Vissing-Jorgensen, 2011). In turn, lower term premiums boost the values of security holdings that are marked-to-market on bank balance sheets, raising banks' net worth and supporting their lending capacity—a phenomenon that Brunnermeier and Sannikov (2014) called *stealth recapitalization* and has been documented, among others, by Chakraborty et al. (2020), Acharya et al. (2019), and Rodnyansky and Darmouni (2017). Our results suggest that when calibrating asset purchases, central banks should consider the potential negative effects on bank profits and bank lending through our expected bank profitability channel. However, our results should not be interpreted as suggesting that asset purchases are contractionary overall, since they operate through multiple other channels, including the cost of capital channel and the signaling channel, beyond the expected bank profitability channel we examine here.[5]

2 A first look at aggregate time-series data

This section provides an initial examination of how the term spread—particularly its term premium component—is related to future economic growth, bank profitability, and lending in aggregate time-series data.

Table 1 reports predictive regressions of four-quarter ahead real GDP growth, real bank loan growth, and bank return on equity on the term spread and its term premium component, respectively. We focus on the 5-year term spread—measured as the difference between the 5-year Treasury yield and the 3-month T-bill yield—to approximately capture the average maturity mismatch in banks' balance sheets. We decompose the term spread into two components: the term premium component, which compensates investors for bearing interest rate risks over the next five years, and the expectations component, which reflects anticipated changes in the short rate over the same horizon. The baseline term premium estimates used throughout the paper are from the no-arbitrage term structure model of Kim and Wright (2005). To control for current and expected future macro conditions, we include the median forecasts of one-year ahead real GDP growth from the Survey of Professional Forecasters (SPF) and the excess bond premium (Gilchrist and Zakrajšek, 2012).[6]

The regression estimates in Table 1 yield two main findings. First, the term spread consistently predicts higher future GDP growth, bank loan growth, and bank profitability, after controlling for short rate changes and concurrent macroeconomic conditions. Second, the coefficient on

[5] See Kuttner (2018) for a recent review of those other channels.
[6] Table OA-1 reports summary statistics.

the term premium is statistically significant across specifications. Because we control for the expectations component of the term spread, these results point to a potential mechanism beyond expectations about the future state of the economy. We hypothesize that this result reflects an expected bank profitability channel, whereby a rise in the term premium incentivizes banks to invest in longer-term assets to capture higher expected excess returns. The next two sections develop this hypothesis further: we first present a simple bank portfolio choice model to build intuition and then describe the empirical identification strategies we use to test the channel.

3 Model

3.1 Setup

We present a dynamic partial equilibrium banking model with the objective of understanding how fluctuations in term premium affect banks' lending decisions. To this end, we use a simple setup where a representative banker takes loan prices as given and maximizes the value of the bank, subject to financing constraints.

State of the economy. Time is continuous and denoted by $t > 0$. There is a pricing kernel, $m_t > 0$, capturing the state of the economy:

$$\frac{\mathrm{d}m_t}{m_t} = -r_t \mathrm{d}t - \kappa_t \mathrm{d}W_{r,t} - g\mathrm{d}W_{\kappa,t}, \tag{1}$$

with

$$\begin{aligned} \mathrm{d}r_t &= \lambda_r \left(\bar{r} - r_t\right) \mathrm{d}t + \sigma_r \sqrt{r_t} \mathrm{d}W_{r,t}, \\ \mathrm{d}\kappa_t &= \lambda_\kappa \left(\bar{\kappa} - \kappa_t\right) \mathrm{d}t + \sigma_\kappa \mathrm{d}W_{\kappa,t}, \end{aligned}$$

where $W_{r,t}$ and $W_{\kappa,t}$ are aggregate Brownian motions representing interest rate (r_t) shocks and term premium (κ_t) shocks, respectively, with an instantaneous correlation of $\varphi_{r\kappa}$.[7] In the appendix we show that similar versions of this pricing kernel can be derived from a preferred-habitat model along the lines of Vayanos and Vila (2021) or a consumption-based model along the lines of Bansal and Yaron (2004).

[7] The interest rate model we use is similar to that of Cox et al. (1985).

Loan prices. We assume loans are only affected by interest rate risks and those risks are priced by the pricing kernel (1).

To simplify the analysis and avoid tracking the entire maturity structure of loans when solving the bank's optimization problem, we assume there is a single loan that pays continuous coupons at the rate $\tau e^{-\tau t}$, corresponding to a duration of $1/\tau$. Additionally, we assume that the loans are default-free.[8] Let $P_t^{(\tau)}$ denote the loan price, which is given by the present discounted value of its future cash flows,

$$P_t^{(\tau)} = E_t \int_t^\infty \frac{m_s}{m_t} \tau e^{-\tau(s-t)} \mathrm{d}s, \tag{2}$$

and is a function of the state variables r and κ. We solve for $P_t^{(\tau)}$ using the Feynman–Kac theorem, which transforms the conditional expectation into a partial differential equation:

$$\left(\frac{\tau}{P^{(\tau)}} - \tau - r\right) \mathrm{d}t + E_t \left[\frac{P_r^{(\tau)}}{P^{(\tau)}} \mathrm{d}r + \frac{1}{2}\frac{P_{rr}^{(\tau)}}{P^{(\tau)}} \mathrm{d}r^2 + \frac{P_\kappa^{(\tau)}}{P^{(\tau)}} \mathrm{d}\kappa + \frac{1}{2}\frac{P_{\kappa\kappa}^{(\tau)}}{P^{(\tau)}} \mathrm{d}\kappa^2 + \frac{P_{\kappa r}^{(\tau)}}{P^{(\tau)}} \mathrm{d}\kappa \mathrm{d}r\right] = -cov_t\left(\frac{\mathrm{d}m}{m}, \frac{\mathrm{d}P^{(\tau)}}{P^{(\tau)}}\right),$$

where the term premium is given by

$$-cov_t\left(\frac{\mathrm{d}m}{m}, \frac{\mathrm{d}P^{(\tau)}}{P^{(\tau)}}\right) = \left(\kappa_t \frac{P_r^{(\tau)}}{P^{(\tau)}} \sigma_r \sqrt{r} + g \frac{P_\kappa^{(\tau)}}{P^{(\tau)}} \sigma_\kappa + \left(\frac{P_r^{(\tau)}}{P^{(\tau)}} \sigma_r \sqrt{r} g + \frac{P_\kappa^{(\tau)}}{P^{(\tau)}} \sigma_\kappa \kappa_t\right) \varphi_{r\kappa}\right) \mathrm{d}t. \tag{3}$$

Banks. Banks take asset prices as given and can trade three instruments: long-term loans, deposits, and fed funds. The balance sheet is given by

$$n_t + \widetilde{b}_t = x_t^{(\tau)} P_t^{(\tau)} + b_t, \tag{4}$$

where n_t is the wealth of the bank, $x_t^{(\tau)}$ is the number of loans at price $P_t^{(\tau)}$, while b_t and $\widetilde{b}_t$ are the value of the fed funds and deposit accounts, respectively. The only difference between deposits and fed funds is that banks pay a lower rate on deposits than the federal funds rate. That is, the fed funds account follows

$$\mathrm{d}b_t = r_t b_t \mathrm{d}t,$$

[8] Assuming a constant, non-zero default probability does not change the analysis. The model could also be extended to allow for a time-varying default probability on loans.

and the deposit account follows

$$\mathrm{d}\widetilde{b}_t = \phi\left(r_t\right)\widetilde{b}_t \mathrm{d}t,$$

with $\phi\left(r_t\right) \leq r_t$ representing the fact that banks have market power in the deposit market and pay a rate lower than the federal funds rate (Drechsler et al., 2017, 2021).[9] As we elaborate below, the presence of a positive deposit spread incentivizes banks to take leveraged positions in long-term loans, a result that is in line with Di Tella and Kurlat (2021). The evolution of banks' wealth is then given by

$$\begin{aligned} \mathrm{d}n_t &= x_t^{(\tau)}\mathrm{d}P_t^{(\tau)} + \mathrm{d}b_t - \mathrm{d}\widetilde{b}_t - cn_t\mathrm{d}t, \\ &= \left(r_t n_t - \left(\phi\left(r_t\right) - r_t\right)\widetilde{b}_t - cn_t\right)\mathrm{d}t + P_t^{(\tau)}x_t^{(\tau)}\left(\frac{\mathrm{d}P_t^{(\tau)}}{P_t^{(\tau)}} - r_t\mathrm{d}t\right), \end{aligned}$$

where c is a parameter that captures the cost, as a share of wealth, of running the deposit franchise.

Banks' optimization problem. We follow the basic banking structure proposed in Gertler and Kiyotaki (2015) (henceforth GK15). Banks pay dividends exogenously with a Poisson probability λ. As argued in GK15, this simple dividend policy prevents banks from growing out of their incentive constraint. We assume a new group of bankers use the dividends as initial capital to restart operations.[10] The bank's objective is to maximize the expected discounted value of future dividends using the aggregate stochastic discount factor

$$V_t = \max_{\left\{x_t^{(\tau)}, \widetilde{b}_t\right\}} E_t \int_t^{\infty} \frac{m_s}{m_t}\lambda e^{-\lambda(s-t)} n_s \mathrm{d}s,$$

subject to

$$\mathrm{d}n_t = \left(r_t n_t - \left(\phi\left(r_t\right) - r_t\right)\widetilde{b}_t - cn_t\right)\mathrm{d}t + P_t^{(\tau)}x_t^{(\tau)}\left(\frac{\mathrm{d}P_t^{(\tau)}}{P_t^{(\tau)}} - r_t\mathrm{d}t\right), \tag{5}$$

$$V_t \geq \rho P_t^{(\tau)} x_t^{(\tau)}, \tag{6}$$

$$\widetilde{b}_t \leq \delta n_t. \tag{7}$$

[9] We specify the function $\phi\left(r_t\right)$ below.

[10] In general equilibrium models, banks pay an aggregate dividend and receive a different amount of resources as startup capital in other to obtain an invariant distribution of wealth in the economy. In our partial equilibrium setup, however, the wealth distribution is not determined and hence we assume that all dividend payments are used as startup capital, without loss of generality.

Constraint (6), following GK15, is an incentive constraint arising from a moral hazard problem. It requires that the value of the bank, V_t, be at least a fraction ρ of the bank's loan holdings, $P_t^{(\tau)} x_t^{(\tau)}$.[11] Because banks can earn a positive spread on deposits, given by $r_t - \phi(r_t)$, they are incentivized to issue as many deposits as possible in order to invest the fed funds. To avoid this outcome, we impose a leverage constraint on deposits, denoted by (7).

Recursive formulation. We write the problem recursively

$$0 = \max_{\left\{x_t^{(\tau)}, \widetilde{b}_t\right\}} m_t \lambda e^{-\lambda t} n_t \mathrm{d}t + E_t \left[\mathrm{d} \left(m_t e^{-\lambda t} V_t \right) \right], \tag{8}$$

subject to (5), (6), and (7). Because the objective function and the constraints are linear in net worth, the solution takes the form of $V_t = \psi_t(\kappa_t, r_t) n_t$. The variable $\psi_t(\kappa_t, r_t)$ represents the bank's marginal value of wealth or "Tobin's Q" (see GK15). Then, the problem can be written as the following partial differential equation for $\psi_t(\kappa_t, r_t)$:

$$0 = \max_{\left\{x_t^{(\tau)}, \widetilde{b}_t\right\}} \frac{\lambda - \lambda \psi_t}{\psi_t} \mathrm{d}t + E_t \left[\frac{\mathrm{d}m}{m} + \frac{\mathrm{d}n}{n} + \frac{\mathrm{d}\psi}{\psi} + \frac{\mathrm{d}\psi}{\psi}\frac{\mathrm{d}n}{n} + \frac{\mathrm{d}\psi}{\psi}\frac{\mathrm{d}m}{m} + \frac{\mathrm{d}m}{m}\frac{\mathrm{d}n}{n} \right],$$

subject to (5), (6), and (7).

3.2 Model calibration and solution

We solve the model under the assumption that the incentive and deposit leverage constraints bind at all times, i.e., $V_t = \rho P_t^{(\tau)} x_t^{(\tau)}$ and $\widetilde{b}_t = \delta n_t$. As discussed in GK15, the incentive constraint is always binding as long as the risky asset yields a positive excess return in equilibrium. Additionally, the leverage constraint on deposits is always binding because the deposit spread $r - \phi(r)$ is always positive.

Calibration. Table 2 shows the calibration of the model's parameters. We calibrate the processes for r_t and κ_t using simulated method of moments to match the statistical properties of the short interest rate and term premium that we use in the empirical part of the paper. More precisely, we choose the parameters $\{\overline{r}, \overline{\kappa}, \sigma_r, \sigma_\kappa, \lambda_r, \lambda_\kappa\}$ to match the mean, standard deviation, and persistence

[11] Our qualitative results are robust to alternative constraints, such as a standard net-worth (or constant-leverage) constraint, $P_t^{(\tau)} x_t^{(\tau)} \leq \rho N_t$, as in, for example, Abadi et al. (2023).

of the observed short-term interest rate and term premium. For simplicity, we assume that shocks to the short rate and term premium are uncorrelated.

For banks, we calibrate the parameters primarily based on values used in the literature. In particular, we set λ and ρ to match those in GK15, and choose c to match the average Tobin's Q reported in that paper. We assume a linear function for the deposit rate, $\phi(r_t) = \phi r_t$, and set ϕ=0.35, following Drechsler et al. (2021), who document that a 100 basis point increase in the short rate raises the average deposit rate by 35 basis points. We set τ=1/20 to target a loan maturity of 20 quarters (5 years), which aligns with the typical maturity of banks' assets. Finally, we set δ to 2.9, consistent with the average ratio of short-term deposits to total equity capital reported in the Call Reports.[12]

Numerical results: Policy functions. Figure 1 shows the model's solution. In all panels, the horizontal axis plots the state variable κ_t—which drives fluctuations in the term premium—while the other state variable, the short-term interest rate r_t, is held fixed at its unconditional mean to simplify the exposition. The figure shows results for three values of ρ, the parameter governing the tightness of the bank's incentive constraint. As discussed below, variations in ρ alters banks' leverage decisions—a central focus of the empirical analysis. In all panels, the solid blue lines depict the solution under the baseline calibration of $\rho = 0.19$.

The upper-left panel shows the term premium, derived in Equation (3). A more negative value of κ_t is associated with a higher term premium. Intuitively, this is because a larger (in absolute value) diffusion component of the stochastic discount factor (κ_t) increases the sensitivity of asset valuations to interest rate shocks.

The upper-right panel shows banks' marginal value of wealth (or "Tobin's Q"), $\psi = V/n$. A higher ψ indicates that banks place greater value on an additional unit of wealth. Notably, ψ is higher in states where the term premium is elevated. Intuitively, a higher term premium raises the expected excess returns on loans and increases the present value of deposits spreads, thereby boosting banks' Tobin's Q.

The middle-left panel shows the expected return on wealth, defined as

$$\mu_{n,t} \equiv E\left[\frac{\mathrm{d}n_t}{n_t}\right]/\mathrm{d}t = r_t\left[1 + (1-\phi)\,\delta\right] - c + \alpha_t TP_t\left(\kappa_t, r_t\right), \tag{9}$$

[12] We use transaction deposits, rather than total deposits, because they are the more liquid components. In the model, deposits are assumed to be instantaneously liquid.

where $TP_t(\kappa_t, r_t)$ denotes the term premium. The expected return on wealth increases with the term premium because a higher term premium implies greater expected excess return on lending, and thus higher future profits. Additionally, as shown in the middle-right panel, banks' leverage on loans, $\alpha_t = x_t^{(\tau)} P_t^{(\tau)} / n_t$, also rises with the term premium. This occurs because α_t is determined by the incentive constraint and therefore is proportional to Tobin's Q, ψ_t, which—as discussed earlier—increases with the term premium. Together, higher leverage and a higher term premium result in a greater expected excess return on wealth when κ_t is low.

