Crowding Out Long-Term Corporate Investment: The Role of Long-Term Government Debt Supply

Antoine Hubert de Fraisse

October 31, 2024

Click here for the most recent version.

Abstract

Using large, plausibly exogenous shocks to the maturity structure of U.S. government debt, I provide causal evidence that the supply of long-term government debt affects the duration of corporate investment. I find that an increase in the supply of long-term government debt causes a crowding out of long-duration investment, via an increase in long-term discount rates. This crowding out manifests through reallocations of capital away from long-duration investment towards short-duration investment. Such reallocations occur across industries, within industries across firms and within firms across divisions. Due to the prevalence of asset-liability maturity matching, the resulting variations in the aggregate duration of investment significantly contribute to fluctuations in aggregate corporate debt maturity. My findings imply that policies which influence the net supply of long-term bonds, such as public debt management and central bank quantitative easing or tightening, affect the composition of corporate investment.

HEC Paris. Email address: antoine.hubert-de-fraisse@hec.edu. I am very grateful to Johan Hombert, Thierry Foucault, and David Sraer for their continuous guidance and support. I am also thankful to Dominique Badoer, Joanne Chen, Fotis Grigoris, Tobias Hoogteijling, Jason Kang, Mark Leary, Yueran Ma, Florian Nagler, Walker Ray, Lukas Schmid, Ioannis Spyridopoulos, and Vincent Tena for great discussions and to Bruno Biais, Saki Bigio, Nicolas Crouzet, Kent Daniel, Olivier Darmouni, François Derrien, Ian Dew-Becker, Andrea Eisfeld, Niels Gormsen, Denis Gromb, Samuel Hanson, Kilian Huber, Augustin Landier, Vincent Maurin, Adrien Matray, Evren Ors, Noémie Pinardon-Touati, Tano Santos, Daniel Schmidt, Desislava Tartova, David Thesmar, Stijn Van Nieuwerburgh, Guillaume Vuillemey, Pierre-Olivier Weill, Irina Zviadadze and seminar and conference participants at UCLA Anderson, Berkeley Haas, Columbia Business School, Columbia University, Chicago Booth Treasury Markets Conference, SFS Cavalcade North America, AFA, Adam Smith Workshop, FIRS, FIFI Conference, MFA, Dauphine PhD Workshop, Macro-Finance Society Workshop, Macro Finance Research Program Summer Session for Young Scholars, and EFA Doctoral Tutorial, for very helpful comments and suggestions. I am thankful to Olivier Dessaint, Thierry Foucault, and Laurent Frésard for sharing their hand-collected measure of projects' horizon.

Can the maturity structure of government debt influence real economic outcomes, particularly corporate investment? This question has gained renewed attention amid recent discussions about the U.S. Treasury's growing reliance on short-term debt issuance.[1] Stressing the relationship between the maturity structure of government debt and real economic outcomes is not new. It was a key justification for central banks' quantitative easing (QE) after the 2007-2008 financial crisis and its more recent reversal with quantitative tightening. With QE, central banks issue short-term reserves to purchase long-term debt, effectively reducing the supply of long-term debt. This strategy aims to lower long-term interest rates and stimulate economic activity, particularly corporate investment.

The common view on how long-term debt supply impacts economic outcomes assumes that investors who accommodate an increase in long-term debt are risk-averse and unable to fully diversify the associated interest rate risk (Vayanos & Vila 2021). Consequently, an increase in long-term debt supply would lead to higher long-term interest rates as compensation for this risk. I refer to this mechanism as the "duration channel." The variation in discount rates resulting from the duration channel should, in turn, influence real investment decisions. However, empirical evidence of such real effects is scarce due to significant identification challenges: the supply of long-term government debt may be endogenous to economic conditions which also affect corporate investment.

In this paper, I use large and plausibly exogenous variation in the supply of long-term government debt—identified through a historical analysis of persistent policy constraints on issuance maturities—to provide causal evidence of the real effects of the duration channel and its impact on the composition of corporate investment. Using financial data on U.S. public firms, I show that a higher supply of long-term government bonds raises discount rates over long horizons, leading to a crowding out of long-duration investment. This crowding out occurs through reallocations of capital from long- to short-duration investment, both across firms (within and across industries) and within firms across different divisions. These reallocations are large. Across firms, a 1-year increase in the average maturity of government debt leads to a reallocation of 4.5% of total investment from long- to short-duration investment. This finding is important because long-term investments are critical for productivity gains,

[1] In a June 2024 Senate hearing, Yellen faced criticism for managing financial conditions. Nouriel Roubini called this strategy "stealth quantitative easing." For a summary, see, e.g., this FT article.

economic growth, and achieving social goals that may not be achievable with short-term investments.[2]

My empirical analysis builds on the framework of limited arbitrage across bond markets (e.g., Vayanos & Vila 2021). I extend this framework by incorporating real investment choices in the form of various investment technologies that differ in cash-flow duration. These technologies are accessible to the same investor who is marginal in bond markets. In the absence of risky payoffs, the representative investor discounts long-term cash flows using equilibrium long-term interest rates and short-term cash flows using short-term interest rates. An increase in the supply of long-term bonds—which is large relative to the marginal investor's limited risk capacity—raises the interest rate risk borne by the investor, causing long-term interest rates to increase in equilibrium: the duration channel. The increase in long-term rates reprices long-term cash flows tied to financial and real assets. This decreases the profitability of new investments with long cash flow durations relative to those with short durations, leading to a reallocation of investment toward shorter-duration investments. I term this the *investment reallocation effect* of the duration channel.

I identify the across-firm investment reallocation effect in a difference-in-difference framework. Specifically, I analyze the heterogeneous investment responses of firms with different investment duration to changes in long-term government debt supply. I measure the investment duration using the firm-level average of the inverse of the firm's depreciation rate on fixed assets, scaled by the significance of fixed assets in total assets.[3] Intuitively, faster asset depreciation reduces the lifespan of cash flows derived from the asset. The key identification assumption is that, conditional on controls, there should be no systematic relationship between the supply of long-term government debt and time-varying factors that can explain the *relative* level of investment of firms with longer investment duration. Identification may be challenging if, for example, the government relied more on short-term financing during economic downturns, precisely when long-term investments are more likely to be constrained (Aghion et al. 2010).

I overcome identification challenges by using plausibly exogenous and quantitatively

[2]Social returns from innovation are significant (Jones & Summers 2020). Long-term investments in infrastructure contribute to output growth (see, e.g., Aghion, Angeletos, Banerjee, & Manova 2010; Donaldson 2018; Röller & Waverman 2001).

[3]Measures based on depreciation rates align with predictions regarding asset lifespan and debt maturity (see, e.g., Geelen, Hajda, Morellec, & Winegar 2023; Kermani & Ma 2022; Livdan & Nezlobin 2021). The measure is primarily a time-invariant firm characteristic that is highly correlated within industries.

significant variation in the U.S. government long-term debt supply from 1965 to 2007. This variation is characterized by five distinct trends. A careful historical examination of Treasury debt management developments reveals that 3 policy constraints (1965, 1992, and 2001), which restricted the maturity of new issuances, and 2 policy relaxations (1975 and 1996), which lifted the first two policy restrictions, qualitatively account for the 5 trends in the average maturity of outstanding government debt. I run counterfactual exercises that demonstrate that the nature of the policy constraints and their persistence fully account for the following trends until the constraints are relaxed.

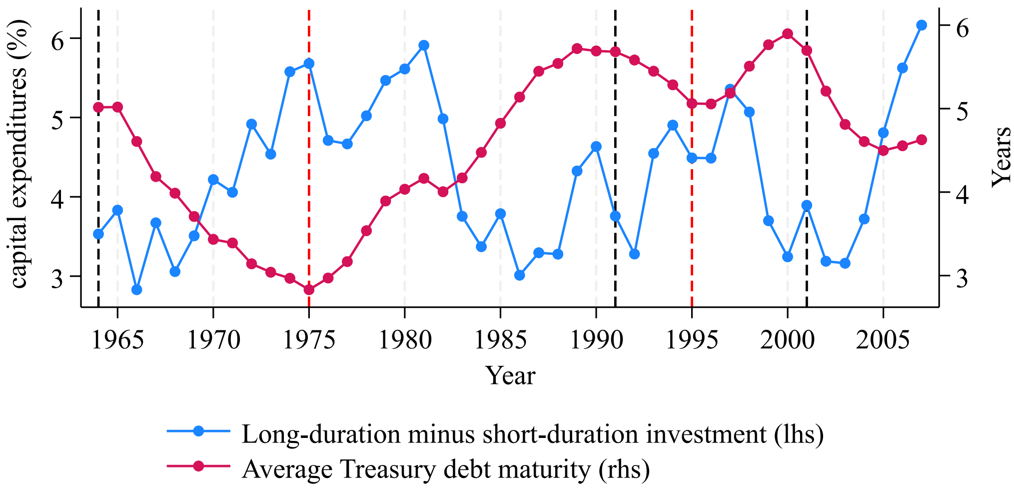
I show that these trends in long-term bond supply, resulting from the persistence of these policy shocks, are plausibly unrelated to other economic conditions that could influence the relative investment of long-duration firms. Through a narrative analysis of the economic environment around these shocks—drawing on congressional records, Treasury Borrowing Advisory Committee minutes and reports, Treasury policy statements, news articles, and economic history accounts (Garbade 2015, 2020)—I find that the three policy constraints, which precede the trends, were not driven by expectations of future economic conditions. Instead, these constraints arose respectively from a statutory limit on long-term bond issuance (conceived 50 years earlier and arbitrarily becoming binding despite no significant economic change), a political view on long-term financing, and a delayed response to outdated economic conditions. Most importantly, I show that the persistence of these constraints, along with the timing of the two related policy relaxations, is independent of economic conditions and instead reflects institutional inertia and a slow congressional process. To mitigate residual concerns about spurious correlations with economic conditions, I control for the relative sensitivity of long-duration investments to an extensive set of macroeconomic variables.

Figure 1 offers preliminary evidence supporting the investment reallocation effect across firms. It illustrates that the difference in investment rates for capital expenditures between firms with above-median investment durations and those with below-median durations is negatively correlated with the average maturity of Treasury debt. In other words, when the supply of long-term bonds increases, long-duration investments tend to decrease.

More formally, my difference-in-difference estimates indicate that a 1-year increase in the average maturity of Treasury debt leads to a 0.8 percentage point drop in the investment rate in capital expenditures of above-median-duration firms, relative to

FIGURE 1: Treasury debt maturity and long-duration investment rate

The figure presents the yearly time series of average Treasury debt maturity value-weighted by outstanding principal (red line with values on the right-hand side axis). The blue line corresponds to the difference in average investment rates (capital expenditures as a percentage of lagged total assets) between firms with above median investment duration (measured by accounting asset maturity) and firms with below median investment duration. The vertical black dashed lines indicate the first year before policy shocks that constrain long-term government debt issuance start binding. The vertical red dashed lines indicate the first year before policy shocks that relaxed constraints on long-term government debt issuance occur.



below-median-duration firms. This reallocation effect is economically large. Given the average investment rate in capital expenditures in my sample, this implies a yearly reallocation of 4.5% of total capital expenditures from long- to short-duration firms. I show that the reduction in capital expenditures among long-duration firms is driven by decreases in expenditures on both machinery and equipment and real estate. Finally, I highlight that long-duration firms also experience reductions in R&D expenses and a lower employment growth.

I confirm that the across-firm reallocation is large enough to significantly affect the aggregate duration of corporate investment for both public and private firms using the Bureau of Economic Analysis (BEA) investment tables. Specifically, a one-year increase in government debt maturity is associated with a 1-standard deviation decrease in aggregate investment duration.

Given that I compare the investment of firms that differ along a measure of tangible investment duration, my results confirm an investment reallocation from firms with long-duration tangible investment towards firms with short-duration tangible investment. I show that the reallocation effect also applies to intangible investments that are key in modern economies.[4] Specifically, I use an alternative measure of the duration of investments that captures the duration of all types of investments: the horizon of

[4]See e.g. Eisfeldt and Papanikolaou (2013), Crouzet and Eberly (2021).

firms' business plans collected from regulatory filings (Dessaint, Foucault, & Frésard 2023). Using the part of the variation in this alternative measure that is orthogonal to the duration of tangible investments, I find a larger response in R&D for long-duration firms compared to the response obtained using my baseline measure. This confirms an investment reallocation from firms with long-duration intangible investment towards firms with short-duration intangible investment.

I show these results are robust to alternative specifications. First, using an event study methodology, I confirm that the estimated effects are not attributable to any single period. Second, using industry-time fixed effects, I show the investment reallocation effect operates equally across industries and across firms in the same industry. Third, I test a reallocation effect within the firm by examining division-level investment responses to long-term government bond supply. An increase in the supply of long-term government debt is associated with a decrease in investment in long-duration divisions. These within-firm results control for firm-level time-varying investment rates, eliminating the concern that investment duration might act as a proxy for firm-wide financial constraints. These results also broaden the scope of investment reallocation, showing that it occurs within firms as well.

I provide evidence in line with a mechanism that relies on changes in long-term discount rates and is independent of firms' financing choices. Specifically, I find that a higher supply of long-term government debt increases long-term yields on both government and corporate bonds. A segmented markets argument would suggest that this should affect more the cost of capital and the investment of long-duration firms that are financed with debt. Instead, an integrated markets argument would predict a unique cost of capital for long-term investments and would suggest changes in investment that depend only on the duration of investment. I find evidence for the latter by comparing the relative investment response of firms with long-duration investment that differ by their ex ante capital structure. First, long-duration firms with a greater reliance on debt financing do not decrease investment more than other long-duration firms. Second, long-duration firms that rely more on *long-term* debt financing do not statistically decrease investment more than other long-duration firms. Third, firms that unconditionally rely more on long-term debt financing decrease investment more than other firms, but only because, on average, they are also long-duration firms.

Consistent with the investment reallocation effect being driven by changes to the relative cost of capital on long-term investments, I compute upper and lower bounds for the semi-elasticity of investment with respect to the cost of capital and show they quantitatively align with previous research.

The investment reallocation effect also has consequences for the maturity of corporate debt. While debt financing does not explain the cross-sectional responses of long-duration firms to long-term bond supply, I show that the unconditional share of debt in the financing of investment is economically large. Consequently, I show that when long-duration firms relatively decrease their investment, they also relatively decrease their net debt issuances. This significantly changes their relative contribution to aggregate debt. I find that because firms match the maturity of their debt to the maturity of their investment, these large changes in the composition of debt contribute significantly to the negative time-series correlation between the maturity of government debt and the maturity of corporate debt highlighted in the literature (Greenwood, Hanson, & Stein 2010). This finding complements the literature that argues the negative time-series correlation arise because firms behave as liquidity providers, absorbing the shocks associated with changes in the maturity structure of government debt. Specifically, my findings suggest that the provision of liquidity by firms in debt markets in the form of long-term financial cash flows can also be facilitated if it is backed by long-term real cash flows.

Finally, I establish external validity of the investment reallocation effect to a large and persistent shock to long-term debt demand. Specifically, I replicate my analysis around a reform which positively influenced the demand for long-term bonds by UK pension funds, the UK's Pensions Act 2004 reform. I conclude that the relative semi-elasticity of investment to the term spread in this context is quantitatively comparable to the baseline semi-elasticity obtained using variation in the U.S. long-term government supply.

Overall, this paper makes three primary contributions. First, it provides the first causal evidence that changes in long-term debt supply affect the duration of corporate investment through the investment reallocation effect. Second, it establishes a connection between this investment reallocation effect and the aggregate time-series variation in corporate debt maturity. Third, it introduces a new potential cost of long-term government financing: issuing long-term debt crowds out long-duration corporate investments that may be more productive. In contrast, policies aimed at reducing the supply of outstanding long-term debt, such as quantitative easing, may stimulate long-term corporate investment.

Related Literature. This paper relates to five strands of literature.

First, this work extends the literature on limited arbitrage in bond markets—stemming from imperfect substitutability Tobin (1958) and preferred-habitat clienteles Vayanos and Vila (2021)—to corporate decision-making.[5] Previous research has primarily linked long-term government debt supply to corporate financing choices. Long-term government debt supply generates variation in the term premium that causes variations in the maturity of corporate debt, reflecting the role of firms as liquidity providers (Badoer & James 2016; Baker, Greenwood, & Wurgler 2003; Greenwood, Hanson, & Stein 2010). Instead, I focus on real effects for corporate investment. Relatedly, Foley-Fisher, Ramcharan, and Yu (2016) find that the Federal Reserve's long-term bond purchases may have helped reduce financial constraints of firms more dependent on long-term debt. I find evidence for a different mechanism which is not dependent on firm financing choices and which links changes in aggregate long-term discount rates to the composition of corporate investment. Despite the investment reallocation effect occurring evenly among firms with less reliance on debt financing, I show that this mechanism, consistent with the aggregate importance of debt financing and maturity matching, explains a significant portion of the correlation between corporate and government debt maturities.

Second, I contribute to the literature studying the real effects of central bank's long-term asset purchases. Existing studies on the real effects of QE on corporate investment have primarily focused on other transmission channels, partly for identification reasons. These channels include the bank lending channel (Chakraborty, Goldstein, & MacKinlay 2020),[6] the direct lending channel (Darmouni & Siani 2023; Grosse-Rueschkamp et al. 2019; Todorov 2020), the portfolio rebalancing channel (Selgrad 2023), and a gap filling channel (Foley-Fisher et al. 2016; Greenwood et al. 2010). Importantly, each of these channels is identified through differences in the financing choices of banks and firms. In this paper, I provide causal evidence of the real effects of

[5]Preferred habitat theories have also been proposed by Culbertson (1957) and Modigliani and Sutch (1966). Greenwood, Hanson, and Vayanos (2024) survey the growing literature on supply-and-demand forces in bond markets. Research on the effects of bond supply and demand, including purchases by the Federal Reserve, on asset prices include Chodorow-Reich (2014); D'Amico and King (2013); Duarte and Umar (2024); Gilchrist, Wei, Yue, and Zakrajšek (2020); Greenwood and Vayanos (2014); Grosse-Rueschkamp, Steffen, and Streitz (2019); Haddad, Moreira, and Muir (2021); Hamilton and Wu (2012); Hanson (2014); Jansen (2021); Krishnamurthy and Vissing-Jorgensen (2011, 2012); Lucca and Wright (2022); Ray et al. (2024); Selgrad (2023); Siani (2022); Todorov (2020). This also relates to growing work on demand-based asset pricing following Koijen and Yogo (2019).

[6]Research on QE and the bank lending channel studying other outcomes, such as loan supply or employment include, e.g., Di Maggio, Kermani, and Palmer (2020); Luck and Zimmermann (2020); Rodnyansky and Darmouni (2017).

the duration channel on corporate investment. I show that this channel has consequences for corporate investment that do not depend on firm financing choices. This is important because the other channels imply that equity-financed firms would not be much affected by QE. My evidence on the real effects of the duration channel suggests that equity-financed firms are also affected by QE.

Third, my results contribute to the literature studying the composition of aggregate investment and in particular the determinants of long-term corporate investment. An important strand of this literature identifies the relevance of credit constraints for the composition of aggregate investment, notably the share of long-term investments, following Aghion et al. (2010).[7] Some articles have also highlighted the role of bank provision of long-term finance for long-term investment and development (see, e.g., Choudhary & Limodio 2022; Gopalan, Mukherjee, & Singh 2016).[8] Another strand of the literature, following Stein (1988), stresses that agency problems have an impact on real investment horizons.[9] I show that large supply and demand shocks in debt markets can change the relative valuation of long-duration investments and be a significant determinant of the composition of aggregate corporate investment. Relatedly, Dew-Becker (2012) shows that changes in the term spread negatively correlate with one-year ahead average duration of investment using aggregated data on investment from the BEA. My contribution is to provide causal evidence for a mechanism that explains the correlation highlighted by Dew-Becker (2012).

Fourth, my paper also contributes to the literature in macroeconomics which, following Friedman (1978), focuses on the implications of government borrowing for corporate investment. My paper is about changes to the supply of government debt *across maturities*, as opposed to changes in government borrowing quantities (see, e.g., Akkoyun, Ersahin, & James 2020; Demirci, Huang, & Sialm 2019; Graham, Leary, & Roberts 2014; Pinardon-Touati 2021). In contrast to this strand, I argue that focusing on the supply of government debt *across maturities* makes it possible to address the critical challenge of endogeneity in two ways. First, by looking at the difference in investment

[7] Aghion et al. (2010) shows that illiquid long-term investment can be rationed in the presence of financial constraints. See, for example, Garicano and Steinwender (2016) and Mendes (2020) for empirical evidence. Research has also shown how credit rationing affects the composition of investment more broadly: see, e.g., Campello, Graham, and Harvey (2010); Darmouni and Sutherland (2024); Eisfeldt and Rampini (2007); Lanteri (2018); Ma, Murfin, and Pratt (2022); Rampini (2018).

[8] Relatedly, Kozlowski (2021) shows theoretically that trading frictions reallocate credit supply and investment toward the short term.

[9] See, for instance Almeida (2019); Asker, Farre-Mensa, and Ljungqvist (2015); Dessaint, Foucault, and Frésard (2023); Gutiérrez and Philippon (2018); Terry (2023).

response between long- and short-duration firms, I control for aggregate investment opportunities. Second, I document that the time series variation in the maturity of government debt is plausibly exogenous to investment opportunities for long-duration investments.

Fifth, my paper also contributes to a long literature on the optimal maturity of government debt (Barro 1979; Lucas & Stokey 1983). Several properties of short-term and long-term financing have been proposed: for instance, long-term financing favors tax smoothing (e.g. Angeletos 2002; Bohn 1990; Buera & Nicolini 2004) at the expense of excessive short-term debt issuance by the financial sector (Greenwood, Hanson, & Stein 2015). I contribute by highlighting a new property of long-term financing: government long-term debt supply crowds out long-duration corporate investment.

The rest of the paper proceeds as follows. Section 1 presents the conceptual framework and theoretical predictions and outlines the empirical strategy and identification assumptions. Section 2 explains the identification strategy. Section 3 discusses the data and measurement choices. Section 4 presents the results for the investment reallocation across firms. Section 5 presents the results for the investment reallocation within firm across divisions. Section 6 uncovers the mechanism. Section 7 highlights the consequences for the aggregate maturity of corporate debt. Section 8 confirms the external validity of the results by studying a plausibly exogenous shock to the demand for long-term bonds in the UK. Section 9 concludes and discusses policy implications.

1. Conceptual framework

I provide a simple framework to explain the idea that an increase in long-term government debt supply increases long-term interest rates and crowds out long-term corporate investment and long-term corporate debt. The framework extends the version of the model of Greenwood et al. (2010) without firms by allowing the bond market arbitrageur (here called firm) to invest in two real investment technologies: a long-term and a short-term investment technology. I illustrate how this framework guides the empirical strategy and discuss the empirical challenges that motivate my identification strategy and measurement choices.

1.1. A simple model

Let there be three periods: $t \in \{0, 1, 2\}$. There are two types of assets. There are default-free one-period bonds with exogenous returns.[10] Their return from time 0 to time 1, denoted $R_{0,1}$, is known at time 0. Their return from time 1 to time 2, denoted $\tilde{R}_{1,1}$ is random from the perspective of time 0, with mean $E[\tilde{R}_{1,1}]$ and variance $Var[\tilde{R}_{1,1}]$, and is known at time 1. There are also default-free long-term bonds with a return from time 0 to time 2, denoted $R_{0,2}$, that is determined in equilibrium of the long-term bond market at time 0.

There are two types of agents: a representative firm owner with mean variance preferences and the government inelastically supplying long-term bonds. The firm owner issues dollar amounts $B_{t,h}$ at time t of bonds of maturity h. Long-term bonds issued by the firm owner are perfect substitutes for the supply of long-term government bonds. The supply of long-term government bonds, g, can be understood as the government supply net of demand by preferred-habitat investors (e.g. pension funds and life insurers with a preference for long-duration assets) and therefore could be positive or negative.

At time 0, the firm owner also have access to two real investment technologies that vary in cash-flow duration, each with no cash-flow risk.[11] I denote $I_{0,h}$ the dollar investment made at time 0 with technology with cash flows accruing at time h. Short- and long-term technologies have an increasing, concave, and differentiable payoff. Investing in the short-term technology pays off $f(I_{0,1})$ at time 1 and 0 at time 2. Investing in the long-term technology pays off 0 at time 1 and $f(I_{0,2})$ at time 2. The firm owner has no cash at time 0 and therefore finances real investments by issuing bonds.

The firm owner maximizes the mean-variance criterion over final period profits $\tilde{\pi}_2$ under resource constraints at each period. That is, the firm owner solves:

$$\text{argmax}_{B_{0,1},B_{0,2},B_{1,1},I_{0,1},I_{0,2}} \quad E\left[\tilde{\pi}_2\right] - \frac{\gamma}{2} Var\left[\tilde{\pi}_2\right] \qquad s.t.$$

$$(\mathbf{BC}_1) : I_{0,1} + I_{0,2} = B_{0,1} + B_{0,2},$$

$$(\mathbf{BC}_2) : B_{0,1}R_{0,1} = B_{1,1} + f\left(I_{0,1}\right),$$

$$(\mathbf{BC}_3) : \tilde{\pi}_2 = f\left(I_{0,2}\right) - B_{1,1}\tilde{R}_{1,1} - B_{0,2}R_{0,2}.$$

[10] The short-term rate could be determined for instance by monetary policy.

[11] Modelling cash-flow risk enables a substantive extension of preferred habitat models and a richer exploration of spillovers from Treasury supply shocks that is outside the scope of this paper. In the presence of cash-flow risk, the same prediction detailed below would qualitatively hold: A higher supply of long-term bonds would expose investors to duration risk, and this should, in turn, reprices assets that are exposed to cash flow risk as long as they are also exposed to duration risk.

It is convenient to define $B^{\mathbf{roll}}_{0,1} = B_{0,1} - f(I_{0,1})/R_{0,1}$, the amount of short-term borrowing at time 0 that cannot be repaid with the proceeds at time 1 from investing in the short-term investment technology at time 0. The problem can be rewritten as:

$$\begin{aligned} \text{argmax}_{B^{\mathbf{roll}}_{0,1}, I_{0,1}, I_{0,2}} \quad & E\left[\tilde{\pi}_2\right] - \frac{\gamma}{2} Var\left[\tilde{\pi}_2\right] \qquad s.t. \\ \tilde{\pi}_2 = & f\left(I_{0,2}\right) - I_{0,2}R_{0,2} + R_{0,2}\left(\frac{f\left(I_{0,1}\right)}{R_{0,1}} - I_{0,1}\right) + B^{\mathbf{roll}}_{0,1}\left(R_{0,2} - R_{0,1}\tilde{R}_{1,1}\right) \end{aligned}$$

The first-order conditions for the investment ($I^*_{0,1}$ and $I^*_{0,2}$) and roll-over risk ($B^{\mathbf{roll}*}_{0,1}$) are:

$$f'(I^*_{0,1}) = R_{0,1}, \quad f'(I^*_{0,2}) = R_{0,2}, \quad \text{and} \quad B^{roll*}_{0,1} = \frac{R_{0,2} - R_{0,1}E\left[\tilde{R}_{1,1}\right]}{\gamma (R_{0,1})^2 Var\left[\tilde{R}_{1,1}\right]} \tag{1}$$

In equilibrium, the marginal return on long-term (short-term) investment equalizes the return on long-term (short-term) bonds. Long-term (short-term) investment falls when the long-term (short-term) interest rate increases.

Although the problem makes clear that the firm owner can completely avoid exposure to interest rate risk by doing maturity matching (setting $B^{\mathbf{roll}}_{0,1}$ to zero), the firm owner chooses some amount of interest rate risk exposure. The firm owner arbitrages the yield curve with carry trades. When the term premium is positive ($R_{0,2} - R_{0,1}E\left[\tilde{R}_{1,1}\right] > 0$), the firm owner finances the purchase of long-term bonds with short-term borrowing in excess of maturity-matching proceeds from short-term investment ($B^{\mathbf{roll}*}_{0,1} > 0$) and vice versa when the term premium is negative.

There is a perfect separation of real investment and arbitrage activities in the sense that real investment technologies do not affect their exposure to rollover risk: $B^{\mathbf{roll}*}$ is not a function of the primitives of investment technologies. This is because the firm owner perfectly hedges the incremental risk exposure from investment technologies, i.e, $\partial B^*_{0,2}/\partial I^*_{0,2} = 1$ from the first period budget constraint.

The market for long-term bonds clears by equating the firm owner demand for long-term bonds ($-B^*_{0,2}$) to long-term government bond supply (g). Assuming without loss of generality that $R_{0,1} = E[\tilde{R}_{1,1}] = 1$ and differentiating the terms of the market clearing condition with respect to g, I obtain the following propositions.

Proposition 1. ***(Asset pricing effect of the duration channel)*** *A higher net supply of long-*

term government bonds raises long-term rates:

$$\frac{dR_{0,2}}{dg} = \left[\frac{1}{\gamma Var[\tilde{R}_{1,1}]} - \frac{\partial I^*_{0,2}}{\partial R_{0,2}}\right]^{-1} > 0.$$

Absorbing a higher inelastic long-term bond supply exposes the firm owner to more interest rate risk. In equilibrium, the return on long-term bonds increases to compensate them. Long-term bond supply has a stronger price effect when the firm owner's risk aversion is high (large γ), or when carry trades are riskier (large $Var[\tilde{R}_{1,1}]$). This extends the result in Greenwood et al. (2010) to a setting with endogenous financing need. A new contribution is that the more elastic long-term investment is ($\partial I^*_{0,2}/\partial R_{0,2}$), the lower the asset pricing effect. This is because of the hedging motive: long-term bond issuance by the firm owner is increasing in long-term investment.

In Section 6, I confirm that in my sample, a higher supply of long-term government debt increase long-term interest rates.

Proposition 2. ***(Investment reallocation effect of the duration channel)*** *A higher (net) supply of long-term government bonds lowers long-term real investments:*

$$\frac{dI^*_{0,2}}{dg} = \frac{\partial I^*_{0,2}}{\partial R_{0,2}} \cdot \frac{dR_{0,2}}{dg} < 0.$$

As the long-term rate interest is increasing in long-term government bond supply and long-term investment is decreasing in the long-term interest rate, long-term investment is decreasing in long-term government bond supply. In practice, the investment reallocation effect may take place both within- and across-firm. On the one hand, it can take place within firms when firms are the same but have several projects varying in cash-flow duration. On the other hand, it can take place across firms if firms have a single type of project, but firms may differ in the average duration of their project.

Proposition 3. ***(Debt consequences of the investment reallocation effect)*** *A higher net supply of long-term government bonds reduces the need for the firm owner's long-term bond issuance to hedge rollover risk from long-term investments as:*

$$\frac{dI^*_{0,2}}{dg} < 0, \quad and \quad \frac{\partial B^*_{0,2}}{\partial I^*_{0,2}} = 1.$$

A higher supply of long-term bonds results in a relative drop in long-term investments and in the amount of the maturity-matched debt. This effect is the debt consequence of the investment reallocation effect.

1.2. Empirical strategy for the test of the investment reallocation effect

To causally identify the investment reallocation effect (Proposition 2) and its debt consequences (Proposition 3), I study real investment and net debt issuance, made by U.S. public firms, in response to low-frequency variation in long-term debt supply by the U.S. Treasury. Specifically, I test whether a higher supply of long-term government debt decreases the quantity of investment (a) across industries, for firms in industries with a longer average investment cash-flow duration (thereafter *investment duration*); (b) within industry across firms, for firms with longer investment duration than their industry peers; (c) within firm across divisions, for divisions with longer investment duration. In addition, I test whether a higher supply of long-term government debt decreases the quantity of net debt issuance for firms with longer investment duration.

More formally, for unit i (industry, firm, or division) in year t, I estimate variations of the following specification:

$$y_{i,t} = \beta \times (g_t \cdot d_i) + \delta \times (g_t \cdot \mathbf{X}_{i,t}) + \theta \times (\mathbf{Z}_t \cdot d_i) + \alpha_i + \gamma_t + \varepsilon_{i,t} \tag{2}$$

where $y_{i,t}$ is either investment or net debt issuance. g_t proxies for the time series of long-term government debt supply, d_i proxies for the investment duration of unit i. $\mathbf{X}_{i,t}$ is a vector of time varying cross-sectional characteristics measured at the level of unit i. Its interaction with g_t controls for the relative response to long-term debt supply of units with better investment opportunities. $\mathbf{Z}_t$ is a vector of time series controls that includes measures of macroeconomic conditions. Its interaction with d_i controls for the relative response to macroeconomic conditions of units with longer investment duration.

