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Term Premium and Bank Lending

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We document an "expected bank profitability" channel linking the term premium to bank lending. We formalize this channel using a dynamic bank portfolio model predicting that a higher term premium raises banks' expected returns from maturity transformation, incentivizing credit provision, with stronger effects for more leveraged banks. Using supervisory microdata, the unanticipated term premium rise after the 2013 Taper Tantrum, and U.S. Basel III capital surprises, we show that more leveraged banks expand lending more, supporting firm-level investment and growth. Our findings suggest unconventional monetary policies compressing the term premium may reduce bank lending, dampening their intended expansionary effects.

Keywords: term premium; yield curve; bank lending; bank profitability; maturity transformation

JEL classifications: E44, E52, E58, G2.

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We study the impact of the term premium—the yield on a long-term bond in excess of the average expected short rate—on bank lending. Because banks fund themselves with short-term and relatively cheap deposits to lend at longer maturities, higher term premiums raise their expected profitability and could stimulate lending. Yet, little is known about whether and how term premiums influence bank lending. We provide evidence consistent with the term premium affecting bank credit through an expected profitability channel: when the yield curve steepens because the term premium rises, banks expand lending in response to higher expected returns from maturity transformation. More broadly, our findings suggest that term premium fluctuations can affect economic activity not only through asset prices and borrowing costs, but also through their effects on bank lending incentives.

The intuition behind the expected bank profitability channel hinges on three features of banks. First, banks fund longer-term assets with shorter-term deposits, exposing their profitability to fluctuations in the term premium. Second, banks pay depositors below-market rates (Drechsler et al., 2017), making deposits a relatively cheap source of short-term funding. Although the term premium compensates all investors for bearing interest rate risks, deposit funding makes this compensation especially valuable for banks. Specifically, when the term premium rises, banks earn higher expected returns on longer-term assets without a commensurate increase in their funding costs. Third, banks face leverage constraints that limit their lending capacity, but higher expected future profits relax these constraints. Taken together, a higher term premium raises expected bank profitability, expands lending capacity under leverage constraints, and strengthens banks' incentives to lend. Our approach departs from the existing literature, which has focused on the level of the short rate—either its current value or its expected future path—by emphasizing the role of the term premium in shaping bank lending outcomes.

We formalize the expected bank profitability channel using a dynamic bank portfolio model along the lines of Gertler and Kiyotaki (2015). In the model, 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 incentivizes them to hold a leveraged exposure to long-term loans. The model delivers two key insights. First, a positive term premium shock increases expected returns to maturity transformation, raises expected bank profitability, relaxes the financing constraint, and boosts bank lending in subsequent periods. Second, this effect is stronger for more leveraged banks, as higher leverage amplifies the effect of term premium fluctuations on the expected return on bank wealth.

We provide extensive empirical evidence supporting the expected bank profitability channel. Our baseline analysis is a difference-in-differences (DiD) design centered on the 2013 Taper Tantrum—an unexpected surge in the term premium following Fed Chair Ben Bernanke's May 22, 2013 congressional testimony, in which he indicated that the Federal Reserve might soon begin tapering asset purchases under its quantitative easing (QE) program. Following these remarks, the term premium increased sharply, consistent with standard theories that predict a higher term premium when the private sector faces an unexpected expansion in the supply of public debt (Vayanos and Vila, 2021). At the time, observers interpreted the announcement as reflecting a less accommodative Fed reaction function rather than an improving economic outlook—for example, as noted in the July 2013 FOMC transcript, survey responses by Primary Dealers indicated that shifting monetary policy expectations and rising policy uncertainty drove the subsequent rise in Treasury yields (FOMC, 2013).

A key identification challenge is that our results could nonetheless be confounded by heterogeneity in banks' economic outlooks: more leveraged banks may be more optimistic about growth prospects and lend more for reasons unrelated to the term premium. We adopt two strategies to mitigate this concern. First, we exploit "surprises" to bank capital arising from the U.S. implementation of Basel III announced in the first half of 2012, which differed from the international standard in ways that generated quasi-random variation in bank leverage (Irani et al., 2021), to identify the differential lending response of more versus less leveraged banks. Second, we directly control for banks' own GDP growth forecasts interacted with a post-Taper Tantrum indicator, absorbing any differential lending response to the economic outlook across bank leverage groups.

The main analysis draws on the supervisory Federal Reserve Y-14Q dataset (henceforth, Y-14), a U.S. credit registry covering individual commercial and industrial (C&I) loans held by large banks subject to stress tests during 2012–2019, which account for close to three-quarters of domestic C&I lending. The loan-level microdata are central to addressing a key identification concern: banks' lending responses to term premium fluctuations may reflect changes in firms' credit demand rather than changes in banks' credit supply, since these quantities are jointly determined and respond to common shocks. To disentangle supply from demand, we compare the lending behavior of banks with different ex-ante leverage that lend to the *same firm in the same quarter*, absorbing time-varying credit demand, changes in firm quality, and other unobserved firm-level shocks (Khwaja and Mian, 2008; Jiménez et al., 2020).

Our results can be summarized as follows. Consistent with the model's predictions, we show that (i) following the Taper Tantrum, more leveraged banks expand lending more than less leveraged banks—reflected in higher loan volumes, lower spreads, and longer maturities—consistent with a credit supply rather than demand interpretation. Comparing a bank at the 25th percentile of capital surprises (2.3 percentage points (pps), more leveraged) to one at the 75th percentile (2.7 pps, less leveraged), the more leveraged bank extended loans that were 1.5% larger and 17 basis points (bps) cheaper after the Taper Tantrum; the corresponding figures under an alternative measure of leverage based on Tier 1 capital are 4.0% and 89 bps.

This increased lending is associated with improved borrower outcomes: (ii) nonfinancial firms borrowing from more leveraged banks have higher investment rates and balance sheet growth in the two years following the Taper Tantrum. We also find that (iii) more leveraged banks reorient their portfolios toward fixed-rate instruments following the term premium rise, increasing both fixed-rate loan originations and holdings of mortgage-backed securities (MBS), consistent with banks seeking greater maturity-transformation exposure in anticipation of higher profits. This fixed-rate reallocation is particularly informative given that about half of C&I loans carry floating rates, making the baseline lending results conservative estimates of the portfolio-wide response. Finally, (iv) more leveraged banks raise deposit rates more than less leveraged banks to fund their lending expansion after the Taper Tantrum.

These results are robust to a number of identification checks. We validate the DiD identifying assumption through parallel trends tests and a placebo exercise, and show that the DiD coefficients are robust to controlling for the interaction of bank leverage with changes in the short rate, the lagged level of the short rate, and high-frequency fed funds rate shocks. These tests help assuage the concern that results may reflect heterogeneous lending responses to changes in short rates. The baseline results are also robust to controlling for the maturity gap and income gap, mitigating asset valuation and income sensitivity as alternative explanations.

To assess the external validity of our findings, we extend the analysis in two directions. First, using high-frequency term premium shocks identified within short windows around FOMC announcements and the full Y-14 sample over 2012–2019, we show that more leveraged banks consistently grant larger loans and charge lower spreads following positive term premium shocks compared to less leveraged banks. Second, using quarterly Call Report data on the universe of U.S. commercial banks spanning 1994–2019, we confirm that a higher term premium is associated with higher loan growth over the long run, with stronger effects at more leveraged banks.

Our work contributes to three strands of literature. First, our paper adds to the literature studying the implications of banks' exposure to interest rate risks—in particular, exposure to the term premium—for bank funding costs and profitability (Aksoy and Basso, 2014; Begenau et al., 2015; Di Tella, 2020; Haddad and Sraer, 2020; Gomez et al., 2021; Schneider, 2025; Wang, 2025). Most studies in this literature focus on the level of the short rate and highlight that bank profits typically rise with it. A few exceptions include Alessandri and Nelson (2015), Borio et al. (2017), 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 when the yield curve steepens. We extend this research by exploring how changes in the yield curve slope—and in particular, its term premium component—affect bank credit, holding loan demand constant. In addition, we provide evidence on how increased bank lending influences the investment policies of nonfinancial firms. In doing so, our paper brings together previously separate strands of research examining how term premiums affect bank profits (English et al., 2018; Paul, 2023), how bank profits influence lending

(Gomez et al., 2021), and how bank lending affects the real economy (see, e.g., Chodorow-Reich (2014); Jiménez et al. (2014); Morais et al. (2019), and Jiménez et al. (2020)).

Second, our paper speaks to the literature on the transmission of monetary policy through banks (Bernanke and Blinder, 1988; Kashyap and Stein, 2000; Drechsler et al., 2021; Jiménez et al., 2012, 2014). Most studies focus on the short-rate policy and document that, following a rate cut, banks increase loan supply, amplifying the stimulative effects of monetary easing through the standard credit channel (Bernanke and Gertler, 1995). In addition, Van den Heuvel (2002)'s bank capital channel argues that a rate cut lowers banks' funding costs and increases profits, which over time relaxes capital constraints and boosts lending, reinforcing the stimulative effects. Our results suggest that, however, under balance sheet policies that aim to lower long-term rates by compressing term premiums (Bernanke, 2013), the expected bank profitability channel documented in this paper could dampen some of the intended stimulus, since a lower term premium reduces banks' expected profits from maturity transformation.[1]

Finally, we contribute to a larger literature on the predictive power of the yield curve for economic growth (Harvey, 1988; Estrella and Hardouvelis, 1991; Hamilton and Kim, 2002; Favero et al., 2005; Ang et al., 2006; Rudebusch et al., 2006; Jardet et al., 2013). Specifically, we highlight the role of financial intermediaries and document an expected bank profitability channel, through which higher term premiums incentivize banks to engage in more maturity transformation and expand loan supply, thereby stimulating economic activity. In related work, Adrian et al. (2019) use aggregate data to explore a similar mechanism, showing that a higher short rate flattens the yield curve, compresses banks' net interest margins, and reduces credit supply. Whereas their analysis emphasizes the short rate, we focus on the term premium as the central driver linking the yield curve slope to bank profitability. This distinction is important because the term premium, as compensation for bearing interest rate risks, may influence bank profits and lending decisions differently from the short rate. Furthermore, we use loan-level microdata and quasi-random variation in bank leverage to isolate the differential lending response of more versus less leveraged banks to term premium

[1] See Altavilla et al. (2018, 2020) and Claessens et al. (2018) for extensive, yet mixed, evidence on the effects of unconventional monetary policies on bank profitability.

fluctuations.

Our findings that banks serve as a key channel through which term premium fluctuations affect the economy have important implications for evaluating and calibrating central bank balance sheet policies. Large-scale asset purchases are now a standard tool for central banks to provide monetary accommodation when the short rate is near its effective lower bound and are typically thought to operate by compressing term premiums (Krishnamurthy and Vissing-Jorgensen, 2011; D'Amico et al., 2012). Lower term premiums boost the values of security holdings marked-to-market on bank balance sheets, raising banks' net worth and lending capacity—a stealth recapitalization (Brunnermeier and Sannikov, 2014) with broad empirical support (Rodnyansky and Darmouni, 2017; Acharya et al., 2019; Chakraborty et al., 2020; Luck and Zimmermann, 2020). Our results point to a countervailing force: term premium compression simultaneously reduces banks' expected profits from maturity transformation, dampening the incentive to lend and potentially offsetting some of the stimulative effects of the asset valuation channel and other expansionary mechanisms (Kuttner, 2018). We discuss these implications further in the conclusion.

1 Model

1.1 Setup

We present a dynamic partial-equilibrium banking model to study how fluctuations in the term premium affect banks' lending decisions. The model features a representative banker who takes loan prices and interest-rate risk premia as given and maximizes the value of the bank subject to financing constraints. The key mechanism is that an increase in the term premium raises the expected excess return from maturity transformation, thereby increasing expected bank profitability. Higher expected profitability raises the continuation value of the bank and allows banks to expand lending in subsequent periods. Because the tightness of the financing constraint is central to this mechanism, we solve the model under alternative calibrations of this constraint. Changing the parameter that governs the tightness of the financial constraint translates into different banks' leverage policies which, in the end, affect lending. This exercise allows us to derive cross-sectional predictions for how banks with different leverage levels respond to term-premium shocks.

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 and pricing interest-rate risk:

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

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 $\varphi_{r\kappa}$. In Online Appendix C 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).

Loan prices. We assume loans are only affected by interest rate risks and those risks are priced by the pricing kernel (1).[2]

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. Let $P_t^{(\tau)}$ denote the loan price, which is given by the present discounted value of its

[2] Extending the analysis to include a constant default risk does not affect our results. Incorporating a time-varying loan spread—reflecting a time-varying probability of default or time-varying market power—that correlates with the term-premium would create a horse-race between the dynamics of the loan spread and the term premium.

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 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

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

and the deposit account follows

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

with $\phi(r_t) \leq r_t$ 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).[3] The evolution of banks'

[3] We specify the function $\phi(r_t)$ below.

wealth is then given by

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

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.[4] 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

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

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

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

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, $P_t^{(\tau)}x_t^{(\tau)}$.[5]

[4] In general equilibrium models, banks pay an aggregate dividend and receive a different amount of resources as startup capital in order 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.

[5] 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).

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), as in Di Tella and Kurlat (2021).

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).

1.2 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 and, on average, greater than the cost of running the deposit franchise.

Calibration. Table 1 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 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. We set $g = 0.05$ to represent the price of risk for shocks to the term-premium state variable. This parameter acts as a scaling factor and does not affect the modeled fluctuations of the term premium.

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 bps. 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 deposits to total equity capital reported in the Call Reports.[6]

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. This constraint plays a central role in the model because it determines how strongly changes in expected profitability translate into lending capacity. In particular, a lower value of ρ relaxes the incentive constraint and implies higher equilibrium leverage. Since leverage amplifies the effect of term-premium fluctuations on expected bank profitability, varying ρ allows us to derive predictions for how banks with different leverage levels respond to term-premium shocks. 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

[6] 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.

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 deposit spreads, thereby boosting banks' Tobin's Q.

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

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

where $TP_t\left(\kappa_t, r_t\right)$ 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:

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

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.[7]

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

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

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 A-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

[7] 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 A-2 in the Appendix.

with a higher ρ derives a larger benefit from diverting the 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 a 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 bps, as shown in the upper-left panel.[8] 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 (lower-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 profitability, bank lending eventually rises above its steady state level.

The lower-middle and lower-right panels of Figure 2 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 leverage. Although not shown, the expected change in bank lending is approximately the net effect of $E_t[\mathrm{d}\psi/\psi]$ and $E_t[\mathrm{d}n/n]$, which is positive.

[8] 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.

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 which we use to guide our empirical specifications:

Testable implication 1 *On average, banks respond to a higher term premium by increasing loan supply.*

Testable implication 2 *This effect is stronger for more leveraged banks because expected profits of those banks rise relatively more for a given increase in the term premium.*

2 Data

The main dataset for our empirical analysis is the supervisory loan-level data collected by the Federal Reserve. We supplement this dataset with information on bank-level balance sheets, bank funding costs, firm balance sheets, and macroeconomic variables, including estimates of term premium shocks. Table 2 presents summary statistics for selected regression variables.

Loan-level data. We use loan-level data from the supervisory Federal Reserve Y-14Q "Wholesale credit risk" H.1. schedule (Y-14 in short), reported quarterly by bank holding companies (BHC) subject to stress tests and with at least $50 billion in assets during the sample period. The dataset covers individual C&I loan commitments above $1 million between reporting BHCs and individual borrowers. We restrict attention to loans made to U.S.-domiciled nonfinancial firms and limit the sample to the 11 reporting banks that also submit GDP growth forecasts to the *Blue Chip Financial Forecasts* survey, which together account for 70% of total C&I loan commitments in the dataset.

The Y-14 dataset has excellent coverage of banking sector activities, covering nearly three-quarters of U.S. commercial and industrial (C&I) loans (Favara et al., 2021) and 80% of total U.S. banking sector assets. Furthermore, the Y-14 borrowing firms account for 65% of U.S. corporate sector debt and 78% of aggregate U.S. gross output (Caglio et al., 2021).

The Y-14 dataset includes detailed information on loan contracts, including loan commitment amount and interest rate spreads, as well as extensive borrower characteristics, including industry, location, and financial variables (e.g., total assets, fixed assets, debt, cash and marketable securities, sales revenue). We use the Y-14 data to study how banks adjust lending in response to changes in the term premium, and to construct a firm-year panel that allows us to assess how term premium changes affect firm-level outcomes (such as total debt growth, asset growth, and investment ratios, measured as the annual growth rate of fixed assets).[9]

Bank-level data. To analyze bank outcomes in larger samples, we use quarterly, merger-adjusted U.S. Call Report data on domestic bank operations from 1994:Q1 to 2019:Q4. From these data, we obtain measures of bank loan growth, profitability (return on equity, ROE), total assets and liabilities, regulatory capital ratio (Tier1 capital over risk-weighted assets), core deposits, securities, and reserves. Using variables from the Call Report, we also construct the maturity gap for each bank—a standard measure of maturity transformation (English et al., 2018). Furthermore, using Federal Reserve Y-9C Consolidated Financial Statements for Holding Companies we obtain proxies of the income gap at the BHC level (Paul, 2023). To examine bank funding costs, we gather information on quarterly rates paid by banks on 12-month certificates of deposit of $10,000, collected at the branch level by RateWatch (for 2000–2019) and stock market returns from the Center for Research in Security Prices (CRSP) for 1994–2019, linked to the Call Report data using the CRSP-FRB file.