Finally, the bottom two panels show the solutions for bank lending. The level of lending is determined by the incentive constraint and is given by

$$L_t = P_t^{(\tau)} x_t^{(\tau)} = \frac{V_t}{\rho} = \frac{1}{\rho}\psi_t n_t.$$

Applying Itô's lemma to this expression, the growth rate of lending satisfies

$$\frac{\mathrm{d}L_t}{L_t} = \frac{\mathrm{d}\psi_t}{\psi_t} + \frac{\mathrm{d}n_t}{n_t} + \frac{\mathrm{d}\psi_t}{\psi_t}\frac{\mathrm{d}n_t}{n_t}. \tag{10}$$

The drift of (10) gives the expected loan growth rate:

$$\mu_{L,t} \equiv E_t\left[\frac{\mathrm{d}\psi_t}{\psi_t}\right] + E_t\left[\frac{\mathrm{d}n_t}{n_t}\right] + E_t\left[\frac{\mathrm{d}\psi_t}{\psi_t}\frac{\mathrm{d}n_t}{n_t}\right]. \tag{11}$$

The second term on the right-hand side is the expected return on wealth, which—as discussed earlier—increases with the term premium. In contrast, the first term, the expected change of Tobin's Q, $E_t\left[\frac{\mathrm{d}\psi_t}{\psi_t}\right]$, decreases with the term premium. This occurs because while ψ_t itself increases with the term premium, it is a stationary variable and therefore is expected to mean-revert; thus, when the term premium increases, ψ_t jumps up but its expected change becomes negative as it is anticipated to revert towards its long-run mean. In our calibration, the positive effect of the increase in expected return on wealth outweighs the negative expected change in ψ. Consequently, expected loan growth rises with the term premium, as illustrated in the lower-left panel of Figure 1.[13]

On impact, however, a negative shock to κ_t (which corresponds to an increase in the term premium) leads to a decline in the value of loans. This occurs because the diffusion component associated with κ_t shocks, denoted $\sigma_{L\kappa,t}$ and shown in the lower-right panel, is slightly positive.

[13] The third term of equation (11), $E_t\left[\frac{\mathrm{d}\psi_t}{\psi_t}\frac{\mathrm{d}n_t}{n_t}\right]$, is relatively small and does not materially affect the results. We plot this covariance in Figure B-2 in the appendix.

More precisely, from Equation (10), the diffusion $\sigma_{L\kappa,t}$ is given by

$$\sigma_{L\kappa,t} \quad = \quad \left(\frac{\psi_\kappa}{\psi} + \alpha_t \frac{P_\kappa^{(\tau)}}{P^{(\tau)}}\right)\sigma_\kappa. \tag{12}$$

In this expression, the derivative ψ_κ is negative (as shown in the top-right panel), while the derivative P_κ is positive. The positive sign of P_κ arises because a lower κ increases the term premium, which in turn reduces the market value of loans. In the baseline calibration, the second effect—reflecting marked-to-market losses on loans—dominates, resulting in an overall positive $\sigma_{L\kappa,t}$.

Figure B-1 provides further detail about how banks' average marginal value of wealth, ψ_t, and bank leverage, α_t, vary with the incentive constraint parameter, ρ, while holding the state variables at their unconditional means. Intuitively, in the moral hazard problem setting of GK15, a bank with a higher ρ derives a larger benefit from diverting bank's assets. Because we assume that the incentive constraint is always binding, the marginal value of wealth equals the benefit (per unit of wealth) of diverting assets. Therefore, a higher ρ (i.e., a higher value of diverting assets) corresponds to a higher average ψ_t. However, as ρ increases, banks face tighter restriction on holding loans, which leads to lower leverage.

Numerical results: Impulse responses. Figure 2 shows the impulse responses to a negative one-standard-deviation shock to κ_t. This shock raises the term premium by approximately 50 basis points, as shown in the upper-left panel.[14] The results under the baseline calibration are shown by the solid blue lines.

The top-middle and top-right panels of Figure 2 display the dynamics of the loan portfolio and banks' equity. On impact, both decline due to marked-to-market losses stemming from the increase in the term premium. The decline in banks' equity simply reflects banks' leveraged exposure to long-term loans. As discussed earlier, the drop in the value of the loan portfolio is due to the positive diffusion term in the loan dynamics (Equation (12)).

However, following the initial losses, banks' equity quickly recovers as banks benefit from higher expected returns on wealth, driven by the increase in term premium and, crucially, by an increase in leverage (low-left panel). Leverage increases because it is proportional to Tobin's Q, which—as discussed above—rises after the term premium shock because the risk-adjusted value of the deposit franchise increases with the term premium. As a result of the increased expected

[14] The standard deviation of κ_t, $\frac{\sigma_\kappa}{\sqrt{2\lambda_\kappa}}$, comes from the invariant distribution. This shock reduces κ_t from the unconditional mean of $\overline{\kappa}$=-0.22 to -0.34, on impact.

profitability, bank lending eventually rises above its steady state level.

The low-middle and low-right panels show the expected changes in Tobin's Q and the expected return on wealth. Since Tobin's Q increases with the term premium, it is expected to decline gradually as it reverts to its mean. In contrast, the expected return on wealth increases due to increases in both the term premium and and leverage. Although not shown, the expected change in the bank lending is approximately the difference between $E_t[\mathrm{d}\psi/\psi]$ and $E_t[\mathrm{d}n/n]$, which is positive. This implies that banks expect to expand their loan portfolios in response to the higher expected profitability brought about by the positive term premium shock.

The dashed and dotted lines illustrate how the results change when the incentive constraint parameter (ρ) is set above or below the baseline value, respectively. Recall that in steady state, bank leverage is inversely related to ρ. As shown by the red-dotted lines, banks with a lower ρ—and therefore higher leverage—exhibit a stronger response to term premium shocks relative to the baseline. This heightened sensitivity reflects the amplifying role of leverage: higher leverage magnifies the effect of an increase in the term premium on banks' expected return on wealth (Equation 9), which in turn translates into greater lending growth (Equation 11).

Therefore, this model generates two main testable implications:

Testable implication 1 *Banks respond to higher expected excess returns on maturity transformation by increasing loan supply.*

Testable implication 2 *This effect is stronger for more leveraged banks because the expected profitability of those banks rises relatively more for a given increase in expected excess returns on maturity transformation.*

4 Empirical Strategy

The model generates predictions for the effects of fluctuations in term premiums on bank lending and profitability. A key econometric challenge in testing these predictions is that unobservable or hard-to-measure variables—such as expectations about the economic outlook or uncertainty—may simultaneously affect term premiums and bank lending. If not properly accounted for, these variables can lead to omitted variable bias and spurious inferences. We take several concrete steps to mitigate this concern. First, we develop an IV strategy that isolates variations in term premiums driven by factors arguably unrelated to domestic economic conditions. Second, we conduct an event study around the sudden and unexpected surge in term premiums during the "Taper Tantrum" following Fed Chair Ben Bernanke's mid-2013 remarks about a potential reduction in the pace of asset purchases. Third, we assess the robustness of our results using alternative measures of term premium shocks, including high-frequency event-study-based monetary policy shocks and a second IV strategy. We describe these approaches in detail below.

Instrumental variable. To isolate exogenous changes in term premiums, our first strategy is to use an IV that influences term premiums for reasons plausibly unrelated to the domestic economic outlook. Specifically, we use foreign official holdings of U.S. Treasury securities, normalized by U.S. GDP. Foreign official investors include central banks, foreign exchange reserve managers, and sovereign wealth funds, among others. This instrument is motivated by the preferred habitat theory of the term premium, which posits that shifts in the available supply of Treasuries—driven, for example, by foreign demand for Treasuries—translate into changes in the term premium (Greenwood and Vayanos, 2014; Vayanos and Vila, 2021).

The instrument must be valid (i.e., independent of U.S. economic conditions) and relevant (i.e., strongly correlated with the term premium). Several pieces of evidence support the instrument's validity. First, a large literature on the effects of foreign official sector demand for U.S. Treasury securities on Treasury yields argues that such demand is primarily driven by foreign reserve management and foreign exchange intervention needs, rather than profit motives (see, e.g., Bernanke et al. (2004), Warnock and Warnock (2009), Beltran et al. (2013), Kaminska and Zinna (2020), and Ahmed and Rebucci (2024)).[15] In a recent study, Tabova and Warnock (2024) use confidential security-level survey data on foreign holdings of U.S. Treasuries to show that foreign official investors are largely price-insensitive, in contrast to domestic and foreign private investors. As a result, variations in foreign official holdings can be interpreted as exogenous "shocks" to the demand for U.S. Treasuries that affect Treasury yields and term premiums. Our approach is similar to Krishnamurthy and Vissing-Jorgensen (2015), who treat the post-1970s increase in foreign official holdings as a shock to the supply of Treasuries available to private investors, arguing that such holdings are unlikely to correlate with U.S. economic conditions. Indeed, as seen in Table OA-2, time-series regressions reveal that foreign official holdings of U.S. Treasuries are uncorrelated with contemporaneous or lagged real GDP growth expectations or with real-time

[15] See also the literature on capital inflows into the U.S. from foreigners seeking U.S. assets to store value, e.g., Caballero and Krishnamurthy (2009) and Caballero et al. (2008) and explanations related to the global savings glut, summarized in Bernanke (2005).

U.S. recession probabilities.

Turning to instrument relevance, Figure 3 shows that our instrument is negatively correlated with the term premium over 1994–2009 (our main sample). This negative correlation is especially pronounced during 2004–2006, when long-term rates remained stable despite rising short rates—a phenomenon that Fed Chair Alan Greenspan famously called a conundrum (Greenspan, 2005) and that Ben Bernanke attributed to the global savings glut (Bernanke, 2005). More formally, Table OA-3 demonstrates that foreign official holdings of U.S. Treasuries are a strong predictor of term premiums. We regress the 5-year Kim-Wright term premium on the instrument, controlling for the short rate and additional macroeconomic controls. The estimates in columns 1–2 indicate that higher demand by foreign official investors for Treasury securities is associated with statistically significant lower term premiums. Columns 3–6 confirm this result using alternative measures of the term premium from the term structure models of Adrian et al. (2013) and Kim and Priebsch (2024), which we describe in detail below and employ in robustness checks of our baseline findings.

Event study around Taper Tantrum. Our second identification strategy exploits a unique episode in which the term premium rose unexpectedly and sharply, while expectations about the economic outlook arguably remained stable. This episode is the "Taper Tantrum" that followed Fed Chair Ben Bernanke's May 22, 2013 remarks during the Q&A session of his semiannual congressional testimony, in which he indicated that the Federal Reserve might "step down" the pace of its quantitative easing program "in the next few meetings." Following these comments, Treasury yields and term premiums surged and remained elevated, as shown in Figure 5, inducing a large monetary policy shock (Bernanke, 2015; Chari et al., 2021). Identification of the term premium's effect on bank lending in this setting requires that the tapering announcement is unrelated to changes in expectations about the future state of the economy—particularly, expectations of an improving outlook. Market commentaries around the Taper Tantrum suggest that economic expectations remained stable. If anything, commentators expressed skepticism about the strength of the economic recovery and interpreted the announcement as a sign that the Fed's reaction function was less accommodative than previously thought (see, e.g., Sinha and Smolyansky (2022)). Nevertheless, to further guard against the possibility that evolving growth expectations confound our results, we limit the sample to banks participating in the Blue Chip Survey and control for their own reported quarterly growth expectations.[16]

[16] The Taper Tantrum period also coincided with regulatory developments that may have constrained lending: large banks had to raise capital in response to stress tests (conducted in 2011 and 2012) and the phase-in of new Basel III

Term premium shocks. We also employ event-study-based term premium "shocks" that isolate plausibly exogenous variations in term premiums using high-frequency interest rate changes around major monetary policy events. A large literature argues that changes over narrow windows surrounding such events primarily reflect surprises in monetary policy announcements, rather than other macroeconomic news. This identification approach, pioneered by Kuttner (2001), has become standard in empirical studies of monetary policy.

We construct term premium shocks in three steps. First, for each FOMC statement and minutes release dates between 1994 and 2019, we calculate one-day changes in the 3-month Tbill yield and in the expectations and term premiums components of the 3-month/5-year term spread, based on the Kim-Wright model. Second, following Miranda-Agrippino and Ricco (2021), we regress those event-day changes on past Greenbook/Tealbook forecasts and use the residuals as measures of "true shocks," purged of potential "Fed information effect" (Romer and Romer, 2000; Nakamura and Steinsson, 2018) or "Fed reaction to news" effect (Bauer and Swanson, 2023). Finally, we aggregate these cleaned event-day shocks into quarterly series by taking the weighted average of cumulative event-day changes, placing more weight on events that occur early in the quarter, as in Gertler and Karadi (2015). Figure OA-1 shows the resulting quarterly term premium shocks alongside the Kim-Wright term premium estimates.

As discussed in the next section, we take the testable hypotheses from the model to the data using two complementary empirical approaches: an IV strategy with bank-level data and an event study using loan-level data. We use the term premium shocks to assess the robustness of our findings, showing that (i) the bank-level findings hold when substituting the Kim-Wright term premium estimates with the event-study-based measures of term premium shocks, and (ii) the event-study results extend beyond the Taper Tantrum episode.

5 Data

Our empirical analysis combines bank- and loan-level data from the U.S. Call Reports and the supervisory Y-14Q dataset collected by the Federal Reserve. We supplement these with data on bank funding costs (deposit rates and stock market returns), firm balance sheets (investment rates, asset growth), county-level real outcomes, and a broad set of macroeconomic variables, as

capital requirements (announced in mid-2012). These developments, if anything, would bias us against finding an increase in lending by more leveraged banks, as higher capital requirements would tend to dampen rather than amplify lending (see, e.g., Aiyar et al. (2014).

described below.

U.S. Call Report data. We use quarterly, merger-adjusted U.S. Call Report data on domestic bank operations from 1994:Q1 to 2019:Q4. The baseline sample includes approximately 11,500 commercial banks headquartered across 409 MSAs, with the number of banks declining from about 8,700 in the early 1990s to about 4,350 by the end of the sample. From these data, we construct measures of bank loan growth (including and excluding off-balance-sheet credit lines), profitability (return on equity), total assets and liabilities, regulatory capital ratio (Tier1 capital over risk-weighted assets), core deposits, securities, reserves, and the maturity gap—a standard proxy for maturity transformation (English et al., 2018).

Y-14Q Loan-level data. We use loan-level data from the supervisory FR Y-14Q H.1 "Wholesale credit risk" schedule, reported quarterly by bank holding companies (BHC) subject to stress tests. These BHCs each held over $50 billion in assets during the sample period and together account for approximately 75% of U.S. commercial and industrial (C&I) loans (Favara et al., 2021) and 80% of total U.S. banking sector assets (Caglio et al., 2021). The dataset covers individual C&I loans above $1 million between each reporting BHC and individual borrowers. We restrict attention to loans made to U.S.-domiciled nonfinancial firms and limit the sample to 15 reporting banks that also submit GDP growth forecasts to the *Blue Chip Financial Forecasts* survey or the FRBNY's *Survey of Primary Dealers*. The firms covered in the Y-14 data account for 65% of U.S. corporate sector debt and 78% of aggregate U.S. gross output (Caglio et al., 2021). For each BHC's main commercial bank, we match balance sheet data from the merger-adjusted Call Report.

The Y-14 data include detailed information on loan contracts, such as loan amount and interest rate spreads, as well as extensive borrower characteristics, including industry, geographic location, financial variables (e.g. total assets, fixed assets, debt, cash and marketable securities), and sales growth. We use these data in two ways: First, to study how banks adjust lending in response to changes in the term premium; and second, to construct a firm-year panel that allows us to assess how term premium changes affect firm-level investment, measured as the annual growth rate of fixed assets.[17]

[17] Public information about the Y-14 data, including reporting forms and data dictionaries, is available on the Federal Reserve's website.

Additional bank- and county-level data. To measure bank funding costs, we use (i) deposit rates on 12-month certificates of deposit (CDs) of \$10,000, collected at the branch level by RateWatch (available quarterly for 2000–2019) and (ii) stock market returns from the Center for Research in Security Prices (CRPS) for 1994–2019, linked to the Call Report data using the CRSP-FRB file. County-level deposit shares from the FDIC Summary of Deposits are used as weights to construct county-level aggregates of bank characteristics. To measure local economic activity, we use the growth rate of county-level nightlight intensity from the VIIRS Nighttime Lights data (Elvidge et al., 2021), a proxy widely used to measure sub-national GDP growth (Pinkovskiy and Sala-i Martin, 2016; Henderson et al., 2012).