The parameter β captures the relative effect of long-term government debt supply on $y_{i,t}$ (investment or net debt issuance) for units with a longer investment duration. The identification of β relies on the standard orthogonality condition:

$$\mathbb{E}\left[(g_t \cdot d_i) \times \varepsilon_{i,t} \mid \alpha_i, \gamma_t, g_t \cdot \mathbf{X}_{i,t}, \mathbf{Z}_t \cdot d_i\right] = 0. \tag{3}$$

The orthogonality condition says that the interaction between the government's long-term debt supply and the unit's investment duration is not correlated with any unobserved factors that affect $y_{i,t}$, conditional on covariates. In other words, after accounting for the fixed effects of each unit, time-specific effects, the interaction between long-term government debt supply and other characteristics of the unit, the interaction between the unit's investment duration and other macroeconomic variables, there should be no remaining systematic relationship between long-term government debt supply and time-varying factors that can explain the relative level of $y_{i,t}$ for units with a longer investment duration. Importantly, time-varying factors that are correlated with long-term government debt supply and the average level of $y_{i,t}$, but not with the relative level of $y_{i,t}$ for units with longer investment duration are not a threat to identification.

The first empirical challenge is related to identifying the variation in g_t that satisfies the orthogonality condition (Equation 3). I address this challenge by using variation in long-term debt supply by the U.S. government that is plausibly exogenous to time-varying factors that are correlated with the differential investment of units with longer investment duration. I detail the plausibly exogenous variation in Section 2. The second empirical challenge is related to measuring d_i. I address this challenge by using the accounting maturity of investments, based on the inverse of the depreciation rate of tangible investments and weighted by the importance of those tangible investments. In Section 3, I detail my measurement choices.

2. Identification: Long-term Treasury bond supply during 1965-2007

To causally identify the investment effect of the duration channel, I exploit low-frequency exogenous variation in long-term government debt supply between 1965 and 2007. I measure the supply of long-term government debt using the average maturity of Treasury debt, value weighted by outstanding principal.[12,13] I denote the average maturity of Treasury debt *TSYMAT*, formally defined as:

$$TSYMAT_t = \frac{\sum_{i=1}^{N_t} P_{i,t} \cdot m_{i,t}}{\sum_{i=1}^{N_t} P_{i,t}},$$

[12] Appendix A presents the descriptive statistics.

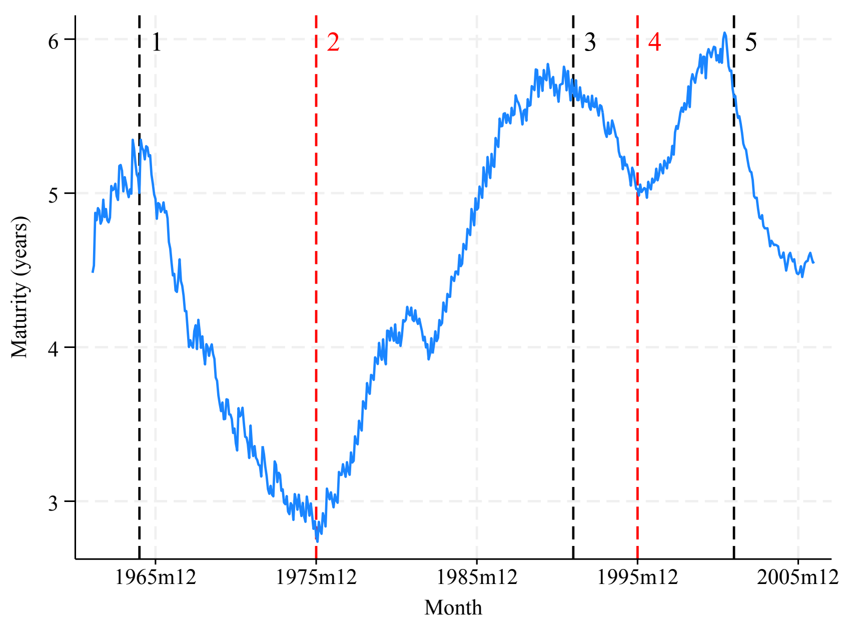
[13] Note that the measure is in face-value terms, rather than market-value terms, to rule out endogeneity concerns that government debt maturity is affected mechanically by variation in the term structure (following Greenwood & Vayanos 2014). An advantage over measures of the share of long-term debt is that it characterizes composition changes across all maturities. Appendix B shows that all my results are robust to alternative proxies for long-term bond supply.

where $P_{i,t}$ denotes the principal of Treasury security i outstanding at time t, $m_{i,t}$ represents its residual maturity at time t in years, and N_t is the total number of Treasury securities outstanding at time t.

The variation in the average maturity of outstanding Treasury debt is characterized by five distinct trends (Figure 2). A careful examination of Treasury debt management actions from 1965 to 2007 reveals that 3 policy shocks (1965, 1992, and 2001), which restricted the maturity of new issuances, and 2 policy shocks (1975 and 1996) that lifted the first two policy constraints, fully account for these 5 trends both qualitatively and quantitatively.

FIGURE 2: Average maturity of U.S. Treasury debt and policy shocks

The figure presents the quarterly time series of the average maturity of Treasury debt value-weighted by outstanding principal. Data comes from the CRSP's daily Treasury bond database. The CRSP U.S. Treasury and Inflation Series include end-of-day price observations for nearly 7,000 U.S. Treasury bills, notes, and bonds from 1961. I replace issue-level missing outstanding amounts by the earliest available issue-level information. The vertical black dashed lines indicate the first year before policy shocks that constrain long-term government debt issuance start binding. The vertical red dashed lines indicate the first year before policy shocks that relaxed constraints on long-term government debt issuance occur. The policy shocks are detailed in the body of the text and in Appendix B.



These shocks create large and persistent variation. The year-to-year standard deviation of the maturity of the government debt in the sample is high, at 0.9 years—around a mean of 4.5 years—and the AR(1) coefficient of 0.96. A one-standard-deviation decrease in debt maturity implies that the representative buyer of Treasury bonds would experience a reduction in exposure to interest rate risk comparable in magnitude to the reduction achieved through the average asset purchase program implemented by the Federal Reserve from 2008 to 2014. [14,15] These properties offer two key advantages over high-frequency identification approaches. First, it allows examination of large, persistent shocks to long-term bond supply, potentially generating meaningful and lasting variations in discount rates. These effects might be missed by high-frequency approaches focused on narrow windows around policy announcements (Nakamura et al., 2021). Second, it enables me to trace the real effects of the duration channel over long periods, crucial to identifying investment effects, as firms slowly incorporate changes in perceived capital costs into their discount rates and investment decisions (Gormsen et al. 2023).

In Section 2.1, I provide a historical description of the policy shocks, how they account for the resulting trends, and discuss how these trends are suitable for causal identification of the investment reallocation effect. In Section 2.2, I discuss residual concerns about identification. In Section 2.3, I show that the persistent shocks quantitatively account for the observed trends in government debt maturity.

2.1. Historical description of the shocks, their persistence, and the resulting trends

A more detailed historical description of the policy shocks can be found in Appendix B.

1. 1965-1975: The interest rate ceiling of 1918 restricts long-term debt issuance.

The Second Liberty Bond Act of 1917 established a 4.25 pp limit on the interest rates for new Treasury bond issuances with initial maturity above 5 years. The post-WWII long-run trend in the level of interest rates led to long-term rates crossing the arbitrary ceiling in 1965 and consequently to a prolonged halt of long-term bond issuances (Figure B.3). By 1967, Treasury officials recognized the role of this ceiling in explaining the decline in the average maturity of government debt and lobbied Congress for its removal. However, the slow political process hindered substantial reform before 1975.[16]

[14] Following Greenwood and Vayanos (2014), I convert a one-standard deviation of the maturity of government debt into units of risk exposures to interest rates, that is, in terms of maturity weighted debt scaled by GDP. Based on the average debt-to-GDP ratio in the sample, a one standard deviation decrease in debt maturity implies a lower interest rate risk exposure worth 38 percentage points of maturity-weighted debt-to-GDP. In Appendix I, I also convert the Fed's bond portfolios from each QE program into units of interest rate risk exposures.

[15] In addition, the variation in long-term government debt supply over 1965-2007 is a relevant variation to study the effects of unconditional long-term government debt supply. During this period, the government sector is one of the largest suppliers: Federal debt represents on average 23 pp of the stock of outstanding domestic non-financial debt securities and loans in the U.S. The figure is computed from the Financial Accounts of the United States data available at www.federalreserve.gov/releases/z1/

[16] Between 1967 and 1975, Congress took partial measures to alleviate the constraints: it expanded the definition of Treasury notes exempt from the ceiling to include those with maturities of up to 7 years in

While the Congress acknowledged that the constraint may have “interfered with good debt management practices”,[17] it was “reluctant to completely remove the ceiling, at least until there has been an opportunity to observe the effects of a limited exception to the ceiling”[18]. It follows that the constraint caused the decline in the average maturity of outstanding Treasury debt between 1965 and 1975.

Exogeneity of the resulting maturity trend. The crossing of interest rates above the old statutory ceiling is unlikely to be a concern for identification, as the timing is arbitrarily determined by the long-term interest rate trend, and this trend does not affect the persistence of the long-term issuance constraint until 1975. Instead, the persistence of the shock is plausibly exogenous to long-duration investment, as it simply reflects the slow political process and Congress’s wariness about repealing long-standing statutory constraints. The positive trend in interest rates could impact more negatively investment by long-duration firms which are more exposed to changes in interest rates. This could attenuate the predicted increase in investment by long-duration firms after the shock. To address this, I control for the correlation between long-duration investment and interest rates by including interest rate levels in Z_t (Equation 2). I also include the level and expectations of real GDP growth and CPI inflation to rule out the effects of rising expectations for output growth and inflation on both interest rates and long-duration investment.

2. 1976-1991: Repeal of the statutory constraint.

The reversal in the maturity of Treasury debt began in 1976, driven by significant and staggered Congressional interventions. These included a series of exemptions from the statutory constraint, which allowed long-term debt issuances up until 1988, when the ceiling was finally removed (Figure B.3). Garbade (2015) presents anecdotal evidence that the rate ceiling created a "countervailing commitment" to restore Treasury debt maturity to pre-constraint levels. These relaxations of the constraint halted the decline in Treasury debt maturity and enabled its recovery, reaching historical highs between 1989 and 1991.

Exogeneity of the resulting maturity trend. The timing of the start of the repeal and the subsequent staggered developments are plausibly exogenous to economic conditions affecting the investment of long-duration firms. Instead, historical evidence points to the

1967 and allowed the Treasury to issue up to $10 billion in bonds above the 4.25 pp limit in 1971. Despite these changes, the average maturity of marketable Treasury debt reached a post-World War II low in 1975.

[17] Committee on Finance, 1971, p. 12.

[18] Committee on Finance, 1971, p. 12.

slow congressional process and Treasury officials' commitment to restoring debt maturity as key drivers between 1976 and 1991, posing no direct identification threats.

3. 1992-1995: Reduction of long-term issuance amid political views about their cost.

The regularization of government debt maturity sparked political debates about the optimal maturity of government debt (Garbade 2015). In February 1992, the Bush administration made a one-off reduction in long-term bond offerings as a cost-saving measure amid a steep yield curve, against the explicit advice of the Treasury Borrowing Advisory Committee. [19] In May 1993, the Clinton Administration made a surprising shift by announcing a permanent reduction in 30-year bond offerings by half (Figure B.3), referring to the enduring "risk premium" in longer-term rates. This unexpected policy change surprised market participants and members of the Treasury Borrowing Advisory Committee. This led to a decline in the average maturity of Treasury debt that lasted until late 1995.

Exogeneity of the resulting maturity trend. The policy shock was justified by the realized and contemporaneous upward-sloping yield curve rather than the expectations about future changes in the slope of the yield curve. Future increases in the slope would make it harder to detect the predicted increase in investment by long-duration firms following the reduction in long-term debt issuance because it would predict a future decline in investment by long-duration firms. However, the contemporaneous slope is unlikely to have the same effects if it does not predict future changes in the slope of the yield curve. I mitigate residual concerns by including business cycle indicators, inflation, and inflation expectations in Z_t (Equation 2). These measures account for variations in the slope of the yield curve arising from the price of interest rate and inflation risk, and expected short rates.

4. 1996-2001: Reversal of 1992-1993 decisions and maturity stabilization.

In May 1996, the Treasury reversed the 1992-1993 decisions and increased the issuance of long-term bonds back to its pre-1992 level (Figure B.3), citing concerns that a continued decline in maturity would increase refinancing risk and hurt market liquidity. The policy change led to a gradual increase in the average maturity of government debt up until 1998. Between 1998 and 2001, budget surpluses reduced the government's refinancing needs and prompted new strategies that led to the stabilization of government debt maturity.

[19] The committee firmly opposed a move toward shorter maturities, stating that "any material change at this time runs the risk of [...] undoing the gains, earned over years, that routine and consistency have contributed in reducing the 'uncertainty premium' in Treasury issues." (First-quarter 1992 TBAC report).

Exogeneity of the resulting maturity trend. Historical evidence suggests that the post-1996 maturity trend is driven by efforts to mitigate the negative effects of the earlier partial suspension of long-term bond issuances, such as increased rollover risk and reduced bond liquidity. The timing of the reversal and the persistence of the new issuance patterns are unlikely to be influenced by economic conditions affecting the relative investment of long-duration firms.

5. 2001-2007: Suspension of 30-year debt issuance.

In October 2001, the Treasury unexpectedly announced the suspension of 30-year U.S. Treasury bond issuance (Figure B.3), citing the aim of paying off federal debt during fiscal surpluses and preserving liquidity in other tenors over the long run. This decision surprised market participants and economists, as discussions about eliminating the 30-year bond had surfaced during the period of surpluses but the decision occurred when the U.S. had returned to a net borrower position. The decline in the average maturity of debt is steep until it is stopped by the reintroduction of 30-year bond issuance in 2006. The suspension persists until 2006 due to a political opposition of the Treasury Secretary to the repeated recommendations by the Treasury Borrowing Advisory Committee to re-issue long-term bonds. Garbade (2015) provides anecdotal evidence suggesting that the cautious stance reflects the Secretary's preference for predictable issuance patterns.

Exogeneity of the resulting maturity trend. The unanticipated suspension suggests that the policy shock was not driven by contemporaneous economic conditions, and its persistence until 2006 appears to be unrelated to factors affecting the investment of long-duration firms. Nevertheless, I include business cycle indicators in Z_t (Equation 2) to control for the coinciding change in the U.S. fiscal position.

Overall, the historical analysis clearly shows that changes in government debt maturity are not directly responding to current or expected long-term investment opportunities. It also confirms that the drivers of the shocks and of the persistence of these shocks do not pose significant threats to identification.

2.2. Residual concerns about identification

There are two other potential forces that could drive the variation in Treasury debt maturity: fluctuations in the size of government debt and shifts in the maturity of government investments. Although these explanations do not align with the historical narrative, I examine them and empirically rule them out.

Long-term Treasury debt supply or Treasury debt supply? Earlier research suggest that changes in the size of government debt drive changes in government debt maturity.[20] Two facts rule out the relevance of the variation in the size of government debt in explaining the variation in the maturity of government debt in my sample. First, while debt-to-GDP is positively associated with the maturity of government debt between 1965 and 1985, the correlation becomes negative between 1985 and 2007 (Figure B.6). Second, prior to 1985, U.S. policymakers' explicit communications are inconsistent with the notion that variations in government debt size drove the drop in Treasury debt maturity and its subsequent recovery. Nevertheless, I address the potential threat to causal identification by showing that all of my results are quantitatively robust to restricting the sample to periods before or after 1985 and to including debt-to-GDP in Z_t.

The duration of government investments. The identification assumption for the causal test of the investment reallocation effect is that the maturity of government debt does not affect long-term corporate investment other than through changes in long-term interest rates. This assumption would be violated if, following policy shocks that constrain long-term government debt issuance, the government reduces the duration of its investments as a way of managing the exposure of its intertemporal budget constraint to fluctuations in interest rates. The government might therefore crowd out long-term private investment by directly competing for investment goods.[21] To address this concern, I compute a measure of government investment duration using data from the BEA government fixed assets table and following a similar approach used to calculate corporate investment duration.[22] A simple visual inspection of the time series variation in Figure B.7 reveals no clear correlation between the duration of government debt and the duration of government investments. I also include this measure in Z_t (Equation 2) and show that this does not affect my baseline findings (Section 4).

[20]For instance, Krishnamurthy and Vissing-Jorgensen (2012), Greenwood and Vayanos (2014), and Badoer and James (2016) instrument government debt maturity with government debt size to GDP with the intuition that a higher debt burden raises rollover risk that can be hedged with longer-term debt issuance. Debt to GDP is arguably a good instrument because it is driven primarily by the accumulation of past deficits rather than by changes in investor demand.

[21]For example, if the government undertakes large-scale public infrastructure projects, it may demand investment goods in the form capital, labor, and materials that would otherwise be available for private sector investments, such as commercial real estate development.

[22]The government investment duration for year t is measured as the average inverse of the depreciation rate across fixed asset classes, weighted by the investment for year t in each respective class.

2.3. Quantitative relevance of the persistent shocks driving realized variation

Although careful examination of historical accounts shows that the 5 plausibly exogenous shocks are qualitatively consistent with the 5 long-term trends in government debt maturity, it is important to assess their quantitative relevance. For this purpose, I compare the realized average maturity of outstanding Treasury debt with those implied by a simple counterfactual issuance pattern (detailed analysis in Section B.1). More precisely, I assume the distribution of new issuances across maturities follows the pre-constraint pattern but the maturity of issuances is capped at the maturity constraint. Specifically, all new issuances that would have been issued at a maturity above the maturity constraint are redistributed to the maturity just below the constraint.[23]

I show that policy constraints explain nearly all the variation in government debt maturity until the constraints are relaxed. Specifically, I show that after each shock, Treasury debt maturity under the constrained counterfactual closely mirrors the realized path.

3. Data and Measurement

3.1. Data

I construct a panel of financial and accounting variables for U.S. non-financial corporations with publicly traded securities at the yearly level using the Compustat Fundamentals database. In addition, to study within-firm effects, I construct a yearly panel at the firm-division level, using segment-level Compustat Segment data.

I exclude financial firms (SIC 6000 to 6999) and public utilities (SIC 4900 to 4999). I also exclude firm-year observations with incorrect ZIP codes, missing state information, missing capital expenditures, missing sales, missing equity value, missing assets, and missing or zero assets. I exclude firms with less than three consecutive years in the sample and drop firms that disappear and reappear in the panel. For the within-firm analysis, I define divisions by aggregating firms' segments' financials at the two-digit SIC level. In addition, I drop firms with divisions active in the financial or utility sectors and focus on firms with at least two divisions in a given year.

I also collect fiscal year-end macroeconomic time series data from the CRSP's daily

[23] In Section B.1, I also demonstrate that the variation in total debt issuance does not mechanically explain the realized path of debt maturity using an alternative counterfactual.

Treasury bond database (for the Treasury bond supply measure), from the U.S. Treasury's website (for interpolated yield curve data for the U.S. Treasury's High Quality Market (HQM)), from the Federal Reserve's website (for interpolated yield curve data for U.S. Treasury bonds, for SOMA holdings, and for flow of funds data on holdings of Treasuries and credit market outstanding amounts), from the FRED database of the Federal Reserve Bank of St. Louis (standard macroeconomic controls), from the Philadelphia Fed's website (for macroeconomic expectations data from the Livingston Survey), from the BEA (for data on aggregate private and government investment), from Lehman/Warga's Corp. database (for secondary bond market data of corporate issuers).

Appendix A presents the definitions and summary statistics of the variables in the sample.

3.2. Measurement of investment duration

The cash flow duration of a firm's average investment is proxied with the inverse of the depreciation rate on a firm's investment stock. In Appendix C, I provide a simple static example to show why the cash-flow duration of a firm's investment should negatively correlate with the depreciation rate of the asset generating those cash flows. Intuitively, faster depreciation reduces the asset's cash-flow lifespan. This intuition aligns with empirical support from the corporate finance literature that measures based on depreciation rates are consistent with predictions from the corporate finance theory on asset durability and lifespan.[24]

I infer depreciation rates from depreciation expenses and net tangible asset stocks from SEC filings available from Compustat annual files.[25] Using a formula inspired by the asset maturity measure of Stohs and Mauer (1996), I proxy the average cash-flow duration of investments of a firm (d_i in Equation 2) with the book value weighted average maturity of assets, which I denote *Asset Maturity*. *Asset Maturity* measures the weighted average maturity of current assets (*CA*) and of net property, plant and equipment (*Net PPE*) and is

[24] Investment duration measures based on firm-reported depreciation correlate with debt maturity (Stohs & Mauer 1996), align with replacement investment rates (Livdan & Nezlobin 2021), and match firm-level debt maturity dynamics and financing cycles (Geelen et al. 2023). Kermani and Ma (2022) show that filing-derived industry-level depreciation rates closely resemble BEA depreciation rates.

[25] Unlike tax filings, where firms may adjust depreciation to optimize tax liabilities, SEC filings offer standardized financial data free from tax incentives, better reflecting the true economic lifespan of assets. Accounting depreciation serves as a reliable proxy for economic depreciation, as firms aim to report it accurately to maintain asset value, investor trust, and compliance with financial reporting standards.

defined as:

$$Asset\ Maturity = \frac{CA}{CA\ + Net\ PPE} \cdot 1 + \frac{Net\ PPE}{CA + Net\ PPE} \cdot \frac{1}{\delta}, \quad \text{where } \delta = \frac{Net\ PPE}{Depreciation}.$$

Fixed assets, or *net PPE*, are assumed to have a maturity equal to *net PPE* divided by depreciation expense net of amortization (*Depreciation*). Under straight-line depreciation, the ratio is equal to the inverse of a firm's depreciation rate on fixed assets.[26] Intuitively, a higher depreciation rate implies a shorter average remaining life for the asset stock, hence a shorter effective lifespan of the asset's cash flows.

Current assets are assumed to have a maturity of one year. Intuitively, it assumes that all current assets are at most used for production in a given fiscal year. My baseline results are quantitatively robust to assuming that current assets have 0-year maturity.

This measure captures both margins of a firm's cash-flow duration. The extensive margin reflects the importance of long-term assets in the firm's investment mix, as longer-duration cash flows are more likely tied to fixed assets than current assets used for production. The intensive margin reflects the duration of long-term assets.

I average the firm-year measure at the firm or industry level, reducing both noise and concerns that the proxy may reflect the firm's life cycle.[27] To illustrate the relevance of the aggregation choice, Figure C.1 reports the time series of *Asset Maturity* averaged at the industry-level (SIC-2digits). The measure is persistent when aggregated at the industry level at a low frequency. Table C.1 decomposes the firm-level variation in *Asset-Maturity*. Fixed effects at industry level explain most of the variation, with 50% explained at the NAICS-3 digit level and 60% at the NAICS-6 digit level. This suggests that *Asset-Maturity* is largely a time-invariant industry characteristic.

Figure C.1 also shows that the aggregated measure at the industry level is well aligned with the intuition about the identity of industries characterized by long-duration investments. Long-duration industries include transportation and mining as opposed to short-duration industries that include trading and business services.

To clarify the sources of within-industry firm-level variation, I regress *Asset-Maturity* on firm characteristics (Table C.1). First, I find that the variation is driven primarily by

[26] In my sample, 79% of firm-year observations are associated with firms reporting the use of straight-line depreciation.

[27] My main results (Section 4) are robust to alternative construction choices, such as backward-looking firm-level averages, averaging over the first five observations for each firm, including amortization within depreciation expenses, focusing on firms that report using straight-line depreciation, assuming that current assets have zero maturity, and using BEA industry-level depreciation rates (Table D.14).

differences in the depreciation rate on fixed assets (the intensive margin), rather than the share of fixed assets (the extensive margin). Second, other firm characteristics do not explain a significant share of the variation. In particular, the source of unexplained variation (about 25%) does not appear to be related with age or the life cycle of firms.Table C.2 decomposes the industry-level and within-industry across-firm variation in *Asset-Maturity* using the sample of firms for which I can decompose investment into different fixed-asset classes. The industry and firm-level variation is economically explained by differences in investment into different asset classes (e.g. more land, buildings and construction, less leases).

Investment cash-flow duration and firm cash-flow duration. The relevant measure of exposure to the duration channel, per the capital budgeting predictions (Proposition 2), is the firm's average investment duration, not the duration of the firm's overall cash flow stream. The latter includes cash flows from new, past, and expected future investments, which may not align with average investment duration. For example, a metal mining firm —generally characterized by long-term investments—may, in steady state, invest annually with cash flows accruing five years later, maintaining a stable cash flow structure. Similarly, business services or consumer goods firms—generally characterized by shorter-term investments—may invest annually with cash flows accruing one year later, also maintaining stable cash flows. While their investment durations differ, their overall cash-flow duration may not. Nonetheless, my results remain qualitatively robust when using firm-wide cash flow duration from Gonçalves (2019) or the price-to-dividend ratio as proxies for investment duration.

4. The investment reallocation effect across firms

In this section, I start by providing causal evidence of the investment reallocation effect across firms for capital expenditures (Section 4.1) and other outcomes (Section 4.2). I show that the across-industries and within-industry across-firms reallocations are equally important (Section 4.3). I show that the across-industries reallocation significantly affects the aggregate duration of corporate investment (Section 4.4). I also show that the investment reallocation effect also applies to intangible investment (Section 4.5). Finally, I detail the robustness of the results (Section 4.6).

4.1. Main result

To test the reallocation of investment across firms (Proposition 2), I compare the investment response to the supply of long-term government debt for firms with different investment duration, proxied with the asset maturity measure averaged at the firm level, *AssetMat*, formally defined in Section 3. I measure firm investment with capital expenditures scaled by lagged firm assets. I proxy the net supply of long-term government bonds with the average maturity of government debt, *TSYMAT*, formally defined in Section 2.

Specifically, for firm f, at fiscal year end t, I run difference-in-difference regressions of the following form:

$$\frac{Capex_{f,t}}{Assets_{f,t-1}} = \beta \cdot TSYMAT_t \cdot AssetMat_f + \delta \cdot TSYMAT_t \cdot X_{f,t} + \theta \cdot Z_t \cdot AssetMat_f + \alpha_f + \gamma_t + \epsilon_{f,t} \tag{4}$$

The vector $X_{f,t}$ includes firm-level controls for investment opportunities and financial constraints: sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and firm size. α_f and γ_t are the firm and year fixed effects. Z_t includes macroeconomic controls to address potential spurious correlations between government debt maturity and economic factors that could influence relatively more long-term corporate investment. Specifically, Z_t includes for the level of interest rates with 1-year Treasury yields, real GDP growth, and year-on-year CPI inflation (measured in levels and using the median one-year-ahead forecast from the Livingston survey), the unemployment rate, credit spreads with the Moody's Seasoned Baa-Aaa Corporate Bond Spread, and a linear trend.[28,29] Standard errors are double clustered at firm and time-levels. The coefficient of interest, β, measures the effect on the investment rate of an increase in the supply of long-term government debt for companies with long-duration investment relative to firms with short-duration investment.

Table 1 presents the estimates of the across-firm investment reallocation effect. Column (1) includes the interaction and base terms as well as firm fixed effects. A higher supply of long-term government bonds is associated with a decrease in investment for long-duration firms. Comparing firms at the 75th percentile of the *Asset Maturity*

[28] The linear trend may account for the growth of the services sector and the decline in manufacturing and industrial production that could explain the negative trend in the duration of investment.

[29] A visual inspection (see Figure B.5) indicates that there is no robust time series correlation between government debt maturity and these macroeconomic variables. Table D.7 shows the baseline results are robust to including the measures of macroeconomic conditions one by one.

distribution relative to firms at the 25th percentile of the distribution—with a 3.1-year interquartile range of *Asset Maturity*, I find that a 1-year increase in the maturity of government debt (1.1 sd) is associated with a $0.136 \times 3.1 = 0.4$ pp drop in the relative investment rate of firms with long-duration investments.

TABLE 1: The investment reallocation effect: across firms

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures expressed in percentage points of lagged total assets. The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). AssetMat is de-meaned to interpret the coefficient on TSYMAT in column (1) as the average effect. The macroeconomic controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures			
	(1)	(2)	(3)	(4)
TSYMAT	-0.727***			
	(0.134)			
TSYMAT × AssetMat	-0.135***	-0.121***	-0.136***	-0.154***
	(0.027)	(0.023)	(0.022)	(0.025)
Firm FE	✓	✓	✓	✓
Time FE	–	✓	✓	✓
Firm Controls x TSYMAT	–	–	✓	✓
AssetMat x Macro Controls	–	–	–	✓
Observations	120275	120275	120275	120275
Adjusted R^2	0.386	0.437	0.470	0.471

I show that this result is economically large. In Table 1, I replace the continuous measure of investment duration with a dummy which equals one for firms with *Asset Maturity* above the (assets-weighted) median across firms. A 1-year increase in the average maturity of Treasury debt is associated with a 0.8 pp drop in the investment rate of firms with a duration of investment greater than the median. Given the average investment rate in the sample (8.3 pp of lagged assets), this implies a yearly reallocation of about $1/2 \times 0.8/8.35 = 4.5\%$ of total public firm investment from long- to short-duration firms.

Columns (2)-(4) of Table 1 gradually include fixed effects and interacted controls. Column (2) adds time fixed effects to control for the composition of industries and firms across time; column (3) includes the interaction of proxies for firm-level investment opportunities and allows controlling for the cross-sectional response to long-term bond supply along other firm-level dimensions; and column (4) includes the interaction of the duration measure with business cycle proxies. The baseline results are robust across all specifications both in terms of statistical significance and magnitude.

In Table D.5, I show that the coefficients estimated on the sample periods of relaxation—increases in long-term bond supply—are somewhat larger than those periods estimated on the sample periods of constraints—decreases in long-term bond supply.[30] This is consistent with the theoretical results in Jiang and Sun (2024) that suggest that a positive long-term bond supply shock is not simply the symmetric of a negative long-term bond supply shock, as positive shocks lead to greater changes in risk premia due to heterogeneity in investor composition.

Event studies. To ensure that the observed outcomes are not attributable to any single period, I employ an event study methodology. I estimate the baseline specification, replacing the time series for the average maturity of Treasury debt with year dummies. More formally, I estimate the following regression equation:

$$\frac{Capex_{f,t}}{Assets_{f,t-1}} = \sum_{\tau} \beta^{(\tau)} \cdot \mathbb{1}_{t=\tau} \cdot AssetMat_f + \sum_{\tau} \delta^{(\tau)} \cdot \mathbb{1}_{t=\tau} \cdot X_{f,t} + \theta \cdot Z_t \cdot AssetMat_f + \gamma_t + \epsilon_{f,t} \tag{5}$$

defined for each firm f, at fiscal year end t. The vector $X_{f,t}$ includes the same controls at the firm level as Equation 4 for investment opportunities, and the vector Z_t includes a linear trend. γ_t represents the year-t fixed effect. Standard errors are clustered at the firm level. Rather than including firm fixed effects, I de-mean the dependent variable at the firm level to obtain the $\beta^{(t)}$ for each year. The coefficients of interest, $\beta^{(t)}$, measure the year-specific differences in investment rate for firms with long-duration of investment relative to firms with short-duration of investment.