[9] Public information about the Y-14 data collection effort, including reporting forms, is available on the Federal Reserve's website.

Term premium shocks. In the main analysis, we employ event-study-based term premium "shocks" that are obtained from high-frequency interest rate changes around major monetary policy events. This approach is inspired by the literature on high-frequency identification of monetary policy shocks (Kuttner, 2001), which argues that changes over narrow windows surrounding such events primarily reflect "surprises" in monetary policy announcements, rather than other macroeconomic news. We construct term premium shocks as follows. First, for each FOMC statement release and minutes release dates between 1994 and 2019, we calculate one-day changes in the 3-month T-bill yield and in the expectations and term premium components of the 3-month/5-year term spread, based on the Kim-Wright model (Kim and Wright, 2005). Second, in line with 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). Third, 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). Panel A in Figure OA-1 shows the resulting quarterly term premium shocks alongside the 5-year term premium series from the term structure model of Kim and Wright (2005).

3 Empirical Strategy

The model generates two testable predictions for the effects of fluctuations in term premiums on bank lending and profitability. Our main identification strategy is a difference-in-differences framework centered on the unanticipated surge in term premiums during the "Taper Tantrum." This episode followed Fed Chair Ben Bernanke's mid-2013 remarks about a potential reduction in the pace of asset purchases, which triggered a rise in the term premium consistent with theories predicting that an unexpected increase in the available supply of public debt raises term premiums (e.g., Vayanos and Vila (2021)). We describe this approach in detail below. In Section 4.4, we generalize our Taper Tantrum results using high-frequency term premium shocks in larger loan- and bank-level samples. Furthermore, Online Appendix B uses an instrumental variables (IV) approach based on foreign official holdings of U.S. Treasuries to study the broader 1994–2019 panel.

3.1 The Taper Tantrum Episode

Our identification strategy exploits an unusual episode in which the term premium rose sharply and unexpectedly, while expectations about the economic outlook remained largely unchanged. 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 QE program "in the next few meetings." Following these comments, Treasury yields and term premiums surged and remained elevated, as shown in Figure 3, inducing a large monetary policy shock (Bernanke, 2015; Chari et al., 2021). This shock can be understood through the lens of the preferred habitat theory, whereby an increase in the amount of debt available to the private sector tends to increase the term premium. We therefore treat Chair Bernanke's remarks as generating a plausibly exogenous rise in the term premium.

A primary identifying assumption is that the tapering announcement is unrelated to changes in expectations about the state of the economy, in particular, expectations of an improving economic outlook. Several pieces of evidence support this assumption. First, market commentaries around the Taper Tantrum suggest that economic expectations remained broadly stable. If anything, observers expressed skepticism about the strength of the economic recovery and interpreted the announcement as "pointing to a less accommodative stance of monetary policy" than previously thought (page 4 of FOMC (2013)). Survey responses by primary dealers presented at the July 2013 FOMC meeting indicated that the leading factors behind the sharp rise in 10-year Treasury yields after May 22, 2013 were shifting expectations for monetary policy and a rise in policy uncertainty, while stronger growth prospects and higher inflation outlook played a lesser or an unimportant role (Sinha and Smolyansky, 2022).[10]

[10] Comparing the April and June 2013 Primary Dealer surveys, there was no change in the median Q4/Q4 2014

To guard against the possibility that evolving growth expectations confound our results, we directly control for banks' own quarterly GDP growth forecasts, both in levels and interacted with a dummy variable for the post-Taper Tantrum period. This approach requires limiting the sample to the banks that regularly participate in the Blue Chip Survey, resulting in 11 banks.[11] Table OA-1 compares the 11 survey-participating banks with the remaining 17 Y-14 banks. The two groups are similar in capital surprises (p=0.608), confirming balance on the key exposure variable (discussed in more detail below). Survey banks, however, hold more regulatory Tier 1 capital (p=0.088) and are larger, consistent with their status as primary dealers and systemically important institutions. To the extent that higher capitalization (lower leverage) implies weaker profit sensitivity to the term premium, this difference works against finding significant effects. We will also show that our key results hold when we drop the GDP growth forecast control and extend the sample to all Y-14 reporting banks. Separately, since the small number of banks can reduce the reliability of standard cluster-robust standard errors (Cameron et al., 2008), we show that our inference is robust, beyond the baseline double-clustering on bank and firm, to: (i) a wild cluster bootstrap test at the bank level with Rademacher weights, (ii) single-clustering on bank, and (iii) triple-clustering on bank, firm, and quarter.

3.2 Banks' Profit Sensitivity to the Term Premium

Our empirical measure of the sensitivity of bank profits to the term premium is leverage on loans (α_t in the model). The model predicts that leverage amplifies the effect of term premium changes on expected profitability and, in turn, on lending (Testable Implication 2): a more leveraged bank earns a larger expected excess return from maturity transformation for a given rise in the term premium, relaxing its financing constraint and supporting credit provision. Since leverage is not randomly allocated among banks, for empirical identification, we exploit quasi-random variation

GDP growth forecast before and after the start of the Taper Tantrum. Furthermore, the average one-year-ahead GDP growth forecast increased by only 10 bps between the March and June 2013 surveys.

[11] A 12th bank participates in the survey over our regression sample period but does not have sufficient loans in the estimation window after excluding 2013:Q2, as discussed in Section 3.3.

in bank leverage (to which we refer as "capital surprises").

Building on Irani et al. (2021), we use bank-specific "surprises" to bank capital requirements following the U.S. implementation of Basel III of June 2012, which differed from the international version by requiring U.S. banks to use higher risk weights for past-due loans and for high-volatility commercial real estate loans, as well as a different set of risk weights for residential mortgages (Berrospide and Edge, 2016). We define the capital surprise as the difference between a bank's actual Tier 1 capital ratio in 2012:Q2 and the new Basel III-compliant regulatory threshold, so that lower values indicate a smaller capital buffer and higher leverage. The average capital surprise is 2.9% of risk-weighted assets and varies between 2.3% at the 25th percentile and 2.7% at the 75th percentile of the cross-sectional distribution (see Table 2). In addition, we use a second measure of leverage based on the regulatory Tier 1 capital ratio (that is, Tier 1 capital divided by risk-weighted assets) at end-2012. In the regressions, both the capital surprise and the Tier 1 capital ratio are multiplied by -1 so that higher values indicate higher leverage.[12]

Table 3 (Panel I) presents the full covariate balance for banks with higher and lower leverage (around the sample median). Under both leverage measures, higher-leverage banks tend to be larger and hold lower shares of core deposits and reserves than lower-leverage banks; these differences are statistically significant and motivate our inclusion of all these characteristics interacted with a dummy for post-Taper Tantrum period in the DiD specification (discussed in Section 3.3 below). Crucially for identification, however, banks with higher and lower leverage are similar in their one-year-ahead GDP growth forecasts, mitigating potential worries that more leveraged banks might lend more because they are more optimistic about the economic outlook rather than because of the higher term premium. In addition, we will conduct parallel pre-trends tests (using both placebo tests and dynamic DiD coefficient charts) to confirm that banks with different leverage levels had similar lending outcomes in the period before the Taper Tantrum.

[12] For simplicity, we refer to the second measure as "Tier 1 leverage" throughout the paper. Note that this measure differs from the Basel III leverage ratio, which is defined as Tier 1 capital divided by total unweighted assets.

3.3 Main Specifications

Bank-lending specification. To test the model's Testable Implication 2—that the responses of bank lending to term premiums depend on ex-ante bank leverage—we adopt a difference-in-differences framework centered on the Taper Tantrum. We exploit the presence of multi-bank firms in the Y-14 dataset, accounting for 23% of all firms, which allows us to examine banks' lending decisions while holding unobserved shocks constant for each firm and quarter. We conduct the analysis in a symmetric window spanning four quarters before and after 2013:Q2, when the Taper Tantrum began. This window allows sufficient time for loan renegotiations, modifications, and new lending decisions to materialize. Specifically, we estimate the following difference-in-differences regression specification:

$$\begin{aligned} \textit{Loan outcome}_{bjt} &= \beta_1 \, \textit{Leverage}_{b,2012} \times \textit{Post} \\ &\quad + \gamma_1' \, \mathbf{X}_{b,2012} \times \textit{Post} \; + \; \gamma_2' \, \mathbf{Z}_{bt} \\ &\quad + \gamma_3' \, \mathbf{Z}_{bt} \times \textit{Post} \; + \; \delta_{jt} + \theta_{bj} + \varepsilon_{bjt}, \end{aligned} \tag{13}$$

where $Loan\ outcome_{bjt}$ refers to loan growth (the log-difference in loan commitments relative to the first quarter the bank-firm pair is observed), the loan spread, or the log of loan maturity (in quarters) for outstanding loans from bank b to firm j in quarter t.[13] $Post$ is a dummy variable equal to one between 2013:Q3 and 2014:Q2 and zero between 2012:Q2 and 2013:Q1. We drop loans outstanding in 2013:Q2 to ensure a clean separation of the pre- and post-Taper Tantrum periods (although results are robust to retaining loans outstanding in 2013:Q2). Our measures of $Leverage_{b,2012}$ are the bank capital surprises and Tier 1 leverage (defined in Section 3.2).

The specifications include standard determinants of bank lending ($\mathbf{X}_{b,2012}$), including bank size (log-assets), the share of core deposits in total liabilities, and the share of securities in total assets, all measured at the end of 2012 and in interaction with the $Post$ dummy. The share of securities

[13] Most of the variation in the quarterly changes in commitment volumes and interest rates comes from loan renegotiations and amendments, affecting about 40% of loans (Bidder et al., 2023), loan renewals for maturing loans, and new loan originations (representing 6.8% of loans).

holdings is meant to capture other standard channels of interest rate transmission to bank lending, such as the bank balance sheet and the asset valuation channels of monetary policy (Greenwald et al., 2024).[14] Additionally, we include bank reserves (as a share of assets) to ensure that the results do not capture the lending effects of deposits at the Federal Reserve accumulated under the QE programs initiated after the 2008 financial crisis, which resulted in an unprecedented injection of reserves into the banking system.[15] The specifications also include bank-level one-year-ahead real GDP growth forecasts Z_{bt} in levels and interacted with $Post$. These forecasts control for banks' expectations of the economic outlook—a key determinant of their lending decisions—as well as any revision to those expectations following the tapering announcement.

The specifications include both firm×quarter fixed effects (δ_{jt}) and bank×firm fixed effects (θ_{bj}). The firm×quarter fixed effects in the sample of loans to multi-bank firms help control for time-varying firm-specific shocks such as loan demand shifters (Khwaja and Mian, 2008; Jiménez et al., 2020) or changes in firm credit risk profile. The bank×firm fixed effects help address potential concerns of nonrandom matching between banks and firms (Schwert, 2018). The model's Testable Implication 2 predicts that the coefficient of interest β_1 should be positive for loan amounts and maturities and negative for loan spreads, implying that more leveraged banks should expand lending more than other banks following a rise in the term premium. We estimate the specification using OLS. Standard errors are double clustered on bank and firm to account for unobserved correlation in outcomes within banks over time—given that leverage treatment variation is at the bank level—and across loans to the same firm given the sample of multi-bank firms (Abadie et al., 2023).

[14] Valuation effects from fluctuations in long-term interest rates may affect bank net worth (Chakraborty et al., 2020; Luck and Zimmermann, 2020; Acharya et al., 2019; Rodnyansky and Darmouni, 2017) or induce portfolio rebalancing strategies from short- to long-term assets associated with declining term premiums under QE policies (Bottero et al., 2022). 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.

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

Real effects specification. We examine whether changes in lending outcomes from more leveraged banks during the Taper Tantrum propagate to the firm level and affect firms' investment decisions and asset growth. To this end, we examine how changes in firm outcomes depend on their ex-ante exposure to the Taper Tantrum through their lenders' leverage using the following specification estimated in a firm-year panel:

$$\begin{aligned} \textit{Real outcome}_{j,t} = \beta_1\, \textit{Post}_t \times \textit{Exposure to bank leverage}_{j,2012} \\ + \gamma_1'\, \mathbf{W}_{jt} + \gamma_2'\, \mathbf{W}_{jt} \times \textit{Post}_t \\ + \theta_j + \delta_{slt} + \varepsilon_{jt}, \end{aligned} \tag{14}$$

where $Real\ Outcome_{j,t}$ is either the total debt growth, the investment rate, or the total asset growth rate of firm j measured over calendar year t. $Post_t$ is a dummy variable equal to one for $t \in \{2013, 2014\}$ and zero for $t = 2012$, so that the pre-period outcome captures growth over calendar year 2012 and the post-period outcomes capture growth over calendar years 2013 and 2014. Since the Taper Tantrum occurred in May 2013, the post-period growth measures capture firm outcomes after the Taper Tantrum. The variable $Exposure\ to\ bank\ leverage_{j,2012}$ captures the average leverage of a firm's lenders as of end-2012, weighted by each lender's share of the firm's total borrowing across all lenders.

Table 3 (Panel II) reports a covariate balance test across firms with above- and below-median exposure to bank leverage. Firms in the two groups are broadly similar in terms of debt-to-asset ratios and cash holdings, though firms with higher exposure tend to be larger. The full set of firm controls $\mathbf{W}_{jt}$ includes lagged firm size (log assets), leverage (ratio of total debt to assets), cash holdings (ratio of cash and marketable securities to assets), and sales growth, all measured at end-2012 and interacted with Post. The specification also includes firm fixed effects (θ_j) and state×industry×year fixed effects (δ_{slt}) to absorb unobserved shocks that are common to firms in a given location s and NAICS-3 industry l.

We estimate these regressions with OLS and cluster the standard errors at the firm level. The coefficient β_1 is expected to be positive, implying that firms borrowing from more leveraged banks should have higher relative debt growth, investment rates, and asset growth after the Taper Tantrum. This prediction holds if relationship-specific frictions give incumbent lenders an advantage in credit provision (Chava and Purnanandam, 2011; Schwert, 2018): firms that borrow from more leveraged banks are better positioned to absorb the increase in bank lending, since switching costs and information asymmetries limit their ability to rapidly reallocate borrowing across lenders.

4 Results

4.1 Taper Tantrum DiD: Bank Lending

Main results. Table 4 reports the regression estimates corresponding to Equation (13). Across specifications, the estimated DiD coefficient in the top panel is significant and indicates a robust and precisely estimated effect of bank ex-ante leverage on post-Taper Tantrum lending, across both measures of leverage considered: higher bank leverage is associated with significantly higher loan commitments, lower spreads, and longer maturities following the Taper Tantrum. These effects are more consistent with a credit-supply interpretation than a demand-side one: if the results reflected higher loan demand at more leveraged banks, we would expect higher quantities and higher (not lower) spreads. In the top panel, columns 1–2 show that, across an interquartile range of capital surprises (2.3 to 2.7 pps of risk-weighted assets), a more leveraged bank extended loans that were 1.5% larger and 17 bps cheaper. The estimates in columns 4–5, using Tier 1 leverage, yield larger effects: moving from a capital ratio of 12.7% to 11.8% of risk-weighted assets, a lower-capital (more leveraged) bank extended loans that were 4.0% larger and 89 bps cheaper. Loan maturities were also relatively longer at more leveraged banks (columns 3 and 6).

In the lower panel of Table 4, we address the potential identification concern that more leveraged banks may also hold more optimistic views about the economic outlook, and if those banks also expect stronger growth and lend more, our baseline estimates could reflect differential growth expectations rather than the response of leverage to the rise in the term premium. We augment the baseline specification with an interaction between bank leverage and banks' own GDP growth forecasts to allow the lending response to growth expectations to vary with leverage. The DiD coefficients remain significant and are similar in magnitude to those in the top panel. These estimates suggest that differential growth expectations are unlikely to fully explain our baseline estimates. Overall, the estimates in Table 4 provide empirical support for the model's Testable Implication 2.

Parallel trends. We validate the DiD identifying assumption of parallel trends using dynamic coefficient plots and placebo tests. Figures OA-2 and OA-3 plot the quarterly DiD coefficients for each outcome variable, estimated separately for capital surprises and Tier 1 leverage, respectively, and support the parallel trends assumption. In the four quarters before the Taper Tantrum (2012:Q2 to 2013:Q1), the coefficients on the interaction terms are small and insignificant, with no systematic pre-trend. This is particularly reassuring for the capital surprise measure, where flat pre-trends mitigate the concern that banks may have adjusted lending in anticipation of the Basel III framework. Following the Taper Tantrum, the coefficients on loan growth and maturity become large and remain positive and significant through the end of the sample window.[16]

We also report a placebo test in Table OA-3 that compares lending outcomes in 2012:Q4–2013:Q1 versus 2012:Q2–2012:Q3, when the term premium was stable (as shown in panel B of Figure OA-1). This test aims to show that the mechanism breaks down in the absence of term premium fluctuations: if the differential lending response of more leveraged banks is driven by the rise in term premiums during the Taper Tantrum, it should not appear in a period of stable term premiums. Across all specifications in Table OA-3, the DiD coefficients are small and insignificant. This result reinforces the conclusion that our baseline differential lending response is specific to the term premium rise after the Taper Tantrum rather than reflecting a pattern of more leveraged banks lending differentially.

[16] The dynamic spread coefficients for the capital surprise are directionally as expected, but in Figure OA-2 individually less precisely estimated due to the smaller sample of loans with loan pricing data. Nevertheless, the average DiD coefficient reported in Table 4 is significant at the 5% level, as it pools information across all post-period quarters.