Macroeconomic data. We use several macroeconomic indicators throughout the analysis. For the term spread, we use the Fama 3-month yield and Fama-Bliss 5-year zero-coupon yields from CRSP. Term premium estimates are drawn from multiple sources: Kim and Wright (2005) from the Federal Reserve Board (FRB), Adrian et al. (2013) from the New York Fed, and Kim and Priebsch (2024), provided by the authors. Additional macroeconomic variables include real GDP growth, GDP deflator inflation, and NBER recession probabilities, sourced from the Federal Reserve Economic Data (FRED) at the St. Louis Fed. The excess bond premium (Gilchrist and Zakrajšek, 2012) is sourced from the FRB. Forecasts of one-year ahead real GDP growth and GDP deflator inflation come from the SPF at the Philadelphia Fed. Total foreign official holdings—along with Chinese and Belgian holdings—of Treasury coupon securities are constructed by Bertaut and Judson (2022) using data from the Treasury International Capital (TIC) reporting system. Although we lack direct data on Chinese *official* holdings, emerging-country holdings of Treasury securities are known to be concentrated in the official sector (Department of the Treasury, Federal Reserve Bank of New York, and Board of Governors of the Federal Reserve System, 2023).

Summary statistics. Table OA-1 presents summary statistics. The Kim-Wright term premium averages 1 ppt with a standard deviation of 75 bps over the longer 1973–2019 sample (panel A). When assessing economic magnitudes, we use a 50 bps change in the term premium—corresponding to the standard deviation of the series in the bank-level sample—as a benchmark magnitude. Over the bank-level sample of 1994:Q1–2019:Q4 (panel B), the average loan growth rate is 4.8% and average ROE is approximately zero. Bank capital ratios at the 25th and 75th percentiles are 11.5% and 18.6%, respectively, in the bank-level sample. These figures are 10.1% and 12.4%, respectively, in the loan-level sample used for the Taper Tantrum analysis (panel C).

6 Results

6.1 Bank-level evidence over 1994–2019

To test the model's implications relating bank lending outcomes to changes in the term premium (Testable Implication 1), we estimate the following specification using bank-quarter panel data:

$$Loan\ growth^{i}_{t,t+4} = \alpha_i + \beta_1\, \Delta y^1_t + \beta_2 \left(y^{20,eh}_t - y^1_t \right) + \beta_3\, y^{20,tp}_t + \tau \mathbf{X}_t + \gamma \mathbf{Z}_{it} + \varepsilon^{i}_{t,t+4} \quad (13)$$

where the dependent variable $Loan\ growth^{i}_{t,t+4}$ is the four-quarter-ahead loan growth at bank i, excluding off-balance-sheet credit line commitments. The term y^n_t denotes the n-quarter yield, while $y^{n,eh}_t \triangleq (1/n) E_t \sum_{i=1}^{n} y^1_{t+i}$ represents the average expected short rates over the next n quarters. The term premium is then defined as $y^{n,tp}_t \triangleq y^n_t - y^{n,eh}_t$. As in Table 1, we focus on the 5-year term spread, measured as the difference between the 5-year Treasury yield and the 3-month T-bill yield.

The additional macro controls, $\mathbf{X}_t$, include realized real GDP growth and GDP deflator inflation, survey forecasts of one-year ahead real GDP growth and GDP deflator inflation, and the excess bond premium. We include bank fixed effects (α_i) and bank MSA fixed effects to control for unobserved local shocks to banks.[18] Bank-level controls, $\mathbf{Z}_{it}$, include lagged loan growth, bank size (log share of the bank's assets in total banking sector assets), the regulatory capital ratio (Tier 1 capital divided by risk-weighted assets), core deposits as a share of total liabilities, and securities as a share of assets. The last term aims to capture potential valuation effects from yield curve movements—for instance, a decline in long-term rates would increase the value of bank assets that are marked to market, boosting earnings, capital, and lending capacity. We also verify that adding the maturity gap, as an alternative measure of these valuation effects, does not alter our results.

To estimate the effects of the term premium ($y^{20,tp}_t$), we use both Ordinary Least Squares (OLS), taking the Kim-Wright term premium as our benchmark measure, and IV estimations using foreign official holdings of U.S. Treasuries as the instrument, as discussed in Section 4. Testable Implication 1 predicts that the coefficient of interest β_3 should be positive.

Level effect of term premium. In Table 3, we report our main results based on the longest sample afforded by data availability (1994:Q1-2019:Q4). The estimation results in columns 1-2 indicate that a higher term premium is associated with higher subsequent loan growth, consistent

[18] MSA refers to the bank's headquarter location, which may change over time.

with model prediction 1. The IV estimate in column 2 has a first-stage F-test statistic for instrument relevance above 100, pointing to a strong instrument. The coefficient estimate in column 2 indicates that a one standard deviation increase in the term premium (50 bps) is associated with a 1.5 ppts increase in loan growth—a meaningful effect compared with the average loan growth of 4.8% and its standard deviation of 13.7% over the sample period.

We use local projections to estimate the dynamic effects of bank loans following a positive shock to the term premium. Using the IV specification in column 2 of Tables 3, we estimate impulse responses of bank lending to a 50 bps increase in the term premium over a period of eight quarters. As shown in the left panel of Figure 4, bank loans steadily increase over the next eight quarters, ending the period approximately 2.5% higher than before the shock.

Differential effects by bank leverage. In columns 3-4 of Table 3 we examine the model's Testable Implication 2 by modifying Equation (13) to include an interaction term between the term premium and bank leverage, along with time fixed effects. The model predicts that the response of bank lending to a term premium shock should be more pronounced for more leveraged banks, as their greater ability to amplify expected returns through leverage makes their profitability, and thus lending, more sensitive to changes in term premiums. Because we focus here on heterogeneity by bank capital ratios, we include interacted bank MSA$\times$quarter fixed effects. These fixed effects span standard quarter fixed effects and absorb the level effects of macro shocks on bank lending behavior, including that of the term premium itself.

The estimates in columns 3-4 of Table 3 show that an increase in term premiums is associated with stronger loan growth at banks with lower capital ratios, consistent with model prediction 2. The coefficient estimates on the interaction term between the term premium and bank capital are statistically significant at the 1% level. In terms of economic magnitude, the IV estimate in column 4 indicates that, following a one-standard-deviation (50 bps) increase in the term premium, a bank at the 25th percentile of the capital ratio distribution (11.5%) experiences four-quarter ahead loan growth that is 0.5 ppts higher than that of a bank at the 75th percentile (18.6%).

Identification robustness checks. We conduct three robustness checks to assess the validity of our identification strategy, as reported in Table OA-4. First, we exclude Chinese or Chinese and Belgian holdings from the measure of total foreign official holdings of U.S. Treasuries used to construct the baseline IV. This adjustment addresses the concern that China's demand for Treasuries—some of which may be funneled through custodial accounts in Belgium—could be systematically related to the U.S. economic outlook due to strong bilateral economic linkages. The estimates in panel A of Table OA-4 shows that this alternative IV yields similar results: a higher term premium induced by lower demand from foreign official demand (excluding China alone or China and Belgium) significantly boosts subsequent bank lending.

Second, in panel B, we replace the Kim and Wright (2005) term premiums with the event-study-based estimates of monetary policy shocks. As discussed in Section 4, these shocks are constructed using high-frequency interest rate changes around FOMC announcement windows to isolate exogenous variations in the term premium. The resulting estimates for both the level and interaction terms are statistically significant at the 5% level and have the expected signs.

Finally, Panel C employs an alternative IV: the maturity-weighted debt to GDP ratio. This instrument is also motivated by the preferred habitat theory, under which increases in the available supply of treasuries raise term premiums (Greenwood and Vayanos, 2014). The estimates using this alternative IV are statistically significant and economically larger than those obtained using our baseline instrument.

Additional checks. Term premium estimates are subject to uncertainty stemming from the underlying term structure model and their parameterizations. To verify that our main results are not driven by a specific term structure model, Table OA-5 presents robustness checks using alternative term premium estimates from Adrian et al. (2013) (ACM) and Kim and Priebsch (2024). A key distinction between the ACM model and the Kim-Wright approach is that the former excludes survey-based measures of short-rate expectations. The Kim-Priebsch model explicitly accounts for the effective lower bound period from 2008 to 2015, which overlaps with our sample period. We first verify that our IV strongly predicts these alternative term premium estimates, even after controlling for the short rate and other macroeconomic factors (see columns 3-6 in Table OA-3). We then re-estimate our baseline regressions using these alternative term premium estimates. The results, shown in panels A and B of Table OA-5, confirm that our conclusions are robust to the choice of the term structure model.

Panels C and D of Table OA-5 show that two alternative standard error estimators—proposed by Driscoll and Kraay (1998) and Kiefer et al. (2000), respectively—yield statistical significance levels that are similar to those obtained under our baseline approach, which clusters at both the bank and quarter levels.

We also examine the stability of the results under changes to variable construction, control variables, and sample period. In columns 1-2 of Table OA-6, we include in the dependent variable off-balance sheet credit lines, which have become increasingly important as contingent liquidity commitments by banks (Acharya et al., 2024). In columns 3-4, we add the lagged maturity gap to better capture valuation effects from long-term interest rate fluctuations that may not be fully captured by the securities-to-asset ratio. Finally, columns 5-6 extend the sample period to 1973:Q2-2019:Q4. Due to data limitations, we replace the core deposit share with the total deposit share and exclude the securities share. In all cases, our main findings remain robust.

6.2 Event study around the Taper Tantrum

In this section, we provide additional evidence on the model's Testable Implication 2—that the responses of bank lending to term premiums depend on ex-ante bank leverage—by conducting an event study around the Taper Tantrum. To this end, we use more granular, loan-level data on bank-firm lending relationship from the Y-14 dataset. An advantage of these data is that it allows us to examine banks' lending decisions while holding borrower-level loan demand constant within each quarter. Our sample focuses on new loans originated to nonfinancial firms during a symmetric window spanning three to six quarters before and after 2013:Q2, when the Taper Tantrum began. We estimate the following difference-in-difference regression specification:

$$\begin{aligned} Loan\ outcome_{bj,t+k} = \beta_1\ Capital\ ratio_{b,2012} \times Post_t + \gamma_1'\,\mathbf{X}_{bt} + \gamma_2'\,\mathbf{X}_{bt} \times Post_t \\ + \gamma_3'\,\mathbf{Z}_{bj} + \delta_{jt} + \varepsilon_{bjt} \end{aligned} \tag{14}$$

where $Loan\ outcome_{bj,t+k}$ refers to the log loan amount or the loan spread on new loans originated by bank b to firm j in quarter $t+k$, within a symmetric window of $k = 3, 4, 5, 6$ quarters before and after 2013:Q2, and zero otherwise. $Post_{t+k}$ is a dummy variable equal to one starting in 2013:Q3 and continuing for up to $k = 6$ quarters afterward (and zero in the period before 2013:Q2). We drop loans originated in 2013:Q2 to clearly separate the pre- and post-Taper Tantrum periods. Similar to previous regressions, we control for standard determinants of bank lending ($\mathbf{X}_{bt}$), including bank size, the share of core deposits in total liabilities, and the share of securities in total assets. Additionally, we include bank reserves (as a share of assets) to ensure that the results do not capture the lending effects of reserves (i.e. deposits at the Federal Reserve) accumulated under the QE programs initiated in November 2008, August 2010, and September 2012, which resulted in an unprecedented injection of reserves into the banking system.[19] The regulatory capital ratio is

[19] Omitting reserves may bias the estimate of β_1, with a sign that depends on the effect of reserves on lending and its correlation with bank leverage. Reserves can influence bank lending through multiple channels, such as asset prices, portfolio reallocation, balance sheet costs, or aggregate demand. Empirically, Kandrac and Schlusche (2021)

measured as of end-2012, thus predetermined relative to the Taper Tantrum-induced term premium changes.

Critically, these specifications include bank-level one-year-ahead GDP growth forecasts from the *Blue Chip Financial Forecasts* and the *Survey of Primary Dealers*, both in levels and interacted with $Post_t$. These forecasts control for banks' baseline expectations of the economic outlook—an important determinant of their lending decisions—as well as any revision to those expectations following the tapering announcement. We also include a bank-firm pair-level variable measuring the duration of the banking relationship as of end-2012 ($\mathbf{Z}_{bj}$), which captures the influence of relationship lending on loan outcomes and helps address concerns of nonrandom matching between banks and firms.[20] The regression includes borrower×quarter fixed effects (δ_{jt}) to control for time-varying loan demand and unobserved firm shocks (Khwaja and Mian, 2008; Jiménez et al., 2020). We estimate the model using OLS, with standard errors double-clustered at the bank-quarter and firm levels. The model's Testable Implication 2 predicts that the coefficient of interest β_1 should be negative, implying that bank with more ex-ante leverage (i.e., those with lower ex-ante capital ratios) should expand lending more in response to a rise in the term premium.

Differential effect by bank leverage. Table 4 reports the regression estimates. Across specifications, the coefficient on $Capital\ ratio_{b,2012} \times Post_t$ is statistically significant and indicates a robust differential effect of bank leverage on post-Taper Tantrum bank lending. In columns 1-4, the estimates suggest that, following the May 2013 event, more ex-ante leveraged banks originated larger and cheaper loans than their less leveraged counterparts, consistent with a supply-side interpretation of lending behavior. Specifically, column 2, which focuses on lending outcomes over a four-quarter window before and after 2013:Q2, shows that banks with capital ratios at the 25th percentile (10%) extended new loans that were approximately 11% larger and 70 bps cheaper than those made by banks at the 75th percentile (12%). These results are consistent with the bank-level evidence from Table 4 and support the model's Testable Implication 2: term premiums have heterogeneous effects on bank lending depending on ex-ante bank leverage.

Placebo test. We check the validity of the identifying assumption of parallel pre-trends in lending by banks with different levels of leverage with a placebo test. The Y-14 data began in 2012:Q1,

find a positive effect of reserve accumulation on lending and risk-taking, while Diamond et al. (2024) document a crowding-out effect.

[20] Ideally, we would include bank×firm fixed effects, but the short window around the Taper Tantrum limits the number of repeated observations per bank-firm pair, making such a specification infeasible.

so we focus on the period between 2012:Q2 and 2013:Q1, when the term premium was stable (see Figure OA-2). Using specifications similar to columns 1-4 of Table 4, we compare lending outcomes between the two-quarter period 2012:Q2-2012:Q3 and 2012:Q4-2013:Q1, using the regulatory capital ratio measured in 2012:Q3. The regression estimates reported in column 5 of Table 4 show no evidence of pre-trends in bank lending, mitigating concerns that unobservable bank characteristics are driving the main results.

External validity. We have shown that the steep rise in the term premium after the start of the Taper Tantrum boosted bank lending. Do these results generalize beyond the Taper Tantrum episode? To answer this question, we use high-frequency term premium shocks and the Y-14 loan-level data spanning the full 2012–2019 sample period in a standard lending regression. This regression relates the growth of outstanding loan commitments and loan spreads to (lagged) term premium shocks interacted with bank leverage. As shown in Table OA-7, the specifications include bank fixed effects, firm×quarter fixed effects, the standard bank controls, as well as interactions of bank characteristics with the short rate and the expectations component of the term spread. The regression estimates on the interaction between bank capital and term premium shocks are statistically significant and consistent with Testable Implication 2, indicating that more leveraged banks increase loan volumes more—and at lower spreads—after an exogenous rise in the term premium.