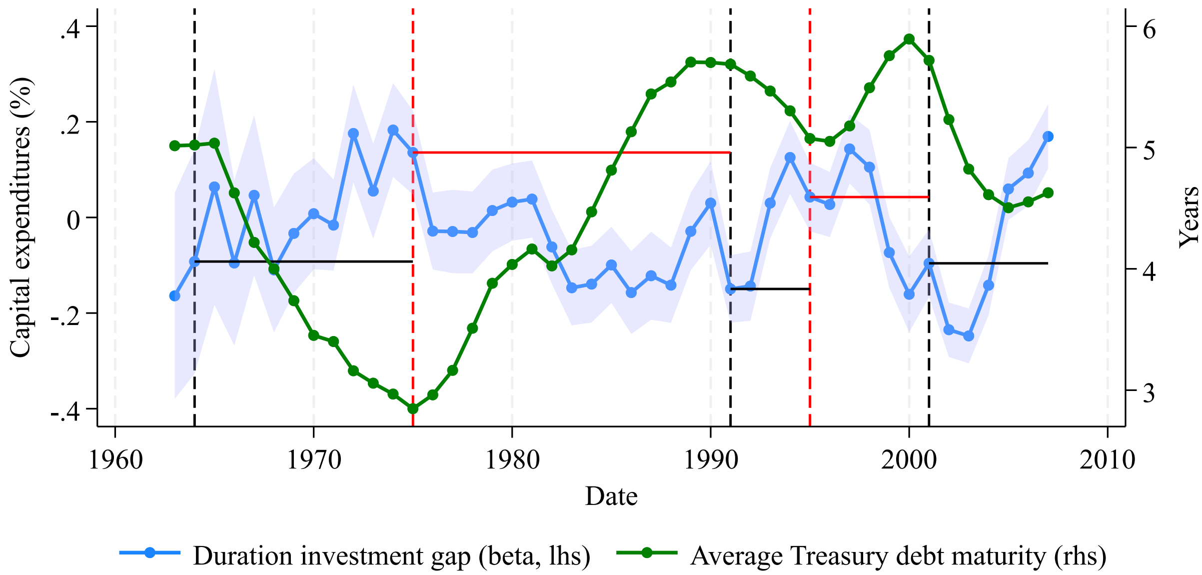
Figure 3 plots the time series of $\beta^{(t)}$ along with the corresponding confidence intervals 95% and the yearly series of government debt maturity. For each policy shock, I include a vertical dotted line marking the last year in which new government issuances were unaffected by the shock—using black lines for shocks that constrained long-term bond issuance and red lines for shocks that relaxed these constraints. For each period following a policy shock, I plot a horizontal line at the level of the coefficient estimated for the last year where new issuances were unaffected, to provide a clear reference point for how (relative) capital expenditures shifted after the shock.

The findings consistently show that all five government debt maturity trends (driven by the 5 policy shocks) are negatively correlated with corresponding trends in (relative) investment by long-duration firms, reinforcing the robustness of the investment

[30] I also show that the baseline result is robust in magnitude and significance when splitting the sample in two halves (1965-1985 and 1986-2007).

FIGURE 3: The investment reallocation effect: event studies

The figure presents the yearly average maturity of Treasury debt (in green, with values on the right y-axis) and the reduced-form estimates $\beta^{(t)}$ (in blue, with values on the left y-axis) based on Equation 5. The dependent variable is capital expenditures expressed in percentage points of lagged total assets and de-meaned by firm. The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). I control for the interaction between a linear trend and AssetMat. I control for the interaction between the same firm-level controls for investment opportunities as Equation 4 and year dummies. Details for variable definition in Appendix A. Confidence intervals in shaded blue are based on standard errors clustered by firm. The vertical black dashed lines indicate the first year before policy shocks that constrain long-term government debt issuance start binding. The vertical red dashed lines indicate the first year before policy shocks that relaxed constraints on long-term government debt issuance occur. The policy shocks are detailed in the body of the text and in Appendix B. For each period following a policy shock, the horizontal line is fixed at the level of the coefficient estimated for the last year before the policy shock.



reallocation effect.

4.2. Other outcomes

I show that long-duration firms also experience a statistically significant drop in R&D expenses and a statistically insignificant drop in acquisitions (Table D.3). The drop in capital expenditures is 3 times larger than the drop in R&D expenses.

I also show that firms experience a significantly lower employment growth. A 1-year increase in government debt maturity is associated with a 0.4 pp drop in employment growth of firms with long-duration investments relative to firms with short-duration investments (firms in the 75th percentile of the *Asset Maturity* distribution relative to firms at the 25th percentile of the distribution in Table D.3).

Finally, I break down the drop in investment associated with more long-term bond supply into investment rates in major categories of property, plant, and equipment: Buildings, Land and Improvement, Construction in Progress, and Machinery and Equipment using the variation in the stock of these assets valued at historical cost (Table D.4). The drop in capital expenditures is explained by a decrease in investment in machinery and equipment and a decrease in investment in real estate, where the latter is 50% of the decrease in investment in machinery and equipment. [31]

4.3. Decomposing the reallocation across industries and within industry across firms

As investment duration is primarily an industry-time-invariant feature (see Section 3), the across-firm reallocation could be, at least partly, driven by reallocations between different industries, with strong implications for industrial policy.

I decompose the across-firm reallocation into across-industries and within-industry across-firm components. Specifically, I compare the baseline specification that uses the firm-level measure of investment duration (Table 1), with alternative ones that either use the industry-level measure or within-industry across-firm variation in the firm-level measure by including industry-time fixed effects.

Table 2 shows that the elasticities are quantitatively similar within and across industries. Table D.16 shows that the results across industries are also quantitatively robust to collapsing the data at the industry level. Using the event study methodology (Equation 5), I show that the five trends in government debt maturity are negatively correlated with the corresponding trends in (relative) investment by firms in long-duration industries (Figure D.1) and by firms with long-duration within-industry

[31] This data is available in the second part of my sample: 1985-2007.

TABLE 2: The investment reallocation effect: across and within industries

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures expressed in percentage points of lagged total assets. The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the asset maturity (AssetMat, in years) averaged at either firm-level or the industry-level. Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). AssetMat is de-meaned to interpret the coefficient on TSYMAT in column (1) as the average effect. The macroeconomic controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firms or alternatively time and industries for specifications using industry-level measures.

	Capital Expenditures				
	(1)	(2)	(3)	(4)	(5)
TSYMAT × AssetMat (firm)	-0.136***		-0.121***		-0.100**
	(0.022)		(0.033)		(0.049)
TSYMAT × AssetMat (NAICS3)		-0.127***			
		(0.042)			
TSYMAT × AssetMat (NAICS6)				-0.122***	
				(0.034)	
Firm Controls x TSYMAT	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓
Time FE	✓	✓	–	✓	–
NAICS3 x Time FE	–	–	✓	–	–
NAICS6 x Time FE	–	–	–	–	✓
Observations	120275	120275	113037	120275	82372
Adjusted R^2	0.470	0.469	0.502	0.470	0.524

(Figure D.2). This suggests that the reallocation effect takes place across and within industries.[32]

4.4. Reallocation across industries and aggregate duration of investment

To gauge the economic importance of the investment reallocation effect, I study whether the across-industries reallocation significantly affects the aggregate duration of corporate investment.

First, I construct a time series of the aggregate investment duration for public firms in the Compustat dataset. The aggregate investment duration is defined as the average BEA industry-level investment duration, weighted by the capital expenditures of each industry. I also construct a similar measure using aggregate industry-level investment data from the BEA. The BEA series has two advantages that are key to quantifying the investment reallocation effect. First, it aggregates investment by public and private firms. Second, it also includes investments in intellectual property.

[32] Consistent with most of the firm-level variation being across industries, a 1-year increase in government debt maturity is associated with a 0.3% drop in investment rate for firms in long-duration industries (75th relative to 25th percentile across NAICS-3 digits industries) and a 0.2% drop in investment rate for long-duration firms within industries (75th relative to 25th percentile across firms within NAICS-3 digits industries).

Table 3 shows in a time series regression that a higher maturity of Treasury debt is associated with a lower maturity of investments for both the representative public firm and the representative firm in the economy. Figure D.3 confirms the strong correlation.

TABLE 3: The investment reallocation effect: aggregate investment duration

The table presents the time series regression estimates of the measure of the aggregate duration of investment (measured as the average industry-level asset maturity weighted by total capital expenditures of each industry) on the average maturity of Treasury debt and other macroeconomic time series. Columns (1) to (4) use the industry-level asset maturity computed from from the Compustat sample and use investment weights at the BEA-industry level from resp. Compustat and BEA fixed-assets tables. Columns (5) and (6) use investment weights at the BEA-industry level from Compustat and the measure of duration from BEA fixed-assets table: the inverse of the industry-level depreciation rate. Details for variable definition in Appendix A. Standard errors reported in parentheses are Newey and West (1987) standard errors allowing for 2 years of lags.

	Duration (Compustat)		Duration (BEA)		Duration (BEA dep.)	
	(1)	(2)	(3)	(4)	(5)	(6)
TSYMAT	-0.12***	-0.11***	-0.10***	-0.08***	-0.15***	-0.13***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Linear trend	-0.00	-0.00	-0.01***	-0.01**	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Macro Controls	–	✓	–	✓	–	✓
Observations	43	43	43	43	43	43
R-squared	0.57	0.68	0.68	0.88	0.59	0.68

This correlation is robust to controlling for measures of macroeconomic conditions. A 1-year increase in government debt maturity is associated with a 0.1-year decline in aggregate investment duration measured with BEA data. This result is large compared to time series variation: its unconditional standard deviation in the sample is 0.2-year, and the standard deviation in the linearly de-trended series is 0.14-year. The results are robust to computing the aggregate duration of investment using BEA industry-level depreciation rates to compute the average industry-level investment duration, as shown in columns (5) and (6).

4.5. Intangible investment reallocation effect

Depreciation-based measures of tangible investment duration may fail to capture intangible investment duration if the two are uncorrelated across firms or industries. Given that I compare the investment of firms that differ along a measure of tangible investment duration, my results confirm an investment reallocation from firms with long-duration tangible investment towards firms with short-duration tangible investment. I show that the reallocation effect also applies to intangible investments that are key in modern economies.[33]

To do so, I use an alternative investment duration measure that captures both

[33] See e.g. Eisfeldt and Papanikolaou (2013), Crouzet and Eberly (2021).

tangible and intangible investments: the business plan horizon disclosed in firms' regulatory filings, as measured by (Dessaint et al. 2023). The authors analyze 13,908 SEC filings from 3,925 firms (1994-2015) by searching terms like "year business plan" or "year strategic plan," and manually recording the horizon when explicitly mentioned (e.g., "3-year"). They find that this measure is highly persistent over time within firms and strongly correlated within industries, aligning with the characteristics of my baseline measure.[34]

I use the variation in the horizon of business plans and the part of this variation that is orthogonal to my baseline proxy based on depreciation rates as alternative measures in the tests of the investment reallocation effect with a specific focus on the context of intangible investments.[35,36]

TABLE 4: The investment reallocation effect: horizon of business plans and R&D

The table presents the reduced-form estimates based on Equation 4 where the dependent variable are respectively capital expenditures (pp of lagged assets) and R&D expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measures are respectively the firm-level average asset maturity (AssetMat, years), the business plan horizon from Dessaint et al. (2023) (BusPlanHorizon, years), and the residual from the regression of BusPlanHorizon on AssetMat (BusPlanHorizon (Res.)) Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures			R&D Expense		
	(1)	(2)	(3)	(4)	(5)	(6)
TSYMAT × AssetMat	-0.154***			-0.047***		
	(0.025)			(0.011)		
TSYMAT × BusPlanHorizon		-0.251**			-0.129***	
		(0.124)			(0.045)	
TSYMAT × BusPlanHorizon (Res.)			-0.170			-0.106**
			(0.122)			(0.045)
Time FE	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Firm Controls x TSYMAT	✓	✓	✓	✓	✓	✓
Horizon x Macro Controls	✓	✓	✓	✓	✓	✓
Observations	120275	120275	120275	120275	120275	120275
Adjusted R^2	0.471	0.469	0.469	0.844	0.843	0.843

Table 4 shows that, consistent with the fact that the measure captures well the cash-flow duration of all types of investments, I find a larger ratio of R&D response to capital expenditures response in columns (2) and (5) relative to the ratio obtained when using

[34]For more details, see Dessaint et al. 2023.

[35]The correlation between my measure of investment duration at the SIC-2 digits level and the measure derived from business plans at the SIC-2 digits level is 0.3.

[36]While my main results remain qualitatively similar with this measure, I prefer the depreciation-based proxy for easier interpretation and its richer variation. The business plan horizon shows limited cross-sectional variation, with around 80% of observations clustered at 3 or 5 years.

the measure of the duration of tangible investments in columns (1) and (4).

This result is robust to using the variation in the business plan horizon measure that is uncorrelated with the asset maturity measure—and is therefore more likely to capture the horizons of investment in intangible capital (columns (3) and (6)). This confirms an investment reallocation from firms with long-duration intangible investment towards firms with short-duration intangible investment.

4.6. Robustness

In Appendix D, I confirm the robustness of the results using alternative empirical specifications and samples.

I use local projections to estimate the dynamic effects of policy shocks on government debt maturity and the relative investment of long-duration firms (Appendix D). This method allows me (i) to trace how capital expenditures by long-duration firms evolve over time after a shock and (ii) to control for the effect of economic conditions at the time of the shock. The results show that sign-adjusted relaxations of constraints on long-term debt issuance predict a positive trend in government debt maturity, peaking at five years, and a negative trend in the relative investment of long-duration firms, peaking at seven years. Most importantly, my results are robust to controlling for the systematic predictive power of macroeconomic conditions at the time of the shock for relative investment at future horizons.

In Table D.5, I also find that the coefficients estimated during the sample periods of constraints are robust to instrumenting variation in the average maturity of government debt with the time series of the difference in government debt maturity between the constrained and unconstrained counterfactuals described in Section 2.3 and detailed in Appendix B.

In Table D.6, I demonstrate that the results are robust to alternative definitions of long-term bond supply—the weighted-average maturity excluding TIPS, the weighted-average duration of Treasury debt payments (coupons and principal), maturity-weighted debt-to-GDP, maturity-weighted debt-to-GDP excluding Federal Reserve's holdings. I also show that the results are robust to horse race regressions that include the interaction term between investment duration and debt-to-GDP.

In Table D.8, I show that the main results are robust to controlling for demand and supply shocks to long-term debt other than the supply of long-term Treasury debt. Such proxies include the supply of Government-Sponsored Enterprise(GSE)-issued or GSE-backed MBS debt, Fed holdings of Treasuries, and foreign holdings of Treasuries- all normalized by GDP. I also show the main results are robust to controlling for government investment duration. Finally, I show that the results are robust when controlling for the median analyst expectations of real output growth and inflation in the sub-samples where expectations data from the Livingston Survey are available.

I measure the distribution of corporate investment pro-cyclicality and show, in Table D.9, that my results are robust to controlling for quintiles of industry-level pro-cyclicality $\times$ time fixed effects.[37]

Finally, I show that my baseline results are robust to measurement choices. In Table D.13, the results are qualitatively unchanged when using separate measures identifying the intensive and extensive margins of the investment duration. In Table D.14, the results are quantitatively robust to alternative definitions for *AssetMat*, including constructing firm-level averages in a backward-looking way and using industry-level BEA depreciation rates. In Table D.15, the results are qualitatively robust when using the firm-wide cash flow duration measure from Goncalves (2021) or the price-to-dividend ratio as proxies for the duration of the investment. Moreover, I show in Table D.12 that the results are not explained by the irreversibility of investments proxied with capital re-deployability (Kim & Kung 2017) or other measures of asset specificity and recovery rates (Kermani & Ma 2022).

5. The investment reallocation effect within firm

In this section, I test and quantify the *within-firm* investment reallocation effect (Proposition 2) in my panel of multi-divisional U.S. public firms. I study within-firm across-division differences in investment responses to long-term government debt supply that correlate with variation in average investment duration across divisions. This within-firm test serves two purposes: First, it controls for firm-time fixed effects, eliminating the concern that investment duration might act as a proxy for firm-wide financial constraints. Second, it also broadens the scope of investment reallocation by showing it may occur within firms as well.

Formally, I estimate equations for the investment rate (measured with division-level

[37] I measure the distribution of cyclicality across NAICS-3 digits industries as the distribution of the point estimates specific to each industry in the OLS regressions of firm-level capital expenditures (scaled by lagged assets) on real GDP growth.

capital expenditures scaled by lagged division total assets) of division d, of firm f, with division-level industry $s(d)$, measured at fiscal year-end t:

$$\frac{Capex_{f,d,s,t}}{Assets_{f,d,s,t-1}} = \beta \cdot TSYMAT_t \cdot AssetMaturity_{s(d)} + \alpha_{f,t} + \gamma_{f,d} + \delta \cdot TSYMAT_t \cdot X_{f,d,t} + \epsilon_{f,d,s,t} \tag{6}$$

The vector $X_{f,d,t}$ includes a division-level measure of the profitability of divisions to control for investment opportunities. Standard errors are double-clustered at firm-division and time-levels. The division-level investment duration measure ($AssetMaturity_{s(d)}$) is calculated as the average firm-level investment duration in the firm-year panel for the industry to which the division belongs. The coefficient of interest β measures the effect on the division-level investment rate of a higher supply of long-term government debt for divisions with a long investment duration relative to divisions with a short investment duration.

The main identification assumption is that the variation in the maturity of outstanding Treasury debt should not reflect otherwise better or worse investment opportunities for divisions belonging to industries with long-duration investments after controlling for the average investment rate across divisions for a firm.

Table 5 presents the estimates from the panel regressions identifying a within-firm investment reallocation effect, gradually adding fixed effects. Column (1) includes the interaction between Treasury debt maturity and firm-level average maturity (defined as the firm-level investment-weighted average over firm segments) and base terms as well as firm-division and time fixed effects. Column (2) instead includes the interaction between Treasury debt maturity and division-level average maturity. Column (3) adds firm-time fixed effects to control for the average investment rate of a firm at each point in time. Column (4) includes the interaction between Treasury debt maturity and division-level profitability.

A higher supply of long-term government bonds is associated with a decrease in investment in divisions specialized in long-duration investments. The results are robust to different fixed effects and the inclusion of the division-level measure of profitability in column (4). A 1-year higher average maturity of Treasury debt is associated with a 0.6 pp drop in the investment rate of divisions with long-duration investments relative to divisions with short-duration investments (divisions at the 75th percentile of the *Asset Maturity* distribution relative to divisions at the 25th percentile of the distribution). The division-level estimates are somewhat larger than the firm-level estimates for the

Table 5: The investment reallocation effect: within firm

The table presents the reduced-form estimates based on Equation 6 where the dependent variable is the division-level capital expenditures expressed in percentage points of lagged total division assets. The sample is the yearly panel of Compustat Segment firm-divisions for 1976-2007. The investment duration measure is the firm-level or division-level asset maturity (AssetMat, in years). Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The macroeconomic controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm-division.

	Capital Expenditures			
	(1)	(2)	(3)	(4)
TSYMAT × AssetMat (firm)	-0.211***			
	(0.0667)			
TSYMAT × AssetMat (division)		-0.264***	-0.247***	-0.252***
		(0.0719)	(0.0624)	(0.0626)
TSYMAT × Profitability				0.966**
				(0.459)
Time FE	✓	✓	–	–
Firm x Division FE	✓	✓	✓	✓
Firm x Time FE	–	–	✓	✓
Observations	48515	48515	48307	48307
Adjusted R^2	0.420	0.419	0.433	0.434

average public firm over 1965-2007 in Section 4. However, they are in the same range as the firm-level estimates in the same sample of multi-divisional firms (column (1)).

By controlling for time-varying firm-level investment rates through the inclusion of firm×time fixed effects, the within-firm results eliminate the possibility that my baseline reallocation effects across firms merely reflect heterogeneous responses to aggregate shocks. This addresses the concern that investment duration might act as a proxy for financial constraints in the firm.[38] The stability of the coefficients confirms the relevance of the overall investment reallocation effect.

6. Mechanism: long-term discount rates

So far, I have shown that the supply of long-term government bonds causally affects the duration of investment. In this section, I provide evidence for the underlying mechanism behind this result: the duration channel. Consistent with Proposition 1, I show that the supply of long-term government bonds is positively associated with the

[38] An implicit assumption is that of efficient internal capital markets. This also rules out the possibility that my across-firm results are driven by a "collateral channel" (Chaney, Sraer, & Thesmar 2012), i.e. the idea that changes in interest rates driven by long-term bond supply may translate into changes in real estate prices, which, in turn, may affect differentially long-duration firms. In Table D.11, I also rule this drives my across-firms result by controlling for the cross-sectional correlation between investment and real estate prices at the state- and MSA-level.

slope of the term structure of government and corporate bonds (Section 6.1). I show that the findings align with the conceptual framework described in Section 1, showing that the investment reallocation effect of the duration channel operates independently of ex ante capital structures and financing choices of firms (Section 6.2). Finally, in Section 6.3, consistent with the duration channel that affects investment through the cost of capital, I compute the upper and lower bounds for the elasticities of investment to the cost of capital.

6.1. Aggregate pricing of long-term cash flows

To test Proposition 1, I run monthly time series regressions of the slope of the term structure on the average maturity of Treasury debt. I include macroeconomic controls which are known to have explanatory power for the term spread. Since yields can depend on persistent factors beyond long-term bond supply and macroeconomic controls (e.g., expected future short rates), the regression residuals are serially correlated, requiring adjustments to the t-statistics. I report Newey and West (1987) standard errors allowing for 36 months of lags. Allowing for more lags does not affect the results.

I compute term spreads on Treasuries using data from interpolated yield curves available on Fed's website. I compute term spreads on corporates from two sources. I use interpolated yield data from the U.S. Treasury's High Quality Market (HQM) Corporate Bond Yield Curve database, which is available from 1985. I also use maturity averages at the monthly level for the secondary market prices from the Lehman/Warga's Corp. bond panel, which is available for 1973-1997. The latter source allows me to look at the transmission to the term structure for lower quality corporate bonds.[39]

Table 6 presents the estimates for different measures of the slope of the term structure on Treasury and corporate bonds. Column (1) presents the results for the 10-year to 1-year term spread on Treasuries on the full sample. Column (2) adds macroeconomic controls that include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, and real GDP growth. Column (3) presents the results for the 10-year to 1-year term premium on Treasuries obtained from Adrian, Crump, and Moench (2013). Column (4) presents the results for the 10-year to 1-year term spread on corporates using HQM corporate data for the sample where the data is available. Column (5) presents the

[39]The HQM data is available on the U.S. Treasury's website. For the Lehman/Warga panel, I follow the cleaning procedures in Gilchrist and Zakrajšek (2012).

results for the 10-year to 1-year term spread on corporates with rating equal to Aaa using Lehman/Warga corporate data for the sample where the data are available. Column (6) presents the results for the 10-year to 1-year term spread on corporates with rating equal to Baa using Lehman/Warga corporate data.

TABLE 6: Average maturity of U.S. Treasury debt and measures of the term spread

The table presents the estimates from time series regressions of different yield spread measures (column heads) for government and corporate bonds. All yield spread measures are computed as the ten-year yield minus the one-year yield. Column (3) is the 10-year term premium measure from Adrian et al. (2013). The sample is monthly for 1965-2007 for Treasuries, monthly for 1985-2007 for HQM Corporates data on corporate bond yield curve, and monthly for 1973-1997 for Lehman/Warga data on corporate bond yield curve. The issuer rating composition is indicated in the bottom row. Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, and real GDP growth. Details for variable definition in Appendix A. Standard errors reported in parentheses are Newey and West (1987) standard errors allowing for 36 months of lags.

	$y10 - y1$ (Treasuries)		$tp10$ (Treasuries)	$y10 - y1$ (Corp)		
	(1)	(2)	(3)	(4)	(5)	(6)
TSYMAT	0.34*	0.28**	0.50***	0.64**	0.44***	0.22***
	(0.19)	(0.11)	(0.10)	(0.26)	(0.08)	(0.03)
Macro Controls	–	✓	✓	✓	✓	✓
Observations	516	516	516	276	300	300
Sample Start	65-07	65-07	65-07	85-07	73-97	73-97
Data				HQM Corp	Lehman/Warga	Lehman/Warga
Rating				>= A-	Aaa	Baa
R-squared	0.07	0.80	0.78	0.80	0.86	0.81

An increase in the maturity of Treasury debt is associated with an increase in the slope of the term structure on Treasuries, consistent with Proposition 2. A lengthening of the maturity of the stock of Treasury debt by 1 year is associated with a 0.3 pp increase in the spread between 10-year Treasury yields and 1-year Treasury yields. The increase in the slope of the term structure is driven by an increase in the term premium rather than an increase in future expected short rates.[40] This is consistent with an increase in the maturity of Treasury debt lowering the price of long-term cash flows provided by the U.S. Treasury.

An increase in the maturity of Treasury debt also lowers the price of long-term cash flows provided by firms. In columns (4)-(6) of Table 6, I show the relation transmits to the term structure for high quality corporate bonds, Aaa-issuers, and Baa-rated issuers.

Consistent with long-term cash flows being more exposed to duration risk, in

[40] My estimates closely match those of Greenwood and Vayanos (2014) for the 1971-2007 sample (0.29 vs. 0.28 in my sample), but are smaller than some of the estimated price impact of the Federal Reserve's QE programs. For example, Krishnamurthy and Vissing-Jorgensen (2011) find LSAP1 caused a 100 bp drop in the 10-year yield. The Fed reduced maturity-weighted debt by 72 pp of GDP during LSAP1 (Appendix I). Hence, my estimates would imply a $0.72 \times 0.28 = 20$ bp yield change. The increased risk aversion during the period preceding QE and the signaling channel of QE for future short rates likely explain this difference.

Table E.2 the effect increases with maturity. I also test additional predictions from the bond supply literature to confirm the robustness of my results. Columns (1)-(2) of Table E.4 show that the slope of the credit spread term structure decreases when the maturity of Treasury debt is high. This means that after an increase in Treasury debt maturity, the rise in discount rates is greater for Aaa-rated issuers than for Baa-rated ones, consistent with Ray et al. (2024)'s predictions and empirical findings using high-frequency shocks. Columns (3)-(4) show that the slope of convenience spreads also decreases with higher maturity of Treasury debt. In other words, following a rise in Treasury debt maturity, the increase in discount rates is larger for Treasury bonds compared to Aaa-rated bonds. This supports Krishnamurthy and Vissing-Jorgensen (2012), showing that the relative convenience of long-term Treasuries decreases with their supply.

Overall, these results confirm that a higher supply of long-term debt increases long-term discount rates, or equivalently, lower the prices of long-term cash flows. The price effect is in line with other studies and is large for both cash flows offered by the government and corporate sector.[41]

These estimates allow me to compare the semi-elasticities of investment from the across-firm reallocation obtained using instrumented variation in the term spread with those obtained using endogenous variation in the term spread. The 2SLS regression in Table E.5 indicates that using variation in the maturity of government debt, a 1pp increase in the term spread is associated with a 0.9 pp drop in the investment rate of firms with long-duration investments relative to firms with short-duration investments (firms at the 75th percentile of the *Asset Maturity* distribution relative to firms at the 25th percentile of the distribution). This compares to a 0.3 pp drop in the investment rate of firms with long-duration investments obtained from endogenous least squares regressions. This is consistent with the reverse causality concern that motivates my identification strategy: better long-duration investment opportunities are likely to cause a supply shock to long-term debt. This would create a positive correlation between long-term investment and long-term rates.

[41] In Table E.3, I show robustness to using alternative measures of long-term bond supply. Consistent with the investment reallocation regressions, I also show the explanatory power of debt-to-GDP—stemming from the positive correlation between debt-to-GDP and debt maturity in the first half of the sample—becomes statistically insignificant in horserace regressions including the average maturity of Treasury debt in the second half of the sample.

6.2. Capital structure

The conceptual framework outlined in Section 1 suggests that the investment reallocation effect of the duration channel is driven by changes in long-term discount rates. Long-term discount rates should reprice all long-duration cash flows independently of firms' ex-ante capital structures and financing choices. This is precisely what I test in this section.

Breakdown the response of firms' assets and liabilities. To understand the financing side of this across-firm reallocation effect, I first decompose the (relative) change in the balance sheets of long-duration firms. Columns (1)-(5) of Table 7 decompose total net assets growth into five components: the change in net PPE, the change in other long-term assets (including acquisitions, for instance), the change in cash and cash equivalents, the change in receivables, and the change in inventories. Columns (6)-(7) decompose total liabilities growth into two components: the change in debt and the change in other liabilities. Column (8) shows the change in book equity. All changes are scaled by lagged assets.

TABLE 7: The investment reallocation effect: decomposing balance sheet changes

The table presents the reduced-form estimates based on Equation 4 where the dependent variables are respectively the change in net PPE (pp of lagged assets), the change in other long-term assets (pp of lagged assets), the change in cash (pp of lagged assets), the change in receivables (pp of lagged assets), the change in inventories (pp of lagged assets), the change in debt (pp of lagged assets), the change in other liabilities (pp of lagged assets), and the change in book equity (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AMat, in years). Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Long-Term Assets		Current Assets			Book Liabilities		Book Equity
	(1) PPE	(2) Other LT	(3) Cash	(4) Receiv.	(5) Invent.	(6) Debt	(7) Other	(8) Equity
TSYMAT × AMat	-0.17***	-0.07***	-0.02	0.04**	0.07***	-0.12***	-0.01	-0.06
	(0.02)	(0.01)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.05)
Controls x TSYMAT	✓	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓	✓	✓
Observations	120035	120035	120035	120035	120035	120035	120035	120035
Adjusted R^2	0.269	0.148	0.079	0.241	0.218	0.097	0.154	0.251

Consistent with the main result for capital expenditures, long-duration firms experience a decrease in net PPE following an increase in government debt maturity. Long-duration firms also experience a decrease in the stock of long-term investments.

About one third of the total decrease in long-term investments is compensated for with an increase in receivables and inventories. This is consistent with a reallocation from long-term investment to short-investment in production within firm. The other two thirds of the total decrease in long-term investments is associated with a decrease in debt and equity, with a more significant effect on debt.

This may be consistent with the idea that shocks to long-term bond supply affect firms only if they get financing from debt markets. However, I show in Table 8 that the book leverage of long-duration firms (measured with debt to total assets or debt to equity) does not significantly correlate with long-term bond supply, which can be reconciled with the fact that long-duration firms have a higher leverage and their relative net debt issuance is therefore more sensitive to changes in investment (30pp of assets on average for firms with above median duration versus 20pp of assets on average for firms with below median duration).

TABLE 8: The investment reallocation effect: changes in capital structure

The table presents the reduced-form estimates based on Equation 4 where the dependent variables are respectively capital expenditures (pp of lagged assets), book leverage (pp of assets), book debt to book equity (pp of book equity). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capex	Book Leverage		Debt-to-Equity	
	(1)	(2)	(3)	(4)	(5)
TSYMAT × AssetMat	-0.136***	0.022	0.019	0.133	-0.112
	(0.022)	(0.059)	(0.061)	(0.242)	(0.250)
Controls x TSYMAT	✓	–	✓	–	✓
Firm FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓
Observations	120168	120168	120168	119742	119742
Adjusted R^2	0.471	0.550	0.570	0.450	0.471

Heterogeneity by capital structure. I show that the investment reallocation effect of the duration channel operates independently of firms' ex-ante leverage and cash holdings. This is consistent with the conceptual framework outlined in Section 1 which highlights that the only relevant source of heterogeneity is the firm's investment duration.

First, I show that long-duration firms with greater reliance on debt financing, measured by above median book leverage, do not exhibit statistically greater responsiveness to long-term bond supply than other long-duration firms (column (1) of Table 9).

Second, I show that long-duration firms with higher cash holdings (above median cash and cash equivalents to assets) or higher liquidity ratios (above median cash and cash equivalents to current liabilities) do not exhibit greater responsiveness to long-term bond supply than other long-duration firms (columns (2) and (3) Table 9).