Control for maturity gap and income gap. In the model, the bank's lending decision depends on the total duration exposure, which, in turn, is a function of both its leverage and the maturity of its assets. Because we model a long-term loan with a fixed maturity, banks can only adjust their leverage margin, so higher leverage acts as the mechanism to increase total duration exposure. The empirical implication is that even if we flexibly control for a bank's measured maturity gap, ex-ante leverage should remain a robust, independent predictor of the bank's lending response to term premium fluctuations. We test this idea in Table OA-4 by augmenting the baseline specification with the end-2012 maturity gap interacted with the Post dummy (Panel I). The maturity gap as an additional control variable further helps assess whether our results are driven by asset valuation effects: banks with a higher maturity gap hold more long-duration assets and therefore experience larger mark-to-market losses on their securities portfolios when the term premium rises, reducing net worth and potentially lending capacity—a channel that would, if anything, bias against our main findings. Consistent with the model's prediction, the DiD coefficients on bank leverage remain significant, while the maturity gap interaction terms are generally insignificant, confirming that the maturity gap does not contain additional information about differential responses to the term premium beyond what leverage already captures. Panel II extends this analysis to the income gap, a broader measure of banks' net interest income sensitivity to rate changes. The results once again suggest that the baseline findings are not driven by heterogeneous income gap exposure across leverage groups. Taken together, these results support the model's prediction that leverage remains informative after controlling for the maturity mismatch, while ruling out asset valuation and income gap effects as alternative explanations.

Control for short rates. Table OA-5 addresses the potential concern that the lending differential by bank leverage could reflect heterogeneous responses to changes in the short rate rather than to changes in term premiums. We augment the baseline specification with three alternative short-rate controls interacted with bank leverage: the contemporaneous change in the short rate (Panel I), the lagged level of the short rate (Panel II), and the high-frequency fed funds rate shock from

Swanson (2021) (Panel III). Across specifications and leverage measures, the DiD coefficients retain their sign, magnitude, and significance, suggesting that our results are not driven by differential sensitivity to short-rate movements rather than term premium variation.

Control for finer fixed effects at the loan level. Table OA-6 examines whether the baseline results are robust to the inclusion of finer fixed effects that absorb unobserved heterogeneity at the loan level. If firms have different types of loan relationships across banks (for instance, they take loans for certain purposes from one bank and other types of loans from another bank), then loan demand could be bank-specific and firm×time fixed effects would fail to absorb all variation in loan demand. In addition, credit dynamics following monetary and financial shocks can vary significantly across loans collateralized by different types of assets (Ivashina et al., 2021). To address these issues, in Panel I we estimate our baseline specifications with finer fixed effects. Specifically, we follow Greenwald et al. (2024) and consider major loan purpose categories including "Mergers and Acquisitions," "Working Capital," "Real estate investment or acquisitions," and "All other purposes," and augment the baseline with firm×loan–purpose×time fixed effects. In Panel II, we repeat the baseline specifications with fixed effects for collateral types given by asset-based loans, earnings-based loans, and unsecured loans (as in Caglio et al. (2021)). In both panels, the DiD coefficients on bank leverage remain significant and similar in magnitude to the baseline.

Bootstrap the standard errors. Tables OA-7 and OA-8 check the validity of our standard error estimates given the small number of bank clusters—a common challenge when treatment variation is at a higher level of aggregation than the outcome (Abadie et al., 2023). Throughout the baseline analysis, standard errors are double clustered on bank and firm. Table OA-7 reports estimates corresponding to two alternative approaches: single clustering on bank (Panel I) and triple clustering on bank, firm, and quarter (Panel II). Moreover, Table OA-8 reports p-values and confidence intervals from a wild bootstrap procedure that accommodates settings with few clusters, using 10,000 replications. The DiD coefficients in these regressions remain statistically significant. In fact, the bootstrap p-values are in some cases smaller than the baseline p-values. This is a reassuring result suggesting that our standard errors are not systematically understated.

4.2 Taper Tantrum DiD: Real Effects

Next, we examine whether the bank lending expansion documented above affects the investment and balance sheet growth of borrowing firms, using the specification in Equation (14). The identifying variation exploits differences in firms' ex-ante exposure to the Taper Tantrum through the leverage of their banks: firms borrowing from more leveraged banks before the Taper Tantrum received more credit at lower spreads, and should exhibit stronger real outcomes after the Taper Tantrum.

The results in Table 5 support this prediction across the outcome variables considered—debt growth, investment rate, and asset growth. Since reliable firm financial data are available on a yearly basis starting only in 2012, we use calendar year 2012 as the pre-period baseline and compare outcomes averaged over 2013–2014 as the post-period, capturing the two-year window following the Taper Tantrum. All DiD coefficients have the directionally anticipated sign. Estimates in columns 2 and 5 indicate that across an interquartile range of firm exposure to bank leverage—1.5 pps for capital surprises and 1.3 pps for Tier 1 leverage—firms borrowing from more leveraged banks had investment rates that were 3.2 pps higher under capital surprises and 1.8 pps higher under Tier 1 leverage in the two years following the Taper Tantrum (relative to average investment rates of 6.6% in the sample). Debt growth and asset growth also increase significantly for firms exposed to more leveraged banks, though with smaller magnitudes.[17]

4.3 Fixed-Rate Reallocation and Bank Funding Costs

Fixed-rate asset allocation. A potential concern with the baseline sample is that about half of all C&I loans carry floating rates and thus bear little interest-rate duration.[18] Because floating-

[17] The real effects results are robust to a shorter window comparing 2012 versus 2013 outcomes (Panel I of Table OA-9), and to the use of more granular county×NAICS-4×year fixed effects in place of the baseline state×NAICS-3×year fixed effects (Panel II of Table OA-9), with coefficients remaining significant and similar in magnitude across both leverage measures and most outcome variables, with the exception of asset growth under capital surprises in Panel II, which becomes marginally insignificant under the NAICS-4 industry classification.

[18] Over 2012–2019, 52% of loans in the Y-14 have floating rates, accounting for 48% of total loan commitments.

rate loans reset with the short rate, they have low direct exposure to the term premium, which works against us finding results in the baseline sample. At the same time, a higher term premium raises the expected profitability of a bank's aggregate fixed-rate portfolio, relaxing the overall lending constraint and generating an expansion across all credit products, including floating-rate instruments. We next provide additional evidence by isolating fixed-rate instruments—which generate a higher expected return than floating-rate instruments when the term premium rises—and test if more leveraged banks expand their relative holdings of such instruments.

Table 6 tests this prediction for fixed-rate loans and fixed-rate securities. Columns 1–2 use the Y-14 loan-level sample and a specification similar to Equation (13) with fewer fixed effects given the small share of new fixed-rate C&I loan originations in the sample. The estimates show that more leveraged banks are significantly more likely to originate new C&I fixed-rate loans following the Taper Tantrum, under both the capital surprise measure and the Tier 1 leverage measure. The DiD coefficient in column 1 represents a 0.36 percentage point increase in the probability of originating a fixed-rate loan, representing a 30% increase relative to the mean of 1.2%. Columns 3–4 extend this analysis to the broader Call Report sample, covering about 1,600 banks. Since capital surprise data are not available for all banks, here we only use Tier 1 leverage. The estimates indicate that, after the Taper Tantrum, more leveraged banks increase their shares of MBS holdings and fixed-rate assets (in total assets) relative to less leveraged banks.[19]

Taken together, the evidence in Table 6 suggests that more leveraged banks reorient their asset portfolios more broadly toward instruments that benefit most from an elevated term premium.

Bank funding costs. Next, we examine how banks finance their lending expansion after an increase in term premiums, focusing on changes in deposit rates on the most common savings instrument—the 12-month CD rate on a $10,000 account. Table OA-10 reports DiD estimates of the effect of bank leverage on deposit rates around the Taper Tantrum, using bank-county-quarter

[19]The share of MBS is the sum of held-to-maturity and available-for-sale mortgage-backed securities (Schedule RC-B) as a share of total assets. The share of fixed-rate assets is defined as one minus the share of floating-rate assets, where floating-rate assets are the sum of floating-rate loans (Call Report Schedule RC-C) and floating-rate securities (Schedule RC-B) as a share of total assets.

data over windows of four to six quarters around 2013:Q2. The results reveal a pattern of gradual adjustment, with insignificant effects at the four-quarter window, but positive and significant at the five-and six-quarter windows. This delayed response suggests that banks first draw down existing funding capacity before competing for new deposits by raising rates. The findings overall suggest that more leveraged banks respond to higher term premiums by gradually raising deposit rates to attract new funding and expand lending capacity, providing a funding mechanism that is consistent with the credit expansion documented in baseline Table 4.

4.4 External Validity

Loan-level analysis over 2012–2019. Do our Taper Tantrum results generalize beyond this single episode? To answer this question, we use high-frequency term premium shocks and the full Y-14 loan-level dataset over 2012–2019, spanning the post-crisis normalization of monetary policy from near-zero rates through the 2015–2018 tightening cycle. The regression relates loan growth, spreads, and maturities to lagged term premium shocks interacted with lagged bank Tier 1 leverage, controlling for bank×firm and firm×quarter fixed effects as well as interactions of bank controls with the term premium shock. The regressions are similar to our baseline DiD in that we hold firm-level demand constant within each quarter while generalizing the source of term premium variation from a single shock to the full time-series of high-frequency monetary policy surprises (described in Section 2). Similar to Table 4, in the bottom panel we consider regressions that additionally control for bank Tier 1 leverage interacted with bank-specific GDP growth forecast.

Table 7 reports the estimates. The coefficients on the interaction between bank leverage and term premium shocks are statistically significant with the anticipated signs across most specifications and outcome variables: more leveraged banks expand loan volumes more and charge lower spreads following a positive term premium shock.[20] The estimates in columns 1-2 of the top panel indicate that a one SD increase in the term premium shock (approximately 3 bps) is associated with loan

[20] The loan maturity estimate in the top panel is positive but insignificant (p=0.112); this coefficient becomes significant at the 10% level in the bottom panel when additionally controlling for the leverage-growth forecast interaction.

growth that is close to 1% higher and loan spreads that are about 5 bps lower across an interquartile range of the bank leverage distribution, consistent with the Taper Tantrum results and Testable Implication 2. These effects are robust to additionally controlling for the interaction of bank leverage with GDP growth forecast in the bottom panel, alleviating the concern that the results may reflect differential sensitivity of more leveraged banks to the economic outlook rather than to term premium movements. Overall, these findings confirm that the Taper Tantrum results reflect a broader pattern of bank lending responses to changes in the term premium and are not solely confined to the 2013 Taper Tantrum episode.

Crucially, as shown in Table OA-2, the loan volume and pricing results are robust to extending the sample to all Y-14 reporting banks and dropping the bank-specific GDP growth forecast controls that require Blue Chip survey participation, confirming that the expected profitability channel is not specific to the relatively small number of survey-participating banks in the main regressions.

Panel analysis over 1994–2019. Online Appendix B provides further external validity evidence using the full 1994–2019 Call Report panel, where we estimate the relation between the term premium and bank loan growth using an IV based on foreign official demand for U.S. Treasuries. The results confirm that a higher term premium is associated with stronger loan growth over the long run, with stronger effects for more leveraged banks.

5 Mechanism: Bank Profitability

The evidence presented so far shows that higher term premiums are associated with an expansion in bank lending. We hypothesize that the underlying mechanism operates through *expected bank profitability*: a higher term premium represents greater expected profits from maturity transformation.

To find empirical support for this mechanism, we re-estimate the models in the broader Call Report sample of banks from Table 6 (columns 3-4). Here, we use the average ROE over the four quarters following quarter t as the dependent variable. The results reported in Table 8 show that more leveraged banks experience greater increases in profitability when the term premium rises, with DiD coefficient estimates significant at the 1% level. Across an interquartile range of Tier 1 leverage in the Call Report sample (11.9 to 16.6 pps), more leveraged banks experience an increase in ROE of approximately 5.6 bps following the Taper Tantrum, relative to an average ROE of 2.1% in the sample. In Online Appendix B we show that this positive and significant relation between the term premium and future bank profitability generalizes to a longer-run period spanning 1994–2019.

These findings are further corroborated by evidence from the equity market. In Table OA-11, we use daily stock returns of listed banks over the 1997–2019 period and a specification that closely follows Paul (2023) and regresses excess stock market returns on the term premium shock series in level and interacted with lagged bank leverage. The estimates indicate that more leveraged banks earn relatively higher excess stock returns following an increase in the term premium, suggesting that investors perceive a higher term premium as improving the future earnings prospects of more leveraged banks.

Together, the results in Tables 8 and OA-11 suggest that the differential lending expansion is accompanied by higher realized and expected future profits at more leveraged banks, providing additional support for the expected bank profitability mechanism linking the term premium to bank lending incentives.

6 Conclusion

We propose an "expected bank profitability" channel through which a higher term premium increases the expected returns from maturity transformation, boosting bank profitability and credit supply. Consistent with this channel, we show empirically that a rise in the term premium is associated with higher profitability and lending among more leveraged banks, and in turn with higher investment and balance sheet growth for bank-dependent firms borrowing from more leveraged lenders. We rationalize these patterns using a dynamic banking model in which banks pay below-market deposit rates and face financial constraints.

Our results have important implications for the design and calibration of unconventional monetary policies, particularly large-scale asset purchase programs. The conventional view of how QE stimulates bank lending emphasizes the asset valuation channel: by compressing the term premium, asset purchases raise the market value of banks' long-duration securities holdings, boosting net worth and lending capacity. Our findings point to a countervailing force that has received less attention: the expected bank profitability channel operates in the opposite direction. When asset purchases compress the term premium, they also reduce banks' expected profits from maturity transformation—the activity that makes bank profits sensitive to the slope of the yield curve. More leveraged banks, which benefit more from a higher term premium, may therefore curtail lending in response to the policy-induced term premium compression, partially offsetting its intended stimulative effects. The net effect on bank lending of a given reduction in the term premium thus depends on the relative magnitudes of these two opposing forces—asset valuation gains on the one hand, and reduced expected profits from maturity transformation on the other—as well as on the leverage and asset composition of the banking sector. More broadly, central banks designing balance sheet policies may consider that the same reduction in term premiums that recapitalizes banks through asset valuation gains may simultaneously dampen their incentive to engage in maturity transformation. The aggregate implications of this channel for the real economy remain an important open question for future research.

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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 ($\sigma_{L\kappa,t}$).

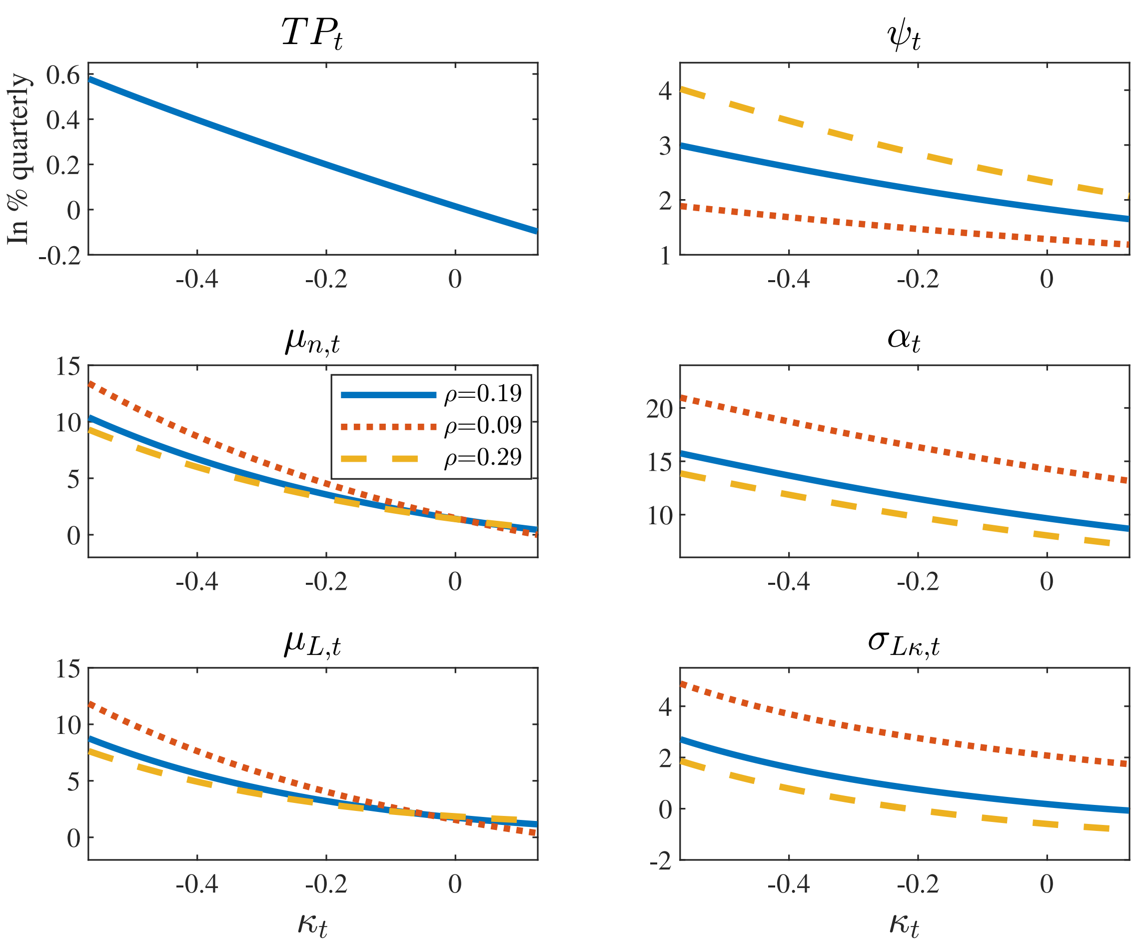


Figure 2: Impulse responses to a κ_t shock in the model

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 bps (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," ($E_t[d\psi/\psi]$). The lower-right panel shows banks' expected change in wealth ($E_t[dn/n]$).