Real effects. Next, we examine whether the relative lending boost at more leveraged banks during the Taper Tantrum translated into improved real outcomes at the firm and local levels. The credit supply effects documented above would affect firm performance if bank-dependent firms found it costly to switch lenders, particularly when some lenders contract loan supply relative to others. To investigate this, we turn to the firm-year dataset extracted from the Y-14 data and examine how changes in firm outcomes depend on their exposure to the Taper Tantrum through their lenders' leverage. We estimate the following specification:

$$\begin{aligned} \mathit{Real\ Outcome}_{j,t+1} = \beta_1\ \mathit{Post}_t \times \mathit{Firm\ Exposure\ to\ Bank\ Capital}_{j,2012} \\ + \gamma_1'\,\mathbf{Z}_{jt} + \gamma_2'\,\mathbf{Z}_{jt} \times \mathit{Post}_t + \theta_j + \delta_{slt} + \varepsilon_{jt} \end{aligned} \tag{15}$$

where $\mathit{Real\ Outcome}_{jt}$ is either the investment rate—measured as the change in capital stock (fixed assets) of firm j between year t and $t+1$—or the total asset growth rate over the same period. Post_t is a dummy variable equal to one in the two or three years after the Taper Tantrum and zero before it, allowing us to compare firm outcomes in 2014-2015 versus 2012-2013, and 2014-2016 versus 2011-2013. The difference-in-differences term, $\mathit{Firm\ Exposure\ to\ Bank\ Capital}_{j,2012}$, captures firms' exposure to the rise in term premiums after the Taper Tantrum through their relationships with lenders with varying ex-ante leverage. It is calculated as the average regulatory capital ratio of a firm's lenders, weighted by the share of borrowing from each lender as of end-2012. Firm controls $\mathbf{Z}_{jt}$ includes size (log assets), leverage (debt/assets), cash holdings (as % of assets), and sales growth (a proxy for growth opportunities, following Whited and Wu (2006)). The specification includes firm fixed effects (θ_j) and state$\times$industry$\times$year fixed effects (δ_{slt}) to absorb unobserved shocks common to firms in a given location s and industry l.

The coefficient of interest is β_1, which we expect to be negative—implying that firms borrowing from more leveraged banks exhibit higher investment and asset growth rates after the Taper Tantrum. This would be consistent with the model's Testable Implication 2, which posits that more leveraged banks expand lending more following an increase in the term premium. The results, reported in panel A of Table 5, support this prediction. The coefficient estimates for β_1 are negative and statistically significant across the various time horizons examined, suggesting that firms borrowing from more leveraged banks before the Taper Tantrum were subsequently able to invest and grow more rapidly. Using the coefficients in columns 2 and 4 and comparing two firms—one previously borrowing from more leveraged lenders (at the 25th percentile of the capital ratio distribution) and the other from less leveraged lenders (the 75th percentile)—we find that the former experienced an investment rate higher by 2 ppts and asset growth rate higher by 2.4 ppts. These effects are meaningful relative to the average investment and asset growth rate of 5.7% and 6.8%, respectively.

Panel B of Table 5 provides additional support for Testable Implication 2 at the county level. Using satellite-recorded nighttime lights as a proxy for local economic activity (Pinkovskiy and Sala-i Martin, 2016; Henderson et al., 2012), we repeat the difference-in-differences regression with data aggregated at the county level. County-level exposures are constructed as weighted averages across banks with deposit-taking operations in a given county, using end-2012 deposit shares as weights. The results suggest that counties with ex-ante more leveraged banks experience higher economic growth in the three years following the Taper Tantrum compared with counties served by less leveraged banks (columns 2 and 4). Additional analysis reported in Table OA-8 covers a longer period 1994–2019 and links county-level nightlights growth to changes in the term premium. The results provide additional support for the model, with the caveat that the estimated differential effects by bank leverage have the expected sign but are statistically insignificant.

Bank funding costs. How do banks finance the growth in lending after a rise in the term premium? To answer this question, we examine changes in deposit rates, focusing on the most common savings instrument—the 12-month certificate of deposit (CD) rate on a $10,000 account. Table OA-9 reports estimates of the level and differential effects of term premiums changes—by bank leverage—using bank-country-quarter data spanning 2001–2019. The results show that higher term premiums are associated with significantly higher deposit rates (panel A, columns 1-2), particularly at banks with lower capital ratios (panel A, columns 3-4). These differential effects by bank leverage are also apparent in the period following the start of the Taper Tantrum (panel B). Overall, these results suggest that banks respond to a rise in term premiums by increasing deposit rates, thereby attracting new funding and expanding their lending capacity.

6.3 Mechanism: Bank profitability

Our evidence so far shows that a steeper yield curve, when driven by a higher term premium, increases the supply of bank credit. We conjecture that the underlying mechanism operates through *expected bank profitability*: a higher term premium represents greater expected profits from maturity transformation.

To support this mechanism, we re-estimate the models from Table 3, using ROE as the dependent variable. The OLS and IV estimates in Table 6 reveal a positive and statistically significant relation between term premiums and future bank profitability. Using the coefficient estimate in column 2, a one standard deviation increase in the term premium (50 bps) is associated with a 28 bps increase in bank ROE over the following four quarters—compared with an average ROE of 0% over the sample period. Impulse responses estimated from local projections, shown in the right panel of Figure 4, indicate that bank ROE rises gradually in response to a 50 bps increase in the term premium, reaching nearly 30 bps above the pre-shock level after eight quarters. Panel B of Table 6 presents additional evidence based on the difference-in-differences set-up in Table 4, examining changes in bank ROE after the start of the Taper Tantrum. The estimates show that more leveraged banks experienced greater increases in profitability as the term premium rose, with statistical significance improving with longer analysis windows.

These findings are corroborated by evidence from the equity market (Table OA-10). Using daily stock returns of listed banks over the period between 1997 and 2019, along with high-frequency measures of term premium shocks and a specification that closely follows Paul (2023), we find that banks—particularly more leveraged ones—earn higher excess stock returns following exogenous increases in term premiums. These results suggest that higher term premiums are perceived by investors as improving banks' future earnings prospects, consistent with the profitability mechanism outlined above.

7 Conclusion

This paper documents that an unexpected rise in the term premium leads to higher bank lending and profitability, particularly among more leveraged banks. We refer to this mechanism as the *expected bank profitability channel*. Our findings are consistent with the predictions of a bank portfolio choice model and offer one potential explanation for the well-established predictive power of the yield curve slope for future economic growth. Specifically, when the yield curve steepens due to an increase in the term premiums—rather than expectations of rising short rates—banks expand their maturity transformation activities and extend more credit. This increase in bank credit supply can, in turn, stimulate the broader economy through the standard credit channels. Our results have important implications for monetary policy: central banks should consider the effects of term premium fluctuations on bank profitability and credit supply when designing and calibrating balance sheet policies, especially in economies more reliant on bank-based financing.

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Figures and Tables

Figure 1: Model solution

This figure shows the model's solution along the κ_t (the term premium factor) dimension (horizontal axis) for three different values of ρ, the parameter capturing the tightness of the incentive constraint. We set $r_t = \bar{r}$. The upper-left panel plots the term premium (TP_t). The upper-right panel shows banks' marginal value of wealth, or "Tobin's Q" (ψ_t). The middle-left panel displays the expected return on wealth ($\mu_{n,t}$). The middle-right panel shows banks' leverage on loans (α_t). The bottom-left panel shows expected loan growth ($\mu_{L,t}$). The bottom-right panel shows the diffusion component of loan growth associated with κ_t shocks ($\sigma_{L\kappa,t}$).

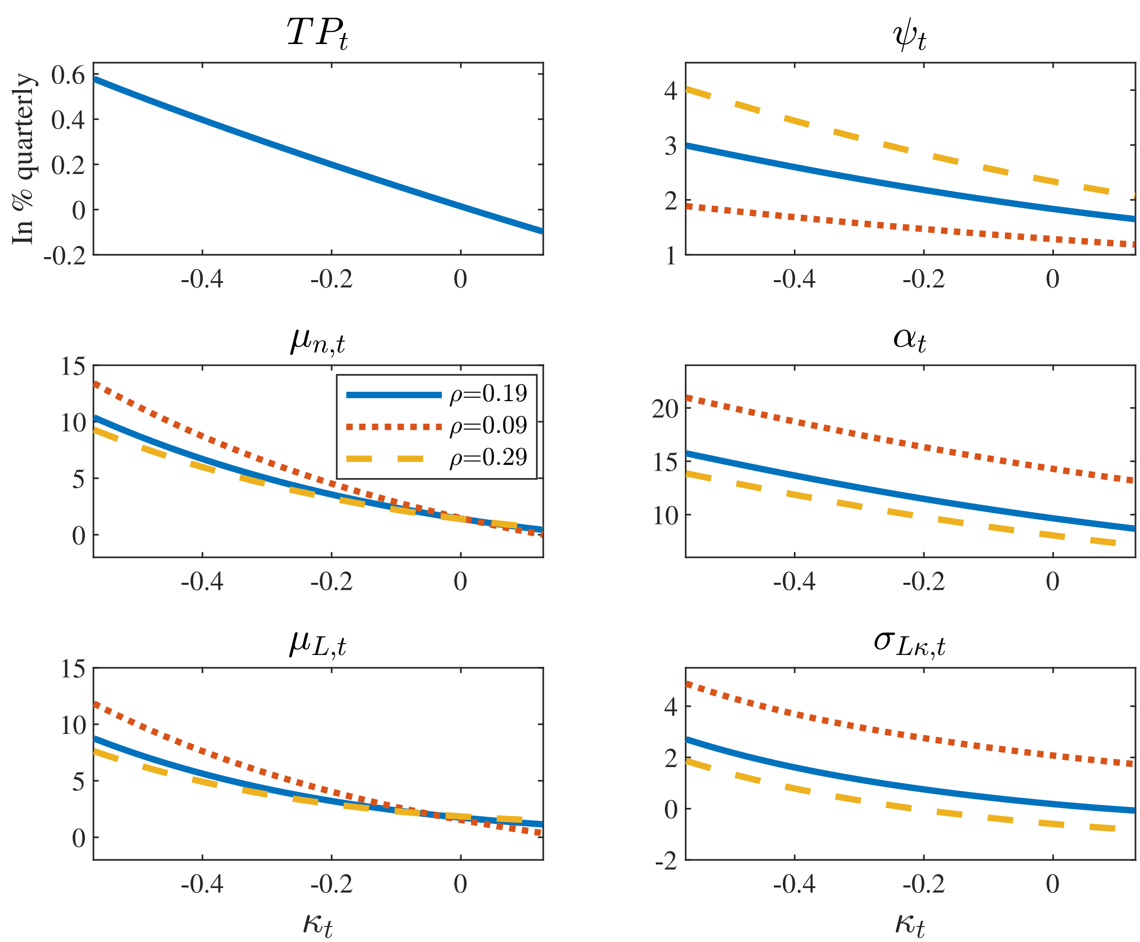


Figure 2: Impulse responses to a κ_t shock in the model

This figure shows the model's impulse-responses to a one standard deviation shock to κ_t in quarter 11. The shock leads to an increase in the term premium of approximately 50 basis points (annualized), corresponding to one unconditional standard deviation of κ_t. The red-dotted and yellow-dashed lines represent model responses under different values of the incentive constraint parameter (ρ). The upper-left panel shows the dynamics of the term premium (TP) following the shock. The upper-middle panel shows the evolution of banks' loans (L_t). The upper-right panel shows the evolution of banks' equity (n_t). The lower-left panel shows banks' leverage (α). The lower-middle panel shows the expected changes in banks' marginal value of wealth, or "Tobin's Q," ($E_t[\mathrm{d}\psi/\psi]$). The lower-right panel shows banks' expected change in wealth ($E_t[\mathrm{d}n/n]$).

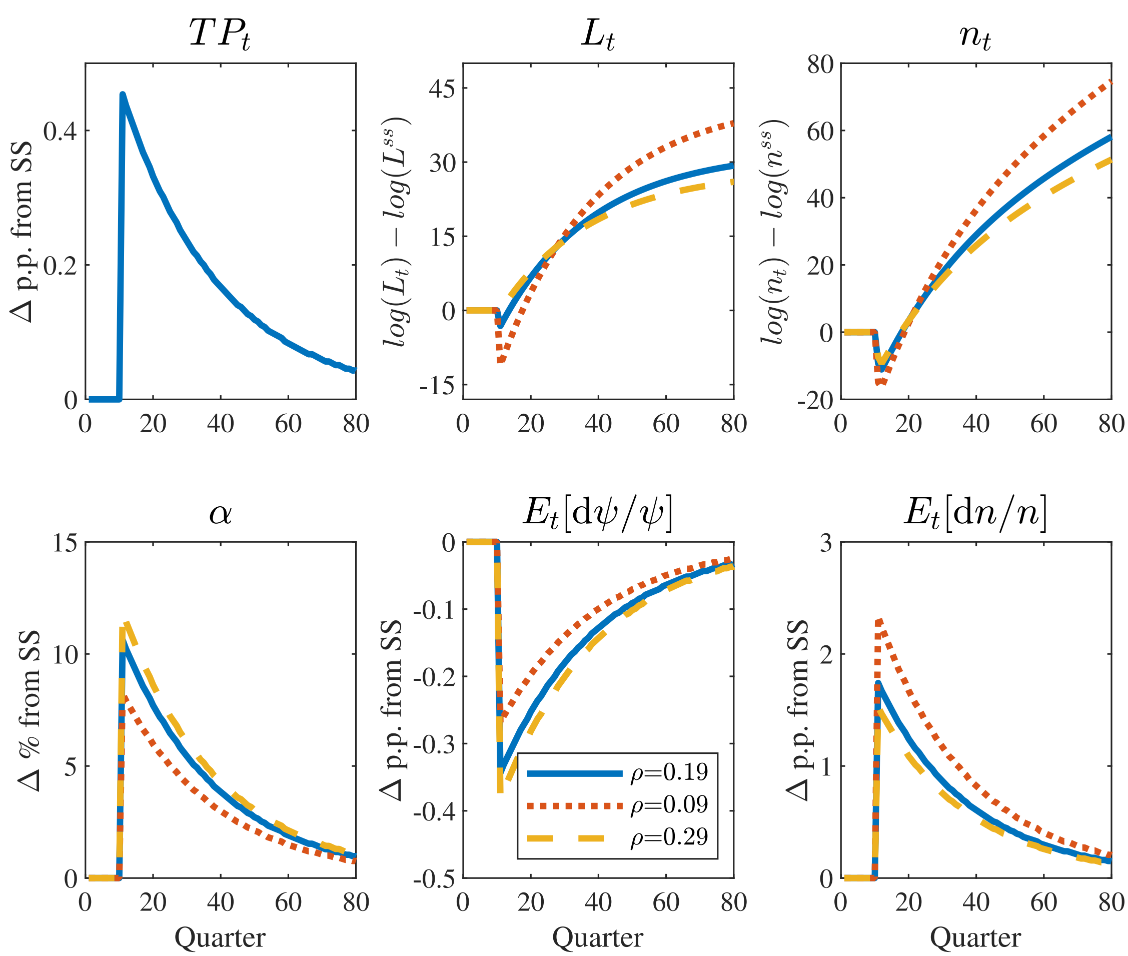


Figure 3: Instrumental variable vs. Term premium (Kim-Wright)

This figure shows (a) the 5-year term premium series from the term structure model of Kim and Wright (2005) and (b) the instrumental variables representing the foreign official holdings of U.S. Treasuries normalized by U.S. GDP.

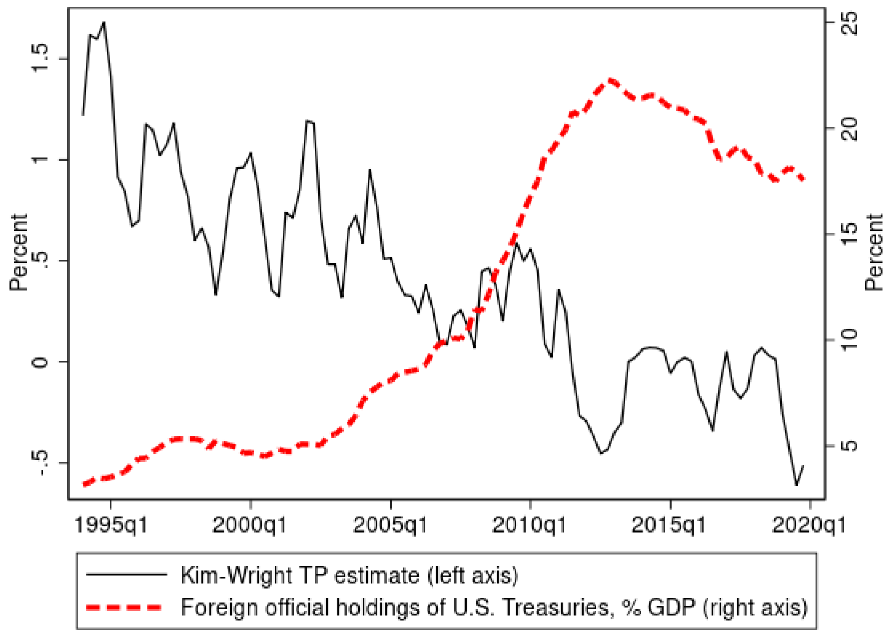


Figure 4: Dynamic responses of bank lending and profits to a rise in the term premium

This figure shows the evolution of bank loans and bank return on equity (ROE) over the eight quarters following a 50-basis-point positive shock to the Kim-Wright 5-year term premium. The results are based on local projection estimations using foreign official holdings of U.S. Treasuries (normalized by U.S. GDP) as the instrumental variable for term premiums. The corresponding specifications for four-quarter ahead outcomes are shown in column 2 of Table 3 and column 2 of Table 6. The shaded area represent 90% confidence intervals, with standard errors double-clustered by bank and quarter.