TABLE 9: The investment reallocation effect: heterogeneity by capital structure

The table presents the reduced-form estimates based on Equation 4 where the dependent variable s capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. The split dummies are respectively a dummy equal to 1 if the firm has above median book leverage, a dummy equal to 1 if the firm has above median ratio of cash and cash equivalents to assets, a dummy equal to 1 if the firm has above median ratio of cash and cash equivalents to current liabilities. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables and lower-level interactions are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures		
	(1)	(2)	(3)
TSYMAT × AssetMat	-0.11***	-0.12***	-0.11***
	(0.03)	(0.03)	(0.02)
TSYMAT × AssetMat × High Leverage	-0.02		
	(0.03)		
TSYMAT × AssetMat × High Cash		-0.01	
		(0.03)	
TSYMAT × AssetMat × High LiqRatio			-0.03
			(0.03)
Firm FE	✓	✓	✓
Time x Split Dummy FE	✓	✓	✓
Controls x TSYMAT	✓	✓	✓
Controls x TSYMAT x Split Dummy	✓	✓	✓
Observations	120271	120272	120273
Adjusted R^2	0.473	0.473	0.474

Third, I show that long-duration firms with heavier reliance on long-term debt financing, measured with the share of long-term debt maturing in more than 5 years, are not statistically more responsive to long-term bond supply than their counterparts. (column (4) Table 10).

Fourth, I show that firms with a higher unconditional reliance on long-term debt financing decrease investment after an increase in long-term bond supply (column (2) in Table 10) *only* because they have longer-duration investments (column (3) in Table 10).

Table 9 and Table 10 rule out a "gap filling channel" (see Greenwood et al. 2010), that is, the idea proposed by Foley-Fisher et al. (2016) that, following a drop in long-term government bond supply, firms with a preference for long-term debt and sufficient financial flexibility fill the "gap" in longer-dated maturities. The increased availability of external funds, in turn, relaxes financial constraints more for these firms, and would predict an increase in investment for long-duration firms with a higher unconditional reliance on debt financing debt and / or a greater unconditional reliance on long-term

TABLE 10: The investment reallocation effect: heterogeneity by debt structure

The table presents the reduced-form estimates based on Equation 4 where the dependent variable s capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). The corporate debt maturity measure is the firm-level average share of debt maturing in 5-years or more (LTDebtShare, in pp of debt). High LTDebtShare is a dummy equal to 1 if the firm has above median LTDebtShare. Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The investment duration and corporate debt shares are standardized to have variance 1. The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables and lower-level interactions are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures			
	(1)	(2)	(3)	(4)
TSYMAT × AssetMat (1-sd)	-0.37***		-0.35***	-0.27**
	(0.06)		(0.06)	(0.13)
TSYMAT × LTDebtShare (1-sd)		-0.22***	-0.10	
		(0.06)	(0.06)	
TSYMAT × High LTDebtShare				0.00
				(0.00)
TSYMAT × AssetMat (1-sd) × High LTDebtShare				-0.13
				(0.14)
Controls x TSYMAT	✓	✓	✓	✓
Controls x TSYMAT x High LTDebtShare	–	–	–	✓
Time FE	✓	✓	✓	–
Firm FE	✓	✓	✓	✓
Time x High LTDebtShare FE	–	–	–	✓
Observations	116818	116818	116818	116813

debt.[42]

Overall, I have shown that, consistent with the duration channel I propose, the investment reallocation effect is independent of the financing choices.

6.3. Elasticities

Consistent with the duration channel that affects investment through the cost of capital, I compute upper and lower bounds for the elasticities of investment to the cost of capital and compare them to the ones obtained in the literature.

Under the assumption of perfect maturity matching, the cost of new debt is a candidate proxy for the marginal cost of capital. It follows that one can measure the semi elasticity of investment to the cost of capital as the ratio of the relative investment response and the relative change in the cost of new debt.

[42]Another prediction would be that the investment response should be larger among less financially constrained firms and larger for debt-financed firm. In Table D.10, I show the opposite: long investment-duration firms that are larger, pay dividends or have A to AAA ratings are *less* responsive than other long investment-duration firms. I also show that long-duration firms with a heavier reliance on debt financing, measured by book leverage above the median, do not exhibit statistically greater responsiveness to long-term bond supply than other long-duration firms (column (1) in Table 9).

Table G.2 and Table G.3 provide suggestive evidence of maturity matching in the sample both at the level of stocks (outstanding debt) and flows (new issuances). Consistent with the ubiquitousness of maturity matching in the data, the average yield-to-maturity of the outstanding bonds issued by long-duration firms increases (column (3) in Table 11). This is consistent with the fact that firms finance investment with maturity-matched debt, an increase in long-term interest rates is reflected in the relative cost of debt of long-duration firms.[43]

Table 11: The investment reallocation effect: investment, net issuance, and debt cost

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is either capital expenditures (pp of lagged assets), net debt issuance (pp of lagged assets), the yield-to-maturity on issued bonds (pp) or interest expenses (pp of debt). The sample is the yearly panel of Compustat firms merged with the Lehman/Warga's database of secondary bond market information for 1973-1997 in columns (1)-(3). (4)-(6). The sample is the yearly panel of Compustat firms for 1965-2007 in columns (4)-(6). The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. The macroeconomic controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables and lower-level interactions are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Bond panel sample			Full sample		
	(1) Capex	(2) NetIss	(3) YTM	(4) Capex	(5) NetIss	(6) Interest Expense
TSYMAT × AssetMat	-0.116**	-0.129	0.037***	-0.137***	-0.088***	0.054***
	(0.057)	(0.100)	(0.013)	(0.022)	(0.030)	(0.021)
Time FE	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Firm Controls x TSYMAT	✓	✓	✓	✓	✓	✓
AssetMat x Macro Controls	✓	✓	✓	✓	✓	✓
Observations	8237	8237	8237	106439	106439	106439
Adjusted R^2	0.629	0.285	0.905	0.480	0.108	0.338

Under the assumption that maturity matching is imperfect, the ratio of the relative investment response and the relative change in the cost of bond debt is an upper bound for two reasons. First, if firms do not match perfectly the duration of new investment with the duration of new issuances, then the denominator, i.e., the change in the observed cost of bonds, is lower than the change in the cost of capital—hence biasing the proxy for the semi-elasticity upwards. Second, the proxy is measured with the average cost of bond debt, which under perfect maturity matching is a good proxy for the average cost of outstanding capital but a biased proxy for the cost of new capital. If a firm has an investment duration of h years and invests every year at a constant pace, its

[43] I also show that a drop in investment by long-duration firms is matched by an increase in their effective cost of debt servicing measured with interest expenses to debt — column (6) in Table 11. This is consistent with maturity matching (Table G.2 and Table G.3) and the investment reallocation being matched by a debt reallocation (Table 7 and Table 11). This also suggests that a significant share of the debt serviced by public firms in my sample is fixed rate.

outstanding capital has a duration of $h/2$-years.[44] Hence under perfect maturity matching and a linear effect of government debt maturity on the slope of the term structure, the cost of capital is likely to be twice higher, and therefore the true elasticity is likely to be 50% of the measured elasticity.

Therefore, an upper bound on the semi-elasticity of investment to the cost of capital is the ratio of the relative investment response and the relative change in the cost of bond debt obtained from Table 11: 0.116/0.037 = 3.1.

I also compute a lower bound on the semi-elasticity of investment to the cost of capital as the ratio of the relative investment response to an upper bound on the relative change in the cost of capital.

To compute an upper bound on the relative change in the marginal cost of capital, I compute the relative change in the maturity-matched cost of new bond debt that would result from three assumptions that maximize the response of the cost of capital: (i) the firm's cost of debt is the Aaa firm cost of debt, (ii) the effect of the government long-term debt supply on the term structure of interest rates is linear in maturities, and (iii) the relative difference in investment cash-flow duration for new investment is twice the difference in *Asset-Maturity*.[45]

Assumptions (i) and (ii) imply that the cost of capital increases by one-tenth of the increase in the 10-year-1-year term spread on Aaa corporates obtained from Table 6 for each increase by one year of investment duration. Assumption (iii) implies that, for each increase by one year of asset maturity, the cost of capital increases by two times the increase for each increase by one year of investment duration.

Following these assumptions, the upper bound on the relative change in the cost of capital would be $2 \times 0.44/10 = 0.09$.[46] This implies a lower bound on the semi-elasticity of investment to the cost of capital of 0.116/0.09 = 1.3.[47]

[44] Implicitly, I abstract from discounting.

[45] If assumption (i) does not hold, the relative change in the cost of capital would be lower as risky cash-flows lower the duration of long duration projects more. Assumption (ii) is unlikely to hold and the relative change in the cost of capital would be lower, since the accounting maturity of the stock of assets is an upper bound for $1/2\times$duration due to the convexity in the effect of discounting. Assumption (iii) is unlikely to hold and the relative change in the cost of capital would be lower, as the effect of long-term debt supply on the term structure of interest rates is concave in maturities (Table E.2).

[46] A 1-year higher Treasury debt maturity is associated with a 0.44 pp increase in the spread between the 10-year Aaa corporate yields and the 1-year Aaa corporate yields (Table 6). Hence, there is an increase in the linear slope by 0.44/10 per maturity (in years).

[47] Note that both the lower and upper bound are likely to be biased upwards because they capture the differential response of firms with longer-duration investments to changes in the cost of capital, compared to firms with shorter-duration investments. Firms with longer-duration investments are expected to

The lower bound and the upper bound are in line with the semi-elasticities computed from the baseline results highlighted in the literature on the response of investment to shocks in bond markets (Coppola 2024; Foley-Fisher et al. 2016; Kubitza 2023).[48]

7. The debt consequences of the investment reallocation effect

In this section, I show that the investment reallocation effect explains a large part of the negative time series between the maturity of government debt and the maturity of corporate debt highlighted in the literature following Greenwood et al. (2010). Specifically, I show that 50% of the negative time series correlation between government debt maturity and aggregate corporate debt maturity is due to changes in net debt issuance of firms which correlate with changes in investment. I also show that at least 15% of the negative time series correlation is due to changes in net debt issuance that correlate with changes in investment that are more significant for (observably) longer-duration firms.

As discussed in Section 1, if the reallocation of investment is matched by a reallocation of net debt issuance and firms pursue maturity matching, a positive shock to the supply of long-term bonds would result in a drop in the issuance of long-term corporate debt (Proposition 3). I have shown that a higher supply of long-term Treasury bonds is associated with a decrease in net debt issuance for long-duration firms comparable in magnitude to the drop in investment (Table 7 and Table 11 in Section 6). In addition, Table G.2 and Table G.3 confirm that the firms in my sample effectively pursue the matching of the maturity of assets and liabilities. It follows that in the aggregate, one should expect a negative time series correlation between government debt maturity and corporate debt maturity due to the investment reallocation effect of the duration channel.

In this section, I quantify the importance of the investment reallocation effect in explaining the negative time series between the maturity of government debt and the maturity of corporate debt.[49] To do so, I quantify how much of the total time series covariance can be explained by changes in net debt issuance that (a) correlate with

respond more because the value of their investment opportunities is more sensitive to aggregate variation in the cost of capital.

[48] In Appendix F, I compute the semi-elasticities implied by the baseline result in these papers.

[49] While the negative correlation has been highlighted in the literature following the seminal finding of Greenwood et al. (2010), it has been attributed to a liquidity provision channel that is independent of investment decisions (Badoer & James 2016; Greenwood et al. 2010).

changes in investment and (b) are stronger for long-duration firms.

I measure the aggregate maturity of corporate debt at time t with the weighted average maturity of corporate debt for the panel of public firms:

$$m_t = \sum_i \frac{D_{i,t}}{\sum_i D_{i,t}} \cdot m_{i,t} = \sum_i w_{i,t} \cdot m_{i,t}$$

where $D_{i,t}$ is the stock of debt of firm i at time t, and $m_{i,t}$ is the average maturity of the debt of firm i at time t, and $w_{i,t}$ is the firm i's debt weight at time t, i.e. is the contribution of firm i's debt at time t to total public firm debt at time t.

I propose the following decomposition for the covariance between government debt maturity and corporate debt maturity:

$$\begin{aligned} Cov(g_t, m_t) = & \underbrace{Cov\left(g_t, \sum_i w_{i,t} \cdot \overline{m}_i\right)}_{\text{Across-firm covariance}} + \underbrace{Cov\left(g_t, \sum_i \overline{w}_i \cdot \left(m_{i,t} - \overline{m}_i\right)\right)}_{\text{Within-firm covariance}} \\ & + \underbrace{Cov\left(g_t, \sum_i \left(w_{i,t} - \overline{w}_i\right)\left(m_{i,t} - \overline{m}_i\right)\right)}_{\text{Cross covariance}} \end{aligned}$$

where $\overline{w}_i = \overline{D}_i / \sum_i \overline{D}_i$, $\overline{m}_i = 1/N_i \sum_i m_{i,t}$, and N_i is the number of panel observations for firm i.

The covariance between government debt maturity and corporate debt maturity is the sum of three covariance terms.

The covariance between government debt maturity and corporate debt maturity can be negative if everything else equal, long-term debt maturity firms (high $\overline{m}_i$) issue less debt (i.e. $w_{i,t}$ decreases) when government debt maturity increases—the *across-firm* covariance term.[50] The covariance can also be negative if everything else equal, some firms reduce the maturity of their debt issuances ($m_{i,t}$ decreases) when government debt maturity increases —the *within-firm* covariance term. The covariance can also be negative, if long-term debt maturity firms (high $\overline{m}_i$) issue less debt (i.e. $w_{i,t}$ decreases) and reduce the maturity of their debt issuances ($m_{i,t}$ decreases) when government debt maturity increases—the *cross* covariance term.

[50] Variation in firm weights may come both from changes to the composition of the panel of firms and from changes to the debt size of each firm present in the panel over time.

First, I measure the aggregate covariance highlighted in Greenwood et al. (2010). Table 12 presents the estimates corresponding to regressions of firm-level debt maturity (proxied by the share of debt maturing in more than five years) on the average maturity of Treasury debt in the panel of U.S. public firms over 1975-2007. To capture the covariance between the aggregate maturity of corporate debt and the average maturity of Treasury debt, these regressions are weighted. In column (1), the dependent variable is the firm-year share of long-term debt and the weight is equal to the firm-year outstanding debt scaled by total outstanding debt in that year. Hence, the coefficient on the maturity of government debt measures the *aggregate* covariance. A 1-year increase in government debt maturity is associated with a 7.3 pp drop in the aggregate share of corporate debt with residual maturity above 5-years.

TABLE 12: Maturity of U.S. Treasury debt and aggregate maturity of corporate debt

The table presents the estimates from weighted regressions where the dependent variable is the firm-level share of debt maturing in 5 years or more (pp of debt). The sample is the yearly panel of Compustat firms for 1975-2007. In columns (1) the dependent variable is the firm-year share of debt maturing in more than five years and the weight is equal to the firm-year outstanding debt scaled by total outstanding debt. In columns (2) the dependent variable is the firm-year share of debt maturing in more than five years and the weight is equal to the firm average over all weights defined as firm-year outstanding debt scaled by total outstanding debt. In columns (3)-(4) the dependent variable is the firm average over all firm-year share of debt maturing in more than five years and the weight is equal to the firm-year outstanding debt scaled by total outstanding debt. In columns (5)-(6) the dependent variable is the firm average over all firm-year share of debt maturing in more than five years and the weight is equal to the firm-year outstanding debt scaled by total outstanding debt that is instrumented with the firm-year net PPE scaled by total net PPE. Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Details for variable definition in Appendix A. Standard errors reported in parentheses are clustered by firm.

	Total	Within firm	Across firm		Across firm (IV)	
	(1)	(2)	(3)	(4)	(5)	(6)
	$m(i,t)$	$m(i,t)$	$\overline{m}(i)$	$\overline{m}(i)$	$\overline{m}(i)$	$\overline{m}(i)$
TSYMAT	-7.3***	-3.6***	-3.3***	-1.8***	-2.9***	-1.9***
	(2.1)	(0.6)	(1.2)	(0.7)	(0.7)	(0.5)
AssetMat				2.7***		3.1***
				(0.4)		(0.2)
constant	48.4***	46.2***	48.1***	31.9***	47.5***	27.4***
	(2.5)	(0.1)	(2.1)	(3.6)	(1.0)	(1.4)
No FE	✓	–	✓	✓	✓	✓
Firm FE	–	✓	–	–	–	–
Observations	76094	76094	76094	76094	76094	76094
Adjusted R^2	0.066	0.417	0.029	0.281	0.017	0.283
weights	w(i,t)	$\overline{w}(i)$	w(i,t)	w(i,t)	$\widehat{w(i,t)}$	$\widehat{w(i,t)}$

I show that the *within-firm* and the *across-firm* covariance explains each half of the aggregate covariance. In column (2), the dependent variable is the firm-year share of long-term debt and the weight is equal to the firm average weight and firm-fixed effects are included. Thus, I have fixed the firm-year weights to the average firm-level weight and I have controlled for composition in the panel with firm fixed effects. Hence, the coefficient on the maturity of government debt measures the *within-firm* covariance, which is approximately one half of the aggregate covariance. In column (3), the dependent variable is the average firm-level share of long-term debt, and the weight is equal to the firm-year outstanding debt scaled by total outstanding debt in that year. Hence, the coefficient on the maturity of government debt measures the *across-firm* covariance which is also roughly one half of the aggregate covariance.

I measure the importance of the investment reallocation effect (across firms) with the size of the covariance between the across-firm term and the government debt maturity—the *across-firm* covariance—that is explained by variations in debt weights that are collinear with variation in investment. In column (5), I use predicted debt weights that are instrumented by variation in weights constructed from net PPE. The intuition is that if the coefficient is unchanged, then all of the *across-firm* covariance is driven by changes in debt weights that correlate with changes in investment weights. The coefficient in column (5) is not statistically different from the coefficient in column (3), indicating that almost all of the *across-firm* covariance is explained by changes in debt composition that correlate with changes in investment composition.

In columns (4) and (6), I include my proxy for investment duration as a control. The coefficient shrinks by about one third in both cases. This suggests that about one third of the across-firm covariance (computed, respectively, with debt weights and instrumented debt weights) is explained by variations in weights that are linear in investment duration. The importance of duration in explaining the variation in weights reinforces the role of the duration channel in explaining the across-firm variance.

More broadly, these results suggest that the investment reallocation effect has the potential to explain some of the correlation highlighted in the aggregate between the time series variation in corporate debt maturity and the term premium.[51]

8. External validity: The UK demand shock

In this section, I exploit another plausibly exogenous demand shock to the net supply for long-term bonds in the UK.

[51] Baker et al. (2003) provide evidence that the time series variation in the maturity of corporate debt strongly correlates with the predictability of bond market returns. That is, the long-term debt share (measured as the ratio of long-term debt to total debt) is high when the term premium is low.

Demand shock: Pensions Fund Act (2004). The Pensions Act of 2004 established a government fund to protect the benefits of pension scheme members from the risk of a pension fund bankruptcy. One of the introduced criteria for the newly created pension fund regulator to take over the funds perceived to be at risk is a pension plan's "accounting deficit"—the difference between the market values of a plan's assets and its liabilities.

A pension fund can reduce the volatility of its "accounting deficit" by investing in long-term government bonds. In fact, the assets providing the best hedge for variation in the present value of pension liabilities are the same assets whose price is used to discount these liabilities.[52] As the Pensions Act of 2004 also instituted fines for underfunded pension plans, it provided strong incentives for pension funds to buy more long-term UK government bonds.

Greenwood and Vayanos (2010) show that as a consequence of the 2004 reform, pension funds increased their exposure to long-term government bonds and reduced that to equities. They provide evidence that between 2005 and 2006, pension funds bought approximately GBP 11 billion of inflation-linked bonds as well as bonds with maturities longer than 15 years, and swapped as much as GBP 50 billion of interest rate exposure so as to increase the duration of their assets. The authors highlight that the increase is substantial in comparison with the GBP 73 billion net government issuance of inflation-linked and long-term bonds between April 2005 and March 2007.

The drop in long-term rates. This increase in demand is matched by a dramatic drop in yields on both inflation-linked and nominal long-term government bonds. Figure 4 documents the dramatic inversion of the UK nominal yield curve. Greenwood and Vayanos (2010) conclude that this yield curve inversion cannot be rationalized based on the expectations hypothesis as it would rely on unrealistic expectations of significant drops in short-term interest rates in the very distant future.[53]

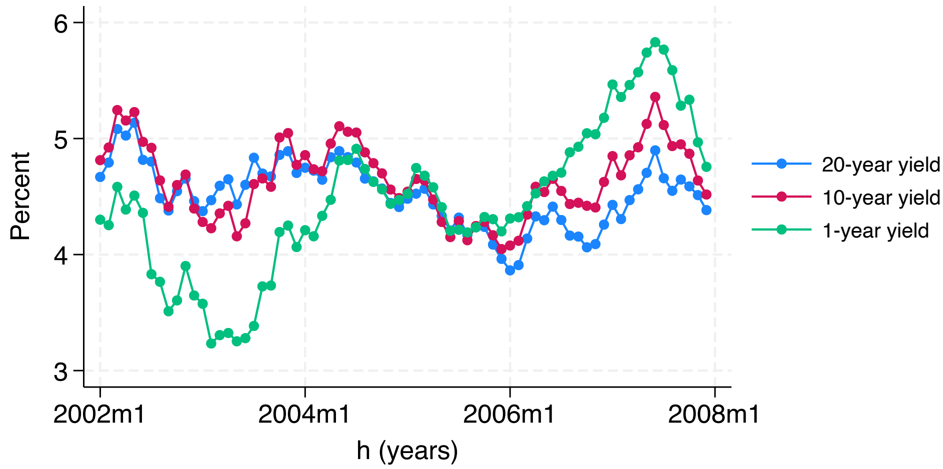
Increase in investment by long-duration firms. The reform allows me to test, in a different setting, the effect of the net supply of long-term bonds for the duration of corporate investment. I focus on a panel of UK firms with publicly traded securities

[52]Pension funds' liabilities have a long-duration and are mostly comprised of inflation linked pension benefits.

[53]Consistent with a "demand shock" interpretation, the authors report that pension-fund managers and the UK Debt Management Office have agreed with the attribution of these changes in price to the policy-driven changes in demand for long-term bonds.

FIGURE 4: Term spread on UK government bonds (2002-2008)

The figure plots the yields on long-term bonds (resp. 10-year and 20-year maturities) and the yield on the 1-year maturity bond. The estimated yield curves data can be found on the Bank of England website.



from 2001 to 2008 obtained from Compustat Global. Table A.6 presents the summary statistics.

I run event-study DiD regressions that compare the investment of firms after the policy shock to before for long-duration firms relative to short-duration firms. I regress investment (measured as capital expenditures scaled by lagged total assets, as before) on event study dummies interacted with the treatment variable: firm-level *Asset Maturity*. Standard errors are clustered at the firm level.

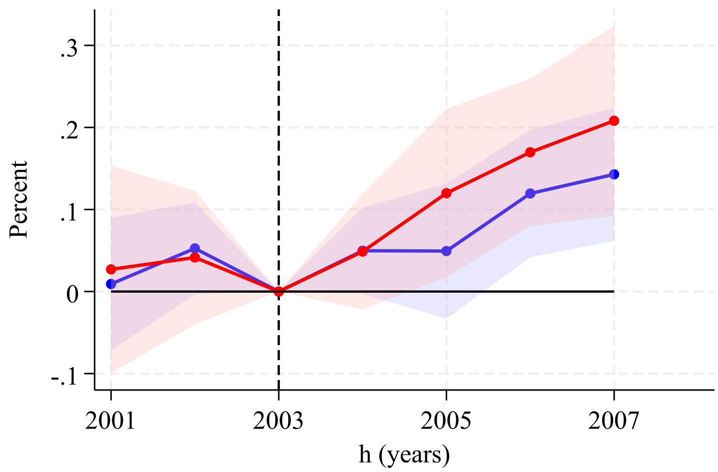
Figure 5 presents the DiD estimates for investment from the specification that includes firm and time fixed effects. After the shock, long-duration firms invest relatively more. The dynamics of the effect are consistent with the cumulative net purchases of long-term bonds by UK pension fund reported in Greenwood and Vayanos (2010) (i.e., growing steadily until at least end of 2006) and the price pressures highlighted in Figure 4 to persist until 2008. Importantly, the parallel trends assumption holds prior to the shock.

Table H.1 presents the related DiD estimates. After the shock, firms at the 75th percentile of the *Asset Maturity* distribution on average increase annual capital expenditures by 0.4% of assets relative to firms at the 25th percentile of the *Asset Maturity* distribution over 2006-2008 where the yield curve inversion is the most severe.

Table H.2 quantifies the changes in term spreads for the UK yield curve (long-term yields over 1-year yield) over the same periods. Relative to 2003 averages, term spreads for respectively 10-year, 20-year, and 25-year yields have dropped by 1, 1.29, and 1.41 pp on

Figure 5: UK event study for investment by long-duration firms

The figure plots the event-study coefficients on the interactions of year dummies and firm-level *Asset Maturity* in the regression where the dependent variable is capital expenditures normalized by lagged total assets based on the yearly panel of Compustat Global UK firms for 2001-2008. The specification in blue corresponds to the specification in the second third column of Table H.1 which includes firm and time fixed effects. The year 2003 acts as the baseline period. Confidence intervals are built at the 95 percent confidence level based on standard errors clustered by firm. Government long-term bond supply is measured with the weighted-average maturity of Treasury debt. Details for variable definition in Appendix A.



average for 2006–2008.

Comparison of semi elasticities to the term spread with U.S. identification. It follows that the shock predicts a difference in the semi-elasticity of investment across investment duration[54] to the term spread ranging from –0.7 pp to –1 pp of assets. This compares to the difference in the semi-elasticity of investment across investment duration of –0.8 pp of assets obtained from the U.S. policy shocks (cf. the 2SLS results in Table E.5). Overall, I find that a plausibly exogenous shock to the demand for long-term bonds in the UK depressed long-term yields and in turn increased the investment of UK public firms in long-duration industries. The exercise confirms the external validity of my baseline results in another plausibly exogenous setting.

9. Conclusion and discussion

In this paper, I show that large shocks to the supply of long-term bonds crowd out long-term investment through a duration channel and long-term debt as a consequence of the investment reallocation effect and asset-liability maturity-matching.

I find that a higher supply of long-term bonds decreases the price of long-term cash

[54] Semi-elasticity of investment to a 1 pp level increase in the term spread (10-year minus 1-yield yield) for a firm with a one standard-deviation higher *Asset Maturity*.

flows, which crowds out long-duration investment. The reallocation of investment towards assets with shorter cash-flow duration, occurs both *across firms* and *within firm across divisions*. Because firms pursue maturity matching, I also show that the aggregate changes to the duration of investment map into aggregate changes to the maturity of corporate debt.

These results are important because they highlight new real effects of government intervention in bond markets on corporate investment. In particular, the evidence presented in this paper can be a relevant input to the trade-offs faced by policy makers for decisions over the maturity of government debt issues. In addition, it contributes to the understanding of the implications of central bank bond purchases for corporate investment.

An important takeaway is the optimal timing of quantitative easing. If financial constraints and costly liquidation of long-duration investments lead to their under-provision in bad times (Aghion et al. 2010; Garicano & Steinwender 2016) and if long-term investments, such as structures or R&D, contribute more to productivity growth, the social planner may want to mitigate the effect of financial constraints on long-term investment in recessions. The investment reallocation effect identified in this paper therefore suggests a rationale for pursuing quantitative easing and incentivizing long-term investments *in recessions* precisely because recessions are characterized by a less than socially optimal provision of long-term investments.

References

Adrian, T., Crump, R. K., & Moench, E. (2013). Pricing the term structure with linear regressions. *Journal of Financial Economics*, *110*(1), 110–138. doi: 10.1016/J.JFINECO.2013.04.009

Aghion, P., Angeletos, G.-M., Banerjee, A., & Manova, K. (2010). Volatility and growth: Credit constraints and the composition of investment. *Journal of Monetary Economics*, *57*(3), 246–265.

Akkoyun, C., Ersahin, N., & James, C. M. (2020). Crowded out from the Beginning: Impact of Government Debt on Corporate Financing. *SSRN Electronic Journal*. doi: 10.2139/SSRN.3528945

Almeida, H. (2019). Is It Time to Get Rid of Earnings-per-Share (EPS)? *The Review of Corporate Finance Studies*, *8*(1), 174–206. doi: 10.1093/RCFS/CFY010

Angeletos, G. M. (2002). Fiscal Policy with Noncontingent Debt and the Optimal Maturity Structure. *The Quarterly Journal of Economics*, *117*(3), 1105–1131. doi: 10.1162/003355302760193977

Asker, J., Farre-Mensa, J., & Ljungqvist, A. (2015). Corporate Investment and Stock Market Listing: A Puzzle? *The Review of Financial Studies*, *28*(2), 342–390. doi: 10.1093/RFS/HHU077

Badoer, D. C., & James, C. M. (2016). The Determinants of Long-Term Corporate Debt Issuances. *Journal of Finance*, *71*(1), 457–492. doi: 10.1111/jofi.12264

Baker, M., Greenwood, R., & Wurgler, J. (2003). The maturity of debt issues and predictable variation in bond returns. *Journal of Financial Economics*, *70*(2), 261–291. doi: 10.1016/S0304-405X(03)00147-8

Barro, R. J. (1979). On the Determination of the Public Debt. *Journal of Political Economy*, *87*(5, Part 1), 940–971. doi: 10.1086/260807

Bohn, H. (1990). Tax Smoothing with Financial Instruments. *The American Economic Review*, *80*(5), 1217–1230.

Buera, F., & Nicolini, J. P. (2004). Optimal maturity of government debt without state contingent bonds. *Journal of Monetary Economics*, *51*, 531–554. doi: 10.1016/j.jmoneco.2003.06.002

Campello, M., Graham, J. R., & Harvey, C. R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics*, *97*(3), 470–487. doi: 10.1016/J.JFINECO.2010.02.009

Chakraborty, I., Goldstein, I., & MacKinlay, A. (2020). Monetary stimulus and bank lending. *Journal of Financial Economics*, *136*(1), 189–218. doi: 10.1016/J.JFINECO.2019.09.007

Chaney, T., Sraer, D., & Thesmar, D. (2012). The Collateral Channel: How Real Estate Shocks Affect Corporate Investment. *American Economic Review*, *102*(6), 2381–2409. doi: 10.1257/AER.102.6.2381

Chava, S., & Roberts, M. R. (2008). How Does Financing Impact Investment? The Role of Debt Covenants. *The Journal of Finance*, *63*(5), 2085–2121. doi: 10.1111/j.1540-6261.2008.01391.x

Chodorow-Reich, G. (2014). Effects of Unconventional Monetary Policy on Financial Institutions. *Brookings Papers on Economic Activity*.

Choudhary, M. A., & Limodio, N. (2022). Liquidity Risk and Long-Term Finance: Evidence from a Natural Experiment. *The Review of Economic Studies*, *89*(3), 1278–1313. doi: 10.1093/RESTUD/RDAB065

Coppola, A. (2024). In Safe Hands: The Financial and Real Impact of Investor Composition Over the Credit Cycle.

Crouzet, N., & Eberly, J. (2021). Intangibles, markups, and the measurement of productivity growth. *Journal of Monetary Economics*, *124*, S92-S109. doi: 10.1016/J.JMONECO.2021.09.005

Culbertson, J. M. (1957). The Term Structure of Interest Rates. *The Quarterly Journal of Economics*, *71*(4), 485–517. doi: 10.2307/1885708

D'Amico, S., & King, T. B. (2013). Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply. *Journal of Financial Economics*, *108*(2), 425–448. doi: 10.1016/J.JFINECO.2012.11.007

Darmouni, O., & Siani, K. (2023). Bond Market Stimulus: Firm-Level Evidence. *SSRN Electronic Journal*. doi: 10.2139/SSRN.3693282

Darmouni, O., & Sutherland, A. (2024). Investment when new capital is hard to find. *Journal of Financial Economics*, *154*, 103806. doi: 10.1016/J.JFINECO.2024.103806

Demirci, I., Huang, J., & Sialm, C. (2019). Government debt and corporate leverage: International evidence. *Journal of Financial Economics*, *133*(2), 337–356. doi: 10.1016/j.jfineco.2019.03.009

Dessaint, O., Foucault, T., & Frésard, L. (2023). The Horizon of Investors' Information and Corporate Investment. *SSRN Electronic Journal*. doi: 10.2139/SSRN.4276832

Dew-Becker, I. (2012). Investment and the Cost of Capital in the Cross-Section: The Term Spread Predicts the Duration of Investment.