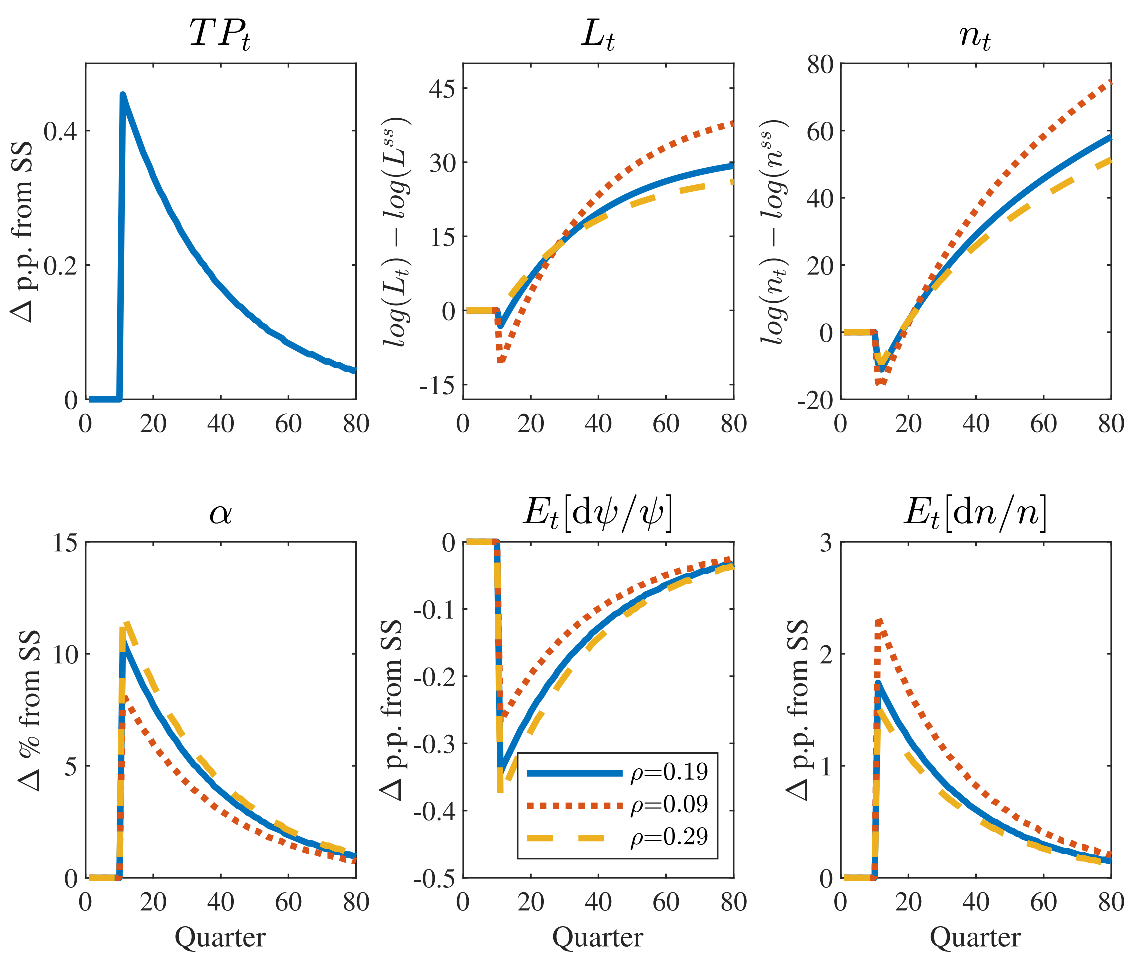


Figure 3: Treasury yields and the term premium during Taper Tantrum

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 QE program. The date of the remarks is marked by the dashed vertical line. Sources: The Treasury yields series is Federal Reserve Economic Data (FRED) series DGS5. The 5-year Kim-Wright term premium series is FRED series THREEFYTP5.

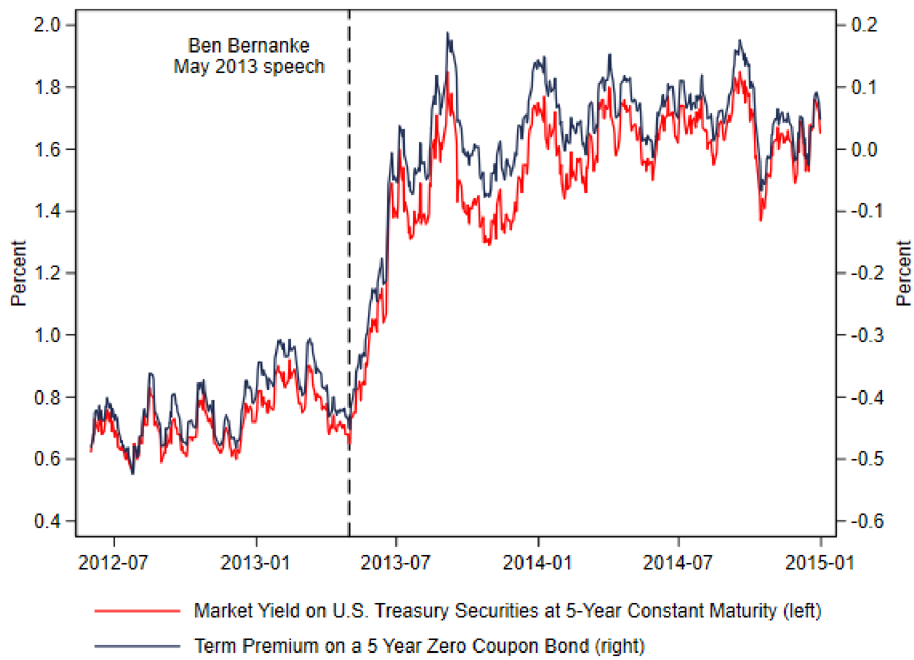


Table 1: Model calibration

		Value	Description	Source
1. $r-$process				
	$\overline{r}$	0.0115	Mean r	SMM
	λ_r	0.0241	AC(1) r	SMM
	σ_r	0.0071	Volatility r	SMM
2. $\kappa-$process				
	$\overline{\kappa}$	-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 1.2.

Table 2: Descriptive statistics for main regression variables

This table reports summary statistics for selected regression variables. To limit the influence of outliers, all continuous variables are winsorized as appropriate, typically at the 1st and 99th percentiles of their respective distributions. See Section 2 for data sources and Section 3 for definitions of bank-level leverage and firm-level exposure to lender leverage.

	N	SD	Mean	P25	P50	P75
A. Taper Tantrum analysis (Y-14, 2012–2014)						
Loan-level variables						
Loan amount (US$ million)	335302	56.856	25.479	2.478	7.449	26.271
Loan growth	335302	1.076	-0.036	-0.468	0.000	0.485
Loan spread (pps)	163587	1.252	2.274	1.500	2.000	2.750
Loan maturity (quarters)	322720	10.100	12.608	4.000	12.000	17.000
0/1 New fixed-rate loan	665209	0.109	0.012	0.000	0.000	0.000
Bank-level variables (Y-14 sample)						
Bank capital surprise (pps)	335302	1.128	2.864	2.301	2.581	2.723
Bank Tier 1 leverage (pps)	335302	1.517	12.394	11.750	11.750	12.670
Bank GDP growth forecast (pps)	335302	0.452	2.373	2.075	2.350	2.650
Bank size (log-assets)	335302	1.144	6.534	5.687	7.144	7.296
Bank core-deposits-to-liabilities	335302	0.087	0.556	0.483	0.537	0.632
Bank securities-to-assets	335302	0.059	0.187	0.150	0.182	0.202
Bank reserves-to-assets	335302	0.074	0.060	0.021	0.047	0.077
Bank maturity gap /100	308643	0.259	0.936	0.740	0.834	1.103
Bank income gap	335302	0.100	0.354	0.304	0.378	0.427
Bank-level variables (Call Report sample)						
Tier 1 leverage (pps)	11246	13.364	15.964	11.879	13.863	16.633
Return on equity	11246	0.022	0.021	0.014	0.022	0.030
MBS (% assets)	11246	0.100	0.098	0.017	0.074	0.147
Fixed-rate assets (% assets)	11209	0.136	0.823	0.786	0.862	0.909
Firm-level variables						
Firm debt growth	102493	0.560	0.060	-0.141	0.001	0.248
Firm investment rate	102456	0.792	0.066	-0.069	0.008	0.164
Firm asset growth	102102	0.323	0.078	-0.033	0.039	0.153
Firm exposure to bank capital surprises	102493	1.086	2.521	1.818	2.435	3.286
Firm exposure to bank Tier 1 leverage	102493	2.966	10.162	10.116	10.838	11.381
Firm size (log-assets)	102102	1.961	17.267	15.870	16.852	18.211
Firm leverage (debt/assets)	102102	0.285	0.430	0.212	0.389	0.605
Firm cash (cash/assets)	102492	0.123	0.090	0.010	0.043	0.121
Firm sales growth	101693	0.318	0.098	-0.011	0.055	0.147
B. Macro variables (2012-2019)						
Term premium shock (Kim and Wright, 2005) ($\times$100)	32	0.033	0.003	-0.021	0.001	0.029
Short-rate	32	0.841	0.639	0.030	0.116	1.150
Δ Short-rate	32	0.156	0.048	-0.008	0.015	0.139
Fed funds rate shock (Swanson, 2021)	31	0.194	0.264	0.201	0.279	0.406
C. Additional variables						
Deposit rate	85888	0.215	0.398	0.250	0.381	0.500
Stock market return	88031	0.027	0.001	-0.010	0.000	0.012

Table 3: Covariate Balance Across Leverage Groups: Bank and Firm Characteristics

This table presents a covariate balance test for banks with higher versus lower leverage (Panel I) and for firms with higher or lower exposure to lender leverage (Panel II). There are $N = 11$ banks and $N = 30,055$ firms in the regression sample in the pre-shock period. Higher versus lower leverage banks are split around the mean. Higher versus lower leverage firms are split around the median of firm's exposure to bank leverage. Columns 3 and 6 in panel I report the p-value of a two-sided test of equality of means across the two groups of banks, with bank-level variables averaged across bank-quarters. Columns 3 and 6 in panel II report the normalized differences between each pair of averages across the two groups of firms (the difference between the two averages, normalized by the square root of the sum of the corresponding variances). Imbens and Rubin (2015) propose that two variables have "similar" means when the absolute normalized difference is less than 0.25. Panel A significance: *p<.1. Panel B significance: † indicates that the normalized difference is larger than 0.25 and thus averages across the two groups are "different". See Section 2 for data sources and Section 3 for definitions of bank- and firm-level leverage measures.

	(A) Capital surprises			**(B) Tier 1 leverage**		
	High leverage bank (1)	**Low leverage bank** (2)	**p-value (1)=(2)** (3)	**High leverage bank** (4)	**Low leverage bank** (5)	**p-value (4)=(5)** (6)
Panel I. Bank characteristics						
Size (log-assets)	6.56	5.40	0.018*	6.06	5.31	0.086*
Core deposits-to-liabilities	0.55	0.61	0.270	0.54	0.65	0.017*
Securities-to-assets	0.25	0.19	0.216	0.20	0.21	0.695
Reserves-to-assets	0.03	0.14	0.049*	0.05	0.18	0.007*
Growth forecast	0.02	0.02	0.591	0.02	0.02	0.108
Panel II. Firm characteristics						
	Firm with high exposure	**Firm with low exposure**	**Normalized difference (1)-(2)**	**Firm with high exposure**	**Firm with low exposure**	**Normalized difference (4)-(5)**
Size (log-assets)	17.7	16.6	0.559†	17.8	16.6	0.670†
Leverage (debt-to-assets)	0.45	0.42	0.131	0.43	0.44	-0.023
Cash (cash-to-assets)	0.08	0.09	-0.117	0.08	0.09	-0.118
Sales growth	0.11	0.11	0.013	0.12	0.10	0.065

Table 4: Term Premium and Bank Lending: DiD Evidence around the Taper Tantrum

This table reports OLS estimates from a difference-in-differences (DiD) regression of bank lending outcomes on bank leverage around the 2013:Q2 Taper Tantrum. The dependent variables are loan growth, spread, and maturity (log). The data are at the loan level and refer to outstanding loan commitments to individual borrowers during a period covering a window of four quarters before and after 2013:Q2, excluding loans outstanding in 2013:Q2 (the quarter of the Taper Tantrum). Post is a dummy variable equal to one during 2013:Q3–2014:Q2 and zero during 2012:Q2–2013:Q1. Bank controls include bank size (log-assets), core deposit share in total liabilities, securities-to-asset ratio, reserves-to-asset ratio (all measured at end-2012) and lagged GDP growth forecasts ("Growth forecast"); all controls enter the specifications in level and interacted with Post. Specifications in the bottom panel additionally control for bank leverage interacted with the growth forecast. See Section 2 for data sources and Section 3 for definitions of leverage measures. Standard errors in parentheses are double clustered by bank and firm. Significance: *p<.1; **p<.05; ***p<.01.

	(A) Capital surprises			**(B) Tier 1 leverage**		
Dependent variable:	(1) **Loan growth**	(2) **Loan spread**	(3) **Loan maturity**	(4) **Loan growth**	(5) **Loan spread**	(6) **Loan maturity**
Bank capital surprise$_{2012}$×Post	0.037***	-0.427**	0.027**			
	(0.009)	(0.182)	(0.009)			
Bank Tier 1 leverage$_{2012}$×Post				0.044***	-0.967**	0.027**
				(0.009)	(0.366)	(0.009)
Observations	335,302	137,842	318,443	335,302	137,842	318,443
R^2	0.5234	0.8033	0.6654	0.5234	0.8068	0.6654
Bank controls × Post	Y	Y	Y	Y	Y	Y
Growth forecast × Post	Y	Y	Y	Y	Y	Y
Bank × Firm FE	Y	Y	Y	Y	Y	Y
Firm × Quarter FE	Y	Y	Y	Y	Y	Y
	(A) Capital surprises			**(B) Tier 1 leverage**		
	Controlling for Bank Leverage × Growth forecast					
Bank capital surprise$_{2012}$×Post	0.031**	-0.317**	0.026**			
	(0.013)	(0.126)	(0.008)			
Bank Tier 1 leverage$_{2012}$×Post				0.037***	-0.985**	0.028**
				(0.011)	(0.376)	(0.009)
Observations	335,302	137,842	318,443	335,302	137,842	318,443
R^2	0.5234	0.8034	0.6654	0.5235	0.8068	0.6654
Bank controls × Post	Y	Y	Y	Y	Y	Y
Growth forecast × Post	Y	Y	Y	Y	Y	Y
Bank leverage × Growth forecast	Y	Y	Y	Y	Y	Y
Bank × Firm FE	Y	Y	Y	Y	Y	Y
Firm × Quarter FE	Y	Y	Y	Y	Y	Y

Table 5: Term Premium and Firm-Level Real Effects: DiD Evidence around the Taper Tantrum

This table reports OLS estimates from a difference-in-differences (DiD) regression of firm-level outcomes on firms' exposure to bank leverage around the 2013:Q2 Taper Tantrum, following the setup in baseline Table 4. The dependent variables are firm debt growth, investment rate, and asset growth. The Post dummy takes value one in 2013–2014 and zero in 2012. Firm controls include firm size (log-assets), leverage (debt-to-asset ratio), cash-to-asset ratio, and sales growth (all measured at end-2012); firm controls enter the specifications in levels and interacted with Post. Industry classification is 3-digit NAICS. See Section 2 for data sources and Section 3 for definitions of leverage measures. Standard errors in parentheses are clustered by firm. Significance: *p<.1; **p<.05; ***p<.01.

	(A) Capital surprises			**(B) Tier 1 leverage**		
Dependent variable:	(1) **Debt Growth**	(2) **Investment Rate**	(3) **Asset Growth**	(4) **Debt Growth**	(5) **Investment Rate**	(6) **Asset Growth**
Firm's Exposure to Bank Leverage$_{2012}$ × Post	0.0083*	0.0217***	0.0041*	0.0080***	0.0139***	0.0055***
	(0.004)	(0.008)	(0.002)	(0.002)	(0.003)	(0.001)
Observations	102,493	97,851	101,810	102,493	97,851	101,810
R^2	0.579	0.493	0.627	0.580	0.494	0.628
Firm controls × Post	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State × Industry × Year FE	Y	Y	Y	Y	Y	Y

Table 6: Term Premium and Fixed-rate Asset Allocation: DiD Evidence around the Taper Tantrum

This table reports OLS estimates from a difference-in-differences (DiD) regression of bank lending outcomes on bank leverage during a period of four quarters before and after the 2013:Q2 Taper Tantrum, excluding 2013:Q2. The data refer to the loan-level baseline Y-14 sample (columns 1–2) or the Call Report bank-quarter sample (columns 3–4). The dependent variables are a dummy variable for new originations of fixed-rate loans (columns 1–2), the share of MBS holdings in total assets (column 3), and the share of fixed-rate assets in total assets (column 4). Bank controls include bank size (log-assets), core deposit share in total liabilities, securities-to-asset ratio, reserves-to-asset ratio (all measured at end-2012) and GDP growth forecast; all controls enter the specifications in level and interacted with Post. Standard errors in parentheses are double clustered by bank and firm in columns 1–2 and single-clustered by bank in columns 3–4. See Section 2 for data sources and Section 3 for definitions of leverage measures. Significance: *p<.1; **p<.05; ***p<.01.