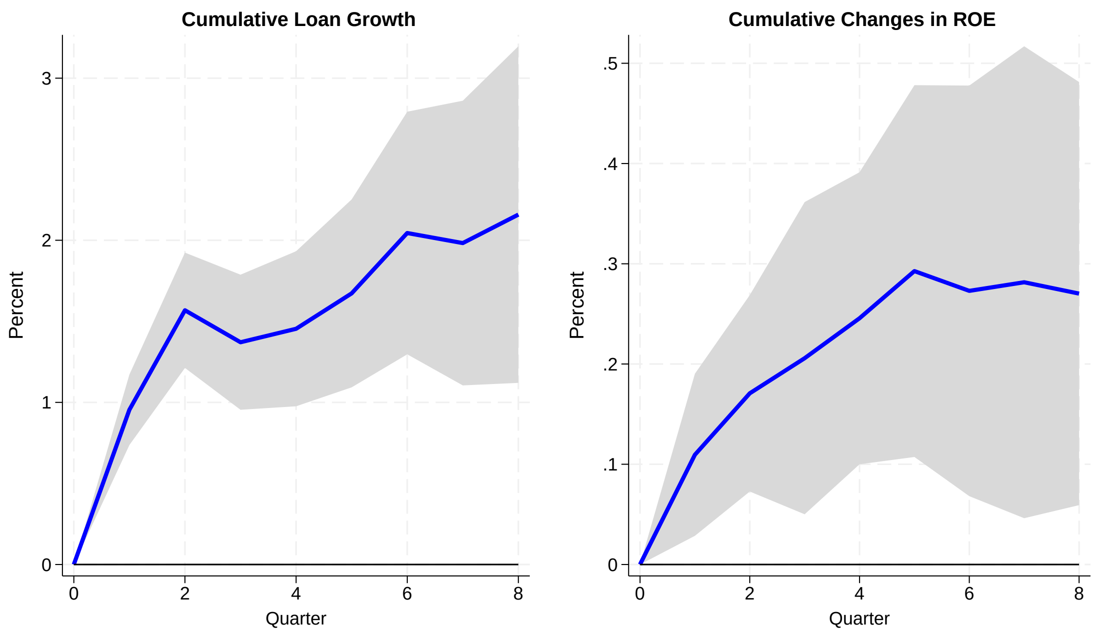


Figure 5: Treasury yields and the term premium during Taper Tantrum

This figure depicts the sharp and sustained rise in the 5-year Treasury yield and in the 5-year term premium during the Taper Tantrum episode following former Chair Ben Bernanke's remarks on May 22, 2013, in which he signaled the Federal Reserve's intention to begin tapering asset purchases under its quantitative easing program. The date of the remarks is marked by the dashed vertical line. The Treasury yields series is the *Market Yield on U.S. Treasury Securities at 5-Year Constant Maturity, Quoted on an Investment Basis* [series code DGS5], retrieved from FRED, Federal Reserve Bank of St. Louis (link). The 5-year Kim-Wright term premium series is retrieved from FRED, Federal Reserve Bank of St. Louis (link).

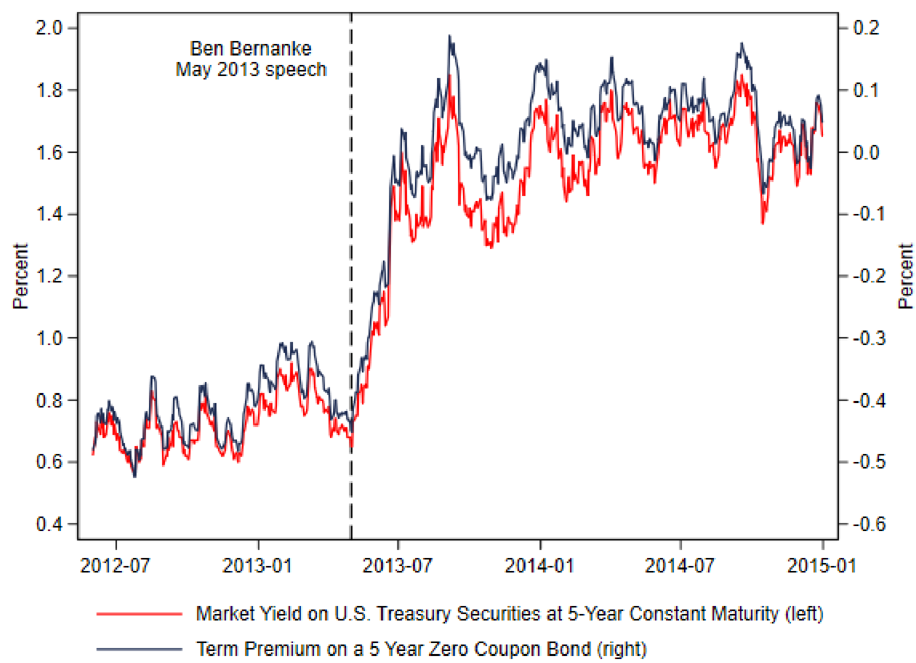


Table 1: Motivating evidence: Predictive power of the term spread and its term premium component in the time series

This table reports OLS regressions using monthly time series data. The dependent variables are real GDP growth, banking system loan growth, and return on equity (ROE). The sample period is 1973:Q1–2019:Q4 for columns 1-4 and 1984:Q4-2019:Q4 for columns 5–6. Macro controls include the lagged change in the short rate measured by the 3-month Tbill yield (ΔSR), the median one-year ahead real GDP growth forecast from the Survey of Professional Forecasters (SPF), the excess bond premium from Gilchrist and Zakrajšek (2012), and the lagged dependent variable. Regressions in columns 2, 4 and 6, which focus on the term premium, additionally control for the expectations component (defined as the 3-month/5-year spread minus the term premium). Time series data on the Kim and Wright (2005) term premium, real GDP growth, and aggregate banking sector variables (total loans and ROE) are obtained from Federal Reserve Economic Data (FRED). Data sources are discussed in more detail in Section 5. Robust and autocorrelation-consistent standard errors in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables:	**Real GDP growth**$_{t,t+4}$		**Bank loan growth**$_{t,t+4}$		**ROE**$_{t,t+4}$	
3m5y term spread$_t$	0.64**		0.87**		1.33**	
	(0.26)		(0.36)		(0.53)	
Term premium$_t$		1.10***		0.90**		1.59**
		(0.37)		(0.39)		(0.65)
Observations	183	183	183	183	137	137
R^2	0.34	0.37	0.60	0.60	0.64	0.64
Macro controls	Y	Y	Y	Y	Y	Y

Table 2: Model calibration

		Value	Description	Source
1. $r-$process				
	$\bar{r}$	0.0115	Mean r	SMM
	λ_r	0.0241	AC(1) r	SMM
	σ_r	0.0071	Volatility r	SMM
2. $\kappa-$process				
	$\bar{\kappa}$	-0.2206	Mean κ	SMM
	λ_κ	0.0332	AC(1) κ	SMM
	σ_κ	0.0299	Volatility κ	SMM
3. Banks				
	λ	0.013	Dividend payout intensity	GK15
	ρ	0.19	Seizure rate	GK15
	ϕ	0.35	Deposit spread	Drechsler et al. (2021)
	c	0.02	Fixed cost	Avg. Tobin's Q in GK15
	τ	1/20	(Inverse) maturity of loans	Avg maturity of 5 years
	δ	2.9	Deposit constraint	Match Call Report

The model calibration is described in Section 3.2.

Table 3: Term premium and bank lending: Bank-level evidence

This table reports OLS and IV estimates from regressions of bank loan growth on the Kim and Wright (2005) term premium and its interaction with bank leverage. Columns 1 and 3 report OLS estimates using the level of the term premium. Columns 2 and 4 report IV results, instrumenting the term premium with foreign official holdings of U.S. Treasuries (normalized by U.S. GDP). In column 4, the interaction term Bank Capital × Term Premium is instrumented by Bank Capital × Foreign UST holdings/GDP. The data are at the bank-quarter level for the period 1994:Q1-2019:Q4. Macro controls include the lagged change in the short rate measured by the 3-month Tbill yield (ΔSR), the expectations component (defined as the 3-month/5-year spread minus the term premium, EH), four-quarter real GDP growth, four-quarter GDP deflator inflation, one-year ahead real GDP growth and GDP deflator inflation forecasts from SPF, and the excess bond premium. Bank controls include lagged bank size (log share of bank assets in total banking system assets), Tier-1 regulatory capital ratio, the share of core deposits in total liabilities, the share of securities in total assets, and lagged loan growth. All regressions include bank MSA fixed effects, based on the location of the bank's headquarter. Standard errors are double-clustered by bank and quarter and reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)
Dependent variable:	**Loan growth$_{t,t+4}$**			
	OLS	**IV**	**OLS**	**IV**
Term premium$_t$	1.85***	3.01***		
	(0.45)	(0.59)		
Bank Capital$_t$ × Term Premium$_t$			-9.53***	-14.05***
			(2.04)	(3.15)
Observations	562568	562,568	557,899	557,899
R^2	0.25	-	0.16	-
First-stage F test	-	217.7		42.94
Macro controls	Y	Y	-	-
Bank controls	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Bank MSA FE	Y	Y	Y	Y
Bank MSA×Year:Quarter FE	-	-	Y	Y

Table 4: Term premium and bank lending: Event study loan-level evidence

This table reports OLS estimates from a difference-in-differences regression centered on the 2013:Q2 Taper Tantrum. The data are at the loan level and refer to new loan originations by Y-14 reporting banks. The samples is symmetric around 2013:Q2 and includes loans originated from three to six quarters before to three to six quarters after 2013:Q2, excluding those originated in 2013:Q2. The dependent variables are loan volume (in log) in panel A and loan spreads in panel B. Bank capital is measured as of end-2012. Post is a dummy variable equal to one in the period after 2013:Q2 and zero otherwise. Column 5 reports a placebo test using data from 2012:Q2-2013:Q1, where the Post dummy equals one in 2012:Q4-2013:Q1 and zero in 2012:Q2-2012:Q3, and Bank capital is measured as of end-2011. Relationship duration is the number of quarters (in log) since the first observed loan for a given bank-firm pair. Bank controls include one-year ahead real GDP growth forecasts from the Blue Chip Financial Forecasts or the Survey of Primary Dealers, bank size (log-assets), the share of core deposits in total liabilities, the share of securities in total assets, and the share of reserves in total assets. Standard errors are double-clustered by bank-quarter and firm and reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)	(5)
Window around Taper Tantrum:	**3Q**	**4Q**	**5Q**	**6Q**	**Placebo**
			A. Loan volume (log)$_{t+1}$		
Bank Capital$_t$ × Post$_t$	-0.035	-0.046*	-0.070***	-0.068***	0.024
	(0.026)	(0.026)	(0.025)	(0.024)	(0.037)
Observations	8,506	11,312	17,489	20,868	5,841
R^2	0.777	0.776	0.884	0.875	0.776
			B. Loan spread$_{t+1}$		
Bank Capital$_t$ × Post$_t$	0.482***	0.297***	0.184**	0.128*	-0.149
	(0.139)	(0.107)	(0.084)	(0.069)	(0.131)
Observations	3,040	3,912	5,360	6,610	2,043
R^2	0.843	0.833	0.846	0.840	0.871
Bank controls×Post	Y	Y	Y	Y	Y
Relationship duration	Y	Y	Y	Y	Y
Growth expectations×Post	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y
Firm×Year:Quarter FE	Y	Y	Y	Y	Y

Table 5: Real effects of term premium: Event-study evidence

This table reports OLS estimates from regressions of real outcomes on the Kim and Wright (2005) term premium and its interaction with bank leverage, following the setup in baseline Table 4. The dependent variables are firm investment rate and asset growth in panel A and county nightlights growth (sourced from the VIIRS Nighttime Lights data (Elvidge et al., 2021).) in panel B. In columns 1 and 3, The Post dummy equals one in 2014-2015 (and zero in 2012-2013); in columns 2 and 4, Post equals one in 2014-2016 (and zero in 2011-2013). In panel A, firms' exposure to bank leverage is defined as the average capital ratio of a firm's lenders, weighted by the firms' share of outstanding total loan commitments from those lenders (both measured at the end of 2012). Firm controls include firm size (log-assets), leverage (total debt in percent of assets), cash and short-term marketable securities (in percent of assets), and sales growth. Industry classification is two-digit NAICS. Standard errors clustered by firm in parentheses. In panel B, the data are at the county-year level. Bank variables are aggregated at the county level as weighted averages of bank-level variables, using deposit shares from June 2012 (FDIC Summary of Deposits) as weights. Bank capital is measured at the end of 2012. County controls include lagged bank size (log share of bank assets in total banking system assets), capital ratio, the share of core deposits in total liabilities, the share of securities in total assets, and the share of reserves in total assets. Standard errors are clustered by county and reported in parentheses. Significance: $^{+}$p<.2; *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)
Window around Taper Tantrum:	**2 yrs**	**3yrs**	**2 yrs**	**3yrs**
Firm-level outcomes	**(A) Firm-level outcomes**			
	Investment Rate$_{t+1}$		**Asset Growth$_{t,t+1}$**	
Firm's Exposure to Bank Capital$_t$ $\times$ Post$_t$	-0.016***	-0.017***	-0.018***	-0.020***
	(0.002)	(0.001)	(0.002)	(0.001)
Observations	66,046	68,521	86,211	89,279
R^2	0.377	0.499	0.339	0.479
Firm controls$\times$Post	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
State$\times$Industry$\times$Year FE	Y	Y	Y	Y
County-level outcomes	**(B) Nightlights growth$_{t,t+1}$**			
Bank Capital$_t$ $\times$ Post$_t$	-0.084^{+}	-0.193***	0.034	-0.156**
	(0.064)	(0.058)	(0.137)	(0.064)
Observations	12,426	18,639	9,315	15,527
R^2	0.250	0.324	0.361	0.226
County controls$\times$Post	-	-	Y	Y
County FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y

Table 6: Mechanism: Term premium and bank profitability

This table reports OLS and IV estimates from regressions of bank return on equity (ROE) on the Kim and Wright (2005) term premium and its interaction with bank leverage. The specifications in panels A and B follow the same setup as in baseline Tables 3 and 4. The dependent variable, ROE, is constructed as the four-quarter average over $t+1$ and $t+4$. In panel A the data are at the bank-quarter level and span 1994:Q1-2019:Q4. Macro controls include changes in the short rate measured by the 3-month Tbill yield (ΔSR), the expectations component (defined as the 3-month/5-year spread minus the term premium, EH), four-quarter real GDP growth, four-quarter GDP deflator inflation, one-year ahead real GDP growth and GDP deflator inflation forecasts from SPF, and the excess bond premium. Bank controls include the lagged ROE, bank size (log share of bank assets in total banking system assets), capital ratio, the share of core deposits in total liabilities and the share of securities in total assets. In panel B the data are at the bank-quarter level and cover a symmetric window of three to six quarters before and after 2013:Q2, when the Taper Tantrum occurred. Bank capital is measured as of end-2012. Post is a dummy variable that equals one in the period after 2013:Q2 and zero otherwise. Bank controls include bank size (log-assets), the share of core deposits in total liabilities, the share of securities in total assets, and the share of reserves in total assets. Standard errors are double-clustered by bank and quarter and reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)
Dependent variable:	**Return on equity$_{t+1,t+4}$**			
	(A) Bank-level evidence			
	OLS	**IV**	**OLS**	**IV**
Term premium$_t$	0.403***	0.566***		
	(0.113)	(0.122)		
Bank Capital$_t$ $\times$ Term Premium$_t$			-0.74***	-1.17***
			(0.19)	(0.27)
Observations	562,182	562,182	557,501	557,501
R^2	0.277	0.276	0.17	0.17
First-stage F test	-	228.3	-	35.19
Macro controls	Y	Y	-	-
Bank controls	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Bank MSA FE	Y	Y	Y	Y
Bank MSA$\times$Year:Quarter FE	-	-	Y	Y
	(B) Event study around Taper Tantrum			
Window around Taper Tantrum:	**3Q**	**4Q**	**5Q**	**6Q**
Bank Capital$_t$ $\times$ Post$_t$	-0.010	-0.014*	-0.016*	-0.020**
	(0.006)	(0.007)	(0.008)	(0.009)
Observations	6,183	9,275	12,430	15,435
R^2	0.807	0.756	0.728	0.699
Bank controls$\times$Post	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y

Appendix

A Derive the pricing kernel from utility maximization problems

We show that the reduced-form pricing kernel (1) can be derived from two types of utility maximization problems. We first look at a preferred-habitat model along the lines of Greenwood and Vayanos (2014). Under this interpretation, shocks to κ_t represent shocks to the supply of Treasury bonds that affect term premiums. We then look at a standard consumption-based model along the lines of Bansal and Yaron (2004), in which shocks to κ_t can be interpreted as shocks to the volatility of consumption growth of the marginal investor.