Di Maggio, M., Kermani, A., & Palmer, C. J. (2020). How Quantitative Easing Works: Evidence on the Refinancing Channel. *Review of Economic Studies*, *87*(3), 1498–1528. doi: 10.1093/restud/rdz060

Donaldson, D. (2018). Railroads of the Raj: Estimating the Impact of Transportation Infrastructure. *American Economic Review*, *108*(4-5), 899–934. doi: 10.1257/AER.20101199

Duarte, J., & Umar, T. (2024). Identifying the Portfolio Balance Mechanism. *SSRN Electronic Journal*. doi: 10.2139/SSRN.4708921

Eisfeldt, A. L., & Papanikolaou, D. (2013). Organization Capital and the Cross-Section of Expected Returns. *Source: The Journal of Finance*, *68*(4), 1365–1406.

Eisfeldt, A. L., & Rampini, A. A. (2007). New or used? Investment with credit constraints. *Journal of Monetary Economics*, *54*(8), 2656–2681. doi: 10.1016/J.JMONECO.2007.06.030

Foley-Fisher, N., Ramcharan, R., & Yu, E. (2016). The impact of unconventional monetary policy on firm financing constraints: Evidence from the maturity extension program. *Journal of*

Financial Economics, *122*(2), 409–429. doi: 10.1016/J.JFINECO.2016.07.002

Friedman, B. M. (1978). Crowding Out or Crowding In? Economic Consequences of Financing Government Deficits. *Brookings Papers on Economic Activity*, *1978*(3), 593. doi: 10.2307/3217952

Garbade, K. (2015). *Treasury debt management under the rubric of regular and predictable issuance: 1983-2012*. Federal Reserve Bank of New York.

Garbade, K. (2020). *Managing the Maturity Structure of Marketable Treasury Debt: 1953-1983* (Tech. Rep. No. 936).

Garicano, L., & Steinwender, C. (2016). Survive another day: Using changes in the composition of investments to measure the cost of credit constraints. *Review of Economics and Statistics*, *98*(5), 913–924.

Geelen, T., Hajda, J., Morellec, E., & Winegar, A. (2023). Financing Cycles. *SSRN Electronic Journal*. doi: 10.2139/SSRN.4025812

Gilchrist, S., Wei, B., Yue, V. Z., & Zakrajšek, E. (2020). The Fed Takes on Corporate Credit Risk: An Analysis of the Efficacy of the SMCCF. doi: 10.3386/W27809

Gilchrist, S., & Zakrajšek, E. (2012). Credit Spreads and Business Cycle Fluctuations. *American Economic Review*, *102*(4), 1692–1720. doi: 10.1257/AER.102.4.1692

Gonçalves, A. (2019). The Short Duration Premium. *SSRN Electronic Journal*. doi: 10.2139/ssrn.3385579

Gopalan, R., Mukherjee, A., & Singh, M. (2016). Do Debt Contract Enforcement Costs Affect Financing and Asset Structure? *The Review of Financial Studies*, *29*(10), 2774–2813. doi: 10.1093/RFS/HHW042

Gormsen, N. J., Huber, K., Thank, W., Bloom, N., Dessaint, O., Eberly, J., … Zhou, M. (2023). Corporate Discount Rates. *SSRN Electronic Journal*.

Graham, J. R., Leary, M. T., & Roberts, M. R. (2014). How Does Government Borrowing Affect Corporate Financing and Investment? *SSRN Electronic Journal*. doi: 10.2139/ssrn.2425916

Greenwood, R., Hanson, S., & Stein, J. C. (2010). A gap-filling theory of corporate debt maturity choice. *Journal of Finance*, *65*(3), 993–1028. doi: 10.1111/j.1540-6261.2010.01559.x

Greenwood, R., Hanson, S., & Vayanos, D. (2024). Supply and Demand and the Term Structure of Interest Rates. *Annual Review of Financial Economics*. doi: 10.1146/ANNUREV-FINANCIAL-082123-110048

Greenwood, R., Hanson, S. G., & Stein, J. C. (2015). A Comparative-Advantage Approach to Government Debt Maturity. *The Journal of Finance*, *70*(4), 1683–1722. doi: 10.1111/JOFI.12253

Greenwood, R., & Vayanos, D. (2010). Price pressure in the government bond market. *American Economic Review*, *100*(2), 585–590. doi: 10.1257/AER.100.2.585

Greenwood, R., & Vayanos, D. (2014). Bond supply and excess bond returns. *Review of Financial Studies*, *27*(3), 663–713. doi: 10.1093/rfs/hht133

Grosse-Rueschkamp, B., Steffen, S., & Streitz, D. (2019). A capital structure channel of monetary policy. *Journal of Financial Economics*, *133*(2), 357–378. doi: 10.1016/J.JFINECO.2019.03.006

Gutiérrez, G., & Philippon, T. (2018). Ownership, Concentration, and Investment. *AEA Papers and Proceedings*, *108*, 432–37. doi: 10.1257/PANDP.20181010

Haddad, V., Moreira, A., & Muir, T. (2021). When Selling Becomes Viral: Disruptions in Debt Markets in the COVID-19 Crisis and the Fed's Response. *The Review of Financial Studies*, *34*(11), 5309–5351. doi: 10.1093/RFS/HHAA145

Hamilton, J. D., & Wu, J. C. (2012). The Effectiveness of Alternative Monetary Policy Tools in a Zero Lower Bound Environment. *Journal of Money, Credit and Banking*, *44*(SUPPL. 1), 3–46. doi: 10.1111/J.1538-4616.2011.00477.X

Hanson, S. G. (2014). Mortgage convexity. doi: 10.1016/j.jfineco.2014.05.002

Jansen, K. A. (2021). Long-term Investors, Demand Shifts, and Yields. *SSRN Electronic Journal*. doi: 10.2139/SSRN.3901466

Jiang, Z., & Sun, J. (2024). Quantitative Tightening with Slow-Moving Capital.

Jones, B. F., & Summers, L. H. (2020). A Calculation of the Social Returns to Innovation. *NBER Working Papers*.

Kermani, A., & Ma, Y. (2022). Asset Specificity of Nonfinancial Firms. *The Quarterly Journal of Economics*, *138*(1), 205–264. doi: 10.1093/QJE/QJAC030

Kim, H., & Kung, H. (2017). The Asset Redeployability Channel: How Uncertainty Affects Corporate Investment. *The Review of Financial Studies*, *30*(1), 245–280. doi: 10.1093/RFS/HHV076

Koijen, R. S., & Yogo, M. (2019). A demand system approach to asset pricing. *Journal of Political Economy*, *127*(4), 1475–1515. doi: 10.1086/701683/SUPPL{_}FILE/2015759DATA.ZIP

Kozlowski, J. (2021). Long-Term Finance and Investment with Frictional Asset Markets. *American Economic Journal: Macroeconomics*, *13*(4), 411–48. doi: 10.1257/MAC.20190353

Krishnamurthy, A., & Vissing-Jorgensen, A. (2011). The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy. *Brookings Papers on Economic Activity*, *42*(2 (Fall)), 215–287.

Krishnamurthy, A., & Vissing-Jorgensen, A. (2012). The aggregate demand for Treasury debt. *Journal of Political Economy*, *120*(2), 233–267. doi: 10.1086/666526

Kubitza, C. (2023). Investor-Driven Corporate Finance: Evidence from Insurance Markets. *SSRN Electronic Journal*. doi: 10.2139/SSRN.3957964

Lanteri, A. (2018). The Market for Used Capital: Endogenous Irreversibility and Reallocation over the Business Cycle. *American Economic Review*, *108*(9), 2383–2419. doi: 10.1257/AER.20160131

Livdan, D., & Nezlobin, A. (2021). Investment, capital stock, and replacement cost of assets when economic depreciation is non-geometric. *Journal of Financial Economics*, *142*(3), 1444–1469. doi: 10.1016/j.jfineco.2021.05.021

Lucas, R. E., & Stokey, N. L. (1983). Optimal fiscal and monetary policy in an economy without capital. *Journal of Monetary Economics, 12*(1), 55–93. doi: 10.1016/0304-3932(83)90049-1

Lucca, D., & Wright, J. H. (2022). *The Narrow Channel of Quantitative Easing: Evidence from YCC Down Under* (Tech. Rep.).

Luck, S., & Zimmermann, T. (2020). Employment effects of unconventional monetary policy: Evidence from QE. *Journal of Financial Economics, 135*(3), 678–703. doi: 10.1016/J.JFINECO.2019.07.004

Ma, S., Murfin, J., & Pratt, R. (2022). Young firms, old capital. *Journal of Financial Economics, 146*(1), 331–356. doi: 10.1016/J.JFINECO.2021.09.017

Mendes, D. (2020). Financial Constraints and Product Market Decisions: The Role of Production Cycles. *SSRN Electronic Journal*(March). doi: 10.2139/ssrn.3596061

Modigliani, F., & Sutch, R. (1966). Innovations in interest rate policy. *The American Economic Review*(56), 178–197.

Pinardon-Touati, N. (2021). Does Government Debt Crowd Out Corporate Investment? A Bank Lending Channel. *SSRN Electronic Journal*. doi: 10.2139/ssrn.3805640

Rampini, A. (2018). Financing Durable Assets.

Ray, W., Droste, M., Gorodnichenko Berkeley, Y. U., Bauer, M., Bidder, R., Fleming, M., ... Wittwer, M. (2024). Unbundling Quantitative Easing: Taking a Cue from Treasury Auctions. *https://doi-org/10.1086/729581*. doi: 10.1086/729581

Rodnyansky, A., & Darmouni, O. M. (2017). The Effects of Quantitative Easing on Bank Lending Behavior. *The Review of Financial Studies, 30*(11), 3858–3887. doi: 10.1093/RFS/HHX063

Röller, L. H., & Waverman, L. (2001). Telecommunications Infrastructure and Economic Development: A Simultaneous Approach. *American Economic Review, 91*(4), 909–923. doi: 10.1257/AER.91.4.909

Selgrad, J. (2023). *Testing the Portfolio Rebalancing Channel of Quantitative Easing* (Tech. Rep.).

Siani, K. Y. (2022). *Raising Bond Capital in Segmented Markets* * (Tech. Rep.).

Stein, J. C. (1988). Takeover Threats and Managerial Myopia. *Journal of Political Economy, 96*(1), 61–80. doi: 10.1086/261524

Stohs, M. H., & Mauer, D. C. (1996). The Determinants of Corporate Debt Maturity Structure. *The Journal of Business, 69*(3), 279–312.

Terry, S. J. (2023). The Macro Impact of Short-Termism. *Econometrica, 91*(5), 1881–1912. doi: 10.3982/ECTA15420

Tobin, J. (1958). Liquidity Preference as Behavior Towards Risk. *Review of Economic Studies, 25*(2), 65–86. doi: 10.2307/2296205

Todorov, K. (2020). Quantify the quantitative easing: Impact on bonds and corporate debt issuance. *Journal of Financial Economics, 135*(2), 340–358. doi: 10.1016/J.JFINECO.2019.08.003

Vayanos, D., & Vila, J.-L. (2021). A Preferred-Habitat Model of the Term Structure of Interest Rates. *Econometrica, 89*(1), 77–112. doi: 10.3982/ecta17440

A. Variables

Variables Description

Firms' financials	Variable description
Total Assets	Total assets measured with Compustat variable *at* in USD mn.
PP&E	Net fixed assets measured with Compustat variable *ppent* in USD mn.
Employment	Total employment measured with Compustat variable *emp* in thousands of employees.
Sales	Total net sales measured with Compustat variable *sale* in USD mn.
Market Value of Equity	Market value of equity measured with Compustat variables as the product of *prcc* and *csho* in USD mn.
Market-Debt Ratio	Market-Debt ratio measured with Compustat variables as $\frac{dltt + dlc}{dltt + dlc + prcc * csho}$.
Market to Book Ratio	Market-to-book ratio measured with Compustat variables as $\frac{at + prcc\_c * csho - ceq - txdb}{at}$.
EBIT to Assets	Earnings before interest and taxes, scaled by total assets measured with Compustat variables as $\frac{in + xint + txt}{at}$
Capex (% of lagged assets)	Capital expenditures (Compustat variable *capx*) scaled by lagged total assets.
R&D (% of lagged assets)	R&D expenses (Compustat variable *xrd*) scaled by lagged total assets. Missing values are replaced by zeros.
Acquisitions (% of lagged assets)	Acquisitions (Compustat variable *acq*) scaled by lagged total assets.
Debt	Debt measured with Compustat variables as *dltt* + *dlc*.
Book leverage	Book leverage measured as *Debt* to *Assets*.
LT debt share (1y)	Share of debt with residual maturity above one year measured with Compustat variables as $(1 - (dlc)/(dlc + dltt))$.
LT debt share (2y)	Share of debt with residual maturity above one year measured with Compustat variables as $(1 - (dlc + dd2)/(dlc + dltt))$.
LT debt share (3y)	Share of debt with residual maturity above one year measured with Compustat variables as $(1 - (dlc + dd2 + dd3)/(dlc + dltt))$.
LT debt share (4y)	Share of debt with residual maturity above one year measured with Compustat variables as $(1 - (dlc + dd2 + dd3 + dd4)/(dlc + dltt))$.
LT debt share (5y)	Share of debt with residual maturity above one year measured with Compustat variables as $(1 - (dlc + dd2 + dd3 + dd4 + dd5)/(dlc + dltt))$.
Sales Growth	Change of a firm's sales in percentage points of previous year's sales.
Sales Growth (2digits SIC)	Yearly average of yearly firm observations for *Sales Growth* aggregated at two-digits SIC industry
Dividend Dummy	Dummy variable taking a value of one if the firm declared dividends on common stock (Compustat variable *dvc*).
IG Rating Dummy	Dummy variable taking a value of one if the firm has a S&P long-term credit rating of BBB- or higher or if it has a S&P short-term credit rating of A-3 or higher. Measured with the S&P ratings database variables *splticrm* and *spsticrm*
Asset Maturity (firm-year)	Book-value-weighted average maturity of assets measured with Compustat Annual variables as $\frac{act}{act + ppent} \cdot 1 + \frac{ppent}{act + ppent} \cdot \frac{ppent}{dp - am}$. Missing amortisation observations (*am*) are replaced by zeros.
Asset Maturity	*Asset Maturity* averaged over the sample by firm.
Asset Maturity (NAICS-3)	*Asset Maturity* averaged over the sample by 3-digits NAICS industry .
Asset Maturity (NAICS-6)	*Asset Maturity* averaged over the sample by 6-digits NAICS industry .
Asset Maturity (w/in NAICS-3)	*Asset Maturity* residualized against NAICS-3 digits fixed effects.
Fixed-Asset Maturity	maturity of fixed assets measured with Compustat variables as $\frac{ppent}{dp - am}$ and averaged over the sample by firm. Missing amortisation observations (*am*) are replaced by zeros.
Fixed-Asset Share	The ratio of *PP&E* to the sum of *PP&E* and *Current Assets* averaged over the sample by firm.
Business Plan Horizon	Two-digits SIC industry's average of the horizon of the business plan that managers disclose from SEC filings obtained from Dessaint et al. (2023).
Business Plan Horizon (res.)	*Business Plan Horizon* residualized against *Asset Maturity*.

Redeployability	Firm-level measure of asset redeployability from Kim and Kung (2017).
Redeployability (equal-weighted)	Firm-level measure (equal-weighted) of asset redeployability from Kim and Kung (2017).
Mobility	Industry-level (SIC2-digits) measure of the mobility of fixed assets from Kermani and Ma (2022).
Customization	Industry-level (SIC2-digits) measure of the customisation of fixed assets from Kermani and Ma (2022).
Recovery Rate	Industry-level (SIC2-digits) average recovery rate for fixed assets from Kermani and Ma (2022).
Age	Time in years since founding date of the company from Jay Ritter's website.
Time from IPO	Time in years since IPO date of the company from Jay Ritter's website.
Num of obs	Firm-level number of observations in the panel.
RE price (State)	Residential house prices at state level from replication package for Chaney et al. (2012).
RE price (MSA)	Residential house prices at MSA level from replication package for Chaney et al. (2012).
Change in FA (Total)	Yearly change in total Fixed-Assets at historical cost (measured with Compustat variables as $fatb + fatl + fate + fatc + fato + fatp + fatn$) scaled by lagged total Fixed-Assets at historical cost.
Change in FA (Machinery and Equipment)	Yearly change in Fixed-Assets (Machinery and Equipment) at historical cost (Compustat variable *fate*) scaled by lagged total Fixed-Assets at historical cost.
Change in FA (Real Estate)	Yearly change in Fixed-Assets (Real Estate) at historical cost (measured with Compustat variables as $fatb + fatl + fatc + fatn$) scaled by lagged total Fixed-Assets at historical cost.

Macroeconomic and asset prices series	Variable description
TreasuryDebtMaturity	Dollar-weighted average maturity of Treasury debt at monthly frequency and expressed in years.
TreasuryDebtMaturity (5-year demeaned)	The residual on the regression of *TreasuryDebtMaturity* on 5-year period indicators
Moody's LT BAA-AAA Spread	Spread in percentage points between yields on the Moody's Seasoned BBB- and AAA-rated corporate bond indices (based on bonds with maturities 20 years and above). The data is retrieved at the monthly frequency from FRED, Federal Reserve Bank of St. Louis.
Total GDP 4Q Growth	Real GDP growth over the past four quarters measured quarterly and expressed in percentage points.
Treasury Debt to GDP	Sum of principals of outstanding Treasury debt from CRSP Treasury scaled by nominal GDP from FRED and expressed in percentage points.
N-y TSY Yield	The yield-to-maturity on the N-year maturity Treasury bond using the U.S. Treasury constant maturity zero-coupon bond yield curve from the Federal Reserve (in percentage points).
H-y Excess Return on N-y TSY	The H-year horizon excess return on the N-year Treasury bond calculated as the holding-period return from buying a N-year bond and selling it H-year later in excess of the return on the H-year bond, computed with the monthly data on U.S. Treasury constant maturity zero-coupon bond yield curve from the Federal Reserve (in percentage points).
y10-y1	The spread between the yield-to-maturity on the 10-year maturity Treasury bond and the yield-to-maturity on the 1-year maturity Treasury bond using the U.S. Treasury constant maturity zero-coupon bond yield curve from the Federal Reserve (in percentage points).

Issuance characteristics	Variable description
Years to Maturity	Maturity of the issue at issuance date in years.
Deal Amount	Loan principal amount (*facilityamt*) for issues in Dealscan and Total principal amount of the issue (*totdolamt*) in USD mn.
Dealscan Flag	Dummy for deal observations that come from the Dealscan dataset (mostly bank loans) as opposed to the SDC dataset (public bonds).

TABLE A.4: Summary statistics: firm-year panel of U.S. public firms (1965-2007)

	Mean	SD	Min	p25	p50	p75	Max	N
Total Assets*	735.68	2,665.63	0.05	17.70	66.94	308.99	39,042.00	120,275
Capital Expenditures*	48.93	171.60	0.00	0.67	3.47	18.71	2,430.00	120,275
Sales*	733.11	2,391.98	0.00	18.52	77.63	354.79	35,214.00	120,275
Employment*	6.08	15.87	0.00	0.18	0.85	3.69	197.60	116,228
AssetMat (firm)**	3.85	2.72	0.99	1.83	2.99	4.94	14.85	120,275
AssetMat (NAICS 3)**	3.84	2.01	1.08	2.16	3.24	4.80	13.01	120,275
AssetMat (NAICS 6)**	3.84	2.24	1.04	2.23	2.99	4.75	14.63	120,275
AssetMat (firm w/in NAICS 3)**	0.02	1.86	-9.28	-0.97	-0.27	0.80	11.91	120,275
FixedAssetMat**	7.53	3.58	0.65	4.83	7.21	9.57	22.05	120,275
FixedAssetShare**	0.35	0.21	0.01	0.18	0.30	0.49	0.88	120,275
BusPlanHorizon	4.31	0.48	1.00	3.99	4.32	4.58	8.00	120,275
BusPlanHorizon (res.)	-0.01	0.47	-3.43	-0.31	0.03	0.31	3.73	120,275
LT debt sh. (1y)	68.88	31.33	0.00	51.75	80.97	93.88	100.00	105,668
LT debt sh. (3y)	43.52	34.05	0.00	5.63	45.50	73.83	100.00	78,316
LT debt sh. (5y)	27.92	29.87	0.00	0.00	18.03	51.31	100.00	76,942
Capex (% of lagged assets)**	8.35	8.39	0.17	2.61	5.54	10.78	55.48	120,275
R&D (% of lagged assets)**	4.30	8.52	0.00	0.00	0.00	4.50	56.84	120,275
Acquisitions (% of lagged assets)**	1.52	4.70	0.00	0.00	0.00	0.00	37.14	120,275
Emp. Growth**	6.21	23.37	-47.67	-5.88	2.50	14.54	100.00	102,903
Profitability*	-0.03	0.62	-16.53	-0.01	0.08	0.14	0.53	120,275
M/B Ratio*	2.15	3.91	0.41	1.00	1.34	2.10	112.99	120,275
Sales Growth*	5.18	49.67	-744.50	-0.89	9.67	21.30	100.00	120,275
IG Rating	0.13	0.34	0.00	0.00	0.00	0.00	1.00	120,275
log(Assets)	4.35	2.15	-6.91	2.87	4.20	5.73	13.08	120,275
log(MCap)	4.12	2.24	-1.84	2.50	3.96	5.65	10.95	120,247
log(PPE)	2.83	2.50	-6.91	1.16	2.75	4.48	9.56	119,982
log(Emp)	-0.20	2.20	-6.91	-1.70	-0.16	1.31	5.29	115,874
Book Leverage*	0.24	0.20	0.00	0.06	0.21	0.36	0.98	120,174
Redeployability	0.40	0.11	0.03	0.36	0.42	0.46	0.91	79,224
Redeployability (eq. wght)	0.33	0.08	0.03	0.30	0.35	0.38	0.70	79,224
Mobility	0.03	0.01	0.01	0.02	0.02	0.03	0.07	117,541
Customization	0.02	0.01	0.01	0.02	0.02	0.02	0.09	117,541
Recovery Rate	0.34	0.09	0.04	0.28	0.35	0.38	0.62	117,541
Age	21.52	20.58	-10.00	9.00	15.00	26.00	167.00	44,746
Time from IPO	6.85	6.45	-23.00	2.00	5.00	10.00	31.00	46,706
Num of obs	21.89	14.44	2.00	10.00	19.00	31.00	58.00	120,275
RE price (State)	210.34	122.53	41.95	123.15	186.63	255.34	727.86	106,955
RE price (MSA)	114.25	55.96	18.77	79.52	103.67	133.57	357.29	95,428
Change in Total FA**	11.08	15.69	-22.43	1.51	8.01	17.89	72.00	53,283
Change in FA (Mach. and Eq.)**	9.41	17.33	-29.80	0.87	5.72	14.26	84.51	49,290
Change in FA (Real Estate)**	3.18	5.28	-8.61	0.00	1.54	5.59	29.05	47,525
Buildings to Total FA**	0.15	0.16	0.00	0.00	0.10	0.27	0.56	43,149
Equipment to Total FA**	0.68	0.21	0.23	0.53	0.70	0.85	1.00	43,149
Leases to Total FA**	0.10	0.13	0.00	0.00	0.03	0.14	0.49	43,149
Construction to Total FA**	0.01	0.02	0.00	0.00	0.00	0.01	0.10	43,149
NatResources to Total FA**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43,149
Land to Total FA**	0.03	0.04	0.00	0.00	0.01	0.04	0.15	43,149
Other FA to Total FA**	0.01	0.05	0.00	0.00	0.00	0.00	0.33	43,149

Note: This table reports summary statistics for the main variables in the yearly panel of Compustat firms from 1965 to 2007. All variables are defined in Appendix A.
* To mitigate the influence of outliers, the variables have been winsorized at the latest stage with tail cuts at the 5th and 95th percentiles of the yearly distributions of the variables.
** To mitigate the influence of outliers, the variables have been winsorized at the latest stage with tail cuts at the 5th and 95th percentiles of the yearly distributions of the variables.

TABLE A.5: Summary statistics: firm-division-year panel of U.S. public firms (1977-2007)

	Mean	SD	Min	p25	p50	p75	Max	N
Total Assets (firm)*	1,974.11	4,452.37	0.38	62.88	303.73	1,539.33	39,042.00	50,070
Capital Expenditures (firm)*	133.12	332.86	0.00	3.02	15.57	87.51	5,326.00	50,070
Employment (firm)*	14.06	23.69	0.00	0.89	3.54	14.40	137.70	49,131
AssetMat (firm average)**	4.32	1.78	0.40	2.98	3.86	5.33	16.39	50,070
Capex (% of assets) (segment)**	2.69	3.05	0.00	0.53	1.48	3.69	14.46	50,070
AssetMat (segment)**	4.05	1.87	1.39	2.62	3.55	4.95	13.06	50,070
Profitability (segment)**	0.12	0.25	-5.77	0.04	0.12	0.20	1.40	50,070

Note: This table reports summary statistics for the main variables in the yearly panel of Compustat Segment firm-divisions from 1977 to 2007. All variables are defined in Appendix A.
* To mitigate the influence of outliers, the variables have been winsorized at the latest stage for tails at the 5th and 95th percentiles of the yearly distributions of the variables.
** To mitigate the influence of outliers, the variables have been winsorized at the latest stage for tails at the 5th and 95th percentiles of the yearly distributions of the variables.

TABLE A.6: Summary statistics: firm-year panel of UK public firms (2001-2008)

	Mean	SD	Min	p10	p25	p50	p75	p90	Max	N
Total Assets*	881.34	3,778.65	0.02	4.05	12.62	52.10	231.25	1,363.00	52,959.00	7,017
Capital Expenditures*	43.88	206.30	0.00	0.06	0.24	1.46	10.82	57.00	3,442.00	7,017
Sales*	760.40	3,047.00	0.00	1.81	9.32	48.98	273.45	1,355.20	51,514.00	7,017
Employment*	7.33	25.20	0.00	0.05	0.16	0.62	3.67	15.61	440.00	5,120
AssetMat (firm)**	4.61	5.82	1.01	1.09	1.31	2.30	4.72	11.45	31.90	7,017
AssetMat (SIC 2)**	5.09	4.73	1.69	1.94	2.15	3.21	4.92	11.21	27.85	7,017
Capex (% of assets)**	5.71	6.61	0.02	0.61	1.44	3.28	6.90	14.86	29.70	7,017

Note: This table reports summary statistics for the main variables in the yearly panel of Compustat Global firm from 2001 to 2008. All variables are defined in Appendix A.
* To mitigate the influence of outliers, the variables have been winsorized at the latest stage with tail cuts at the 5th and 95th percentiles of the yearly distributions of the variables.
** To mitigate the influence of outliers, the variables have been winsorized at the latest stage with tail cuts at the 5th and 95th percentiles of the yearly distributions of the variables.

TABLE A.7: Summary statistics: macroeconomics monthly series (1965-2007)

	Mean	SD	Min	p10	p25	p50	p75	p90	Max	N
TSYMAT	4.58	0.93	2.74	3.16	3.93	4.66	5.44	5.70	6.04	504
TSY DUR	5.95	1.14	3.83	4.10	5.04	6.02	6.99	7.30	7.47	504
TSY MWD	250.93	118.06	78.58	101.84	136.84	233.21	371.77	412.22	451.28	504
TSY D/GDP	40.01	13.06	20.12	24.83	26.74	39.08	52.33	59.66	62.27	504
Baa-Aaa Spread	1.02	0.42	0.32	0.62	0.73	0.90	1.22	1.63	2.69	504
Unemployment rate	5.89	1.51	3.40	3.90	4.80	5.70	7.00	7.70	10.80	504
Real GDP Gwth	3.33	2.21	-2.56	0.15	2.34	3.48	4.49	6.04	8.58	504
Inflation	0.00	0.00	-0.01	0.00	0.00	0.00	0.01	0.01	0.02	504
y20	7.82	2.40	4.44	5.25	5.92	7.35	8.85	11.68	14.51	306
y15	7.83	2.25	4.35	5.26	6.20	7.56	8.75	11.55	14.42	422
y10	7.31	2.47	3.33	4.53	5.55	6.90	8.40	11.10	15.32	504
y5	7.00	2.45	2.29	4.23	5.35	6.65	8.10	10.71	14.82	504
y1	6.46	2.90	1.01	3.36	4.80	5.90	7.81	10.12	16.72	504
c15	8.14	1.85	5.24	5.91	6.76	7.77	9.43	10.33	13.07	276
c10	7.89	2.05	4.52	5.40	6.43	7.48	9.25	10.25	13.66	276
c5	7.35	2.22	3.17	4.55	5.80	7.04	8.93	9.90	14.16	276
c1	6.31	2.55	1.39	2.72	4.65	6.03	8.14	9.31	13.29	276
y20-y1	1.74	1.37	-2.27	-0.00	0.78	1.59	2.70	3.80	4.53	306
y15-y1	1.26	1.42	-2.89	-0.53	0.34	1.24	2.10	3.46	4.38	422
y10-y1	0.86	1.15	-3.07	-0.52	0.07	0.79	1.69	2.39	3.29	504
y5-y1	0.62	0.86	-2.75	-0.42	0.06	0.58	1.26	1.74	2.44	504
c15-c1	1.84	1.23	-0.65	0.42	0.95	1.58	2.67	3.89	4.61	276
c10-c1	1.58	1.07	-0.59	0.35	0.76	1.32	2.31	3.39	3.97	276
c5-c1	1.04	0.76	-1.44	0.19	0.46	0.89	1.62	2.25	2.87	276

Note: This table reports summary statistics of monthly average values for the main macroeconomic variables in the firm panel over 1965-2007. All variables are defined in Appendix A.

TABLE A.8: Summary statistics: macroeconomics yearly series (1965-2007)

	Mean	SD	Min	p10	p25	p50	p75	p90	Max	N
TSYMAT	4.53	0.94	2.78	3.08	3.92	4.57	5.39	5.66	5.90	42
TSY DUR	5.90	1.15	3.91	4.09	4.98	6.00	6.98	7.22	7.40	42
TSY MWD	251.24	119.15	83.03	108.76	144.12	234.48	371.75	411.06	443.75	42
TSY D/GDP	40.38	13.15	20.91	25.38	26.73	39.25	52.63	59.99	61.91	42
Baa-Aaa Spread	1.08	0.44	0.34	0.67	0.78	0.95	1.28	1.74	2.32	42
Unemployment rate	5.89	1.56	3.40	3.90	4.90	5.70	7.00	7.80	10.80	42
Real GDP Gwth	3.32	2.26	-1.95	0.15	2.09	3.54	4.49	5.58	8.46	42
Inflation	0.00	0.00	-0.00	-0.00	-0.00	0.00	0.00	0.01	0.01	42
y20	7.65	2.36	4.76	5.14	5.65	7.20	8.85	11.60	13.32	26
y15	7.65	2.21	4.73	5.14	6.02	7.35	8.76	11.52	13.25	36
y10	7.20	2.40	4.03	4.56	5.70	6.75	8.08	10.54	13.72	42
y5	6.88	2.39	3.12	4.44	5.17	6.18	7.73	10.42	13.11	42
y1	6.41	2.85	1.31	3.61	4.72	5.78	7.67	10.11	14.88	42
c15	7.94	1.80	5.67	5.74	6.33	7.59	9.23	10.37	12.32	23
c10	7.66	1.97	5.17	5.40	5.95	7.27	8.93	10.25	12.48	23
c5	7.11	2.10	4.02	4.42	5.61	6.88	8.84	9.81	12.05	23
c1	6.21	2.43	1.65	2.94	4.84	6.06	8.21	8.87	10.89	23
y20-y1	1.73	1.37	-0.08	-0.00	0.72	1.54	2.44	3.80	4.18	26
y15-y1	1.20	1.49	-2.16	-0.53	0.23	0.97	2.17	3.60	3.91	36
y10-y1	0.80	1.23	-2.04	-0.52	-0.01	0.78	1.63	2.58	3.06	42
y5-y1	0.55	0.95	-1.71	-0.48	-0.01	0.55	1.22	1.74	2.38	42
c15-c1	1.73	1.26	0.26	0.46	0.82	1.17	2.69	4.04	4.31	23
c10-c1	1.46	1.15	0.05	0.29	0.55	1.08	2.14	3.43	3.77	23
c5-c1	0.91	0.89	-0.79	0.18	0.25	0.75	1.26	2.25	2.87	23

Note: This table reports summary statistics of end of year of monthly average values for the main macroeconomic variables in the firm panel over 1965-2007. All variables are defined in Appendix A.