	(A) Y-14 sample		**(B) Call Report sample**	
Dependent variable:	(1) **0/1 New fixed-rate loan**	(2) **0/1 New fixed-rate loan**	(3) **MBS (% assets)**	(4) **Fixed-rate assets (% assets)**
Bank capital surprise$_{2012}$ ×Post	0.0036**			
	(0.0014)			
Bank Tier 1 leverage$_{2012}$ ×Post		0.0043***	0.0202*	0.0514**
		(0.0011)	(0.0109)	(0.0206)
Observations	665,209	665,209	12,848	12,808
R^2	0.2073	0.2074	0.954	0.927
Bank controls×Post	Y	Y	Y	Y
Growth forecast×Post	Y	Y	-	-
Bank FE	Y	Y	Y	Y
Firm FE	Y	Y	-	-
Quarter FE	Y	Y	Y	Y

Table 7: Term Premium and Bank Lending: External Validity Evidence 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. The data are at the bank-firm-loan level during 2012:Q1-2019:Q4. Bank controls include lagged bank size (log-assets), core deposit share in total liabilities, securities-to-asset ratio, reserves-to-asset ratio and GDP growth forecasts; all controls enter the specifications in level and interacted with the term premium shock. Specifications in the bottom panel additionally control for lagged bank leverage interacted with the growth forecast. See Section 2 for data sources and Section 3 for definitions of leverage measures. Standard errors in parentheses are double clustered on bank and firm. Significance: *p<.1; **p<.05; ***p<.01.

Dependent variable:	(1) **Loan growth**	(2) **Loan spread**	(3) **Loan maturity**
Bank Tier 1 leverage$_{t-1}$ $\times$ Term Premium Shock$_{t-1}$	0.2165*	-1.1670***	0.1058
	(0.1105)	(0.2594)	(0.0614)
Observations	1,044,732	418,235	1,029,177
R^2	0.5061	0.8310	0.6520
Bank controls×TP shock	Y	Y	Y
Growth forecast×TP shock	Y	Y	Y
Bank FE	Y	Y	Y
Firm×Quarter FE	Y	Y	Y
Bank×Firm FE	Y	Y	Y
	Controlling for Bank Leverage × Growth Forecast		
Bank Tier 1 leverage$_{t-1}$ $\times$ Term Premium Shock$_{t-1}$	0.2173*	-1.2385***	0.1062*
	(0.1071)	(0.3150)	(0.0595)
Observations	1,044,732	418,235	1,029,177
R^2	0.5062	0.8311	0.6520
Bank controls×TP shock	Y	Y	Y
Growth forecast×TP shock	Y	Y	Y
Bank leverage×Growth forecast	Y	Y	Y
Bank FE	Y	Y	Y
Firm×Quarter FE	Y	Y	Y
Bank×Firm FE	Y	Y	Y

Table 8: Term Premium and Bank Profitability: DiD Evidence around the Taper Tantrum

This table reports OLS estimates from a difference-in-differences (DiD) regression of bank profitability on bank leverage during a period of four, five, or six quarters before and after the 2013:Q2 Taper Tantrum, excluding 2013:Q2. The data refers to the Call Report bank-quarter sample. The dependent variable is average ROE over the four quarters following quarter t. Bank controls include bank size (log-assets), core deposit share in total liabilities, securities-to-asset ratio, and reserves-to-asset ratio (all measured at end-2012) and enter the specifications in level and interacted with Post. Standard errors in parentheses are clustered by bank. See Section 2 for data sources and Section 3 for definitions of leverage measures. Significance: *p<.1; **p<.05; ***p<.01.

Dependent variable:	**Return on equity**$_{t+1,t+4}$		
	(1)	(2)	(3)
Window around Taper Tantrum:	**4 quarters**	**5 quarters**	**6 quarters**
Bank Tier 1 leverage$_{2012}$×Post	0.0120***	0.0132***	0.0145***
	(0.0037)	(0.0038)	(0.0041)
Observations	11,246	14,046	16,835
R^2	0.8241	0.7999	0.7765
No. banks	1552	1591	1619
Bank controls×Post	Y	Y	Y
Bank FE	Y	Y	Y
Quarter FE	Y	Y	Y

Appendix

A Model Solution: Additional Results

Figure A-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.

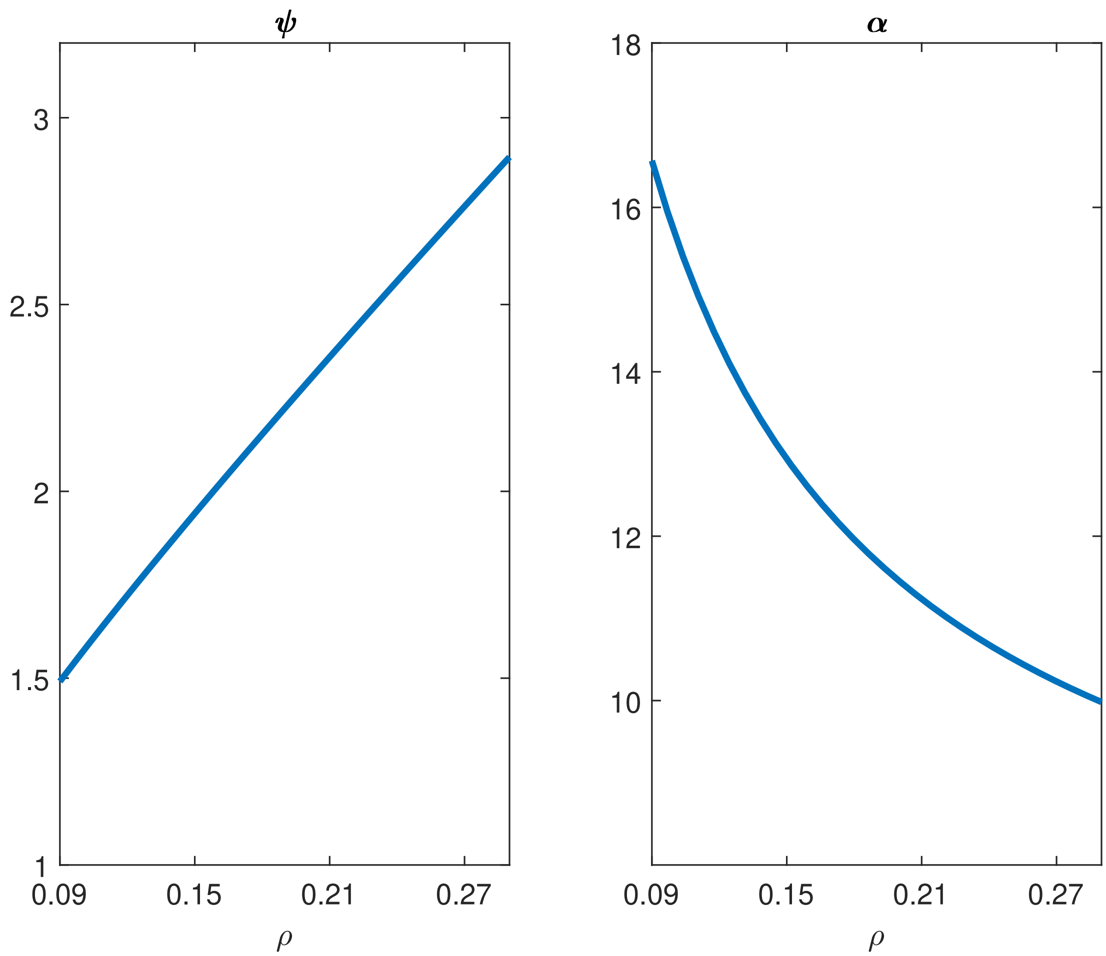


Figure A-2: Expected lending growth components, $\mu_{n,t}$, $E_t[\mathbf{d}\psi/\psi]$, and $cov_t[\mathbf{d}\psi/\psi, \mathbf{d}n/n]$

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.

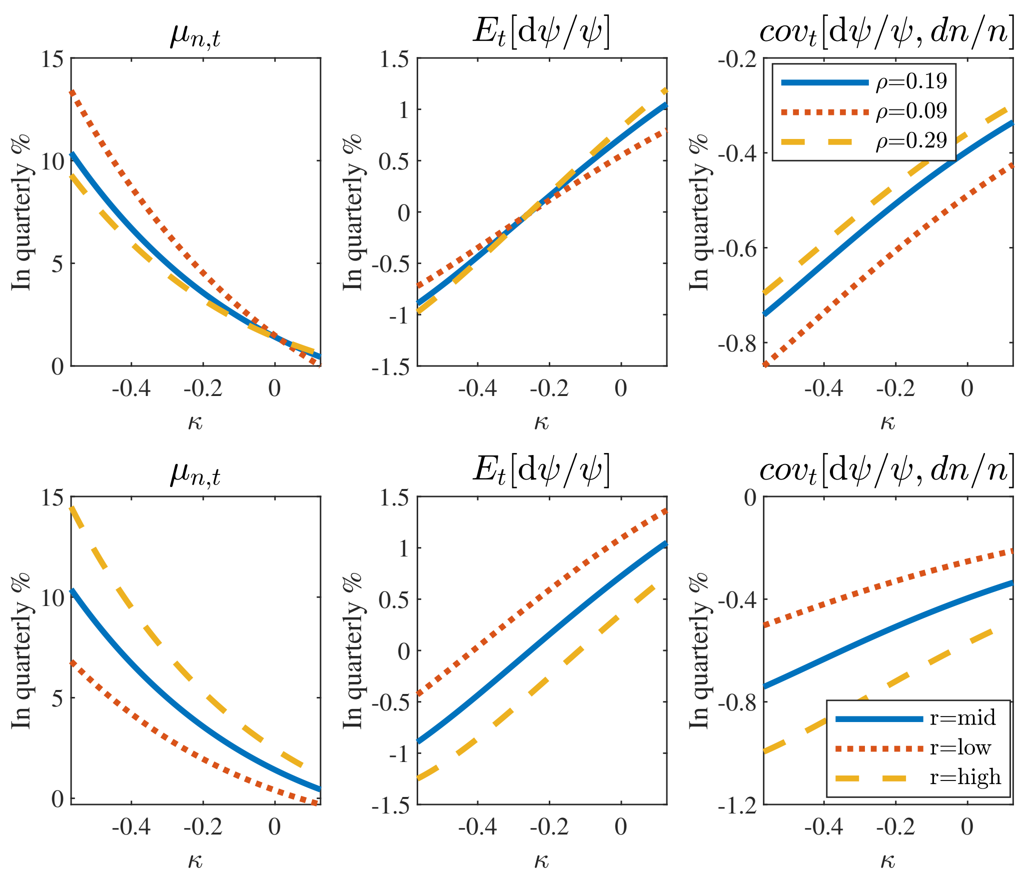
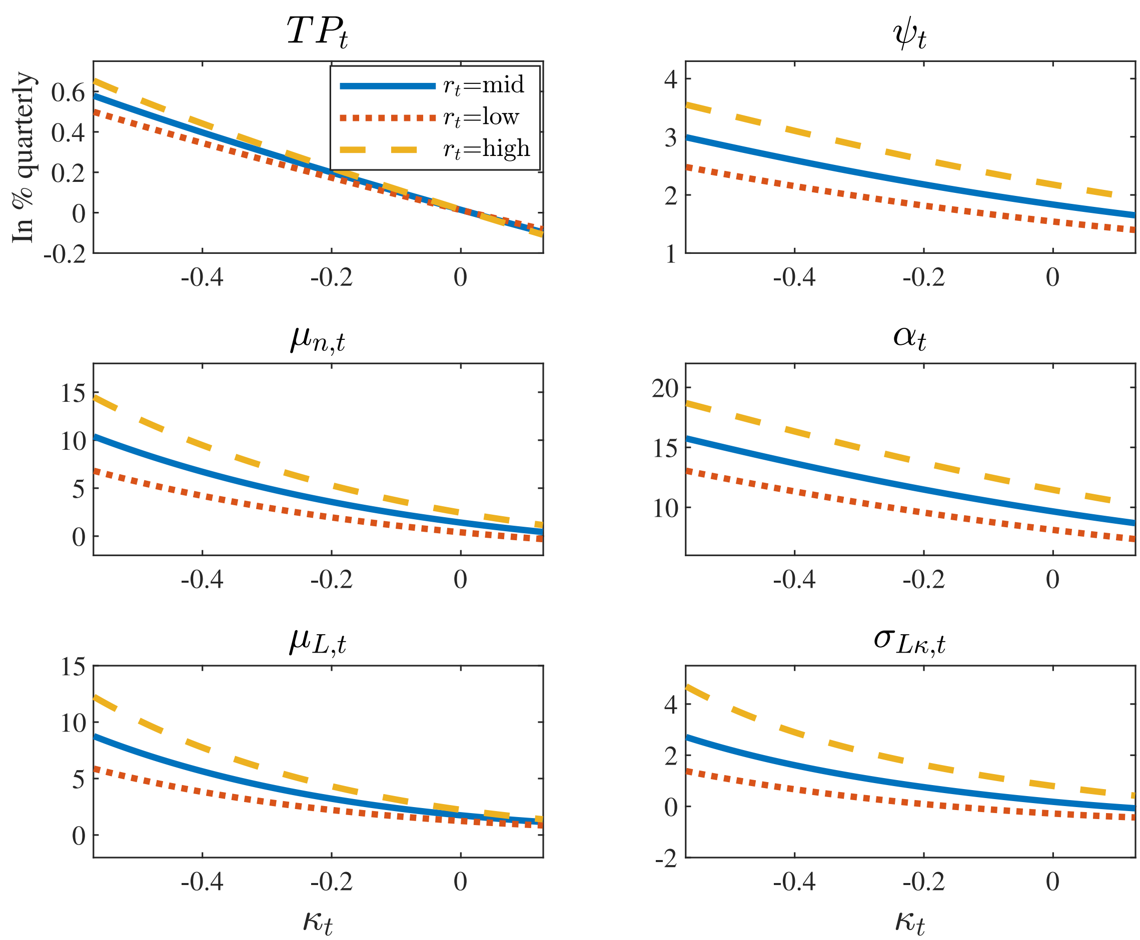


Figure A-3: Model solution for different levels of r_t

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 ($\sigma_{L\kappa,t}$).



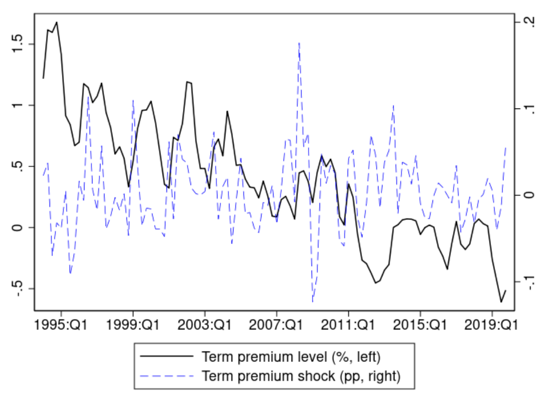
Online Appendix

A Empirical Analysis: Additional Results

Figure OA-1: Term Premium Shocks and Placebo Tests

Panel A 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. *Panel B* 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, where we compare lending outcomes over 2012:Q4–2013:Q1 versus 2012:Q2–2012:Q3 (see Table OA-3). The term premium series is the Term Premium on a 5-Year Zero Coupon Bond (FRED series THREEFYTP5). See Section 2 for details on the construction of term premium shocks.