A.1 Preferred-habitat framework

The preferred-habitat model follows Greenwood and Vayanos (2014) (GV14 hereafter). We give the basic outline here and refer the readers to GV14 for more details.

First, we state a simplified version of the term premium in our model. Without loss of generality, consider the case in which the short rate follows an Ornstein–Uhlenbeck process:

$$\mathrm{d}r_t = \lambda_r \left(\bar{r} - r_t\right) \mathrm{d}t + \sigma_r \mathrm{d}W_{r,t},$$

and the correlation between κ_t and r_t shocks is 0 (i.e., $\varphi_{\kappa r} = 0$). Under these assumptions, the term premium in our model (equation (3)) can be simplified to:

$$\mu_t - r_t = \kappa_t \frac{P_r^{(\tau)}}{P} \sigma_r + g \frac{P_\kappa^{(\tau)}}{P} \sigma_\kappa = \kappa_t \theta_1^{(\tau)} + \theta_0^{(\tau)}. \tag{A-1}$$

where $\mu_t \mathrm{d}t = E_t \left[\mathrm{d}P_t^{(\tau)} / P_t^{(\tau)} \right]$.[21]

Second, we show that equation (A-1) can be derived from a preferred-habitat model. As presented in detail in GV14, the arbitrageur's problem is

$$\max_{\left\{X_t^{(\tau)}\right\}_{\tau \in (0,T]}} \quad E_t \left[\mathrm{d}W_t\right] - \frac{a}{2} Var_t \left[\mathrm{d}W_t\right],$$

subject to the budget constraint

$$\mathrm{d}W_t = W_t r_t \mathrm{d}t + \int_0^T X_t^{(\tau)} \left(\frac{\mathrm{d}P_t^{(\tau)}}{P_t^{(\tau)}} - r_t \right) \mathrm{d}\tau.$$

[21] Agents in the GV14 model price a zero-coupon yield curve, while our model prices a loan with a perpetually decaying coupon. The conclusions are the same whether we price a zero-coupon loans or the perpetually decaying coupons, the only difference would be in the parameters $\theta_1^{(\tau)}$ and $\theta_0^{(\tau)}$.

We consider a net supply process that do not depend on bond prices,

$$S_t^{(\tau)} = \zeta^{(\tau)} + \theta^{(\tau)}\kappa_t \tag{A-2}$$

where the process for κ_t is the same as in our model,

$$\mathrm{d}\kappa_t = \lambda_\kappa \left(\overline{\kappa} - \kappa_t\right) \mathrm{d}t + \sigma_\kappa \mathrm{d}W_{\kappa,t}.$$

In equilibrium, the demand from arbitrageurs is equal to the supply, $X_t^{(\tau)} = S_t^{(\tau)}$. Guessing (and later verifying) that loan prices follow

$$P_t = \exp\left(-\left[A_r^{(\tau)} r_t + A_\kappa^{(\tau)}\kappa_t + C^{(\tau)}\right]\right), \tag{A-3}$$

the first order conditions for the arbitrageurs can be written as

$$\mu_t^{(\tau)} - r_t = A_r^{(\tau)} a\sigma_r^2 \int_0^T X_t^{(\tau)} A_r^{(\tau)} \mathrm{d}\tau + A_\kappa^{(\tau)} a\sigma_\kappa^2 \int_0^T X_t^{(\tau)} A_\kappa^{(\tau)} \mathrm{d}\tau. \tag{A-4}$$

Define

$$\begin{aligned}
\lambda_{r,0}^{(\tau)} &= a\int_0^T \zeta^{(\tau)} A_r^{(\tau)} \mathrm{d}\tau, \\
\lambda_{r,1}^{(\tau)} &= a\int_0^T \theta^{(\tau)} A_r^{(\tau)} \mathrm{d}\tau, \\
\lambda_{\kappa,0}^{(\tau)} &= a\int_0^T \zeta^{(\tau)} A_\kappa^{(\tau)} \mathrm{d}\tau, \\
\lambda_{\kappa,1}^{(\tau)} &= a\int_0^T \theta^{(\tau)} A_\kappa^{(\tau)} \mathrm{d}\tau.
\end{aligned}$$

Substituting the net loan supply process (A-2) and the market clearing condition into the first order conditions (A-4), the expected excess return on a loan with maturity τ can be written as

$$\mu_t^{(\tau)} - r_t = \lambda_0^{(\tau)} + \lambda_1^{(\tau)}\kappa_t \tag{A-5}$$

with

$$\begin{aligned}
\lambda_0^{(\tau)} &= A_r^{(\tau)}\sigma_r^2\lambda_{r,0}^{(\tau)} + A_\kappa^{(\tau)}\sigma_\kappa^2\lambda_{\kappa,0}^{(\tau)} \\
\lambda_1^{(\tau)} &= A_r^{(\tau)}\sigma_r^2\lambda_{r,1}^{(\tau)} + A_\kappa^{(\tau)}\sigma_\kappa^2\lambda_{\kappa,1}^{(\tau)}
\end{aligned}$$

Note that the term premium (A-5) has the same form as in our model, (A-1). Hence, changes in κ_t in our model can be thought as shocks to net loan supply that affect the term premium dynamics in the context of a preferred habitat model.

A.2 Consumption-based pricing framework

We present a simple representative-agent consumption-based model to illustrate the type of preferences and endowment processes that can deliver a stochastic discount factor (SDF) similar to the one presented in the main text. The setup is essentially Bansal and Yaron (2004), model 2, but for simplicity we assume that there are no shocks to expected consumption growth.[22] The setup consists of a representative agent with recursive preferences, following Duffie and Epstein (1992b):

$$U_t = E_t \int_t^{\infty} f\left(c_s, U_s\right) \mathrm{d}s, \tag{A-6}$$

$$f\left(c, U\right) = \frac{1}{1-\frac{1}{\psi}} \left\{ \rho c^{1-\frac{1}{\psi}} \left[\left(1-\gamma\right) U\right]^{\frac{\frac{1}{\psi}-\gamma}{1-\gamma}} - \rho\left(1-\gamma\right) U \right\},$$

were γ is the risk aversion parameter, ψ is the elasticity of intertemporal substitution, c is agent's consumption, and U is the utility level. As shown in Duffie and Epstein (1992a), the SDF, m_t, is given by

$$\frac{\mathrm{d}m_t}{m_t} = \frac{\mathrm{d}f_c}{f_c} + f_U \mathrm{d}t,$$

where f_c and f_U is partial derivative of $f\left(c, U\right)$ with respect to c and U, respectively. The consumption process follows

$$\begin{aligned} \frac{\mathrm{d}c_t}{c_t} &= \mu \mathrm{d}t + \sqrt{\exp\left(v_t\right)}\, \mathrm{d}W_{1,t}\,, \\ \mathrm{d}v_t &= \lambda_v \left(v - v_t\right) \mathrm{d}t + \kappa \mathrm{d}W_{2,t}, \end{aligned}$$

where v_t is the log of consumption growth variance. It can be shown that the value function depends on two state variables, consumption level and volatility level (Duffie and Epstein, 1992b; Campbell et al., 2003):

$$U = \frac{\left(\xi\left(v\right) c\right)^{1-\gamma}}{1-\gamma},$$

where $\xi\left(v\right)$ is a unknown function that has to be solved using the integral (A-6). The partial derivatives can be written as

$$\begin{aligned} f_c &= \rho c^{-\gamma} \xi^{\frac{1}{\psi}-\gamma}, \\ f_U &= \left(\frac{\frac{1}{\psi}-\gamma}{1-\frac{1}{\psi}}\right) \rho \left\{ \xi^{\frac{1}{\psi}-1} - 1 \right\}. \end{aligned}$$

[22] The analysis would be the same if we assume that shocks to expected consumption growth are perfectly correlated with consumption growth (or level) shocks.

Using Ito's lemma,

$$\begin{aligned}
\frac{\mathrm{d}f_c}{f_c} &= -\gamma\frac{\mathrm{d}c}{c}+\frac{1}{2}\gamma\left(\gamma+1\right)\left(\frac{\mathrm{d}c}{c}\right)^2 \\
&\quad +\left(\frac{1}{\psi}-\gamma\right)\frac{\mathrm{d}\xi}{\xi}+\frac{1}{2}\left(\frac{1}{\psi}-\gamma\right)\left(\frac{1}{\psi}-\gamma-1\right)\left(\frac{\mathrm{d}\xi}{\xi}\right)^2 \\
&\quad -\gamma\left(\frac{1}{\psi}-\gamma\right)\frac{\mathrm{d}c}{c}\frac{\mathrm{d}\xi}{\xi}
\end{aligned}$$

Therefore, the SDF is

$$\frac{dm_t}{m_t} = -r_t\mathrm{d}t-\gamma\sqrt{\exp\left(v_t\right)}\mathrm{d}W_{1,t}-\left(\frac{1}{\psi}-\gamma\right)\frac{\xi_v}{\xi}\kappa\mathrm{d}W_{2,t}, \tag{A-7}$$

with

$$\begin{aligned}
r_t &= \left(\frac{\gamma-\frac{1}{\psi}}{1-\frac{1}{\psi}}\right)\rho\left\{\xi^{\frac{1}{\psi}-1}-1\right\}+\gamma\mu-\gamma\left(\gamma+1\right)v_t \\
&\quad +\left(\frac{1}{\psi}-\gamma\right)\left[\frac{\xi_v}{\xi}\lambda_v\left(v-v_t\right)+\frac{1}{2}\frac{\xi_{vv}}{\xi}\kappa^2\right]+\frac{1}{2}\left(\frac{1}{\psi}-\gamma\right)\left(\frac{1}{\psi}-\gamma-1\right)\left(\frac{\xi_v}{\xi}\kappa\right)^2
\end{aligned}$$

where ξ_v is the partial derivative of ξ with respect to v. Notice the SDF (A-7) is similar to Equation (1) in Section 3:

$$\frac{\mathrm{d}m_t}{m_t}=-r_t\mathrm{d}t-\kappa_t\mathrm{d}W_{r,t}-g\mathrm{d}W_{\kappa,t}.$$

Interpreted through this model, shocks to κ can be thought of as shocks to consumption growth volatility. One difference from the simple preferred-habitat model presented above or our reduced-form model is that shocks to κ_t in this model would also affect the level of the short rate, r_t.

Finally, the function $\xi(\nu)$ solves the ordinary differential equation

$$0=\frac{\rho}{1-\frac{1}{\psi}}\left\{\xi^{\frac{1}{\psi}-1}-1\right\}+\mu-\frac{\gamma}{2}\exp\left(v\right)+\frac{\xi_v}{\xi}\lambda_v\left(v-v_t\right)+\frac{1}{2}\frac{\xi_{vv}}{\xi}\kappa^2-\frac{\gamma}{2}\left(\frac{\xi_v}{\xi}\kappa\right)^2,$$

which can be solved numerically and has a unique solution provided that the state variables are strong Markov (Duffie and Lions, 1992).

B Model solution: Additional results

Figure B-1: Bank's marginal value of wealth and leverage across bank incentive constraints

This figure shows the solution for bank's marginal value of wealth (or Tobin's Q), $\psi(\bar{r}, \bar{\kappa})$, and bank leverage, $\alpha_t = x_t^{(\tau)} P_t^{(\tau)} / n_t$, for different values of the incentive constraint parameter, ρ.

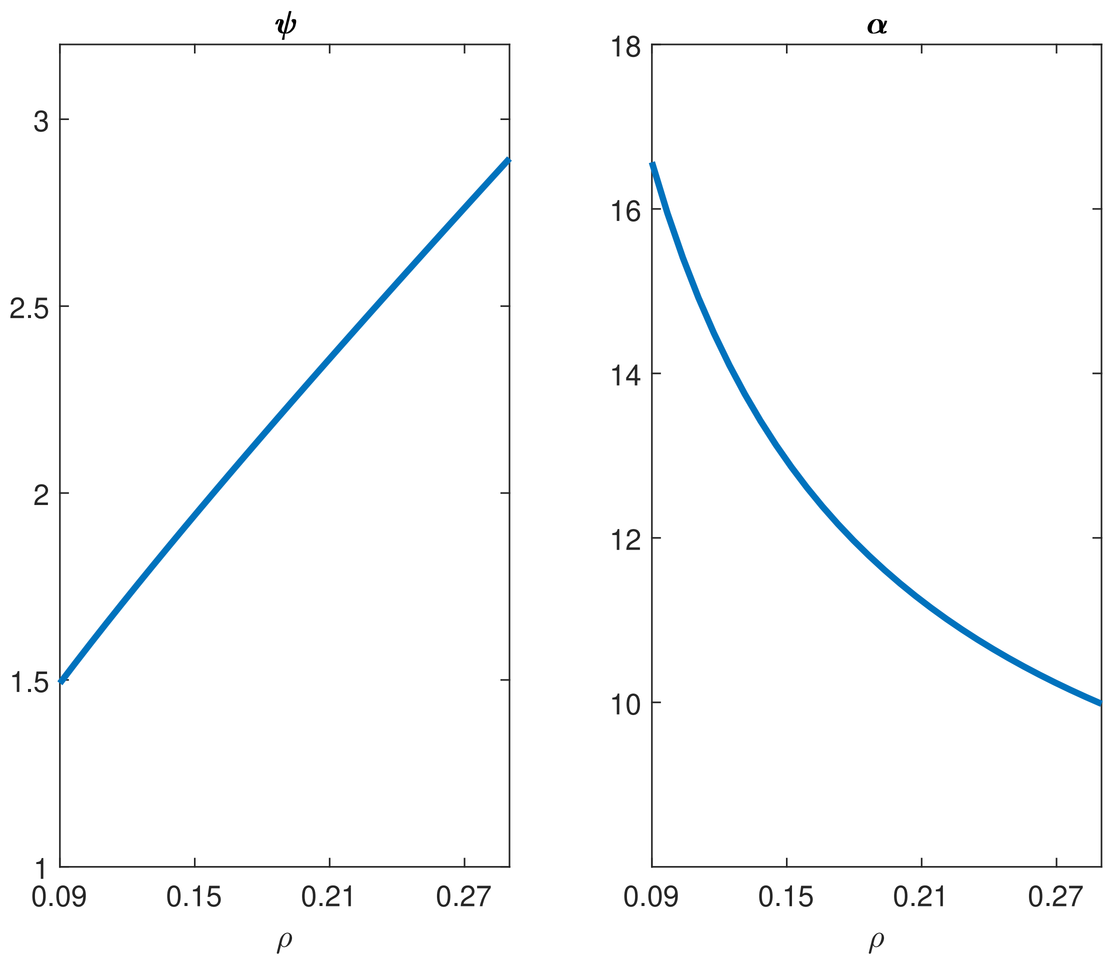


Figure B-2: Expected lending growth components, $\mu_{n,t}$, $E_t[\mathbf{d}\psi/\psi]$, and $cov_t[\mathbf{d}\psi/\psi, \mathbf{d}n/n]$

This figure shows the model's solution for the components of expected lending growth in equation (11) across the κ dimension. The top panels show the solution for different values of ρ. The bottom panels show the solutions for different levels of the interest rate. $\psi(\bar{r}, \bar{\kappa})$ and $\alpha_t = x_t^{(\tau)} P_t^{(\tau)} / n_t$ for different levels of ρ.