B. Identification

In this section, I provide details about the management over the maturity of debt issues by the U.S. Treasury and about the 5 policy shocks driving variation in the average maturity of outstanding Treasury debt over 1965-2007.

Objective function of the U.S. Treasury's office of Debt Management

The long-standing goal of the U.S. Treasury's office of Debt Management is to "maintain the lowest cost of borrowing over time"[55] and the stated strategies to pursue this goal are:

(1) Offer high quality products through regular and predictable issuance
(2) Promote a robust, broad, and diverse investor base
(3) Support market liquidity and market functioning
(4) Keep a prudent cash balance
(5) Maintain manageable rollovers and changes in interest expense

In this context, both the objective and strategy (5) may highlight a trade-off between issuing short-term debt to save an historically positive term premium and issuing long-term debt to maintain rollover risk sufficiently low.[56]

However, in support of strategies (1) and (2), the Overview of Treasury's Office of Debt Management makes clear that the Treasury is not "a market timer" and "doesn't react to current rate levels or short-term fluctuations in demand". This owes notably to one central characteristic of the Treasury as an issuer: it is "too large an issuer to behave opportunistically in debt markets".

An examination of Treasury debt management from the 1960s confirms the historical salience of such message in the practice and alleviate the concerns that variation in Treasury debt maturity is exogenous to corporate investment opportunities.

[55] See the Overview of Treasury's Office of Debt Management.

[56] Roll-over risk is the risk of unexpected changes in rates coming from two main sources: one the one hand unanticipated and persistent strengthening of the economy, and on the other hand the exposure to short-term market disruptions.

U.S. Treasury debt maturity: Policy shocks

In this section, I provide a summary of the main decisions by the U.S. Treasury affecting the average maturity of marketable government debt and in particular the 3 main policy constraints over long-term debt issuance (and their repeals) driving most variation in Treasury debt maturity. This summary draws heavily on Garbade (2015) and Garbade (2020).

Pre-sample developments: From World War II

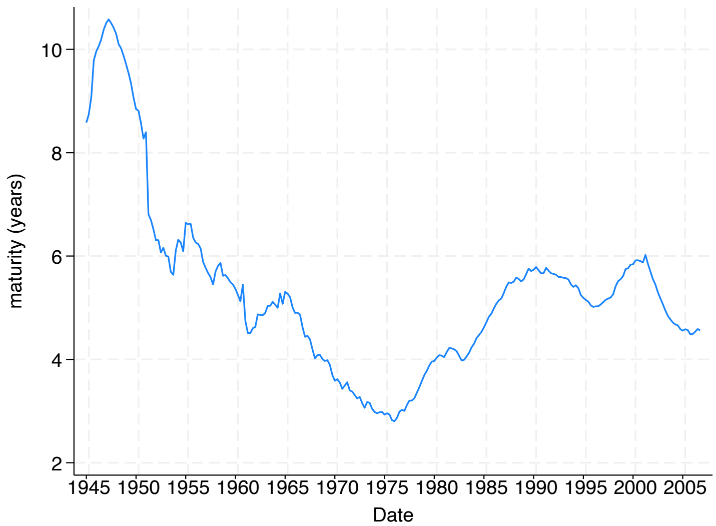
- **1945-1952**: During World War II, the Treasury issued substantial long-term debt, and by the end of 1945, total marketable debt stood at $199 billion, with 65% maturing in over a year and 30% in more than ten years. However, from 1946 to 1952, the Treasury shifted primarily to short-term debt for several reasons, including reduced postwar borrowing needs, increased flexibility from issuing across different maturities, and political pressure to manage borrowing costs (see Figure B.1).
- **1953-1959**: From 1953 to 1959, Treasury issuance of long-term debt was historically erratic due to political pressures, economic conditions, and fluctuating interest rates. Officials were occasionally hesitant to issue long-term debt during recessions, fearing it would hinder recovery, and sometimes avoided it during expansions due to rising interest rates and low investor demand. This behavior contributed to the volatility in the average maturity of the Treasury's debt during that period.
- **1960-1964**: From 1959 to 1964, U.S. Treasury officials focused on extending the maturity of government debt. Given the significant fluctuations in interest rates during this period, extending debt maturity allowed the Treasury to lock in rates for longer periods, reducing the risks of refinancing short-term debt at potentially higher rates. The introduction of advance refundings in 1960 facilitated this strategy, enabling the Treasury to issue about $4 billion annually in long-term bonds and increasing the average maturity from 4 years and 2 months to 5 years and 2 months by 1964.

1. 1965-1975: Interest rate statutory ceiling from 1918 binds and constrains long-term Treasury debt issuance, resulting in a decline in the average maturity of Treasury debt.

- **1965: the statutory constraint binds.** The Treasury's practice of offering long-term bonds came to an abrupt halt in 1965 when rising yields across all maturities surpassed

FIGURE B.1: Average maturity of U.S. Treasury debt and policy shocks

The figure presents the quarterly time series of the average maturity of Treasury debt value-weighted by outstanding principal.



the 4.25pp statutory ceiling set in 1918, which restricted the issuance of new bonds with maturities longer than five years. The origins and history of this constraint are detailed below.

- **Background on the 1918 statutory constraint**: Before 1917, Congress tightly controlled federal debt management, limiting the Treasury's discretion. However, World War I's borrowing needs shifted this authority to the Treasury. The Second Liberty Bond Act of 1917 introduced two key constraints.[57] First, bonds could not be issued with an interest rates exceeding 4pp (raised to 4.25pp in 1918) while other Treasury debt instrument could (including Treasury bills). Second, Treasury notes, which were also exempted from the interest rate restriction, were defined in 1919 with a maturity limit of five years (Garbade 2020). Thus, when market yields for bonds with maturities over five years exceeded 4.25pp, the Treasury was restricted to issuing debt with maturities shorter than five years. Between the mid-1920s and 1965, this ceiling was rarely a binding constraint, except briefly in 1932 and 1959.[58]

- **1965-1975: Relevance of the statutory constraint in explaining the drop in maturity.** Following the persistent halt initiated by the constraint, the average maturity of marketable Treasury debt decreased significantly, dropping from 5.3 years in

[57] See The Second Liberty Bond Act of 1917.

[58] The ceiling restricted the issuance of Treasury bonds in late 1931 and early 1932, following Britain's exit from the gold standard, as well as during 1959 and early 1960 (Garbade 2020).

mid-1965 to 2.7 years by mid-1975. This decline was directly linked to the statutory ceiling on interest rates, which restricted the Treasury's ability to issue long-term debt during this period (Garbade 2020). Treasury officials acknowledged the importance of this constraint, while Congress occasionally recognized the need for greater flexibility in issuing debt across various maturities. The following statements illustrate this:

  - Secretary Fowler's, at the 1967 hearing before the Senate's Committee on Finance, said "this shortening (maturity) tendency is unwelcome. It presents a problem that should be dealt with, in an orderly and systematic way, so that we do not face an excessive pileup of maturing debt", also stating "they are no imminent dangers but they are potential problems that can be [...] minimized if we would make a careful, orderly effeort to stretch out" debt maturity.[59]
  - Secretary John B. Connally, in 1971, testified before the Ways and Means Committee that the interest rate ceiling since mid-1965 had constrained long-term bond issuance, leading to an accumulation of short-term debt. Congress responded by taking some action to mitigate the effective constraint in the same year.[60]
  - On March 9, 1971, the Committee on Finance acknowledged that "the Treasury Department may well be correct in assuming that the 4.25 percent interest rate limit has interfered with good debt management practices." [61]
  - Congress expressed its reluctance to fully remove the ceiling, stating it was "reluctant to remove the ceiling completely, at least until there has been an opportunity to observe the effects of a limited exception to the ceiling." [62]
  - In 1975, U.S. Deputy Treasury Secretary Simon urged the Senate's Committee on Finance for measures to "arrest the decline in the average maturity" and address the "need for frequent refinancings"[63]

- **Efforts to mitigate the constraint.** Despite some efforts, detailed below, to mitigate the impacts of this constraint, the Treasury did not prevent the average maturity of marketable Treasury debt from reaching a post-WWII low (see Figure B.1).

[59]See Hearing before the Committee on Finance, United States Senare, 1967.
[60]See Ways and Means Committee Hearing. 1971.
[61]See Committee on Finance (1971, p. 12). See also Ways and Means Committee Hearing. 1971.
[62]See Committee on Finance (1971, p. 12).
[63]See Annual Report of the Secretary of the Treasury on the State of the Finances, 1975.

- **1967: Increasing the maximum maturity of a note to seven years.** Congress attempted to alleviate the statutory constraint's impact by passing an act which raised the maximum maturity of a note to seven years. [64]
- **1971: First exemptions.** Another act, in 1971, allowed Treasury officials to issue up to $10 billion in bonds with interest rates above 4.25pp, but the effects were minimal.[65]

- **Series of significant Congress decisions.** The trend reversal in the average maturity of Treasury debt occurred in 1976 and results from significant interventions by Congress. In March 1976, Congress extended the maximum maturity of a note from seven to ten years and raised the exemption from the ceiling to $12 billion.[66] This exemption was subsequently raised several times, from $17 billion in 1976[67] to $70 billion in 1980.[68]

  In early 1982, Congress failed to timely increase the ceiling exemption, preventing the issuance of 20- and 30-year bonds in April and July. However, a significant increase of $110 billion in September 1982 allowed the Treasury to restart issuance. This marks the second phase of the staggered repeal, with much larger exemptions granted in subsequent years (up to $270 billion in 1987) before the ceiling was finally removed in 1988.

- **1976-1991: Regaining flexibility lost from statutory constraints.** These changes halted the decline in Treasury debt maturity and facilitated a recovery until the late 1980s. Garbade (2015) provides anecdotal evidence showing that the rate ceiling created a "countervailing commitment" to lengthen Treasury debt maturity, which persisted into the early 1990s and was driven by the desire to regain flexibility lost due to the statutory constraint.

- **Timing and pace of recovery.** The establishment of the currently prevailing predictable and regular debt offering framework between 1975 and 1977 contributed to a gradual adjustment in Treasury debt maturity. By institutionalizing consistent issuance patterns, the Treasury enabled market participants to anticipate future offerings and adapt to changes in the debt landscape. As a result, the average

[64]See Act of June 30, 1967.
[65]The Act of March 17, 1971
[66]Act of March 15, 1976.
[67]Act of June 30, 1976.
[68]Act of October 3, 1980.

maturity of Treasury debt began to recover steadily, reflecting the countervailing commitment to respond to the previous constraints under the predictable and regular offering framework. By 1983, regular issuances of 4-, 5-, and 7-year notes, along with 20-year bonds, demonstrated the successful reintegration of longer maturities into the Treasury's portfolio, illustrating a gradual shift toward stability in debt management practices. With no significant change in issuance patterns that contributed to the mechanical increase in Treasury debt maturity until 1989, the average maturity of Treasury debt plateaued at historical highs between 1989 and 1991.

3. 1992-1995: Reduction of 30-year bond offerings reflecting political views about the cost of long-term financing.

- **Political discussions about the potential costs of the previous maturity extension.** The flexibility regained, first discussions emerged about the potential costs of the maturity extension of the previous decade program. Polarized views emerged within the U.S. Treasury regarding about the potential benefit of lowering the maturity of government debt to regain fiscal flexibility Garbade (2015). The previous decade's maturity extension program had resulted in long-term debt with higher interest payments, effectively constraining the Treasury's ability to respond to changing economic conditions. By shifting toward shorter maturities, some officials proposed that the Treasury may reduce overall interest burdens. Despite concerns about increasing refinancing risks, [69] the U.S. Treasury adjusted its debt management strategy between 1992 and 1993 by significantly reducing the issuance of long-term securities, particularly 30-year bonds, in favor of shorter-term debt.

- **1992: Temporary reduction of 30-year bond offerings.** In February 1992, the U.S. Treasury temporarily reduced long-term debt issuance by marginally decreasing the offering of 30-year bonds from $12 billion to $10 billion while increasing the sale of shorter-term securities. This decision was driven by the idea of lowering taxpayer costs, as Treasury Secretary Nicholas Brady highlighted the importance of reviewing the debt maturity structure in the context of a steep yield curve. However, this change faced resistance from the Treasury Borrowing Advisory Committee, which

[69] The committee firmly opposed a move toward shorter maturities, stating that "any material change at this time runs the risk of [...] undoing the gains, earned over years, that routine and consistency have contributed in reducing the 'uncertainty premium' in Treasury issues." (First-quarter 1992 TBAC report).

advocated for maintaining consistent long-term offerings to preserve the credibility and predictability of Treasury financing.

- **1993: Durable reduction of 30-year bond offerings.** In 1993, a series of events triggered a significant downward shift in the maturity of Treasury debt. In mid-February, the White House released “A Vision of Change for America”, outlining the Clinton Administration’s agenda and projecting potential savings from shortening issuance maturities for 1994-1998, but vague details left market participants confused. [70] By early March, the Treasury Borrowing Advisory Committee advocated for the continued issuance of 30-year bonds, citing their "near perpetual nature" and importance as benchmarks for state and corporate issuers, warning that reduced 30-year offerings would harm long-term market liquidity and increase roll-over risks. In May, the Treasury announced a durable reduction of 30-year bond offerings by half, aligning with the administration’s budgetary strategy for financing cost savings through shorter maturities. Officials emphasized that this change was driven not by current interest rates but by the enduring "risk premium in longer-term rates," asserting they would not reverse course and predicting the average maturity of Treasury debt would be one year lower in five years. [71] This unexpected shift surprised market participants and some committee members, marking a departure from long-term securities issuance and raising concerns about the Treasury’s ability to manage refinancing risks (Garbade, 2015).

- **1993-1995: predictable maturity shortening** Hence the decision to reduce 30-year bond offerings leads to a predictable and mechanical decrease in the average maturity of Treasury debt up until late 1995 as highlighted in Figure 2.

4. 1996-2000: Reversing the decline initiated by the 1992-1993 decisions.

- **The decision.** The decline in the average maturity of Treasury debt halted in May 1996 when the Treasury announced that starting in the second half of 1996, they would increase the offering frequency of 10-year notes to six times a year (up from four) and 30-year bonds to three times a year (up from two).

- **The rationale.** The Treasury Borrowing Advisory Committee cited two main reasons for this policy change. First, they warned that a continued decline in Treasury debt

[70] See A Vision of Change for America.

[71] Transcript of the mid-quarter refunding press conference, May 5, 1993.

maturity could elevate refinancing risk. As noted by Garbade (2015), Treasury officials viewed five years as the lower limit of their comfort zone for average maturity. Second, the committee pointed out that the 1993 decision to issue 30-year bonds semiannually had negatively affected market liquidity, recommending the reinstatement of quarterly offerings to restore it. Thus, the decision to increase long-term issuances focused more on reversing past policies than on responding to changing market conditions or macroeconomic factors.

- **1998-2000: contain the lengthening in the maturity under fiscal surpluses** By resuming longer-term bond issuance, the Treasury allowed the average maturity to increase gradually. However, as budget surpluses grew in the late 1990s, officials recognized the need to contain a steep rise in average maturity. In response, the Treasury implemented strategic measures, including scheduled reopenings of notes and bonds and a buyback program aimed at containing the average maturity of existing debt, countering projections that it could rise from 5.7 years to nearly 8 years by 2004. In the late 1990s and early 2000s, these debt management policies focused on maintaining an appropriate maturity structure and enhancing market liquidity. Scheduled reopenings allowed for smaller offerings, meeting liquidity needs in the secondary market while preserving benchmark issues. The restructuring of the auction calendar also limited long-term securities issuance to ensure market stability. Although 30-year bond issuance dropped from $32 billion in 1996 to $15 billion by 2001, proactive measures kept the average maturity stable at around 5.5 years by the end of 2001.

5. 2001-2007: Decline in the maturity of government debt following the 2001 unexpected suspension of 30-year debt issues.

- **The decision.** In October 2001, U.S. Treasury Secretary Fisher announces a suspension of debt issues of 30-year U.S. Treasury bond citing the objective of paying off federal debt in times fiscal surpluses and of preserving liquidity in other tenors in the long run.[72]

- **Unanticipated nature of the decision.** The policy change surprised market participants, as the fiscal position was deteriorating and the U.S. had returned to a

[72] See U.S. Department of the Treasury, 2001, Press release, October 31.

net borrower position (Badoer & James 2016). The latter unanticipated decision is the main driver of the subsequent decrease in the average maturity of Treasury debt.[73]

- **Evidence of investor response to the unanticipated shock.** Duarte and Umar (2024) find support for the hypothesis that the policy change was unanticipated as it led to immediate and significant market reactions. On the day of the announcement, October 31, 2001, there was a sharp rise in the price of 30-year USTs, with a 2.1% return difference between 30-year and 10-year USTs. This impact persisted throughout the suspension, but a notable reversal occurred when the U.S. Treasury announced the potential resumption of 30-year UST auctions on May 4, 2005. This impact persisted throughout the suspension, but a notable reversal occurred when the U.S. Treasury announced the potential resumption of 30-year UST auctions on May 4, 2005. The impact of this policy shock extended beyond immediate market reactions. Badoer and James (2016) and Duarte and Umar (2024) demonstrate that the suspension led in the following years to significant changes in corporate bond issuance and investor behavior, particularly among life insurance companies. These market participants had to adjust their strategies in response to the unexpected change, further illustrating the exogenous nature of the decision.

- **The reversal.** In August 2005, the U.S. Treasury officially announced the reintroduction of the 30-year Treasury Bond for 2006, reversing the 2001 policy that had suspended its issuance. This announcement was part of the Treasury's Quarterly Refunding statement on August 3, 2005, following an initial indication of the potential resumption on May 4, 2005.[74] The decision to reinstate the 30-year bond was influenced by several factors, including a changing fiscal outlook that shifted from budget surpluses to deficits, which necessitated more diverse financing options, as well as the substantial market demand for long-term government securities that had gone unmet since the suspension.

[73]See The Economist, 2001, "CutShort", November 1.

[74]See U.S. Department of the Treasury, 2005, Press release, August 3.

B.1. Quantitative relevance of the persistent shocks driving realized variation in the maturity of Treasury debt

To assess the quantitative relevance of the issuance constraints in explaining the variation in the maturity of outstanding Treasury debt, I conduct two counterfactual exercises. These exercises compare the realized average maturity of Treasury debt to counterfactual average maturities of Treasury debt under two simple alternative distributions of issuances but under the same realized aggregate net debt issuance.

In the first counterfactual, referred to as the *unconstrained counterfactual*, I assume that, following a policy constraint, total net debt issuances matches the realized aggregate Treasury issuance, but the distribution of issuances across maturities follows the pattern prevailing before the policy constraint. This allows me to assess how the maturity structure would have evolved without the policy constraint's impact on issuance distribution. Let $\mathrm{I}_{\text{realized},t}$ represent the realized total net debt issuance in year t, and $\mathrm{s}_{\text{pre-shock},m}$ denote the average share of net debt issuance allocated to maturity m over the five years before the shock.[75] Following the policy constraint, the counterfactual issuance for each maturity m in year t is computed as

$$\mathrm{I}_{\text{unconstrained},m,t} = \mathrm{s}_{\text{pre-shock},m} \times \mathrm{I}_{\text{realized},t}.$$

Total issuance across maturities equals the realized total debt issuance as $\sum_m \mathrm{s}_{\text{pre-shock},m} = 1$. This is akin to a shift-share design, where the 'shifter' is aggregate net debt issuance and the 'exogenous shares' are the pre-constraint shares.

In the second counterfactual, referred to as the *constrained counterfactual*, total net debt issuance remains the same as the realized amount, but the distribution of issuances across maturities prevailing before the policy constraint adjusts for the policy constraint. Debt issuance at maturities greater than or equal to the shortest constrained maturity is redistributed to the highest unconstrained maturity. Let $\mathrm{m}_{\text{constraint},t}$ represent the maturity constraint in year t (e.g., 7 years for the 1965 shock, 10 years for the 1992 and 2001 shocks). Formally, the counterfactual issuance for maturity m after the

[75] For the 2001 shock, the years 2000 and 2001 are excluded from the calculation of the pre-shock average. As detailed in the historical accounts in the previous subsections, these years are affected by the choice of the government to reduce long-term debt issuance through both lower long-term debt gross issuances and bond buybacks to constrain the mechanical increase in the maturity of government debt due to lower financing needs due to the surpluses in 1999 and 2000.

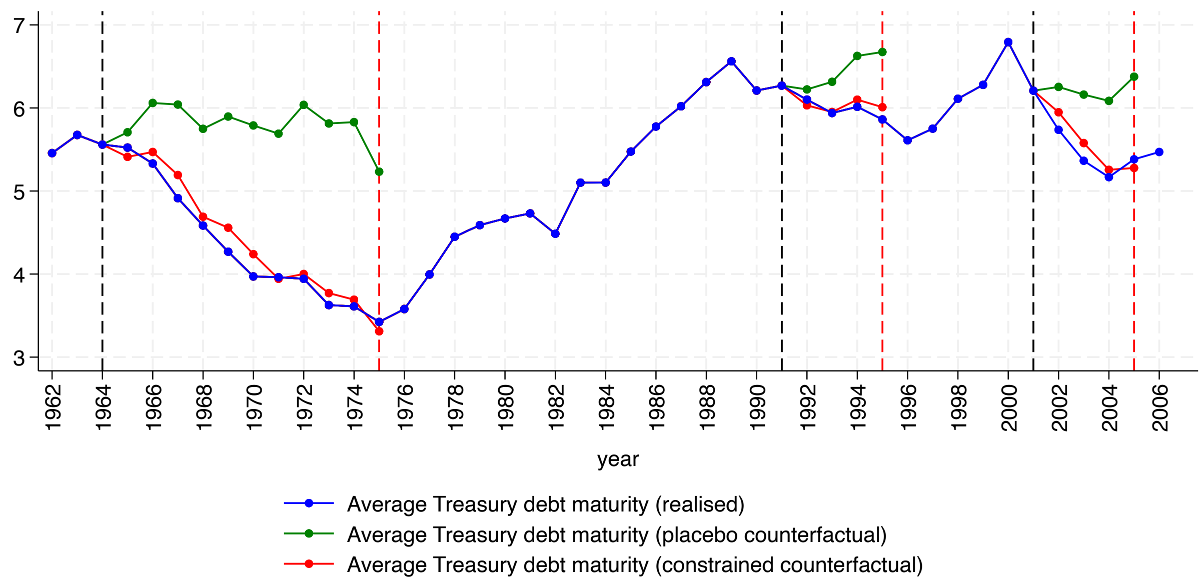
shock is:

$$
\mathrm{I}_{\text{constrained},m,t} = \begin{cases} \mathrm{s}_{\text{pre-shock},m} \times \mathrm{I}_{\text{realized},t}, & \text{if } m < \mathrm{m}_{\text{constraint},t} \\ \left(\mathrm{s}_{\text{pre-shock},m} + \sum_{m > \mathrm{m}_{\text{constraint},t}} \mathrm{s}_{\text{pre-shock},m}\right) \times \mathrm{I}_{\text{realized},t}, & \text{if } m = \mathrm{m}_{\text{constraint},t} \\ 0. & \text{if } m > \mathrm{m}_{\text{constraint},t} \end{cases}
$$

Figure B.2 compares the realized trajectory of the average maturity of Treasury debt to the trajectories under both the unconstrained and constrained counterfactual scenarios.

FIGURE B.2: Average maturity of U.S. Treasury debt and counterfactual issuance patterns

The figure presents the yearly time series of the average maturity of Treasury debt value-weighted by outstanding principal in perspective of two counterfactual paths for the average maturity of Treasury debt in the years following policy shocks that constrained long-term debt issuance until the repeal of the constraint. The vertical black dashed lines indicate the first year before policy shocks that constrain long-term government debt issuance start binding. The vertical red dashed lines indicate the first year before policy shocks that relaxed constraints on long-term government debt issuance occur. The policy shocks are detailed in the body of the text and in Appendix B. In the first counterfactual, the unconstrained counterfactual, I assume that the total net debt issuance across maturities is identical to the realized aggregate Treasury net debt issuance, but the distribution of issuances follows the same pattern prevailing in the 5 years preceding each policy shock. In the second counterfactual, the constrained counterfactual, I assume the total net debt issuance is the same as the realized one, and I adjust the distribution of pre-shock issuance weights to reflect the constraints imposed by the policy shocks, where debt issuances at maturities larger or equal to the shortest constrained maturity are redistributed to the highest unconstrained maturity. More details in the body of the text.



Under the unconstrained counterfactual, Treasury debt maturity would have remained unchanged after each shock. This indicates that the variation in total net debt issuance cannot mechanically explain the realized trajectory of Treasury debt maturity.

In contrast, following each shock, the constrained counterfactual shows a trajectory similar to the realized one, highlighting the significant impact of the persistent policy constraints following the shock. These constraints account for nearly all the variation in government debt maturity until the reversal policy shocks occur.

I do not compute the counterfactual debt maturity after the 1976 and 1996 reversal shocks. Reversing the constraints may require larger long-term issuance shares compared to pre-constraint shares, with the pace of reversal hindered by political frictions, such as Congress's failure to approve exemptions in 1981. In line with debt management developments, I implicitly assume the realized convergence path is exogenous to investment duration and driven by the goal to bring Treasury debt maturity within certain bounds' (Garbade 2020).

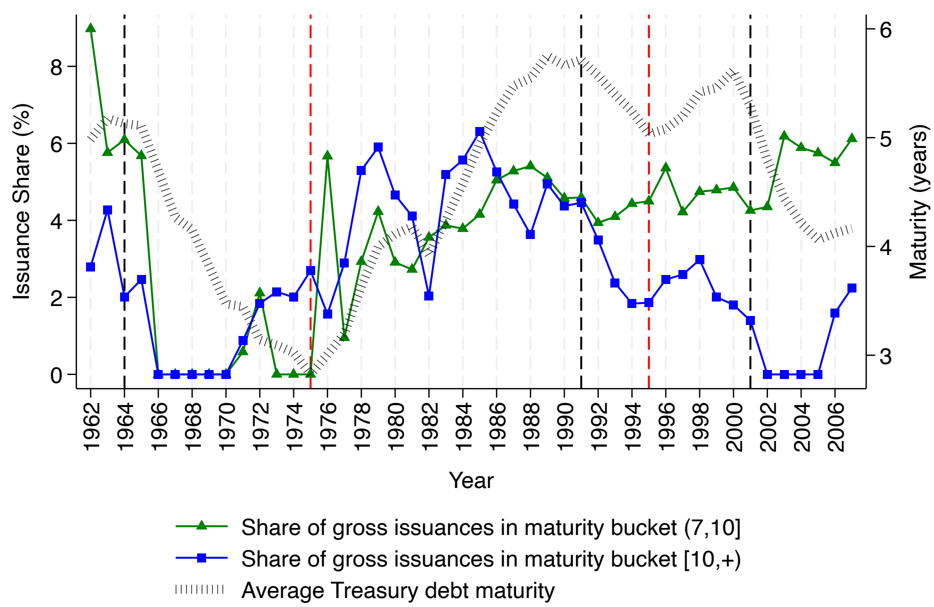
In addition to demonstrating the relevance of policy constraints, I show in Section 4 that my results are robust to two approaches: (a) focusing on the years after policy shocks that constrained long-term U.S. Treasury issuance, excluding periods after reversal shocks, and (b) using the difference in government debt maturity between the constrained and unconstrained counterfactuals as an instrument for variation in average debt maturity. This instrument isolates the impact of policy shocks by comparing changes in the maturity mix of new issuances with the counterfactual where the shocks did not occur.

Issuance patterns

FIGURE B.3: Gross issuance shares

The figure presents the yearly time series of the average maturity of Treasury debt value-weighted by outstanding principal and the share of gross issuances in maturity buckets (7,10] and [10,+), respectively excluding Treasury Inflation-Protected Securities (TIPS) and including TIPS from the calculations. The vertical black dashed lines indicate the first year before policy shocks that constrain long-term government debt issuance start binding. The vertical red dashed lines indicate the first year before policy shocks that relaxed constraints on long-term government debt issuance occur. The policy shocks are detailed in the body of the text and in Appendix B.

(a) Excluding TIPS



(b) Including TIPS

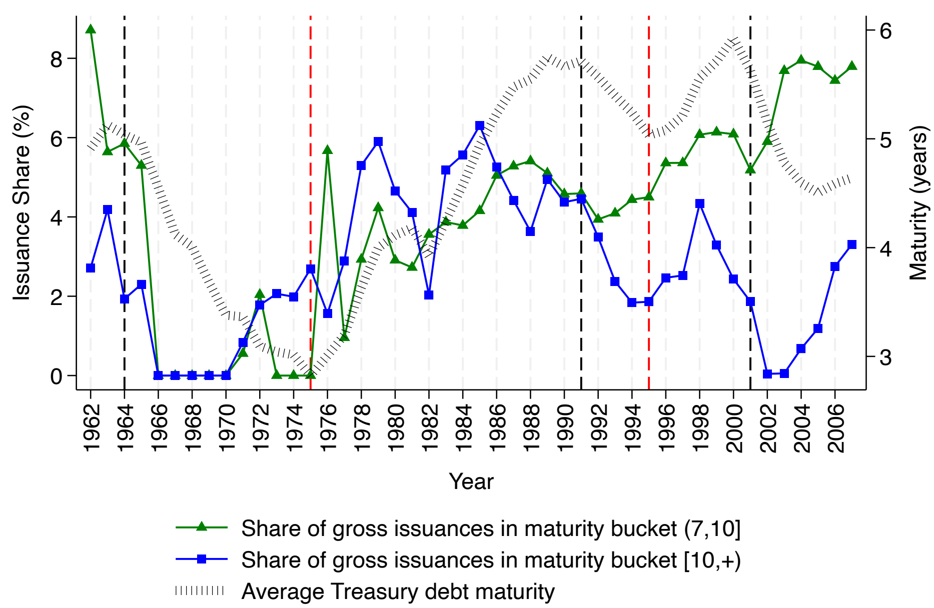
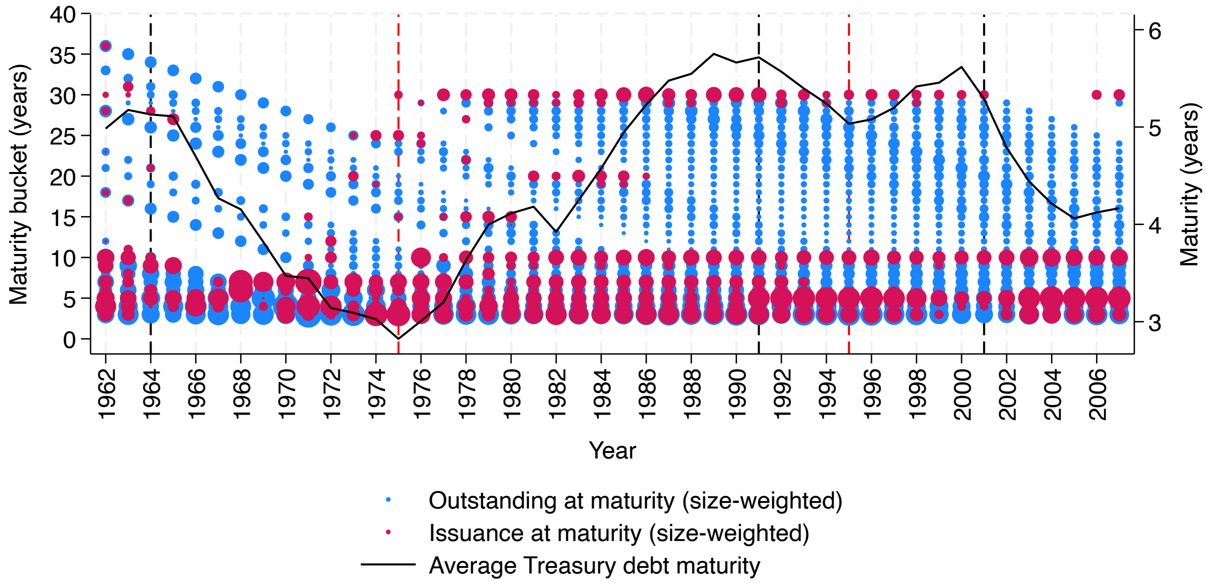


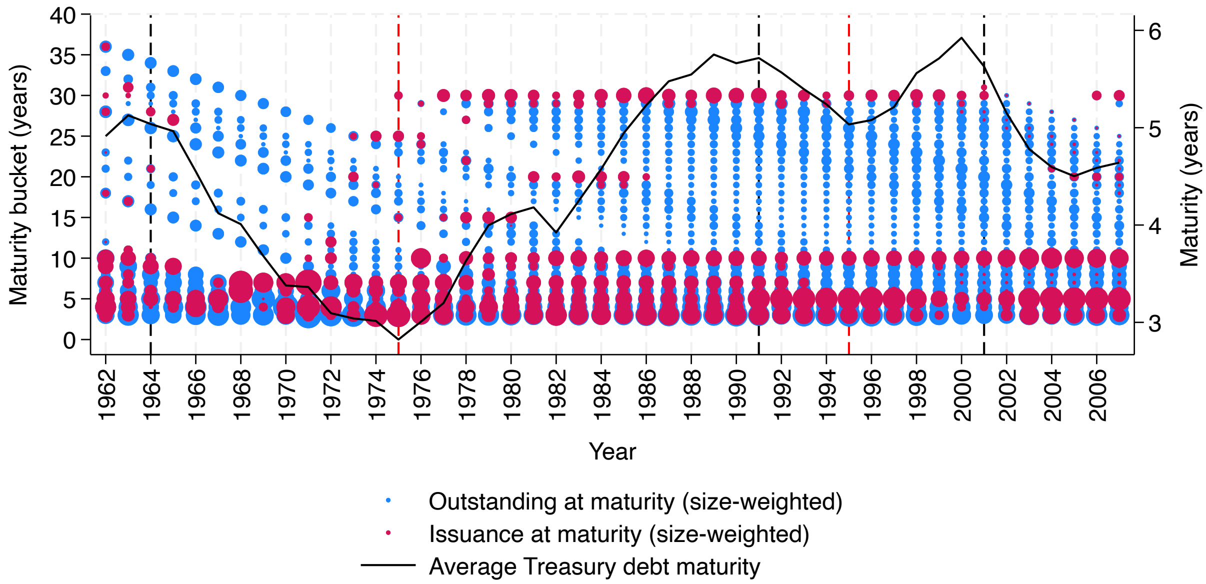
FIGURE B.4: Gross issuance weights

The figure presents the yearly time series of the average maturity of Treasury debt value-weighted by outstanding principal and weighted gross issuances and outstanding amounts by maturity bucket, respectively excluding Treasury Inflation-Protected Securities (TIPS) and including TIPS from the calculations. I drop maturity buckets below or equal to 2 years for visualization. The weights are respectively the share in each bucket of total yearly issuance and the share in each bucket of total yearly outstanding amounts. The vertical black dashed lines indicate the first year before policy shocks that constrain long-term government debt issuance start binding. The vertical red dashed lines indicate the first year before policy shocks that relaxed constraints on long-term government debt issuance occur. The policy shocks are detailed in the body of the text and in Appendix B.