(A) Term Premium vs. Term Premium Shocks



(B) Term Premium Level During Placebo Tests

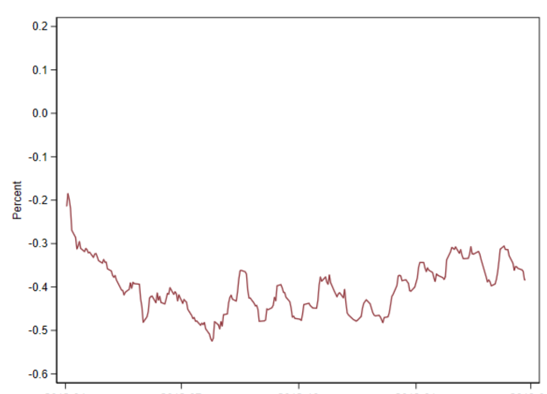
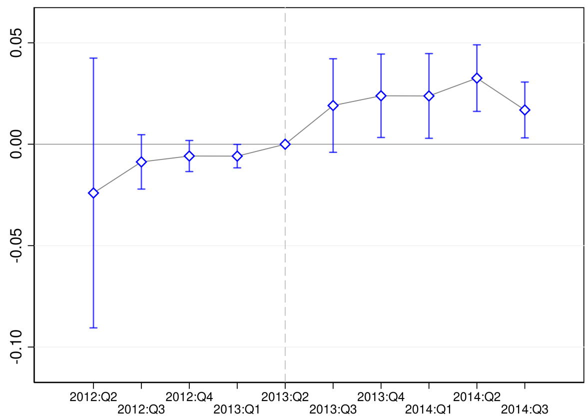


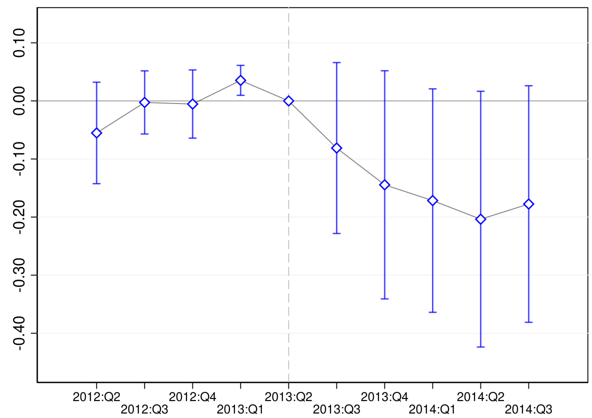
Figure OA-2: Dynamic DiD Coefficient Plots around Taper Tantrum: Capital surprises

This figure shows the estimated DiD coefficients with the associated 90% confidence levels of the dynamic variant of the specification in columns 1–3 of baseline Table 4 (top panel) with interaction effects between the main measure of bank leverage (capital surprises) and quarterly dummies. Outcome variables are loan growth, spread, and maturity (log). Confidence intervals are indicated by the dashed vertical lines.

(a) Loan Growth



(b) Loan Spread



(c) Loan Maturity

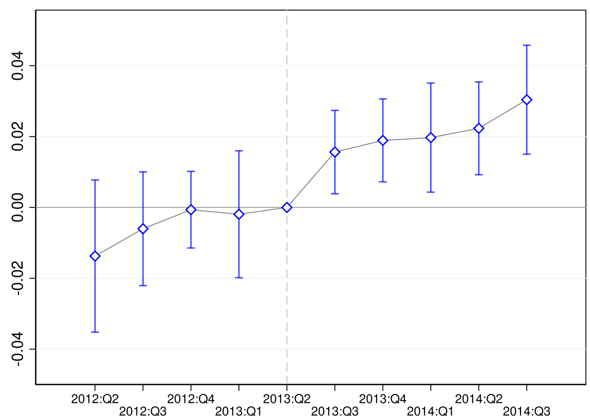


Figure OA-3: Dynamic DiD Coefficient Plots around Taper Tantrum: Tier 1 Leverage

This figure shows the estimated DiD coefficients with the associated 90% confidence levels of the dynamic variant of the specification in columns 4–6 of baseline Table 4 (top panel) with interaction effects between bank Tier 1 leverage and quarterly dummies. Outcome variables are loan growth, spread, and maturity (log). Confidence intervals are indicated by the dashed vertical lines.

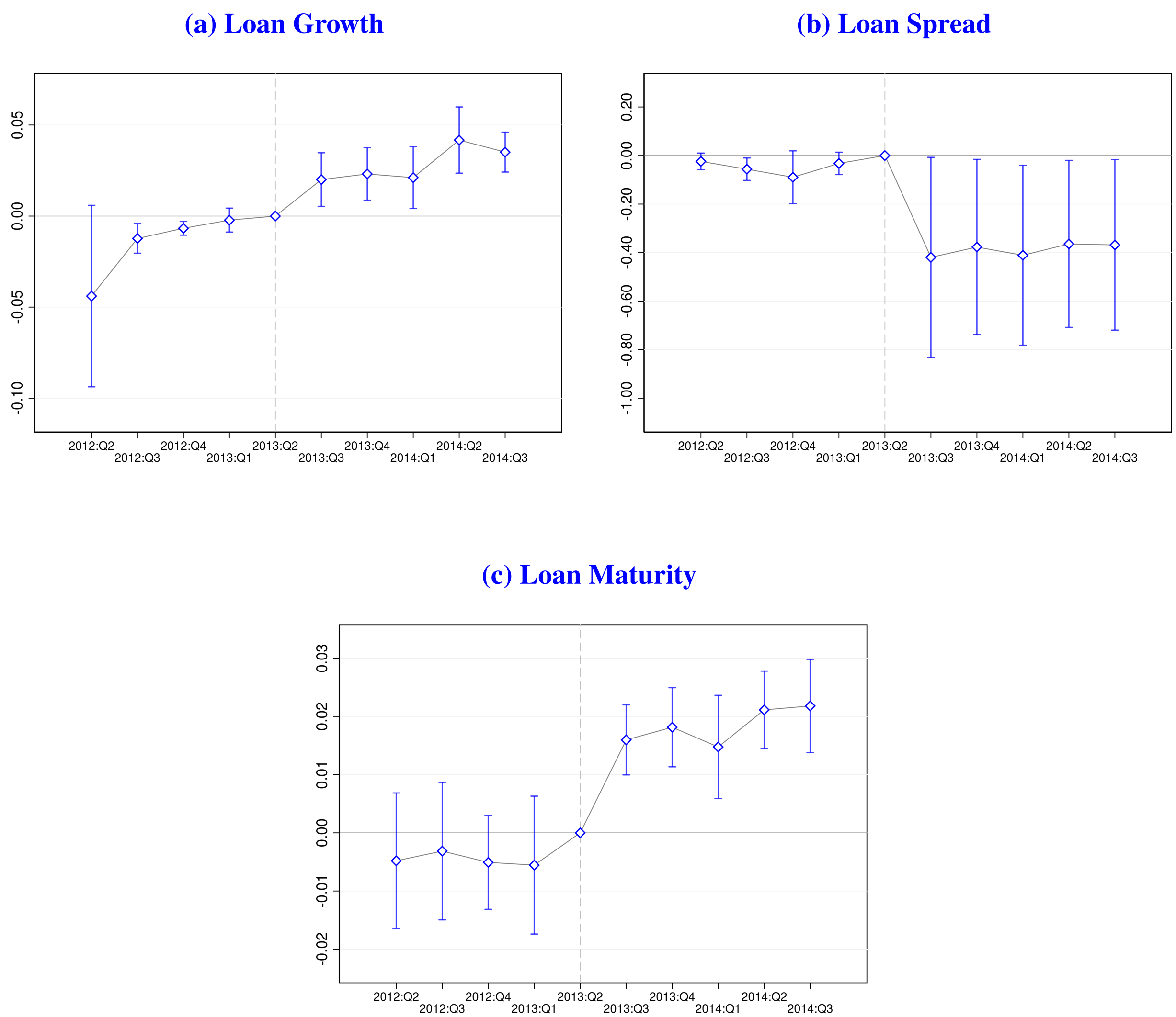


Table OA-1: Covariate Balance: Survey-Participating Banks vs. Other Banks

This table presents a covariate balance test comparing the $N = 11$ Y-14 reporting banks that participate in the Blue Chip Financial Forecasts survey ("survey banks") with the $N = 17$ remaining Y-14 reporting banks ("other banks"), based on characteristics measured at end-2012. Column 3 reports the p-value of a two-sided test of equality of means across the two groups, with bank-level variables averaged across bank-quarters. See Section 2 for data sources and Section 3 for definitions of leverage measures. Significance: *p<.1.

	Survey banks (1)	**Other banks (2)**	**p-value (1)=(2) (3)**
	Panel A. Key bank leverage variables		
Bank capital surprise	2.77	3.05	0.608
Bank Tier 1 leverage	13.47	12.09	0.088*
	Panel B. Other bank characteristics		
Bank size (log-assets)	5.69	4.74	0.019*
Bank core deposits-to-liabilities	0.59	0.58	0.842
Bank securities-to-assets	0.21	0.16	0.185
Bank reserves-to-assets	0.10	0.05	0.252
Bank maturity gap	0.82	0.90	0.568
Bank income gap	0.37	0.30	0.158

Table OA-2: Term Premium and Bank Lending: External Validity Evidence over 2012–2019, Full Y-14 Sample

This table replicates the specification in the top panel of Table 7 for the full sample of Y-14 reporting banks, dropping the GDP growth forecast controls that require Blue Chip survey participation. The data are at the bank-firm-loan level during 2012:Q1–2019:Q4. Bank controls include lagged bank size (log-assets), core deposit share in total liabilities, securities-to-asset ratio, and reserves-to-asset ratio; all controls enter the specifications in level and interacted with the term premium shock. See Section 2 for data sources and Section 3 for definitions of leverage measures. Standard errors in parentheses are double clustered on bank and firm. Significance: *p<.1; **p<.05; ***p<.01.

Dependent variable:	(1) **Loan growth**	(2) **Loan spread**	(3) **Loan maturity**
Bank Tier 1 leverage$_{t-1}$ × Term Premium Shock$_{t-1}$	0.2362*	-0.8333***	0.0335
	(0.1108)	(0.2145)	(0.0631)
Observations	1,449,925	589,051	1,410,810
R^2	0.5179	0.8283	0.6566
Bank controls×TP shock	Y	Y	Y
Growth forecast×TP shock	–	–	–
Bank FE	Y	Y	Y
Firm×Quarter FE	Y	Y	Y
Bank×Firm FE	Y	Y	Y

Table OA-3: Taper Tantrum DiD: Placebo Tests

This table reports OLS estimates from a placebo DiD regression centered on a window immediately before the regression sample, comparing lending outcomes in 2012:Q4–2013:Q1 versus 2012:Q2–2012:Q3, when the term premium was stable (see panel B of Figure OA-1). The data are at the loan level and refer to outstanding loans of Y-14 reporting banks. The dependent variables are loan commitment growth (log), spread, and maturity (log). Bank controls, fixed effects, and other specification details are the same as in the top panel of baseline Table 4. See Section 2 for data sources and Section 3 for definitions of leverage measures. Standard errors in parentheses are double clustered by bank and firm. Significance: *p<.1; **p<.05; ***p<.01.

Dependent variable:	(1) **Loan growth**	(2) **Loan spread**	(3) **Loan maturity**
		Panel I: Capital Surprises	
Bank capital surprises$_{2012}$ × Post	−0.005	0.011	0.009
	(0.007)	(0.029)	(0.006)
Observations	142,345	60,370	134,684
R^2	0.391	0.768	0.610
Bank controls × Post	Y	Y	Y
Growth forecast × Post	Y	Y	Y
Bank × Firm FE	Y	Y	Y
Firm × Quarter FE	Y	Y	Y
		Panel II: Tier 1 Leverage	
Bank Tier 1 leverage$_{2012}$×Post	−0.003	0.007	0.004
	(0.004)	(0.013)	(0.002)
Observations	142,345	60,370	134,684
R^2	0.391	0.768	0.610
Bank controls × Post	Y	Y	Y
Growth forecast × Post	Y	Y	Y
Bank × Firm FE	Y	Y	Y
Firm × Quarter FE	Y	Y	Y

Table OA-4: Taper Tantrum DiD: Control for Maturity Gap and Income Gap

This table reports OLS estimates from a DiD regression centered on the 2013:Q2 Taper Tantrum, showing key specifications from Table 4 with the following changes. In panel I we control for the maturity gap interacted with Post; in panel II, we control for the income gap interacted with Post (the level effects of the maturity gap and income gap drop out from the estimation as they are spanned by the bank fixed effects). The data are at the loan level and refer to outstanding loans of Y-14 reporting banks. The dependent variables are loan growth, spreads, and maturity (log). Bank controls, fixed effects, and other specification details are the same as in baseline Table 4. See Section 2 for data sources and Section 3 for definitions of leverage measures. Standard errors double clustered by bank and firm in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(A) Capital surprises			**(B) Tier 1 leverage**		
Dependent variable:	(1) **Loan growth**	(2) **Loan spread**	(3) **Loan maturity**	(4) **Loan growth**	(5) **Loan spread**	(6) **Loan maturity**
	Panel I: Controlling for Maturity Gap × Post					
Bank capital surprise$_{2012}$×Post	0.019*	−0.419***	0.020*			
	(0.009)	(0.112)	(0.009)			
Bank Tier 1 leverage$_{2012}$×Post				0.030**	−0.711***	0.024**
				(0.010)	(0.142)	(0.009)
Maturity gap$_{2012}$ × Post	0.073	0.308	−0.001	0.040	0.856***	−0.026
	(0.098)	(0.337)	(0.031)	(0.102)	(0.143)	(0.026)
Observations	307,300	130,925	291,738	307,300	130,925	291,738
R^2	0.528	0.808	0.661	0.528	0.810	0.661
	Panel II: Controlling for Income Gap × Post					
Bank capital surprise$_{2012}$×Post	0.027	−0.859**	0.033***			
	(0.022)	(0.374)	(0.009)			
Bank Tier 1 leverage$_{2012}$×Post				0.040**	−2.523***	0.025**
				(0.018)	(0.311)	(0.009)
Income gap$_{2012}$ × Post	0.163	8.672	−0.096	0.060	26.946***	0.024
	(0.300)	(4.998)	(0.103)	(0.231)	(3.957)	(0.099)
Observations	335,302	137,842	318,443	335,302	137,842	318,443
R^2	0.523	0.804	0.665	0.523	0.813	0.665
Bank controls × Post	Y	Y	Y	Y	Y	Y
Growth forecast × Post	Y	Y	Y	Y	Y	Y
Bank × Firm FE	Y	Y	Y	Y	Y	Y
Firm × Quarter FE	Y	Y	Y	Y	Y	Y

Table OA-5: Taper Tantrum DiD: Control for Short-Rate Changes and Shocks

This table reports OLS estimates from a DiD regression centered on the 2013:Q2 Taper Tantrum, showing key specifications from Table 4 with the following changes. In panels I and II, we control for changes in the short-rate in changes (ΔSR) and levels, interacted with bank leverage; in panel III, we control for Fed Funds Rate identified shocks (from Swanson (2021)) interacted with Post. The data are at the loan level and refer to outstanding loans of Y-14 reporting banks. The dependent variables are loan growth, spread, and maturity (log). Bank controls, fixed effects, and other specification details are the same as in baseline Table 4. See Section 2 for data sources and Section 3 for definitions of leverage measures. Standard errors double clustered by bank and firm in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(A) Capital surprises			(B) Tier 1 leverage		
Dependent variable:	(1) **Loan growth**	(2) **Loan spread**	(3) **Loan maturity**	(4) **Loan growth**	(5) **Loan spread**	(6) **Loan maturity**
	Panel I: Controlling for Bank Leverage × Δ Short Rate					
Bank capital surprise$_{2012}$×Post	0.037***	−0.456**	0.027**			
	(0.009)	(0.196)	(0.009)			
Bank Tier 1 leverage$_{2012}$×Post				0.044***	−0.948**	0.027**
				(0.009)	(0.355)	(0.009)
Bank leverage × Δ Short rate	0.007	−1.729	−0.005	0.041	1.107	0.065**
	(0.039)	(1.070)	(0.031)	(0.039)	(0.767)	(0.021)
Observations	335,302	137,842	318,443	335,302	137,842	318,443
R^2	0.523	0.803	0.665	0.523	0.807	0.665
	Panel II: Controlling for Bank Leverage × Short Rate (Lag)					
Bank capital surprise$_{2012}$×Post	0.038***	−0.335*	0.028**			
	(0.009)	(0.160)	(0.010)			
Bank Tier 1 leverage$_{2012}$×Post				0.040***	−1.042**	0.021*
				(0.012)	(0.392)	(0.010)
Bank leverage × Short rate (lag)	0.028	2.386**	0.026	−0.104	−1.960*	−0.135***
	(0.149)	(0.929)	(0.060)	(0.129)	(1.054)	(0.039)
Observations	335,302	137,842	318,443	335,302	137,842	318,443
R^2	0.523	0.803	0.665	0.523	0.807	0.665
	Panel III: Controlling for Bank Leverage × Fed Funds Rate Shock					
Bank capital surprise$_{2012}$×Post	0.037***	−0.428**	0.027**			
	(0.009)	(0.183)	(0.009)			
Bank Tier 1 leverage$_{2012}$×Post				0.044***	−0.962**	0.026**
				(0.009)	(0.361)	(0.009)
Bank leverage × FFR shock	0.003	0.185	0.007	−0.007	−0.315	−0.018**
	(0.014)	(0.184)	(0.009)	(0.014)	(0.193)	(0.007)
Observations	335,302	137,842	318,443	335,302	137,842	318,443
R^2	0.523	0.803	0.665	0.523	0.807	0.665
Bank controls × Post	Y	Y	Y	Y	Y	Y
Growth forecast × Post	Y	Y	Y	Y	Y	Y
Bank × Firm FE	Y	Y	Y	Y	Y	Y
Firm × Quarter FE	Y	Y	Y	Y	Y	Y

Table OA-6: Taper Tantrum DiD: Finer Fixed Effects

This table reports OLS estimates from a DiD regression centered on the 2013:Q2 Taper Tantrum, showing key specifications from Table 4 with the following changes. In panels I and II we control for firm×loan purpose×quarter dummies or collateral type×quarter dummies, respectively. Loan purpose categories are “Mergers and Acquisitions,” “Working Capital,” “Real estate investment or acquisitions,” and “All other purposes." Loan collateral categories are asset-based loans and earnings-based loans. The data are at the loan level and refer to outstanding loans of Y-14 reporting banks. The dependent variables are loan growth, spread, and maturity (log). Bank controls, fixed effects, and other specification details are the same as in baseline Table 4. See Section 2 for data sources and Section 3 for definitions of leverage measures. Standard errors double clustered by bank and firm in parentheses. Significance: *p<.1; **p<.05; ***p<.01.