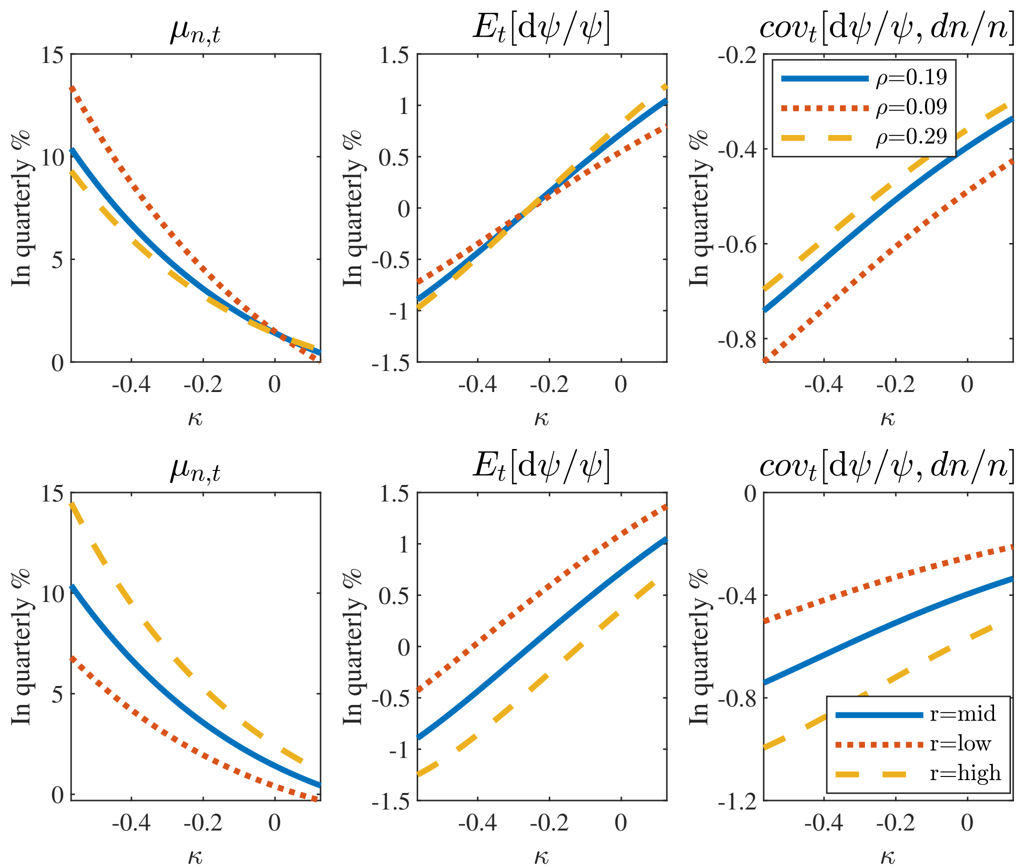
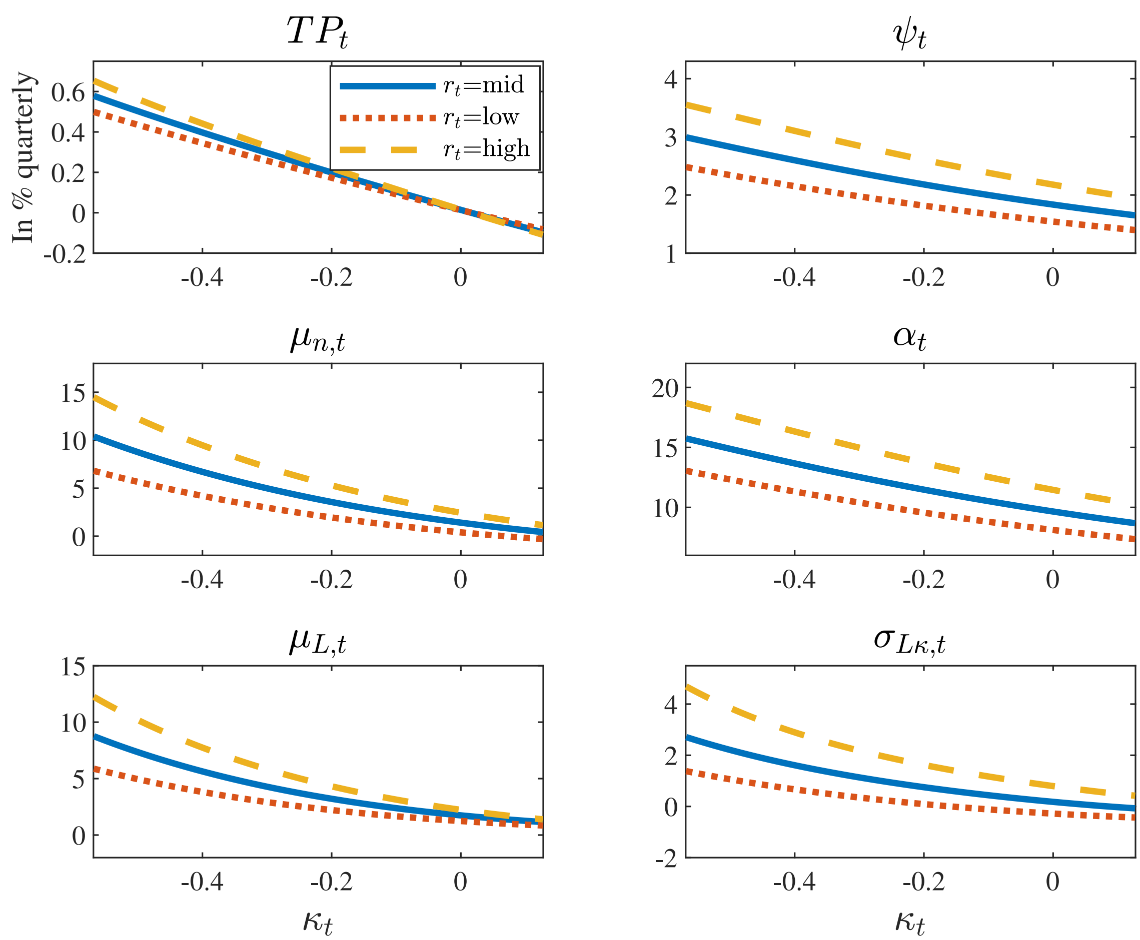


Figure B-3: Model solution for different levels of r_t

This figure shows the model's solution across different values of κ_t (the term premium factor) dimension (horizontal axis) for three levels of r_t (the short rate). The solid line is when r_t is at its unconditional mean, the dashed (dotted) line is when r_t is two standard deviations above (below) its mean. The upper-left panel shows the term premium (TP_t). The upper-right panel shows banks' marginal value of wealth, or "Tobin's Q" (ψ_t). The middle-left panel shows the expected return on wealth ($\mu_{n,t}$). The middle-right panel shows banks' leverage on loans (α_t). The bottom-left panel shows the expected loan growth ($\mu_{L,t}$). The bottom-right panel shows the diffusion component of loan growth associated with κ_t shocks ($\sigma_{L\kappa,t}$).



Online Appendix
Why Does the Yield Curve Predict GDP Growth? The Role of Banks

Figure OA-1: Term premium vs. Term premium shocks

This figure shows (a) the 5-year term premium series from the term structure model of Kim and Wright (2005) and (b) high-frequency term premium shocks estimated as changes in the Kim-Wright term premium on FOMC event days. See Section 4 for details on the construction of term premium shocks.

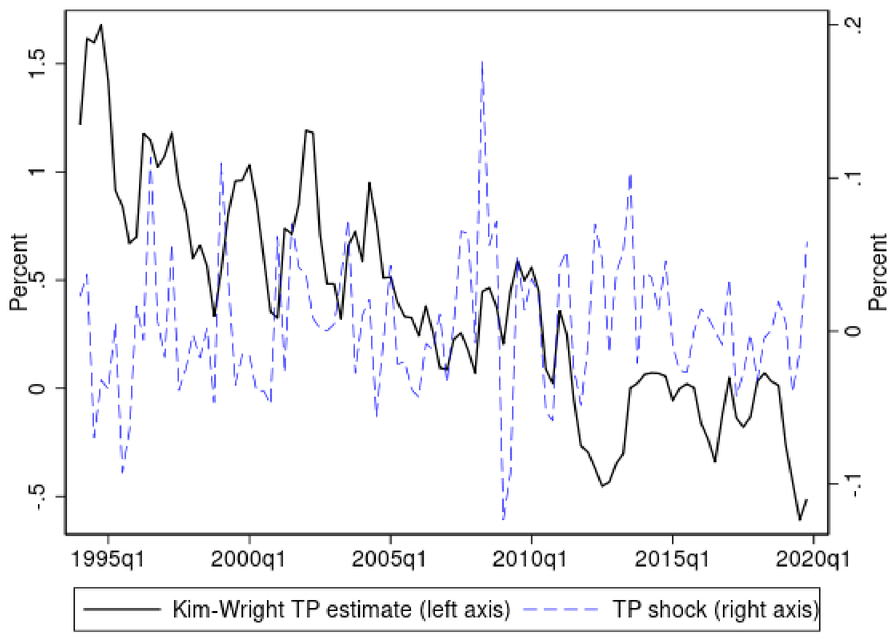


Figure OA-2: Term premium during Taper Tantrum placebo tests

This figure depicts the 5-year term premium during the period over which we conduct placebo tests for the Taper Tantrum analysis between 2012:Q2 and 2013:Q1. The term premium series is the Term Premium on a 5 Year Zero Coupon Bond [series code THREEFYTP5], retrieved from FRED, Federal Reserve Bank of St. Louis (link).

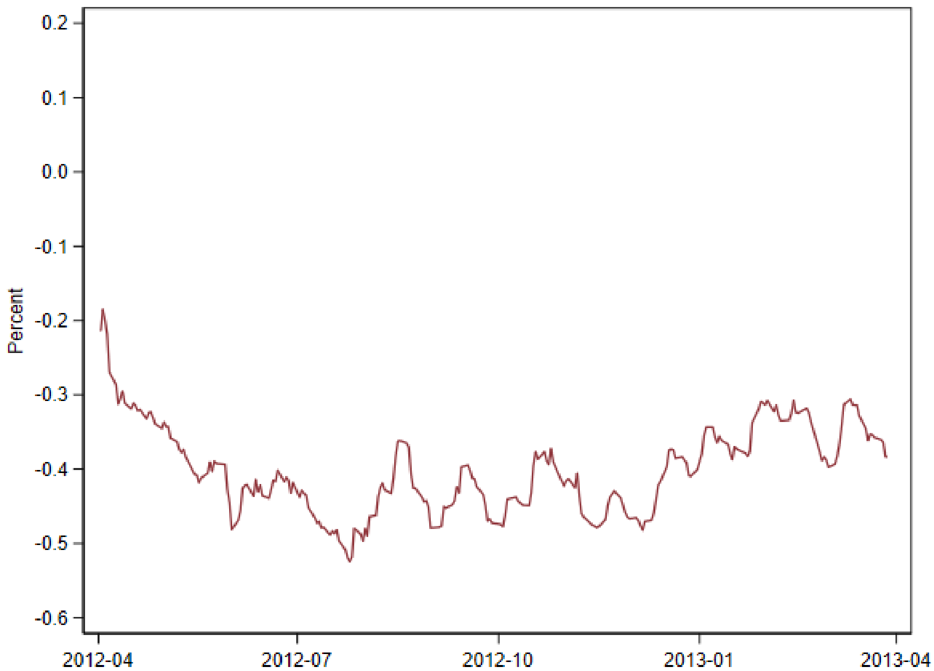


Table OA-1: Descriptive statistics for main regression variables

This table reports summary statistics for selected regression variables. Term premium levels and shocks are based on term structure models from Kim and Wright (2005) (baseline), Adrian et al. (2013) and Kim and Priebsch (2024) (robustness). Aggregate variables (panel A) are reported for the 1973–2019 period, except ROE (1984–2019) and the Kim-Wright term premium shock (1994–2019). Bank-level variables (panel B) are reported for the 1994–2019 period. Event-study variables are reported for a five-quarter window (panel C) or a two-year window (panel D) around 2013:Q2. See Section 5 for details on data sources and variable definitions.

	N	SD	Mean	P25	P50	P75
A. Aggregate variables						
Real GDP growth	183	0.021	0.026	0.016	0.028	0.041
Bank loan growth	183	0.04	0.03	0.011	0.035	0.063
Return on equity	137	0.038	0.113	0.09	0.119	0.147
Term premium (Kim-Wright 2005) x 100	183	0.754	1.008	0.413	1.015	1.489
Term premium shock (Kim-Wright 2005) x 100	100	0.04	0.004	-0.023	0.001	0.031
Alt. Term premium (Adrian et al 2013) x 100	183	0.824	1.217	0.524	1.224	1.685
Alt. Term premium (Kim and Priebsch 2024) x 100	183	0.865	0.93	0.308	1.015	1.489
IV (Foreign official holdings of UST/U.S. GDP)	183	0.069	0.074	0.022	0.044	0.101
Alt. IV (Excluding holdings by China)	183	0.042	0.055	0.022	0.039	0.069
Alt. IV (Excluding holdings by China and Belgium)	183	0.039	0.053	0.022	0.038	0.068
Alt. IV (Maturity-weighted Treasury outstanding/GDP)	183	1.217	2.745	1.649	2.92	3.769
Expectations (Kim-Wright 2005) x 100	183	1.176	0.127	-0.45	0.229	1.081
Δ Short rate x 100	183	1.77	-0.046	-0.927	-0.018	0.938
One-year ahead expected real GDP growth	183	0.01	0.028	0.024	0.028	0.032
One-year ahead expected GDP deflator inflation	183	0.019	0.034	0.019	0.025	0.043
GDP deflator inflation	183	0.023	0.033	0.018	0.024	0.037
Excess bond premium	183	0.52	0.063	-0.245	-0.061	0.243
B. Variables in bank-level analysis						
Loan growth	562568	0.137	0.048	-0.025	0.036	0.104
Return on equity	556908	0.03	-0.001	-0.006	0	0.006
Bank size (log-share of bank assets)	562568	1.101	-10.555	-11.297	-10.619	-9.897
Capital ratio (Tier1/RWA)	562568	0.099	0.167	0.115	0.142	0.186
Core deposits-to-liabilities	562568	0.123	0.789	0.727	0.809	0.875
Securities-to-assets	562568	0.15	0.241	0.127	0.221	0.333
Maturity gap (months)	524586	25.4	43.812	25.181	38.469	57.342
C. Variables in event-study loan-level analysis						
Loan amount (US$ million)	17489	87.215	29.551	1.550	7.500	26.800
Log(amount)	17489	2.326	15.478	14.254	15.830	17.104
Loan spread (ppts)	6794	1.223	2.346	1.500	2.193	3.000
Bank size (log-assets)	17489	1.136	6.540	5.678	7.158	7.285
Capital ratio (Tier1/RWA)	17489	0.022	0.118	0.101	0.102	0.124
Core deposits-to-liabilities	17489	0.065	0.187	0.159	0.183	0.200
Securities-to-assets	17489	0.094	0.567	0.489	0.545	0.620
Reserves-to-assets	17489	0.082	0.076	0.030	0.053	0.089
One-year ahead real GDP growth (bank level, x100)	17489	0.438	2.337	2.075	2.363	2.600
D. Variables in event-study real effects analysis						
Firm investment rate	86211	0.484	0.057	-0.079	0.021	0.170
Firm asset growth	85961	0.266	0.068	-0.031	0.051	0.154
Firm exposure to bank capital (x100)	86211	3.111	9.902	10.116	10.555	11.317
Firm size (log-assets)	86211	2.076	17.518	16.023	17.006	18.531
Firm leverage (debt/assets)	86211	0.272	0.348	0.123	0.312	0.523
Firm cash (cash/assets)	86211	0.143	0.106	0.011	0.050	0.143
Firm sales growth	86211	0.301	0.051	-0.025	0.050	0.135
Nightlights growth (county-level, x100)	18639	17.252	-5.160	-15.368	-4.262	4.862
Capital ratio (county level, x100)	18639	3.966	14.829	12.549	13.932	16.005
Deposit rate (bank-county-quarter, x100)	299576	1.363	1.592	0.463	1.142	2.385