(a) Excluding TIPS



(b) Including TIPS

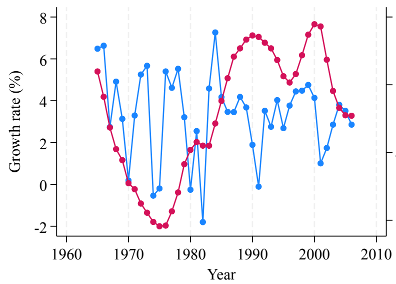


Treasury debt maturity and economic coniditions

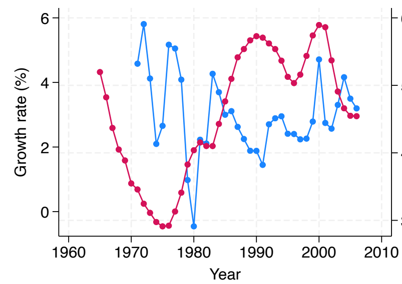
FIGURE B.5: Treasury debt maturity and macroeconomic series

The subfigures present the yearly time series of the average maturity of Treasury debt value-weighted by outstanding principal (in red) in perspective with other macroeconomic time series (in blue).

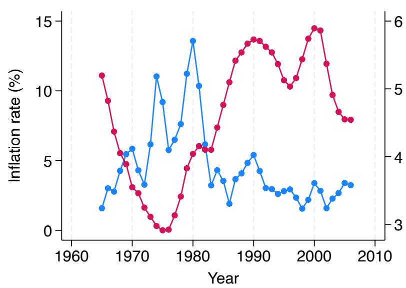
(a) 4-quarters real GDP growth



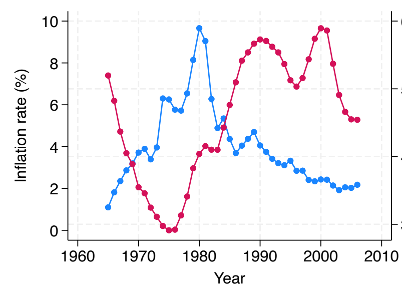
(b) 4Q real GDP growth (1y-ahead median exp.)



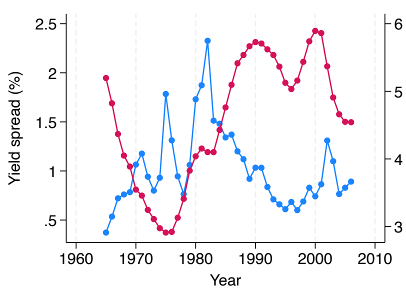
(c) Inflation (YoY)



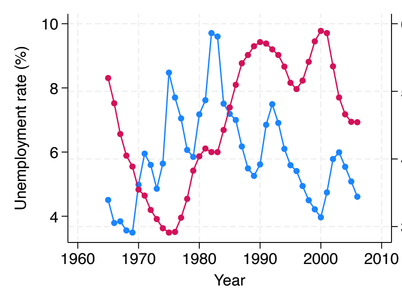
(d) Inflation (YoY, 1y-ahead median exp.)



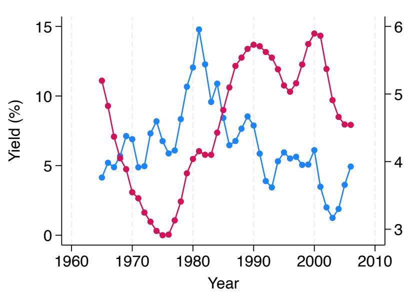
(e) Corporate bond credit spread



(f) Unemployment Rate



(g) 1-year yield



(h) Government investment duration

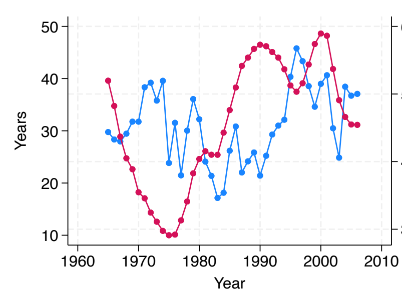


FIGURE B.6: Treasury debt maturity and Treasury debt size

The figure presents the yearly time series of the average maturity of Treasury debt value-weighted by outstanding principal in perspective with the time series of total outstanding Treasury debt to nominal U.S. GDP.

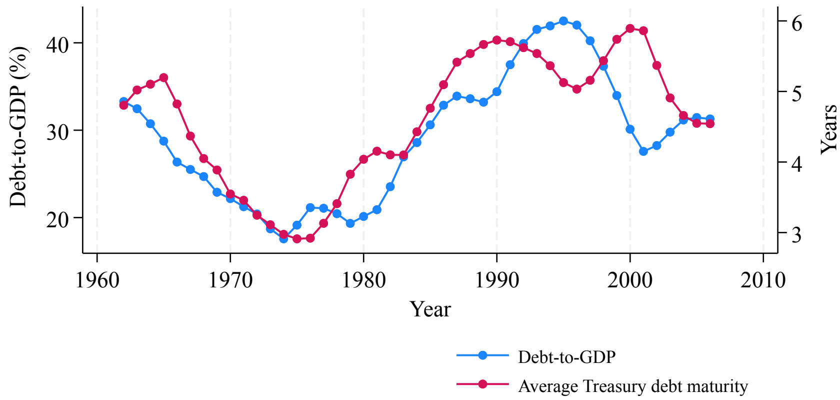
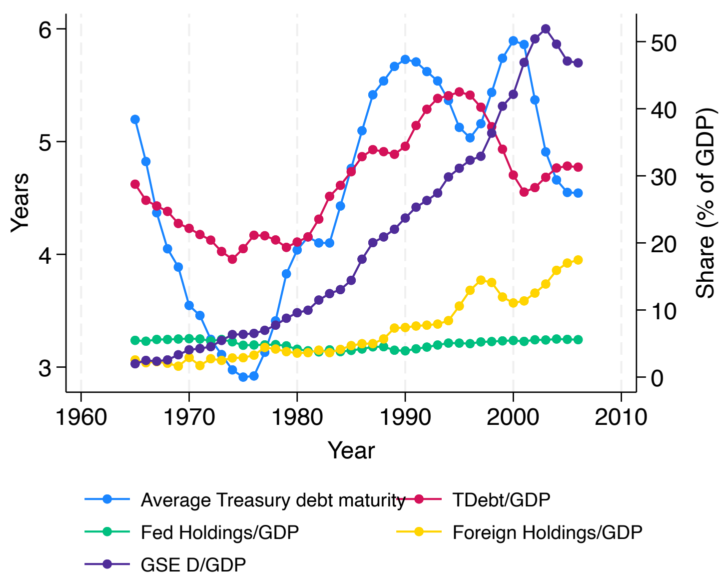


FIGURE B.7: Treasury debt maturity and other demand and supply shocks to long-term debt markets

The figure presents the yearly time series of the average maturity of Treasury debt value-weighted by outstanding principal (in red) in perspective with measures of long-term bond supply and demand (in blue). Such measures include total outstanding Treasury debt, total Government-Sponsored Enterprise(GSE)-issued or GSE-backed MBS debt, total Fed holdings of Treasuries, and total foreign holdings of Treasuries- all normalized by GDP.



C. Measurement

Negative correlation between cash flow duration and depreciation rates

Consider a static example of a potential investment at time $t = 0$ consisting in buying an asset with an initial stock A_0 that depreciates at a constant rate δ in each period. At time t, the stock of the asset is, therefore, given by $A_t = A_0(1-\delta)^t$. The asset generates cash flows at time $t \geq 1$ which are a constant fraction f of its contemporaneous stock. The present value of the investment is

$$V = f \cdot A_0 \sum_{t=1}^{\infty} \left(\frac{1-\delta}{1+r}\right)^t = f \cdot A_0 \cdot \frac{1-\delta}{r+\delta} \tag{7}$$

The duration of an investment is commonly defined as the percentage change of the present value of the investment for a 1 percentage point decrease in its discount rate. Taking the natural logarithm of both sides of Equation 7 and computing the derivative with respect to r, I obtain the duration of the investment, denoted D:

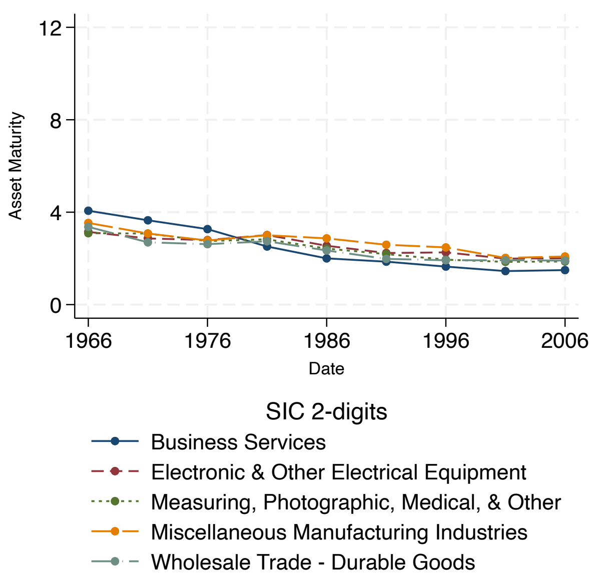
$$D \approx -\frac{\partial lnV}{\partial r} = \frac{1}{r+\delta}$$

The duration of the investment (D) and depreciation rate of the underlying asset (δ) are negatively correlated: faster depreciation leads to a shorter effective lifespan of the asset's cash flows. In the special case where $r = 0$, the cash-flow duration of the investment is exactly the inverse of the depreciation rate δ.

FIGURE C.1: Variation in Asset Maturity by industry and time

The figure reports the time series by industry (SIC-2digits) of *Asset Maturity* averaged at the industry-level by 5-year periods from 1966 to 2010 for the universe of firms in Compustat. Only the industries with the most extreme average values for 2001-2005 and with at least 100 underlying firms are represented.

(a) Bottom 5 industries



(b) Top 5 industries

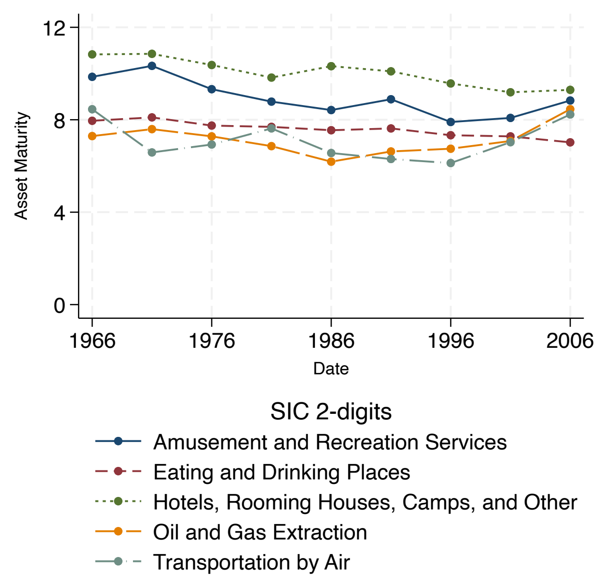


Table C.1: Explaining variation in Asset Maturity

The table presents the regression estimates where the dependent variable is the firm-level average asset maturity. The sample is the firm-level dataset that averages variables at the firm-level over the panel of Compustat firms for 1965-2007. The last two columns are estimated on the sample with non missing information about age and time to IPO. Details for variable definition in Appendix A. Standard errors reported in parentheses are clustered by firm.

	Asset Maturity (firm)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fixed-Asset Mat.				0.6***	0.4***				
				(0.0)	(0.0)				
Fixed-Asset Sh.					5.3***				
					(0.1)				
log(Assets)						-0.8***	-0.7***	-0.6***	-0.6***
						(0.0)	(0.0)	(0.1)	(0.1)
log(PPE)						1.4***	1.2***	1.1***	1.0***
						(0.0)	(0.0)	(0.0)	(0.0)
log(Emp)						-0.6***	-0.6***	-0.5***	-0.5***
						(0.0)	(0.0)	(0.0)	(0.0)
log(MCap)							-0.0	0.0	0.0
							(0.0)	(0.0)	(0.0)
Ebit to Assets							-0.0	-0.0	-0.0
							(0.0)	(0.0)	(0.0)
Leverage							1.3***	1.1***	1.1***
							(0.1)	(0.1)	(0.1)
CapEx to Assets							1.7***	2.0***	2.1***
							(0.3)	(0.3)	(0.3)
M/B ratio							0.0	0.0	0.0
							(0.0)	(0.0)	(0.0)
R&DEx to Assets							-0.0***	-0.0***	-0.0**
							(0.0)	(0.0)	(0.0)
LT debt sh. (1y)							0.0	-0.0	0.0
							(0.0)	(0.0)	(0.0)
LT debt sh. (5y)							0.0***	0.0***	0.0***
							(0.0)	(0.0)	(0.0)
Time to IPO									0.0***
									(0.0)
Age									-0.0
									(0.0)
Average year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
NAICS3 FE	–	✓	–	–	–	–	–	–	–
NAICS FE	–	–	✓	✓	✓	✓	✓	✓	✓
State FE	–	–	–	–	–	–	✓	✓	✓
Observations	13208	13200	12905	12905	12905	12834	12833	6944	6944
Adjusted R^2	0.040	0.494	0.580	0.887	0.938	0.710	0.723	0.740	0.743

TABLE C.2: Explaining variation in Asset Maturity: cross-section of fixed-assets

The table presents the regression estimates where the dependent variable is the firm-level average asset maturity. The sample is the firm-level dataset that averages variables at the firm-level over the panel of Compustat firms for 1965-2007 with non missing information about fixed assets at historical cost. Details for variable definition in Appendix A. Standard errors reported in parentheses are clustered by firm.

	Asset Maturity (firm)					
	(1)	(2)	(3)	(4)	(5)	(6)
Buildings to FA	7.8***		5.2***		4.9***	3.4***
	(0.3)		(0.3)		(0.3)	(0.2)
Equipment to FA	-2.1***		-1.2***		-1.1***	-0.3**
	(0.2)		(0.1)		(0.1)	(0.1)
Leases to FA	-3.2***		-3.0***		-2.1***	-1.8***
	(0.4)		(0.3)		(0.3)	(0.3)
Construction to FA	18.8***		12.5***		10.8***	5.9***
	(1.7)		(1.4)		(1.4)	(1.1)
Land to FA	19.6***		11.6***		8.7***	8.1***
	(1.7)		(1.4)		(1.5)	(1.3)
Other to FA	-7.8***		-5.3***		-4.1***	-3.3***
	(0.7)		(0.7)		(0.7)	(0.6)
log(Assets)						-0.5***
						(0.1)
log(PPE)						1.0***
						(0.0)
log(Emp)						-0.5***
						(0.0)
log(MCap)						-0.1**
						(0.0)
No FE	✓	–	–	–	–	–
Average year FE	–	✓	✓	✓	✓	✓
NAICS3 FE	–	✓	✓	–	–	–
NAICS FE	–	–	–	✓	✓	✓
State FE	–	–	–	–	–	✓
Observations	4601	4592	4592	4289	4289	4274
Adjusted R^2	0.322	0.457	0.569	0.567	0.644	0.744

D. The investment reallocation channel

TABLE D.1: The investment reallocation effect: across firms (with controls)

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures expressed in percentage points of lagged total assets. The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). AssetMat is de-meaned to interpret the coefficient on TSYMAT in column (1) as the average effect. The macroeconomic controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures			
	(1)	(2)	(3)	(4)
TSYMAT	-0.727***			
	(0.134)			
TSYMAT × AssetMat	-0.135***	-0.121***	-0.136***	-0.154***
	(0.027)	(0.023)	(0.022)	(0.025)
TSYMAT × Sales Growth			-0.008***	-0.008***
			(0.002)	(0.002)
TSYMAT × M/B Ratio			0.014	0.015
			(0.042)	(0.042)
TSYMAT × Profitability			-0.255	-0.268
			(0.243)	(0.246)
TSYMAT × Dividend Payer			0.417***	0.410***
			(0.105)	(0.105)
TSYMAT × IG Rating			-0.094	-0.084
			(0.149)	(0.149)
TSYMAT × Size			0.060*	0.060*
			(0.035)	(0.035)
Firm FE	✓	✓	✓	✓
Time FE	–	✓	✓	✓
AssetMat x Macro Controls	–	–	–	✓
Observations	120275	120275	120275	120275
Adjusted R^2	0.386	0.437	0.470	0.471

Table D.2: The investment reallocation effect: discrete measure

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures expressed in percentage points of lagged total assets. The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is a dummy for firm-level average asset maturity above its (asset-weighted) median in the distribution across firms (High AssetMat). Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The macroeconomic controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures			
	(1)	(2)	(3)	(4)
TSYMAT	-0.598***			
	(0.133)			
TSYMAT × High AssetMat	-0.631***	-0.711***	-0.750***	-0.843***
	(0.135)	(0.129)	(0.120)	(0.145)
Time FE	–	✓	✓	✓
Firm FE	✓	✓	✓	✓
Firm Controls x TSYMAT	–	–	✓	✓
High AssetMat x Macro Controls	–	–	–	✓
Observations	120275	120275	120275	120275
Adjusted R^2	0.387	0.437	0.470	0.470

Table D.3: The investment reallocation effect: other outcomes

The table presents the reduced-form estimates based on Equation 4 where the dependent variables are respectively capital expenditures (pp of lagged assets), R&D expenses (pp of lagged assets), acquisitions (pp of lagged assets), and employment growth expressed (pp). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. The macroeconomic controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capex	R&D	Acq	Emp Gwth
	(1)	(2)	(3)	(4)
TSYMAT × AssetMat	-0.154***	-0.047***	-0.011	-0.115*
	(0.025)	(0.011)	(0.008)	(0.063)
Time FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Firm Controls x TSYMAT	✓	✓	✓	✓
AssetMat x Macro Controls	✓	✓	✓	✓
Observations	120275	120275	120275	101676
Adjusted R^2	0.471	0.844	0.244	0.254

Table D.4: The investment reallocation effect: breakdown by fixed-assets

The table presents the reduced-form estimates based on Equation 4 where the dependent variables are respectively capital expenditures (pp of lagged assets),the change in the total stock of fixed assets valued at historical cost (pp of lagged total stock), the change in Machinery and Equipment valued at historical cost (pp of lagged total stock), and the change in Real Estate valued at historical cost (pp of lagged total stock). The sample is the yearly panel of Compustat firms for 1985-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capex	FA (Total)	FA (Machinery and Equip.)	FA (Real Estate)
	(1)	(2)	(3)	(4)
TSYMAT × AssetMat	-0.142***	-0.152	-0.134	-0.062*
	(0.041)	(0.092)	(0.088)	(0.032)
Time FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
AssetMat x linear trend	✓	✓	✓	✓
Observations	42378	42378	42378	42378
Adjusted R^2	0.454	0.248	0.243	0.222

Table D.5: The investment reallocation effect: different time periods

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The samples are the cuts of the yearly panel of Compustat firms for years indicated in column heads. The "Constraints" sample includes the years where long-term governement debt issuance is constrained by the policy shocks, i.e. [1965,1975], [1992,1995], and [2002,2005]. The "Relaxations" sample includes years where long-term government debt issuance is relaxed from the constraints, i.e. [1976,1991], and [1996,2001]. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). Column (5) presents the two-stage-least-squares estimate obtained using the time series of the difference in government debt maturity between the constrained and unconstrained counterfactuals defined in Section 2 as an instrument for government debt maturity. The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	1965-2007	1965-1985	1986-2007	Constraints	Constraints (IV)	Relaxations
	(1)	(2)	(3)	(4)	(5)	(6)
TSYMAT × AssetMat	-0.117***	-0.098***	-0.115**	-0.085**	-0.128***	-0.172***
	(0.024)	(0.037)	(0.052)	(0.036)	(0.040)	(0.039)
Time FE	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Controls x TSYMAT	✓	✓	✓	✓	✓	✓
AM x Linear Trend	✓	✓	✓	✓	✓	✓
Observations	120275	42068	77649	42228	42228	70701
Adjusted R^2	0.470	0.529	0.481	0.535	0.035	0.486

TABLE D.6: The investment reallocation effect: measures of long-term bond supply

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured with respectively the weighted-average maturity of Treasury debt (TSY MAT, in years), weighted-average maturity of Treasury debt excluding TIPS, weighted average duration of Treasury debt (TSY WAD, in years), maturity-weighted Treasury debt-to-GDP (TSY MWD, in 100pp of GDP), maturity-weighted Treasury debt-to-GDP excluding Federal Reserve holdings of Treasuries, and Treasury debt-to-GDP (TSY D/GDP, in 100pp of GDP). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TSYMAT × AssetMat	-0.14***						-0.15***
	(0.02)						(0.03)
TSYMAT (excl. TIPS) × AssetMat		-0.12***					
		(0.02)					
TSY WAD × AssetMat			-0.11***				
			(0.02)				
TSY MWD × AssetMat				-0.08***			
				(0.02)			
TSY MWD (excl Fed.) × AssetMat					-0.09***		
					(0.02)		
TSY D/GDP × AssetMat						-0.01***	0.00
						(0.00)	(0.00)
Time FE	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓
Supply x Firm Controls	✓	✓	✓	✓	✓	✓	✓
Observations	120275	120275	120275	120275	120275	120275	120275
Adjusted R^2	0.470	0.470	0.469	0.470	0.471	0.468	0.471

Table D.7: The investment reallocation effect: robustness to cyclical sensitivities

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures					
	(1)	(2)	(3)	(4)	(5)	(6)
TSYMAT × AssetMat	-0.136***	-0.151***	-0.132***	-0.136***	-0.112***	-0.154***
	(0.023)	(0.023)	(0.022)	(0.022)	(0.022)	(0.025)
Baa-Aaa Spread × AssetMat	0.002					-0.042
	(0.040)					(0.069)
U-rate × AssetMat		-0.029**				-0.043***
		(0.011)				(0.016)
1y yield × AssetMat			0.017**			0.024***
			(0.007)			(0.008)
Real GDP Gwth × AssetMat				-0.015**		-0.029***
				(0.006)		(0.008)
Inflation (yoy) × AssetMat					0.018***	-0.007
					(0.006)	(0.007)
Linear trend × AssetMat						-0.002
						(0.003)
Firm Controls x TSYMAT	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
Observations	120275	120275	120275	120275	120275	120275
Adjusted R^2	0.470	0.470	0.470	0.470	0.470	0.471

TABLE D.8: The investment reallocation effect: sensitivities to other macroeconomic shocks

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TSYMAT × AssetMat	-0.14***	-0.11***	-0.14***	-0.14***	-0.13***	-0.12***	-0.16***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
GSE D/GDP × AssetMat		-0.00*					
		(0.00)					
TSY Foreign Hold. (%) × AssetMat			0.00				
			(0.01)				
Fed Hold. (%) × AssetMat				-0.01			
				(0.04)			
Govt. Inv. Duration × AssetMat					0.01***		
					(0.00)		
CPI Gwth Exp. × AssetMat						0.02**	
						(0.01)	
Real GDP Gwth Exp. × AssetMat							-0.04***
							(0.01)
Firm Controls x TSYMAT	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓	✓
Observations	120275	120275	120275	120275	120275	120275	114586
Adjusted R^2	0.470	0.470	0.470	0.470	0.470	0.470	0.474

TABLE D.9: The investment reallocation effect: cyclicality of firms investment

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. The capital expenditures cyclicality quintiles are taken from the distribution of the point estimates specific to each industry in the OLS regressions of firm-level capital expenditures (scaled by lagged assets) on real GDP growth. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures		
	(1)	(2)	(3)
TSYMAT × AssetMat	-0.136***	-0.128***	-0.123***
	(0.022)	(0.023)	(0.021)
TSYMAT × Capex Cyclicality Quintile		0.187	
		(0.211)	
Time FE	✓	✓	–
Firm FE	✓	✓	✓
Capex cyclicality quintile x Time FE	–	–	✓
Firm Controls x TSYMAT	✓	✓	✓
Observations	120275	120275	120219
Adjusted R^2	0.470	0.470	0.475

Table D.10: The investment reallocation effect: heterogeneity by proxies for financial constraints

The table presents the reduced-form estimates based on Equation 4 where the dependent variables are respectively capital expenditures (pp of lagged assets) and net debt issuance (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. The split dummies are respectively a dummy equal to 1 if the firm has above median total assets, a dummy equal to 1 if the firm pays dividends, a dummy equal to 1 if the firm has SP LT rating falling in A-AAA. For the latter split dummy, the sample is reduced to rated firms. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables and lower-level interactions are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures			Net debt issuance		
	(1)	(2)	(3)	(4)	(5)	(6)
TSYMAT × AssetMat	-0.20***	-0.16***	-0.12***	-0.19***	-0.16***	-0.11***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)
TSYMAT × AssetMat × High Size	0.08**			0.07**		
	(0.03)			(0.03)		
TSYMAT × AssetMat × Dividend		0.06*			0.08*	
		(0.04)			(0.05)	
TSYMAT × AssetMat × Rating = A-AAA			0.00			0.00
			(0.00)			(0.00)
Firm FE	✓	✓	✓	✓	✓	✓
Time x Split Dummy FE	✓	✓	✓	✓	✓	✓
Controls x TSYMAT x Split Dummy	✓	✓	✓	✓	✓	✓
Observations	120093	120090	36791	119322	120090	36833
Adjusted R^2	0.480	0.476	0.147	0.481	0.106	0.152

Table D.11: The investment reallocation effect: robustness to collateral channel

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1975-2007, where MSA-level real estate prices are available. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures				
	(1)	(2)	(3)	(4)	(5)
TSYMAT × AssetMat	-0.169***	-0.169***	-0.134***	-0.171***	-0.127***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
RE price (State) × AssetMat		-0.000	-0.000		
		(0.000)	(0.000)		
RE price (MSA) × AssetMat				-0.000	-0.001
				(0.000)	(0.000)
Time FE	✓	✓	–	✓	–
Firm FE	✓	✓	✓	✓	✓
State x Time FE	–	–	✓	–	–
MSA x Time FE	–	–	–	–	✓
Firm Controls x TSYMAT	✓	✓	✓	✓	✓
Observations	84420	84420	84249	84420	84364
Adjusted R^2	0.482	0.483	0.496	0.483	0.500

TABLE D.12: The investment reallocation effect: investment duration and irreversibility

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007, where firm and industry-level measures of irreversibility from Kim and Kung (2017) and Kermani and Ma (2022) are available. The investment duration measure is the firm-level average asset maturity (AssetMat or AM, in years). Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Redeployability (Kim & Kung 2017)			Asset-specificity (Kermani & Ma 2023)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TSYMAT × AssetMat	-0.15***	-0.14**	-0.15**	-0.16***	-0.15***	-0.16***	-0.16***
	(0.05)	(0.06)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)
TSYMAT × Redep.		0.12					
		(1.01)					
TSYMAT × Redep. (e-w)			-0.38				
			(1.34)				
TSYMAT × Mobility					-10.57*		
					(5.58)		
TSYMAT × Customization						14.35**	
						(7.08)	
TSYMAT × Recov. Rate							-0.68
							(0.61)
Time FE	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓
Controls x TSYMAT	✓	✓	✓	✓	✓	✓	✓
AM x Macro Controls	✓	✓	✓	✓	✓	✓	✓
Observations	78834	78834	78834	117541	117541	117541	117541
Adjusted R^2	0.483	0.483	0.483	0.470	0.471	0.471	0.471

TABLE D.13: The investment reallocation effect: margins of investment duration

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is respectively firm-level average asset maturity (AssetMat, in years), firm-level average fixed asset maturity (FixedAssetMat, in years), firm-level average fixed asset share (FixedAssetShare, in pp), and the orthogonal components of the latter two. Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures			
	(1)	(2)	(3)	(4)
TSYMAT $\times$ AssetMat	-0.144***			
	(0.022)			
TSYMAT $\times$ FixedAssetMat		-0.052***		
		(0.018)		
TSYMAT $\times$ FixedAssetShare			-0.023***	
			(0.003)	
TSYMAT $\times$ FixedAssetMat (residualised)				-0.092***
				(0.031)
TSYMAT $\times$ FixedAssetShare (residualised)				-0.038***
				(0.005)
Time FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Firm Controls x TSYMAT	✓	✓	✓	✓
Observations	120275	120275	120275	120275
Adjusted R^2	0.470	0.469	0.471	0.471

TABLE D.14: The investment reallocation effect: alternative *Asset Maturity* definitions

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is respectively the baseline measure equal to firm-level average asset maturity (AM, in years), the time varying firm-level measure, the backward-looking average measure, the measure constructed from observations of firms reporting straight-line depreciation, the measure constructed without substracting amortisation from depreciation, the measure accounting for zero maturity of current assets, the measure using the BEA depreciation rate at the BEA industry level and the first firm-level asset maturity in the panel. Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSY, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TSY × AM	-0.14***							
	(0.02)							
TSY × AM (time-var.)		-0.07***						
		(0.02)						
TSY × AM (backward)			-0.12***					
			(0.02)					
TSY × AM (SL dep.)				-0.10***				
				(0.02)				
TSY × AM (w/ amort.)					-0.14***			
					(0.02)			
TSY × AM (CA 0 mat)						-0.13***		
						(0.02)		
TSY × AM (BEA dep.)							-0.12***	
							(0.02)	
TSY × AM (first)								-0.06***
								(0.02)
Time FE	✓	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓
Controls x TSYMAT	✓	✓	✓	✓	✓	✓	✓	✓
Observations	120275	118712	119776	104124	120275	120275	117537	120068
Adjusted R^2	0.470	0.519	0.474	0.446	0.470	0.470	0.466	0.471

TABLE D.15: The investment reallocation effect: alternative duration proxies (firm average and lagged values)

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measures are respectively the firm-level average asset maturity (AssetMat), the firm-level average Gonçalves (2019)'s cash-flow duration (Dur.), the firm-level average price-to-dividend ratio (P/D Ratio), the firm-level average median analyst long-term growth forecast from IBES (IBES LTGExp.). I also consider the lagged point-in-time measures in column (5) to (7). All investment duration measures are standardized to have variance equal to 1. Government long-term bond supply is measured with the weighted-average maturity of Treasury debt (TSYMAT, in years). The firm-level controls include sales growth rate, market-to-book ratio, profitability, a dummy equal to one for investment-grade firms, and size. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	Capital Expenditures						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TSYMAT × AssetMat	-0.36***						
	(0.06)						
TSYMAT × Dur. (Goncalves)		-0.23***					
		(0.09)					
TSYMAT × P/D ratio			-0.16**				
			(0.07)				
TSYMAT × IBES LTGExp.				0.09			
				(0.12)			
TSYMAT × L.Dur. (Goncalves)					-0.01***		
					(0.00)		
TSYMAT × L.P/D ratio						-0.00***	
						(0.00)	
TSYMAT × L.IBES LTGExp.							-0.01
							(0.01)
Time FE	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓
Firm Controls x TSYMAT	✓	✓	✓	✓	✓	✓	✓
Observations	104962	104962	62922	74662	56530	38625	36313
Adjusted R^2	0.474	0.473	0.495	0.499	0.531	0.536	0.583

TABLE D.16: The investment reallocation effect: across industries (collapsed)

The table presents the reduced-form estimates based on Equation 4 where the dependent variable is capital expenditures expressed in percentage points of lagged total assets. The sample is the yearly industry panel of Compustat firms for 1965-2007. The yearly industry panel is obtained by summing raw figures from the firm panel. The investment duration measure is the asset maturity (AssetMat, in years) averaged at the NAICS-3digits industry-level. Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The macroeconomic controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and NAICS-3digits industry.