	(A) Capital surprises			(B) Tier 1 leverage		
Dependent variable:	(1) **Loan growth**	(2) **Loan spread**	(3) **Loan maturity**	(4) **Loan growth**	(5) **Loan spread**	(6) **Loan maturity**
	Panel I: Controlling for Firm × Loan Purpose × Time Fixed Effects					
Bank capital surprise$_{2012}$×Post	0.043***	−0.402**	0.036***			
	(0.010)	(0.158)	(0.010)			
Bank Tier 1 leverage$_{2012}$×Post				0.049***	−0.844**	0.038***
				(0.010)	(0.294)	(0.010)
Observations	270,551	102,248	256,323	270,551	102,248	256,323
R^2	0.568	0.826	0.713	0.568	0.828	0.713
Firm × Loan purpose × Quarter FE	Y	Y	Y	Y	Y	Y
Bank controls × Post	Y	Y	Y	Y	Y	Y
Growth forecast × Post	Y	Y	Y	Y	Y	Y
Bank × Firm FE	Y	Y	Y	Y	Y	Y
Firm × Quarter FE	Y	Y	Y	Y	Y	Y
	Panel II: Controlling for Collateral Type × Time Fixed Effects					
Bank capital surprise$_{2012}$×Post	0.019*	−0.407**	0.027**			
	(0.009)	(0.174)	(0.009)			
Bank Tier 1 leverage$_{2012}$×Post				0.028***	−0.948**	0.022*
				(0.009)	(0.356)	(0.011)
Observations	335,302	137,842	318,443	335,302	137,842	318,443
R^2	0.538	0.805	0.674	0.538	0.808	0.674
Loan collateral type × Quarter FE	Y	Y	Y	Y	Y	Y
Bank controls × Post	Y	Y	Y	Y	Y	Y
Growth forecast × Post	Y	Y	Y	Y	Y	Y
Bank × Firm FE	Y	Y	Y	Y	Y	Y
Firm × Quarter FE	Y	Y	Y	Y	Y	Y

Table OA-7: Taper Tantrum DiD: Alternative Clustering of Standard Errors

This table reports OLS estimates from a DiD regression centered on the 2013:Q2 Taper Tantrum, showing key specifications from Table 4, with standard errors that are single-clustered on bank (panel I) or triple clustered on bank, firm, and quarter (panel II). The data are at the loan level and refer to outstanding loans of Y-14 reporting banks. The dependent variables are loan growth, spread, and maturity (log). Bank controls, fixed effects, and other specification details are the same as in baseline Table 4. See Section 2 for data sources and Section 3 for definitions of leverage measures. Significance: *p<.1; **p<.05; ***p<.01.

	(A) Capital surprises			**(B) Tier 1 leverage**		
Dependent variable:	(1) **Loan growth**	(2) **Loan spread**	(3) **Loan maturity**	(4) **Loan growth**	(5) **Loan spread**	(6) **Loan maturity**
			Panel I: Single Cluster on Bank			
Bank capital surprise$_{2012}$×Post	0.037***	−0.427*	0.027**			
	(0.010)	(0.226)	(0.010)			
Bank Tier 1 leverage$_{2012}$×Post				0.044***	−0.967*	0.027**
				(0.010)	(0.455)	(0.011)
Observations	335,302	137,842	318,443	335,302	137,842	318,443
R^2	0.523	0.803	0.665	0.523	0.807	0.665
Bank controls × Post	Y	Y	Y	Y	Y	Y
Growth forecast × Post	Y	Y	Y	Y	Y	Y
Bank × Firm FE	Y	Y	Y	Y	Y	Y
Firm × Quarter FE	Y	Y	Y	Y	Y	Y
			Panel II: Triple Cluster on Bank, Firm, and Quarter			
Bank capital surprise$_{2012}$×Post	0.037*	−0.427*	0.027**			
	(0.018)	(0.198)	(0.008)			
Bank Tier 1 leverage$_{2012}$×Post				0.044**	−0.967*	0.027**
				(0.016)	(0.417)	(0.009)
Observations	335,302	137,842	318,443	335,302	137,842	318,443
R^2	0.523	0.803	0.665	0.523	0.807	0.665
Bank controls × Post	Y	Y	Y	Y	Y	Y
Growth forecast × Post	Y	Y	Y	Y	Y	Y
Bank × Firm FE	Y	Y	Y	Y	Y	Y
Firm × Quarter FE	Y	Y	Y	Y	Y	Y

Table OA-8: Taper Tantrum DiD: Bootstrapping the Standard Errors

This table reports the results of a wild cluster bootstrap test at the bank level with Rademacher weights and 10,000 replications. The test is carried out with the STATA boottest command. The data are at the loan level and refer to outstanding loans of Y-14 reporting banks. The dependent variables are loan growth, spread, and maturity (log). Bank controls, fixed effects, and other specification details are the same as in baseline Table 4. See Section 2 for data sources and Section 3 for definitions of leverage measures. Significance: *p<.1; **p<.05; ***p<.01.

	Loan growth		**Loan spread**		**Loan maturity**	
	(1) *Baseline*	(2) *Bootstrap*	(3) *Baseline*	(4) *Bootstrap*	(5) *Baseline*	(6) *Bootstrap*
DiD coefficient	0.037		−0.427		0.027	
p-value (DiD = 0)	0.009	0.018	0.039	0.004	0.010	0.043
95% CI lower limit	0.019	0.010	−0.828	−1.155	0.008	0.000
95% CI upper limit	0.056	0.065	−0.025	−0.176	0.046	0.054
Significant at:	1%	5%	5%	1%	1%	5%
Observations	335,302	335,302	137,842	137,842	318,443	318,443
R^2	0.523	–	0.803	–	0.665	–
Bank controls × Post	Y	Y	Y	Y	Y	Y
Growth forecast × Post	Y	Y	Y	Y	Y	Y
Bank × Firm FE	Y	Y	Y	Y	Y	Y
Firm × Quarter FE	Y	Y	Y	Y	Y	Y

Table OA-9: Taper Tantrum DiD: Real Effects with Finer Industry Classification

This table reports OLS estimates from a difference-in-differences (DiD) regression of firm-level real outcomes on firms' exposure to bank leverage around the 2013:Q2 Taper Tantrum, following the setup in baseline Table 5. The dependent variables are firm debt growth, investment rate, and asset growth. In panel I, the Post dummy takes value one in 2013 and zero in 2012. In panel II, the Post dummy takes value one in 2013–2014 and zero in 2012. Variable definitions, controls and other specification details are as in baseline 5. Industry classification is 3-digit NAICS in panel I and 4-digit NAICS in panel II. Standard errors in parentheses are clustered by firm. See Section 2 for data sources and Section 3 for definitions of leverage measures. Significance: *p<.1; **p<.05; ***p<.01.

	(A) Capital surprises			**(B) Tier 1 leverage**		
	Debt Growth	**Investment Rate**	**Asset Growth**	**Debt Growth**	**Investment Rate**	**Asset Growth**
	(1)	(2)	(3)	(4)	(5)	(6)
Panel I: 2012 vs 2013, State × NAICS-3 × Year Fixed Effects						
Firm's Exposure to Bank leverage$_{2012}$ × Post	0.0073	0.0275***	0.0052**	0.0092***	0.0161***	0.0074***
	(0.005)	(0.008)	(0.002)	(0.002)	(0.003)	(0.001)
Observations	59,398	56,114	59,110	59,398	56,114	59,110
R^2	0.685	0.578	0.712	0.686	0.578	0.713
Firm controls × Post	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State × Industry × Year FE	Y	Y	Y	Y	Y	Y
Panel II: 2012 vs 2013–2014, State × NAICS-4 × Year Fixed Effects						
Firm's Exposure to Bank leverage$_{2012}$ × Post	0.0090*	0.0174**	0.0038	0.0085***	0.0126***	0.0051***
	(0.005)	(0.008)	(0.003)	(0.002)	(0.003)	(0.001)
Observations	97,670	93,050	96,995	97,670	93,050	96,995
R^2	0.616	0.530	0.651	0.616	0.530	0.652
Firm controls × Post	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
State × Industry × Year FE	Y	Y	Y	Y	Y	Y

Table OA-10: Term premium and bank funding costs: Deposit rates

This table reports OLS estimates from a difference-in-differences (DiD) regression of deposit rates on bank regulatory leverage around the 2013:Q2 Taper Tantrum, following the setup in baseline Table 4. The dependent variable is the 12-month certificate of deposit (CD) rate for an account size of $10,000. The data are at the bank-county-quarter level and cover a symmetric window of four to six quarters before and after 2013:Q2. 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 in parentheses are double clustered by bank and quarter. See Section 2 for data sources and Section 3 for definitions of leverage measures. Significance: *p<.1; **p<.05; ***p<.01.

	Deposit Rate		
	(1)	(2)	(3)
Window around Taper Tantrum:	**4 quarters**	**5 quarters**	**6 quarters**
Bank Tier 1 leverage$_{2012}$×Post	0.0003	0.0139**	0.0117**
	(0.0031)	(0.0047)	(0.0039)
Observations	815	1,054	1,294
R^2	0.9804	0.9754	0.9736
Bank controls × Post	Y	Y	Y
Bank capital × ΔSR	Y	Y	Y
Growth forecast × Post	Y	Y	Y
Bank FE	Y	Y	Y
County FE	Y	Y	Y
Quarter FE	Y	Y	Y

Table OA-11: 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 data are at the bank holding company-day level. The dependent variable is the daily stock market return on FOMC meeting days (excluding the 9/11 meeting) for 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. Bank controls include lagged bank size, regulatory capital ratio (Tier 1 capital divided by assets), the share of core deposits in total liabilities, the share of securities in total assets, and the maturity gap. Standard errors in parentheses are double clustered by bank and FOMC date. See Section 2 for data sources and Section 3 for definitions of leverage measures. 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 Tier 1 leverage$_t$ × Term Premium Shock$_t$			0.911**	0.907**	0.938**
			(0.375)	(0.375)	(0.372)
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×Term premium shock	-	-	-	-	Y
Bank capital×ΔSR	-	-	Y	Y	Y
Macro controls	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y
FOMC date FE	-	-	-	-	Y

B Alternative Identification: IV Evidence over 1994–2019

This section develops an alternative identification strategy that corroborates the main results. Using an instrumental variable (IV) based on foreign official demand for U.S. Treasuries, we obtain results over the full 1994–2019 sample that are consistent with our baseline findings, suggesting that our conclusions are not confined to the specific 2013 Taper Tantrum episode.[21]

The Instrumental Variable (IV). The IV strategy aims to isolate changes in term premiums using a variable that influences term premiums for reasons plausibly unrelated to the domestic economic outlook. This instrument 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 change the compensation bond market intermediaries require for bearing interest rate risks, thereby driving fluctuations in the term premium (Greenwood and Vayanos, 2014; Vayanos and Vila, 2021). Our IV focuses on the demand side, isolating term premium fluctuations driven by foreign official demand for U.S. debt, measured as 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.[22]

The identifying assumption is that changes in foreign official Treasury holdings are driven primarily by exogenous factors—such as foreign central banks' reserve management and foreign exchange intervention needs—rather than the U.S. economic outlook or other factors affecting Treasury supply. The following evidence supports instrument validity. A large literature argues that foreign official sector demand for U.S. Treasury securities is driven by foreign reserve management and foreign exchange intervention needs, rather than by 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)).[23] Tabova and Warnock (2024) use confidential security-level survey data to show that foreign official investors are largely price-insensitive, in contrast to domestic and foreign private investors: neither the quantity of foreign official purchases nor the duration of their holdings react to changes in U.S.-foreign yield differentials. This evidence supports interpreting variations in foreign official holdings as plausibly exogenous shifts in demand that affect Treasury

[21] Unless otherwise noted, all coefficient magnitudes cited in this section refer to the Call Report bank-level sample over 1994:Q1–2019:Q4 (summary statistics in panel B of Table 2).

[22] 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 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). Thus, we approximate official holdings for these two countries using total TIC-reported holdings.

[23] Related explanations emphasize foreigners' demand for U.S. assets as safe store of value (e.g., Caballero and Krishnamurthy (2009) and Caballero et al. (2008)) and the global savings glut (Bernanke (2005)).

yields and term premiums but are not driven by contemporaneous U.S. macroeconomic conditions.

This IV strategy is closely related 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. Consistent with this view, estimates in Table OB-1 show that foreign official holdings of U.S. Treasuries are uncorrelated with contemporaneous or lagged real GDP growth forecasts and with real-time U.S. recession probabilities, providing further support for the validity of the instrument. As a descriptive consistency check, we also find that foreign official Treasury holdings are negatively correlated with the term premium, rather than increasing when term premiums rise, a pattern that is difficult to reconcile with yield-seeking behavior but consistent with reserve-driven, price-insensitive demand.

Turning to instrument relevance, Panel A in Figure OB-1 shows that our instrument is negatively correlated with the term premium over 1994–2019. To visually assess the instrument's relevance conditional on other business-cycle variables, we construct a residual–residual (partial regression) plot by regressing both the term premium and the instrument on a set of macroeconomic controls and plot the resulting residuals in Panel B.[24] By the Frisch–Waugh–Lovell theorem, the comovement between the two sets of residuals provides a visual analogue of the first-stage regression results. Conditioning on macroeconomic factors, the two series display substantial negative comovement, as expected, with a correlation of −0.86.

Table OB-2 reports formal IV relevance tests, showing that foreign official holdings of U.S. Treasuries strongly predict the term premium over our main sample period. Here, we regress the 5-year Kim-Wright term premium on the instrument, controlling for the short rate and additional macroeconomic factors. 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. The estimates in 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) (provided by the authors), which we describe in detail below and employ in robustness checks of our findings. In addition, we show that the first stage F-statistics across most specifications comfortably exceed the rule-of-thumb threshold value of 10 (and in many cases, a value of 100, see Lee et al. (2022)).

We provide supporting evidence for the model's implications relating bank lending outcomes to changes in the term premium—in level and interacted with bank leverage—by estimating the

[24] The controls 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, as well as short rate changes and the expectations component of the term spread.

Table OB-1: First stage—Instrument validity

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 and two estimates of U.S. recession probabilities. Panel I reports contemporaneous regressions, while Panel II reports regressions with one-period lagged predictors. The data are quarterly and cover the period 1994:Q1-2019:Q4 in columns 1–3 and 1974:Q1-2019:Q4 in columns 4–6. The two recession probability estimates are the smoothed U.S. recession probability based on coincident indicators from the (Chauvet and Piger, 2008) model (FRED series RECPROUSM156N) and the Sahm real-time recession indicator (FRED series SAHMREALTIME). Newey-West standard errors accounting for heteroscedasticity and autocorrelation up to the 4th lag in parentheses. *p<.1; **p<.05; ***p<.01.

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

following specification using bank-quarter panel data over 1994:Q1-2019:Q4:

$$Bank\ outcome^i_{t,t+4} = \alpha_i + \beta_1\, \Delta y^1_t + \beta_2 \left(y^{20,eh}_t - y^1_t\right) + \beta_3\, y^{20,tp}_t + \tau \mathbf{X}_t + \gamma \mathbf{Z}_{it} + \varepsilon^i_{t,t+4} \tag{B-1}$$

where the dependent variable $Bank\ outcome^i_{t,t+4}$ is the four-quarter-ahead loan growth (excluding off-balance-sheet credit line commitments) at bank i. We also run regressions where the dependent variable is bank return on equity to test if higher term premiums are associated with higher profitability. 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

Figure OB-1: Instrumental variable vs. Term premium (Kim-Wright)

Panel A shows the 5-year term premium series from the term structure model of Kim and Wright (2005) (blue solid line) and the IV representing the foreign official holdings of U.S. Treasuries normalized by U.S. GDP (red dashed line). Panel B plots the residuals from regressing both variables on a set of standard macro controls (lagged change in the short rate measured by the 3-month T-bill yield, the median one-year-ahead real GDP growth forecast from the SPF, and the excess bond premium).

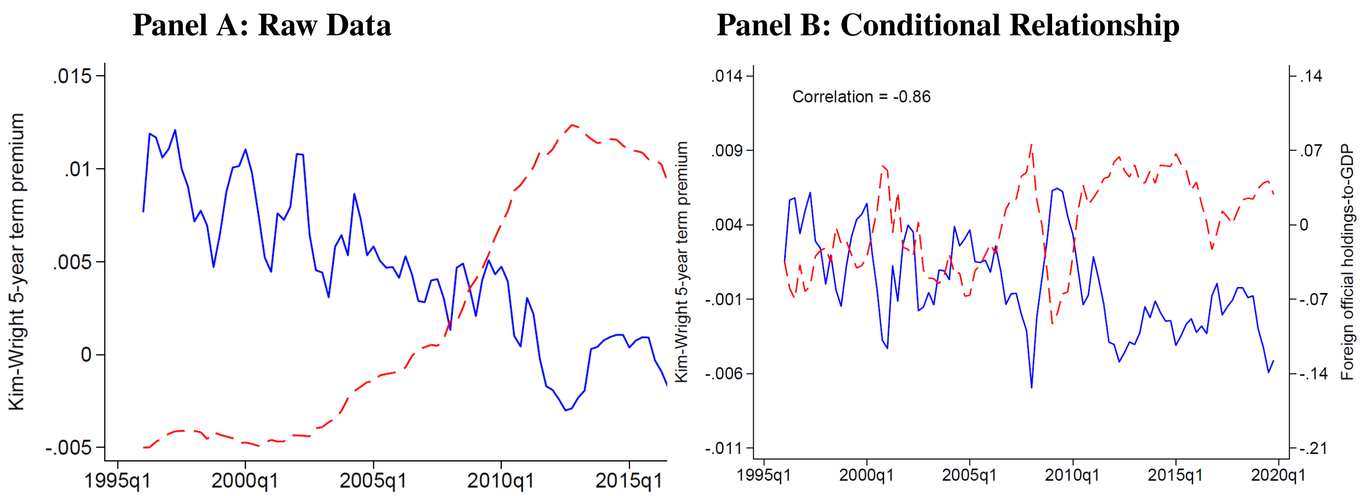


Table OB-2: First stage—Instrument relevance

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 IV. All regressions control for the short rate, measured by the 3-month T-bill 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 in parentheses. *p<.1; **p<.05; ***p<.01.