Table OA-2: First stage—Instrument exogeneity

This table reports OLS estimates from time series regressions of the instrumental variable—Foreign official holdings of U.S. Treasuries, normalized by U.S. GDP—on one-year-ahead real GDP growth forecast from the SPF and two estimates of U.S. recession probabilities. Panels A and B report contemporaneous regressions, while columns C and D report regressions with one-period lagged predictors. The data are quarterly and cover the period 1994:Q1-2019:Q4 in panels B and C and 1974:Q1-2019:Q4 in panels A and D. The two recession probability estimates are the smoothed U.S. recession probability based on coincident indicators from the (Chauvet and Piger, 2008) model (series RECPROUSM156N in FRED) and the Sahm real-time recession indicator (series SAHMREALTIME in FRED). Newey-West standard errors accounting for heteroscedasticity and autocorrelation up to the 4th lag are reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	**Foreign official holdings of U.S. Treasuries (% GDP)$_t$**					
Contemporaneous	**(A) 1994:Q1-2019:Q4**			**(B) 1974:Q1-2019:Q4**		
One-year ahead real GDP growth$_t$	-0.0238			-0.0126		
	(0.0158)			(0.0089)		
Chauvet-Piger recession probability$_t$		-0.0001			-0.0003	
		(0.0003)			(0.0003)	
Sahm recession probability$_t$			-0.0012			-0.0107
			(0.0118)			(0.0131)
Observations	104	104	104	181	181	181
Lagged	**(C) 1994:Q1-2019:Q4**			**(D) 1974:Q1-2019:Q4**		
One-year ahead real GDP growth$_{t-1}$	-0.0228			-0.0121		
	(0.0156)			(0.0089)		
Chauvet-Piger recession probability$_{t-1}$		0.0000			-0.0003	
		(0.0003)			(0.0003)	
Sahm recession probability$_{t-1}$			0.0018			-0.0096
			(0.0117)			(0.0136)
Observations	104	104	104	180	181	181

Table OA-3: First stage—Instrument relevance

This table reports OLS estimates from contemporaneous time series regressions of the 5-year term premium from the Kim and Wright (2005), Adrian et al. (2013) and Kim and Priebsch (2024) models, respectively, on the instrumental variable (Foreign official holdings of U.S. Treasuries, normalized by U.S. GDP). All regressions control for the short rate, measured by the 3-month Tbill yield. Columns 2, 4, and 6 additionally include macro controls: real GDP growth, GDP deflator inflation, one-year ahead real GDP growth and GDP deflator inflation forecasts from the SPF, and the excess bond premium. The sample period is 1961:Q3-2019:Q4 in columns 1, 3 and 5; and 1973:Q1-2019:Q4 in columns 2, 4, and 6, reflecting the availability of the excess bond premium time series. Robust and kernel-based autocorrelation-consistent standard errors are reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	**Kim-Wright term premium$_t$**		**Adrian-Crump-Moench term premium$_t$**		**Kim-Priebsch term premium$_t$**	
Foreign official holdings of U.S. Treasuries (% GDP)$_t$	-0.03***	-0.07***	-0.04***	-0.05***	-0.05***	-0.07***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	234	187	234	187	232	185
R^2	0.19	0.62	0.60	0.82	0.67	0.85
Macro controls	-	Y	-	Y	-	Y

Table OA-4: Identification checks on baseline bank-level IV results

This table examines the robustness of the baseline IV results in Table 3 to a set of identification checks. Panel A reports IV estimates when Chinese or Chinese and Belgian holdings of U.S. Treasuries, respectively, are excluded from the baseline instrumental variable. Panel B replaces the Kim and Wright (2005) term premium with high-frequency Kim-Wright term premium *shocks*. Panel C employs an alternative IV: the maturity-weighted debt-to-GDP ratio, constructed following Greenwood and Vayanos (2014). The data are at the bank-quarter level and cover the period 1991:Q1-2019:Q4. Macro controls, bank controls, and fixed effects are the same as in baseline Table 3. Standard errors are double-clustered by bank and quarter and aer reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)
Dependent variable:	**Loan growth$_{t,t+4}$**			
	(A) IV Modifications			
	Drop China		**Drop China and Belgium**	
Term Premium$_t$	2.60***		2.71***	
	(0.52)		(0.53)	
Bank Capital$_t$ $\times$ Term Premium$_t$		-12.31***		-12.81***
		(3.15)		(3.16)
Observations	562,568	557,899	562,568	557,899
First-stage F test	271.1	44.37	294.5	43.75
	(B) Term Premium Shocks		**(C) Alternative IV**	
Term Premium$_t$	34.41**		3.12**	
	(14.25)		(1.43)	
Bank Capital$_t$ $\times$ Term Premium$_t$		-106.56**		-31.13**
		(41.71)		(12.96)
Observations	562,568	557,899	336,254	294,021
First-stage F test	-	-	31.58	20.35
Macro controls	Y	-	Y	-
Bank controls	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Bank MSA FE	Y	Y	Y	Y
Bank MSA$\times$Year:Quarter FE	-	Y	-	Y

Table OA-5: Robustness of bank-level results to alternative term premium estimates and clustering of standard errors

This table examines the robustness of baseline results in columns 1-2 of Table 3 to alternative term premium estimates and to alternative standard error estimators. We consider alternative term premium estimates from the term structure model in Adrian et al. (2013) (panel A) and Kim and Priebsch (2024) (panel B). For alternative approaches to estimating standard errors, we use the Driscoll-Kraay estimator with four lags (panel C) and Kiefer standard errors (panel D). The dependent variable is bank loan growth. The data are at the bank-quarter level and cover the period 1994:Q1-2019:Q4. All other aspects of the regressions, including control variables and fixed effects, are the same as in baseline Table 3. Significance: $^{+}$p<.2; *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)
Dependent variable:	**Loan growth$_{t,t+4}$**			
	OLS	**IV**	**OLS**	**IV**
	(A) Adrian et al. (2013) term premium		**(B) Kim and Priebsch (2024) term premium**	
Term Premium$_t$	0.54^{+}	3.90***	1.25***	2.01***
	(0.34)	(1.06)	(0.37)	(0.43)
Observations	562,568	562,568	562,568	562,568
R^2	0.24	-	0.25	-
First-stage F test		37.54		291.2
	(C) Driscoll and Kraay (1998) SE with 4 lags		**(D) Kiefer et al. (2000) SE**	
Term Premium$_t$	1.85***	3.01***	1.85***	3.01***
	(0.55)	(0.89)	(0.09)	(0.11)
Observations	562,568	562,568	562,568	562,568
R^2	0.25	-	0.25	-
First-stage F test		88.73		1.195e+06
Macro controls	Y	Y	Y	Y
Bank controls	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y
Bank MSA FE	Y	Y	Y	Y

Table OA-6: Robustness of bank-level estimates to alternative variables and sample period

This table examines the robustness of baseline results in Table 3 to three modifications: (A) including credit lines in the dependent variable measuring bank loan growth (columns 1-2), (B) controlling for the lagged maturity gap (columns 3-4); and (C) extending the estimation to a longer sample period (columns 5-6). The dependent variable is bank loan growth including credit lines in columns 1-2 and excluding credit lines in columns 3-6. The data are at the bank-quarter level and cover the period 1994:Q1-2019:Q4 in columns 1-4 and 1973:Q2-2019:Q4 in columns 5-6. Macro controls, bank controls, and fixed effects are the same as in baseline Table 3, except in columns 5-6, where we omit the securities-to-asset ratio and use the total capital-to-asset ratio instead of the Tier 1 capital-to-risk-weighted asset ratio, due to data availability in the longer sample period. Standard errors are double-clustered by bank and quarter and reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01..

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:			**Loan growth$_{t,t+4}$**			
	IV	**IV**	**IV**	**IV**	**IV**	**IV**
	(A) Add credit lines		**(B) Control for maturity gap**		**(C) Longer sample period**	
Term Premium$_t$	2.15***		3.59***		2.89***	
	(0.54)		(0.74)		(0.72)	
Bank Capital$_t$ $\times$ Term Premium$_t$		-14.30***		-15.44***		-2.29
		(3.14)		(3.75)		(4.23)
Observations	562,140	557,461	522,036	517,544	1,615,825	1,621,745
First-stage F test	218.2	42.89	159.2	33.26	131.3	73.37
Macro controls	Y	-	Y	-	Y	-
Bank controls	Y	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y		
Bank MSA FE	Y	Y	Y	Y	Y	Y
Bank MSA$\times$Year:Quarter FE	-	Y	-	Y	-	Y

Table OA-7: Term premium and bank lending: External validity tests over 2012–2019

This table reports OLS estimates from a regression of bank lending outcomes on the interaction between bank leverage and the high-frequency term premium shock during 2012:Q1-2019:Q4. The data are at the bank-firm-loan level and refer to outstanding loans to nonfinancial firms reported quarterly over this period. The regression specification is:

$$\begin{aligned} \textit{Loan outcome}_{bj,t+1} &= \beta_1 \textit{Capital ratio}_{bt} \times \textit{Term premium shock}_t \\ &+ \gamma_1' \mathbf{X}_{bt} + \gamma_2' \mathbf{X}_{bt} \times \textit{Term premium shock}_t + \gamma_3' \mathbf{Z}_{bjt} + \delta_{j\text{-}t} + \varepsilon_{bjt} \end{aligned}$$

where $\textit{Loan outcome}_{bj,t+1}$ denotes either the growth rate of loan commitments or loan spreads from bank b to firm j in quarter $t+1$. The high-frequency term premium shock is calculated as changes in the Kim-Wright term premium on FOMC event days (see Section 4). Bank controls ($\mathbf{X}_{bt}$) include bank-specific one-year ahead GDP growth forecasts from the Blue Chip Survey or the Survey of Primary Dealers, bank size (log share of bank assets in total banking system assets), capital ratio, the share of core deposits in total liabilities, the share of securities in total assets, and the share of reserves in assets. Relationship duration is defined as the number of quarters since the first observed loan for a given bank-firm pair (log). All specifications include firm-time fixed effects. Standard errors are double-clustered by bank-time and firm and reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)
Dependent variable:	**Loan growth$_{t,t+1}$**		**Loan spread$_{t+1}$**	
Bank Capital$_t$ $\times$ Term Premium Shock$_t$	-0.495***	-0.525***	0.966*	1.119*
	(0.176)	(0.178)	(0.540)	(0.565)
Observations	783,004	783,004	306,850	306,850
R^2	0.372	0.372	0.807	0.807
Relationship duration	Y	Y	Y	Y
Bank controls $\times$ Term premium	Y	Y	Y	Y
Bank capital $\times$EH, $\times$SR	-	Y	-	Y
Bank FE	Y	Y	Y	Y
Firm$\times$Year:Quarter FE	Y	Y	Y	Y

Table OA-8: Real effects of term premium: County-level evidence over 1994–2019

This table reports OLS and IV estimates from regressions of county-level nightlights growth on the term premium and its interactions with bank leverage. The data are at the county level and cover the period 1994–2019. The dependent variable is the annual growth rate of nightlights, sourced from the VIIRS Nighttime Lights data (Elvidge et al., 2021). Bank variables are aggregated to the county level as weighted averages of bank-level variables, with weights based on deposit shares from the FDIC Summary of Deposits. County controls include lagged bank size (log share of bank assets in total banking system assets), capital ratio, the share of core deposits in total liabilities, and the share of securities in total assets. Standard errors are double-clustered by county and year and reported in parentheses. Significance: $^{+}$p$<$ .2; *p$<$.1; **p$<$.05; ***p$<$.01.

	(1)	(2)	(3)	(4)
Dependent variable:	**County Nighlights Growth$_{t,t+1}$**			
	OLS	**IV**	**OLS**	**IV**
Term Premium$_t$	1.095^{+}	2.067***		
	(0.750)	(0.610)		
Bank Capital$_t$ $\times$ Term Premium$_t$			-0.016	-0.012
			(0.019)	(0.019)
Observations	77,639	77,639	77,639	77,639
R^2	0.200	-	0.435	-
First-stage F-stat	-	115	-	131.5
County controls	Y	Y	Y	Y
Macro controls	Y	Y	-	-
County FE	Y	Y	Y	Y
Year FE	-	-	Y	Y

Table OA-9: Term premium and bank funding costs: Deposit rates

This table reports OLS and IV estimates from regressions of bank funding costs on the Kim and Wright (2005) term premium and its interaction with bank leverage. The dependent variable is the 12-month certificate of deposit (CD) rate for an account size of $10,000. Panels A and B follow the same regression specification as in baseline Tables 3-4. In panel A the data are at the bank-county-quarter level and cover 2001:Q1-2019Q4. Macro controls include lagged change in the short rate measured by the 3-month Tbill yield (ΔSR), the expectations component (defined as the 3-month/5-year spread minus the term premium, EH), four-quarter real GDP growth, four-quarter GDP deflator inflation, one-year ahead real GDP growth and GDP deflator inflation forecasts from the SPF, and the excess bond premium. Bank controls include lagged bank size (log share of bank assets in total banking system assets), capital ratio, the share of core deposits in total liabilities and the share of securities in total assets. In panel B the data are at the bank-county-quarter level and cover a symmetric window of three to six quarters before and after 2013:Q2. Bank capital is measured as of end-2012. Post is a dummy variable that equals one in the periods after 2013:Q2 and zero otherwise. Bank controls include lagged bank size (log-assets), the share of core deposits in total liabilities, and the share of securities in total assets. Standard errors are double-clustered by bank and quarter and reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)
Dependent variable:	**Deposit rate$_{t+1}$**			
	(A) Bank-level evidence			
	OLS	**IV**	**OLS**	**IV**
Term premium$_t$	0.2427***	0.2520***		
	(0.0150)	(0.0168)		
Bank Capital$_t$ $\times$ Term Premium$_t$			-0.0003***	-0.0005***
			(0.0001)	(0.0001)
Observations	299,576	299,576	299,576	299,576
R^2	0.9142	0.8959	0.9521	0.0089
First-stage F-stat		111.8		190.5
Bank controls	Y	Y	Y	Y
Bank capital$\times$EH, $\times$SR	-	-	Y	Y
Macro controls	Y	Y	-	-
Bank and County FE	Y	Y	Y	Y
Quarter FE	-	-	Y	Y
	(B) Event study around Taper Tantrum			
Window around Taper Tantrum:	**3Q**	**4Q**	**5Q**	**6Q**
Bank Capital$_t$ $\times$ Post$_t$	0.0058	0.0009	-0.0122**	-0.0115**
	(0.0000)	(0.0030)	(0.0044)	(0.0041)
Observations	521	815	1,054	1,294
R^2	0.9806	0.9803	0.9753	0.9736
Bank controls$\times$Post	Y	Y	Y	Y
Growth expectations$\times$Post	Y	Y	Y	Y
Bank and County FE	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y

Table OA-10: Term premium and bank profits: Stock market returns

This table presents OLS regressions of bank stock market returns on term premium shocks and their interactions with bank leverage. The dependent variable is the daily stock market return on FOMC meeting days (excluding the 9/11 meeting), using a sample of 729 listed bank holding companies over the period 1997:M2–2019:M12. The high-frequency term premium shock is calculated as changes in the Kim and Wright (2005) term premium on FOMC event days (see Section 4 for details). Bank controls include bank size (log share of bank assets in total banking system assets), regulatory capital ratio (Tier1/Assets), the share of core deposits in total liabilities, the share of securities in total assets, and the maturity gap. The specifications also control for the contemporaneous market return, lagged short rate changes and the lagged expectations component (defined as the 3-month/5-year spread minus the term premium, EH). Standard errors are double-clustered by bank and FOMC date and reported in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	**Stock market return$_{t,t+1}$**				
Term Premium Shock$_t$	0.110***	0.111***	0.179***	0.180***	
	(0.039)	(0.039)	(0.053)	(0.053)	
Bank Capital$_t$ $\times$ Term Premium Shock$_t$			-0.911**	-0.907**	-0.939**
			(0.375)	(0.375)	(0.373)
Observations	88,031	88,031	88,031	88,031	88,031
R^2	0.132	0.132	0.132	0.133	0.188
Bank controls	-	Y	-	Y	Y
Bank controls$\times$Term premium	-	-	-	-	Y
Macro controls (EH, SR)	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y
FOMC date FE	-	-	-	-	Y