Dependent variable:	(1) **Kim-Wright term premium$_t$**	(2)	(3) **Adrian-Crump-Moench term premium$_t$**	(4)	(5) **Kim-Priebsch term premium$_t$**	(6)
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

the average expected short rates over the next n quarters. The term premium is then defined as $y_t^{n,tp} \triangleq y_t^n - y_t^{n,eh}$.

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 (HQ location) MSA fixed effects to control for unobserved local economic shocks to banks.[25] 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. As in the main analysis, we multiply the regulatory capital ratio by -1 so that higher values represent higher leverage, and refer to this variable as "Tier 1 leverage" throughout. The securities-to-asset ratio 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.

Testable Implication 1 predicts that the coefficient of interest β_3 is positive. The model also predicts that the response of bank lending to a term premium increase is 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 (Testable Implication 2). This implication can be tested by modifying Equation (B-1) to add an interaction term between the term premium and bank leverage, which should yield a negative coefficient. We present estimates based on Ordinary Least Squares (OLS) alongside IV estimations that use foreign official holdings of U.S. Treasuries as the instrument, taking the Kim-Wright term premium as our benchmark measure. Standard errors are double clustered on bank and quarter.

Level effect of the term premium. The estimation results in columns 1–2 of Table OB-3 indicate that a higher term premium is associated with higher subsequent loan growth, consistent with Testable Implication 1. The IV estimate in column 2 has a first-stage F-statistic above 100, pointing to a strong instrument. A one SD increase in the term premium (of approximately 50 bps in the longer bank-year sample spanning 1994-2019) is associated with a 1.5 ppt increase in loan growth—a meaningful effect relative to average loan growth of 4.8% and a SD of 13.7% over the sample period. Using local projections based on the IV specification in column 2, we estimate that bank lending responds gradually to a 50 bps term premium increase, rising approximately 2% above the pre-shock level after eight quarters (panel A of Figure OB-2).

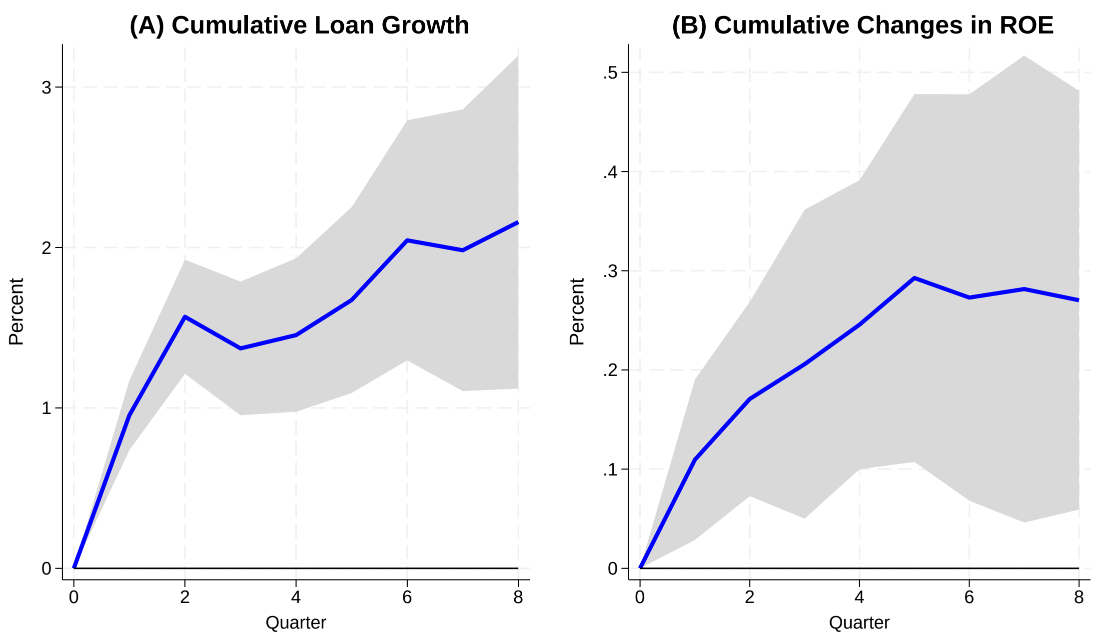
Turning to bank profitability, estimates in columns 5–6 of Table OB-3 reveal a positive and significant relation between higher term premium and subsequent bank return on equity. Using the coefficient estimate in column 6, a 50 bps increase in the term premium is associated with a

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

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 OB-2, 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.

Figure OB-2: Dynamic responses of bank lending and profits to a rise in the term premium

This figure shows the evolution of bank loans (panel A) and bank return on equity (ROE, panel B) over the eight quarters following a 50 bps increase in 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 OB-3 and the same regression with ROE as the outcome variable. The shaded areas represent 90% confidence intervals, with standard errors double clustered by bank and quarter.



Differential effects by bank leverage. In columns 3-4 of Table OB-3 we examine the model's Testable Implication 2. Because we focus on heterogeneity by bank leverage, we include interacted bank MSA×quarter fixed effects, which span quarter fixed effects and thus absorb the level effects of macro shocks on bank lending behavior, including that of the term premium itself. The estimates show that an increase in term premiums is associated with stronger loan growth at more leveraged banks, consistent with model prediction 2. The IV estimate in column 4 indicates that, following a 50 bps increase in the term premium, across an interquartile range of the capital ratio distribution (11.5% to 18.6% in this sample), a more leveraged bank experiences four-quarter ahead loan growth

Table OB-3: Term Premium, Bank Credit, and Bank Profitability: Alternative IV Evidence over 1994–2019

This table reports OLS and IV estimates from regressions of bank loan growth (panel A) and bank profitability (panel B) on the Kim and Wright (2005) term premium and its interaction with bank Tier 1 leverage. In columns 4 and 8, the interaction term bank Tier 1 leverage × Term Premium is instrumented by Bank Tier 1 Leverage × Foreign UST holdings/GDP. The data are at the bank-quarter level for the period 1994:Q1-2019:Q4. In columns 1-2 and 5-6, macro controls include the lagged change in the short rate (ΔSR), the expectations component (defined as the 3-month/5-year spread minus the term premium), one-year-ahead real GDP growth and GDP deflator inflation forecasts, and the excess bond premium. Bank controls include lagged bank size, the share of core deposits in total liabilities, the share of securities in total assets, and lagged dependent variable. Standard errors in parentheses are double clustered by bank and quarter. *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(A) Loan growth$_{t,t+4}$				**(B) Return on equity$_{t+1,t+4}$**			
	OLS	**IV**	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**
Term premium$_t$	1.85***	3.01***			0.403***	0.566***		
	(0.45)	(0.59)			(0.113)	(0.121)		
Bank Tier 1 Lev.$_t$ × Term Premium$_t$			9.53***	14.05***			0.74***	1.17***
			(2.04)	(3.15)			(0.19)	(0.27)
First-stage F test	-	217.7	-	42.94	-	228.3	-	35.19
Observations	562,568	562,568	557,899	557,899	562,182	562,182	557,501	557,501
R^2	0.25	-	0.16	-	0.277	-	0.17	-
Macro controls	Y	Y	-	-	Y	Y	-	-
Bank controls	Y	Y	Y	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y
Bank MSA FE	Y	Y	Y	Y	Y	Y	Y	Y
Bank MSA×Quarter FE	-	-	Y	Y	-	-	Y	Y

that is 0.5 pps higher than a less leveraged bank.

Sample robustness checks. First, we examine the stability of the results under changes to variable construction, control variables, and sample period. In columns 1-2 of Table OB-4, we include in the dependent variable off-balance sheet credit lines, which in recent decades 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. Across specifications, the main findings remain robust.

Identification robustness checks. We conduct three additional analyses to assess the validity of our identification strategy. First, we exclude Chinese or Chinese and Belgian holdings from the

Table OB-4: Robustness to alternative outcome variable and controlling for maturity gap

This table examines the robustness of IV results in Table OB-3 to two modifications: including credit lines in the dependent variable measuring bank loan growth (columns 1–2), and controlling for the lagged maturity gap (columns 3–4). The dependent variable is bank loan growth and the data are at the bank-quarter level over 1994:Q1-2019:Q4. Macro controls, bank controls, and fixed effects are the same as in Table OB-3. Standard errors in parentheses are double clustered by bank and quarter. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)
Dependent variable:	**Loan growth$_{t,t+4}$**			
	IV	**IV**	**IV**	**IV**
	(A) Add credit lines		**(B) Control for maturity gap**	
Term Premium$_t$	2.15***		3.59***	
	(0.54)		(0.74)	
Bank Tier 1 Lev.$_t$ × Term Premium$_t$		14.30***		15.44***
		(3.14)		(3.75)
First-stage F test	218.2	42.89	159.2	33.26
Observations	562,140	557,461	522,036	517,544
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×Quarter FE	-	Y	-	Y

measure of total foreign official holdings of U.S. Treasuries used to construct the main IV. This adjustment addresses the potential 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 columns 1–4 of Table OB-5 show that this modification in the construction of the IV does not change the main results: a higher term premium stemming from lower demand from foreign official investors (excluding China alone or China and Belgium together) is associated with higher subsequent bank lending. Second, in columns 5–6, we replace the Kim and Wright (2005) term premium estimates with the identified term premium shocks constructed using high-frequency interest rate changes around FOMC announcement windows (and used in the main analysis). The resulting estimates for both the level and interaction terms are significant and have the expected signs.

Alternative term premium estimates. Term premium estimates are subject to uncertainty stemming from the underlying term structure model and their parameterizations. To verify that our IV results are not driven by a specific term structure model, we use alternative term premium estimates

Table OB-5: Robustness to IV modifications and term premium shocks

This table examines the robustness of the IV results in Table OB-3 to a set of modifications. Columns 1–4 report IV estimates when Chinese or Chinese and Belgian holdings of U.S. Treasuries, respectively, are excluded from our main IV. Columns 5–6 replace the Kim and Wright (2005) term premium with high-frequency Kim-Wright term premium shocks and estimate the regressions with OLS. 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 Table OB-3. Standard errors in parentheses are double clustered by bank and quarter. *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	**Loan growth$_{t,t+4}$**					
	IV	**IV**	**IV**	**IV**	**OLS**	**OLS**
	(A) IV Modifications				**(B) TP Shocks**	
	Excl. China		**Excl. China/Belgium**			
Term premium$_t$	2.60***		2.71***		34.41**	
	(0.52)		(0.53)		(14.25)	
Bank Tier 1 Lev.$_t$×Term Premium$_t$		12.31***		12.81***		106.56**
		(3.15)		(3.16)		(41.71)
First-stage F test	271.1	44.37	294.5	43.75	–	–
Observations	562,568	557,899	562,568	557,899	562,568	557,899
Macro controls	Y	–	Y	–	Y	–
Bank controls	Y	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y	Y
Bank MSA FE	Y	Y	Y	Y	Y	Y
Bank MSA×Quarter FE	–	Y	–	Y	–	Y

from Adrian et al. (2013) (ACM) and Kim and Priebsch (2024). Unlike the Kim-Wright model, the ACM model excludes survey-based measures of short-rate expectations, while the Kim-Priebsch model explicitly accounts for the effective lower bound period between 2008 and 2015, which overlaps with our sample period. Estimates in columns 3-6 in Table OB-2 confirm that our IV strongly predicts these alternative term premium estimates, even after controlling for the short rate and other macroeconomic factors. We re-estimate our baseline regressions using these alternative term premium estimates. The results, shown in the top panels of Table OB-6, confirm that our conclusions are robust to the choice of the term structure model.

Alternative standard error estimates. The bottom panels of Table OB-6 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 double clusters the standard errors at the bank and quarter levels.

Table OB-6: Robustness to alternative term premium estimates and clustering of standard errors

This table examines the robustness of OLS and IV results in columns 1-2 of Table OB-3—estimating the level relationship between the term premium and loan growth—to alternative term premium estimates and standard error estimators. We consider alternative term premium estimates from the term structure model in Adrian et al. (2013) and Kim and Priebsch (2024) in the top panel. For alternative approaches to estimating standard errors, we use the Driscoll-Kraay estimator with four lags and Kiefer standard errors in the lower panel. The data are at the bank-quarter level and cover the period 1994:Q1-2019:Q4. Macro controls, bank controls, and fixed effects are the same as in Table OB-3. Significance: *p<.1; **p<.05; ***p<.01.

	(1)	(2)	(3)	(4)
Dependent variable:	**Loan growth$_{t,t+4}$**			
	OLS	**IV**	**OLS**	**IV**
	Adrian et al. (2013) Term Premium		**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)
First-stage F test	-	37.54	-	291.2
Observations	562,568	562,568	562,568	562,568
R^2	0.24	-	0.25	-
	Driscoll and Kraay (1998) standard errors with 4 lags		**Kiefer et al. (2000) standard errors**	
Term Premium$_t$	1.85***	3.01***	1.85***	3.01***
	(0.55)	(0.89)	(0.09)	(0.11)
First-stage F test	-	88.73	-	1.195e+06
Observations	562,568	562,568	562,568	562,568
R^2	0.25	-	0.25	-
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

C Deriving the Pricing Kernel from Equilibrium Models

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.

C.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:

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

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:

$$\mu_t - r_t = \kappa_t \frac{P_r^{(\tau)}}{P}\sigma_r + g\frac{P_\kappa^{(\tau)}}{P}\sigma_\kappa = \kappa_t\theta_1^{(\tau)} + \theta_0^{(\tau)}. \tag{C-2}$$

where $\mu_t \mathrm{d}t = E_t\left[\mathrm{d}P_t^{(\tau)}/P_t^{(\tau)}\right]$.[26]

Second, we show that equation (C-2) 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

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

[26] 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 functions $\theta_1^{(\tau)}$ and $\theta_0^{(\tau)}$.

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

$$S_t^{(\tau)} = \zeta^{(\tau)} + \theta^{(\tau)}\kappa_t \tag{C-3}$$

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

$$P_t^{(\tau)} = \exp\left(-\left[A_r^{(\tau)} r_t + A_\kappa^{(\tau)}\kappa_t + C^{(\tau)}\right]\right), \tag{C-4}$$

the first-order conditions for the arbitrageurs can be written as

$$\mu_t^{(\tau)} - r_t = A_r^{(\tau)} a\sigma_r^2 \int_0^T X_t^{(u)} A_r^{(u)}\,\mathrm{d}u + A_\kappa^{(\tau)} a\sigma_\kappa^2 \int_0^T X_t^{(u)} A_\kappa^{(u)}\,\mathrm{d}u. \tag{C-5}$$

Define

$$\lambda_{r,0} = a\int_0^T \zeta^{(u)} A_r^{(u)}\,\mathrm{d}u, \qquad \lambda_{r,1} = a\int_0^T \theta^{(u)} A_r^{(u)}\,\mathrm{d}u,$$
$$\lambda_{\kappa,0} = a\int_0^T \zeta^{(u)} A_\kappa^{(u)}\,\mathrm{d}u, \qquad \lambda_{\kappa,1} = a\int_0^T \theta^{(u)} A_\kappa^{(u)}\,\mathrm{d}u.$$

Substituting the net loan supply process (C-3) and the market clearing condition into the first-order conditions (C-5), the expected excess return on a loan with maturity τ can be written as

$$\mu_t^{(\tau)} - r_t = \lambda_0^{(\tau)} + \lambda_1^{(\tau)}\kappa_t, \tag{C-6}$$

with

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

C.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.[27] The setup consists of a representative agent with recursive preferences, following Duffie and Epstein (1992b):

$$U_t = E_t \int_t^{\infty} f(c_s, U_s)\, \mathrm{d}s, \tag{C-7}$$

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

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 $f(c,U)$ with respect to c and U, respectively. The consumption process follows

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

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):

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

where $\xi(v)$ is a unknown function that has to be solved using the integral (C-7).

Therefore, the SDF is

$$\frac{dm_t}{m_t} = -r_t \mathrm{d}t - \gamma \sqrt{\exp(v_t)} \mathrm{d}W_{1,t} - \left(\frac{1}{\psi} - \gamma\right) \frac{\xi_v}{\xi} \kappa \mathrm{d}W_{2,t}, \tag{C-8}$$

with $r(v_t)$ and where ξ_v is the partial derivative of ξ with respect to v. Notice the SDF (C-8) is similar to Equation (1) in Section 1:

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

Interpreted through this model, shocks to κ can be thought of as shocks to consumption growth

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

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 $\xi(v)$ solves the ordinary differential equation

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

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