	Capital Expenditures		
	(1)	(2)	(3)
TSYMAT × AssetMat (NAICS3)	-0.058	-0.151**	-0.172**
	(0.075)	(0.069)	(0.066)
Industry FE	✓	✓	✓
Time FE	✓	✓	✓
AssetMat x Linear Trend	–	✓	✓
AssetMat x Macro Controls	–	–	✓
Observations	3179	3179	3179
Adjusted R^2	0.493	0.495	0.497

FIGURE D.1: Event studies: across industries

The figure presents the yearly average maturity of Treasury debt (in green, with values on the right y-axis) and the reduced-form estimates $\beta^{(t)}$ (in blue, with values on the left y-axis) based on Equation 5. The dependent variable is capital expenditures expressed in percentage points of lagged total assets and de-meaned by firm. The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the industry-level average asset maturity (AssetMat, in years). I control for the interaction between a linear trend and AssetMat. I control for the interaction between the same firm-level controls for investment opportunities as Equation 4 and year dummies. Details for variable definition in Appendix A. Confidence intervals in shaded blue are based on standard errors clustered by NAICS-3digits industry. The vertical black dashed lines indicate the first year before policy shocks that constrain long-term government debt issuance start binding. The vertical red dashed lines indicate the first year before policy shocks that relaxed constraints on long-term government debt issuance occur. The policy shocks are detailed in the body of the text and in Appendix B. For each period following a policy shock, the horizontal line is fixed at the level of the coefficient estimated for the last year before the policy shock.

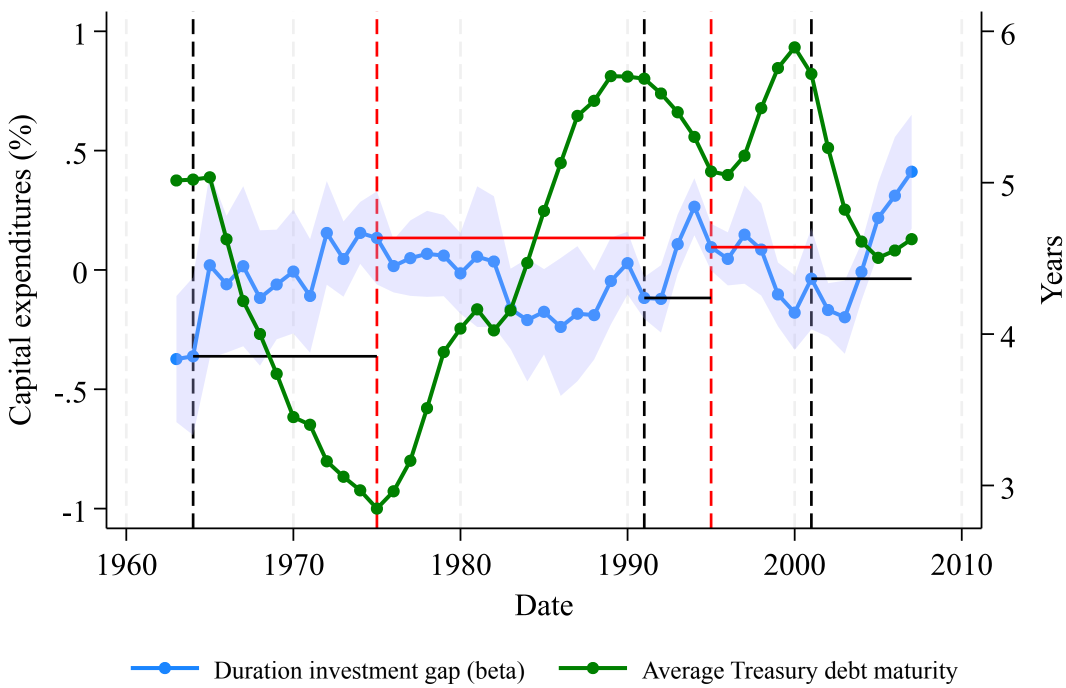


FIGURE D.2: Event studies: within industry across firms

The figure presents the yearly average maturity of Treasury debt (in green, with values on the right y-axis) and the reduced-form estimates $\beta^{(t)}$ (in blue, with values on the left y-axis) based on Equation 5. The dependent variable is capital expenditures expressed in percentage points of lagged total assets and de-meaned by firm-dvision. The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). To get within-industry across-firm identification, I add NAICS-3digits industry-time fixed effects. I control for the interaction between a linear trend and AssetMat. I control for the interaction between the same firm-level controls for investment opportunities as Equation 4 and year dummies. Details for variable definition in Appendix A. Confidence intervals in shaded blue are based on standard errors clustered by firm. The vertical black dashed lines indicate the first year before policy shocks that constrain long-term government debt issuance start binding. The vertical red dashed lines indicate the first year before policy shocks that relaxed constraints on long-term government debt issuance occur. The policy shocks are detailed in the body of the text and in Appendix B. For each period following a policy shock, the horizontal line is fixed at the level of the coefficient estimated for the last year before the policy shock.

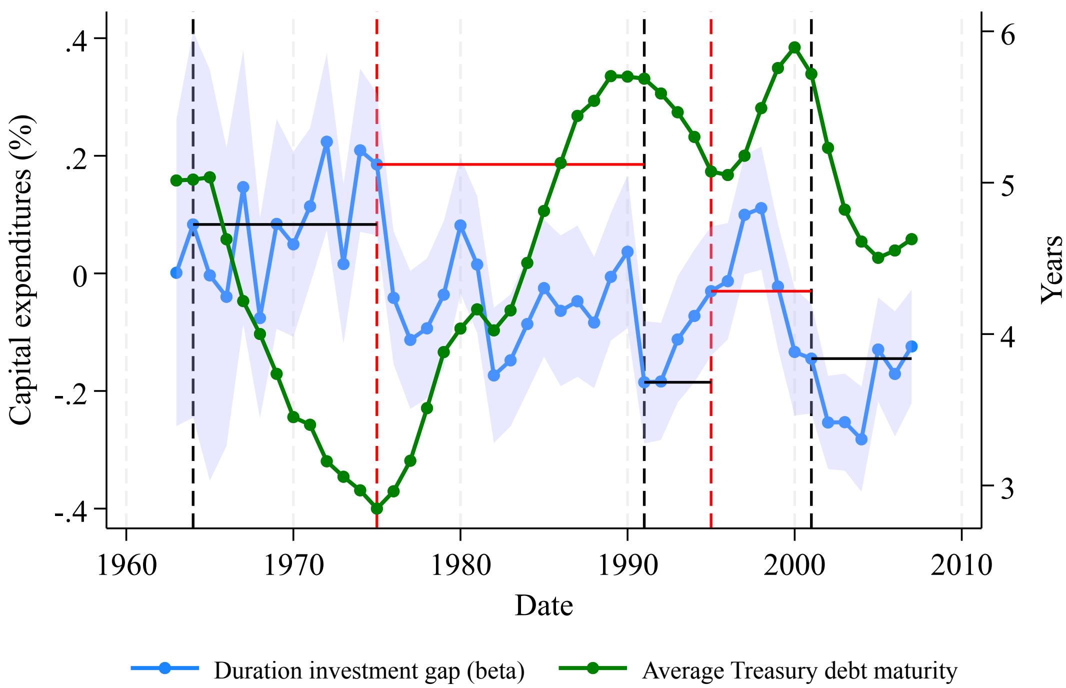
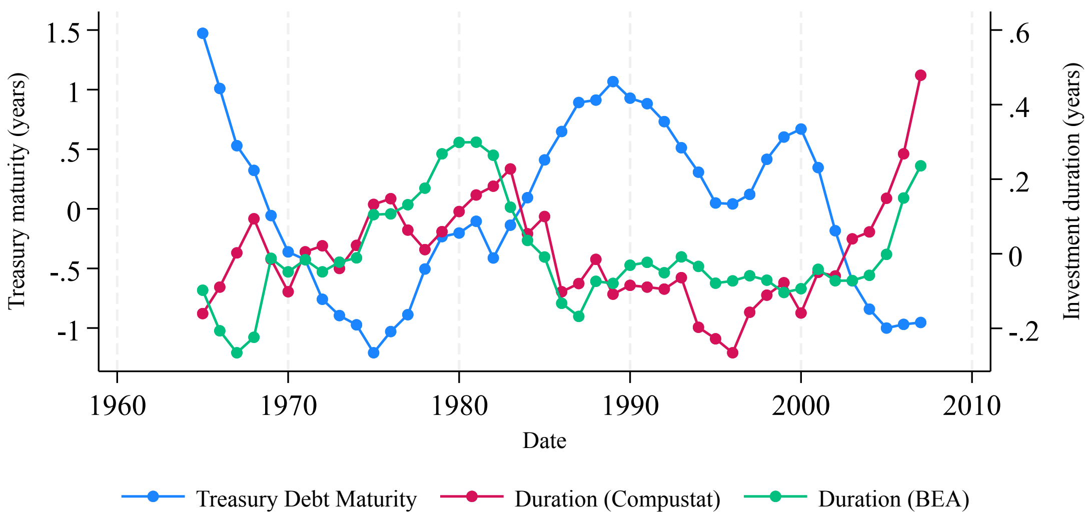


FIGURE D.3: Aggregate investment duration and Treasury debt maturity

The figure presents the yearly average maturity of Treasury debt and the aggregate duration of investment (measured as the average industry-level asset maturity weighted by total capital expenditures of each industry). The Compustat measure uses the industry-level asset maturity computed from the Compustat sample and uses investment weights at the BEA-industry level from Compustat. The BEA measure uses the industry-level asset maturity computed from the Compustat sample and uses investment weights at the BEA-industry level from BEA fixed-assets table. The variables are linearly detrended.



Local projections

I use local projections to estimate the dynamic effects of policy shocks on government debt maturity and the relative investment of long-duration firms. This method allows me to (i) trace the path of relative capital expenditures following the shocks at different time horizons, capturing both immediate and long-run effects and (ii) to control for the effect of economic conditions at the time of the shock.

More formally the local projection graph in Figure D.4 plots for each horizon h, the estimates $\beta^{(h)}$ from the following local projection equation:

$$\frac{Capex_{f,t+h}}{Assets_{f,t+h-1}} = \beta^{(h)} \cdot s_t \cdot AssetMat_f + \delta^{(h)} \cdot s_t \cdot X_{f,t} + \theta^{(h)} \cdot Z_t \cdot AssetMat_f + \alpha_f^{(h)} + \gamma_t^{(h)} + \epsilon_{f,t+h} \tag{8}$$

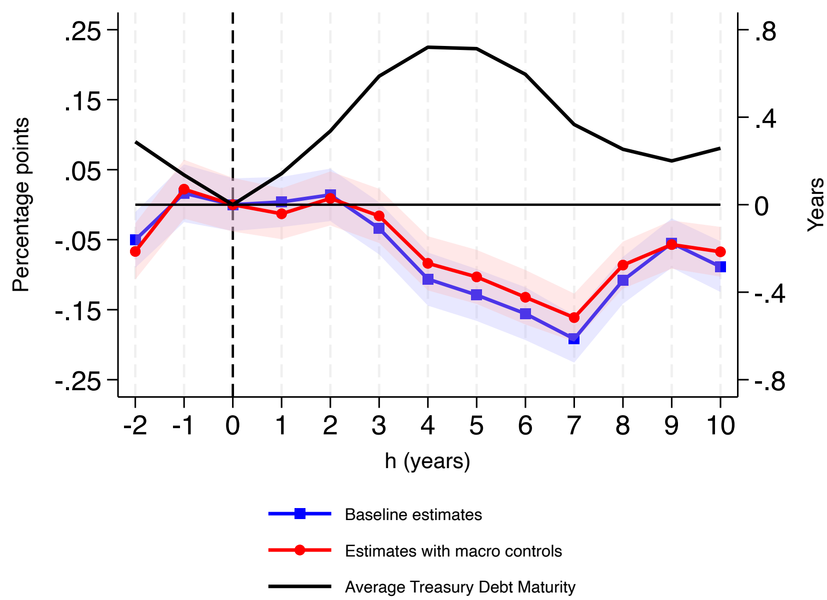
defined for each firm f, at fiscal year end t. For each horizon h, the dependent variable is the ratio of capital expenditures to lagged assets at $t + h$. The policy shock variable, s_t, equals -1 in the last year before new long-term government issuances are constrained (specifically in 1964, 1991, and 2001), 1 in the last year before a relaxation of these constraints (1975 and 1995), and 0 otherwise. The vector $X_{f,t}$ includes the same firm-level controls as in Equation 4 for investment opportunities, and the vector Z_t includes the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. $\alpha_f^{(h)}$ and $\gamma_t^{(h)}$ are the firm and year fixed effects for each local projection. Standard errors are clustered at the firm level. The coefficient of interest, $\beta^{(h)}$, measures the average difference in investment rates between firms with long-duration investments and firms with short-duration of investment h years after the first year preceding a policy shock that relaxes long-term bond issuance.

One key advantage of local projections in identifying the causal effect of the investment reallocation effect is the ability to control for macroeconomic conditions at the time of the shock. By incorporating interactions of macroeconomic controls with my proxy for investment duration, I account for the systematic predictive power of current macroeconomic conditions on the relative investment behavior of long-duration firms at future time horizons.

Figure D.4 plots, for each horizon, the estimate for the coefficient on the interaction term between investment duration and the policy shock variable alongside the 95% confidence intervals and the estimate for the coefficient on the policy shock variable in the time series local projection for the response of the government debt maturity series. My findings reveal that the average (sign-adjusted) policy shock predicts a positive trend

FIGURE D.4: Local projections around policy shocks

The figure presents the local-projection estimates $\beta^{(h)}$ (in blue and red, with values on the left y-axis) based on Equation 8. The dependent variable is capital expenditures expressed in percentage points of lagged total assets. The sample is the yearly panel of Compustat firms for 1962-2011. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). For the specification whose estimates are plotted in red, I control for the interaction between macroeconomic controls and AssetMat and for the interaction between firm-level controls for investment opportunities and the policy shock variable as explained in the body of the section. For the specification whose estimates are plotted in blue, I exclude the interaction terms between macroeconomic controls and AssetMat. The policy shock variable equals -1 in the last year before new long-term government issuances are constrained (specifically in the years 1964, 1991, and 2001), 1 in the last year before a relaxation of these constraints (1975 and 1995), and 0 otherwise. The policy shocks are detailed in the body of the text and in Appendix B. Details for variable definition in Appendix A. Confidence intervals in shaded blue and red are based on standard errors clustered by firm.



in government debt maturity, accompanied by a negative trend in the relative investment of long-duration firms. The trend in government debt maturity peaks at approximately five years, while the relative investment peaks around seven years.

Most importantly, controlling for the systematic predictive power of macroeconomic conditions does not affect the estimates quantitatively. This confirms the plausible exogeneity of the policy shock regarding the relative investment behavior of long-duration firms at future horizons, thereby reinforcing the causal identification of the investment reallocation effect.

E. Mechanism

TABLE E.1: Average maturity of U.S. Treasury debt and measures of the term spread: Yearly regressions

The table presents the estimates from time series regressions of different yield spread measures (column heads) for government and corporate bonds. In column (1) the dependent variable is the difference between the average 5-year to 1-year term spread for yields on bonds issued by corporates with credit rating Baa and the average 5-year to 1-year term spread on yields of bonds issued by corporates with credit rating Aaa. In column (2) the dependent variable is the difference between the average 10-year to 1-year term spread for yields on bonds issued by corporates with credit rating Baa and the average 10-year to 1-year term spread on yields of bonds issued by corporates with credit rating Aaa. In column (3) the dependent variable is the difference between the average 5-year to 1-year term spread for yields on bonds issued by corporates with credit rating Aaa and the average 5-year to 1-year term spread for yields on Treasuries. In column (4) the dependent variable is the difference between the average 10-year to 1-year term spread for yields on bonds issued by corporates with credit rating Aaa and the average 10-year to 1-year term spread for yields on Treasuries. The sample is monthly for 1973-1997 where Lehman/Warga data on corporate bond yield curve is available. Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, and real GDP growth. Details for variable definition in Appendix A. Standard errors reported in parentheses are Newey and West (1987) standard errors allowing for 36 months of lags.

	$y10 - y1$ (Treasuries)		$tp10$ (Treasuries)	$y10 - y1$ (Corporates)		
	(1)	(2)	(3)	(4)	(5)	(6)
TSYMAT	0.34*	0.28*	0.51***	0.67**	0.48***	0.22***
	(0.18)	(0.14)	(0.13)	(0.27)	(0.09)	(0.03)
1-year yield		-0.31***	0.04	-0.45***	-0.44***	-0.16***
		(0.04)	(0.06)	(0.05)	(0.05)	(0.04)
Unemp.		0.54***	0.53***	0.53***	0.30***	0.30***
		(0.08)	(0.09)	(0.10)	(0.05)	(0.06)
Credit Spread		0.48	0.74*	1.55***	0.64*	0.25
		(0.28)	(0.37)	(0.32)	(0.36)	(0.36)
GDP Growth		0.07	0.10	0.18**	0.11**	0.06**
		(0.07)	(0.06)	(0.08)	(0.05)	(0.02)
π (1y)		-2.20	4.55	7.46	5.72	-2.95
		(5.34)	(5.17)	(11.61)	(4.27)	(1.84)
Observations	43	43	43	23	25	25
Sample Start	65-07	65-07	65-07	85-07	73-97	73-97
Data				HQM Corp.	Lehman/Warga	Lehman/Warga
Rating				>= A-	>= A-	>= B-
R-squared	0.09	0.84	0.84	0.87	0.91	0.89

TABLE E.2: Average maturity of U.S. Treasury debt maturity and yield curve

The table presents the estimates from time series regressions of different yield spread measures (indicated in column heads) for government and corporate bonds. The sample is monthly for 1972-2007 for Treasuries, and monthly for 1985-2007 for HQM Corporates data on corporate bond yield curve. Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, and real GDP growth. Details for variable definition in Appendix A. Standard errors reported in parentheses are Newey and West (1987) standard errors allowing for 36 months of lags.

(a) Government bonds

	$y3-y1$	$y5-y1$	$y7-y1$	$y10-y1$	$y15-y1$
	(1)	(2)	(3)	(4)	(5)
TSYMAT	0.15**	0.30***	0.41***	0.53***	0.64***
	(0.06)	(0.09)	(0.10)	(0.10)	(0.10)
Controls	✓	✓	✓	✓	✓
Observations	432	432	432	432	432
Sample Start	1972-2007	1972-2007	1972-2007	1972-2007	1972-2007
R-squared	0.75	0.81	0.83	0.85	0.86

(b) Corporate bonds

	$c3-c1$	$c5-c1$	$c7-c1$	$c10-c1$	$c15-c1$
	(1)	(2)	(3)	(4)	(5)
TSYMAT	0.38**	0.59***	0.64***	0.64**	0.72***
	(0.16)	(0.20)	(0.23)	(0.26)	(0.24)
Controls	✓	✓	✓	✓	✓
Observations	276	276	276	276	276
Sample Start	1985-2007	1985-2007	1985-2007	1985-2007	1985-2007
R-squared	0.50	0.71	0.77	0.80	0.85

TABLE E.3: Long-term bond supply and the term spread: alternative measures

The table presents the estimates from time series regressions of different yield spread measures (10-year minus 1-year Treasury yield) for government bonds. The sample is monthly for 1965-2007 in columns (1)-(6) and for 1985-2007 in columns (7)-(8). Government long-term bond supply is measured with respectively the weighted-average maturity of Treasury debt (TSY MAT, in years), weighted average duration of Treasury debt (TSY WAD, in years), maturity-weighted Treasury debt-to-GDP (TSY MWD, in 100pp of GDP), and Treasury debt-to-GDP (TSY D/GDP, in 100pp of GDP). The controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, and real GDP growth. Details for variable definition in Appendix A. Standard errors reported in parentheses are Newey and West (1987) standard errors allowing for 36 months of lags.

	$y10-y1$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TSY MAT	0.28**				0.26*	0.68***	0.68***
	(0.11)				(0.15)	(0.15)	(0.15)
TSY DUR		0.24***					
		(0.09)					
TSY MWD			0.25***				
			(0.08)				
TSY D/GDP				2.95**	0.31		-0.09
				(1.42)	(1.87)		(2.02)
Controls	✓	✓	✓	✓	✓	✓	✓
Observations	516	516	516	516	516	264	264
Sample Start	65-07	65-07	65-07	65-07	65-07	85-07	85-07
R-squared	0.80	0.81	0.81	0.79	0.80	0.88	0.88

Table E.4: Long-term bond supply and the term structure of credit spreads and convenience yields

The table presents the estimates from time series regressions of different yield spread measures (column heads) for government and corporate bonds. In column (1) the dependent variable is the difference between the average 5-year to 1-year term spread for yields on bonds issued by corporates with credit rating Baa and the average 5-year to 1-year term spread on yields of bonds issued by corporates with credit rating Aaa. In column (2) the dependent variable is the difference between the average 10-year to 1-year term spread for yields on bonds issued by corporates with credit rating Baa and the average 10-year to 1-year term spread on yields of bonds issued by corporates with credit rating Aaa. In column (3) the dependent variable is the difference between the average 5-year to 1-year term spread for yields on bonds issued by corporates with credit rating Aaa and the average 5-year to 1-year term spread for yields on Treasuries. In column (4) the dependent variable is the difference between the average 10-year to 1-year term spread for yields on bonds issued by corporates with credit rating Aaa and the average 10-year to 1-year term spread for yields on Treasuries. The sample is monthly for 1973-1997 where Lehman/Warga data on corporate bond yield curve is available. Government long-term bond supply is measured by the weighted-average maturity of Treasury debt (TSYMAT, in years). The controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, and real GDP growth. Details for variable definition in Appendix A. Standard errors reported in parentheses are Newey and West (1987) standard errors allowing for 36 months of lags.

	(Baa5-Baa1)-(Aaa5-Aaa1)	(Baa10-Baa1)-(Aaa10-Aaa1)	(Aaa5-Aaa1)-(T5-T1)	(Aaa10-Aaa1)-(T10-T1)
	(1)	(2)	(3)	(4)
TSYMAT	-0.02	-0.19**	-0.07	-0.14**
	(0.04)	(0.08)	(0.06)	(0.06)
Controls	✓	✓	✓	✓
Observations	300	300	300	300
Sample Start	73-97	73-97	73-97	73-97
R-squared	0.35	0.55	0.48	0.44

Table E.5: Term structure and the cross-section of investment: OLS vs 2SLS

The table presents the OLS and 2SLS estimates based on Equation 4 where the dependent variable is capital expenditures (pp of lagged assets). The sample is the yearly panel of Compustat firms for 1965-2007. The investment duration measure is the firm-level average asset maturity (AssetMat, in years). Government long-term bond supply is swapped from the equation with yield spread between 10-year constant maturity Treasury debt (expressed in pp). As for 2SLS, the yield spread is instrumented by government long-term bond supply measured with the weighted-average maturity of Treasury debt. The macroeconomic controls include the 1-year Treasury yield, the Baa-Aaa credit spread, the unemployment rate, the inflation rate, real GDP growth, and a linear trend. Details for variable definition in Appendix A. All coefficients on non-interacted explanatory variables are not reported for ease of presentation. Standard errors reported in parentheses are double clustered by time (fiscal year-end) and firm.

	OLS		2SLS	
	(1)	(2)	(3)	(4)
Term Spread × AssetMat	-0.109***	-0.111***	-0.254***	-0.276***
	(0.022)	(0.020)	(0.052)	(0.051)
Firm FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
AssetMat x Macro Controls	✓	✓	✓	✓
Firm Controls x TermSpread	–	✓	–	–
Firm Controls x TSYMAT	–	–	–	✓
Observations	120275	120275	120275	120275
Adjusted R^2	0.438	0.471	0.001	0.059

F. Implied semi-elasticities of investment to the cost of debt from the literature

- Coppola (2024) shows that increasing a firm's share of insurer ownership by 50 percentage points is associated with a reduction in offering yields on new debt of the order of 120 basis points (p. 34) and an increase in capital expenditures and acquisitions of 2 to 3 percentage points of lagged total assets (p. 31-32). This implies a semi-elasticity of investment (in percentage point of lagged assets) to a percentage point change in the cost of new debt between 1.7 (=2/1.2) and 2.5 (=3/1.2).

- Foley-Fisher et al. (2016) show that long-term yields dropped by 42 bp over the two-day period around the announcement of the Fed's maturity extension program (p. 411-412). The authors show that firms financed with long-term debt (long-term debt dependence equal to 1 where long-term debt dependence is defined as the share of debt with residual maturity above one year) experienced an increase in PPE growth of the order of 8.5 percentage points (Table 8, p. 427) relative to firms not financed with long-term debt (long-term debt dependence equal to 0). To translate this PPE growth to changes in investment scaled by lagged assets, I assume the share of PPE in assets is the same as in my sample (=.31) since the authors do not report this statistics. This suggests a semi-elasticity of investment (in percentage point of lagged assets) to a percentage point change in the long-term yields of 6.3 (=0.31*8.5/0.42). I assume that the effect on long-term rates is equal to the change in the yield on new debt for firms financed with long-term debt relative to firms not financed with long-term debt. This implies a semi-elasticity of investment (in percentage point of lagged assets) to a percentage point change in the cost of new debt of 6.3.

- Kubitza (2023) shows that when insurers additionally purchase 1% of a firm's outstanding bonds, the firm experiences a 10 bps reduction in secondary bond market yields (p. 21) and a 5.93 percentage points (of lagged bond debt) increase in investment (Table 8 on p. 51). He shows that the average ratio of bond debt to total debt is 0.77 in the author's sample (Table 1, p. 44). I assume that the share of total debt to assets is the same as in my sample (=.24), as the author does not report this statistic. I assume that the change in the secondary bond market yields is a lower bound for the change in the primary bond market yield. This implies an upper bound on the semi-elasticity of investment (in percentage point of lagged assets) to a percentage point change in the cost of new debt of 11 (=.24*0.77*5.93/0.1).

G. The debt consequences of the investment reallocation effect

Issuance data

I construct a dataset of debt issues by non-financial firms over 1975-2007 aggregated at the firm-year level from debt issue-level observations extracted from the Thomson Reuters LPC Dealscan and SDC Platinum New Issues databases. The debt issue-level observations are extracted from the Thomson Reuters LPC Dealscan and Thomson Reuters SDC Platinum New Issues databases.

TABLE G.1: Summary statistics: firm-year panel of issuances by U.S. public firms (1975-2007)

	Mean	SD	Min	p25	p50	p75	Max	N
Issuance maturity	8.38	7.21	0.02	4.83	6.87	10.01	100.07	9,481
Issuance amount	514.15	1,808.07	0.09	33.90	125.00	355.00	44,400.00	9,481
Dealscan Dummy	0.55	0.47	0.00	0.00	0.67	1.00	1.00	9,481
Total Assets*	3,540.63	6,126.32	1.43	239.52	929.90	3,533.65	39,042.00	9,481
Capital Expenditures*	228.07	388.72	0.00	11.10	51.24	237.15	2,430.00	9,481
Sales*	3,177.90	5,278.40	0.02	221.57	847.93	3,475.04	35,214.00	9,481
Employment*	18.64	28.21	0.00	1.33	5.43	22.00	137.70	9,368
AssetMat (firm)**	4.98	3.02	1.03	2.60	4.20	6.73	13.96	9,481
LT debt sh. (1y)	83.29	21.20	0.00	77.78	91.47	97.70	100.00	9,240
LT debt sh. (3y)	64.19	28.49	0.00	47.17	70.79	86.73	100.00	7,921
LT debt sh. (5y)	44.48	30.23	0.00	17.75	47.04	68.02	100.00	7,777
Profitability*	0.07	0.15	-3.95	0.04	0.09	0.13	0.53	9,481
M/B Ratio*	1.64	1.26	0.50	1.10	1.37	1.82	72.10	9,481
Sales Growth*	10.69	26.41	-422.05	1.54	9.48	20.76	100.00	9,481
IG Rating*	0.36	0.48	0.00	0.00	0.00	1.00	1.00	9,481
logat	6.79	1.86	0.36	5.48	6.84	8.17	10.57	9,481
log(Assets)	6.84	1.94	0.36	5.48	6.84	8.17	13.08	9,481
log(MCap)	6.36	2.14	-1.84	4.89	6.46	7.90	10.95	9,474
log(PPE)	5.55	2.13	-2.90	4.04	5.65	7.18	9.56	9,479
log(Emp)	1.62	1.89	-6.91	0.31	1.70	3.10	4.93	9,328
Book Leverage*	0.35	0.19	0.00	0.22	0.33	0.47	0.98	9,481

Note: This table reports summary statistics for the main variables in the yearly panel of issuances by Compustat firms from 1975 to 2007. All variables are defined in Appendix A.
* To mitigate the influence of outliers, the variables have been winsorized at the latest stage with tail cuts at the 5th and 95th percentiles of the yearly distributions of the variables.
** To mitigate the influence of outliers, the variables have been winsorized at the latest stage with tail cuts at the 5th and 95th percentiles of the yearly distributions of the variables.

I extract detailed terms and conditions for individual corporate loans from Dealscan and for individual debt securities including non-convertible debt securities, debt shelf registrations, U.S. Rule 144A non-convertible debt, and medium-term note programs from SDC (Thomson). Following Badoer and James (2016), I exclude asset- and mortgage-backed debt, secured debt, pass-through securities, equipment trust certificates, lease obligations, convertible debt, preferred stock that has been misclassified as debt, equity-linked certificates, and perpetual debt. I only keep USD-denominated deals with non-missing positive deal amounts. I discard duplicates entry within and across both databases—identified as observations with the same issuer, issuance and maturity dates, deal amount and maturity. Credit lines are excluded because they are less likely to isolate the timing of large investments as opposed to term loans.

I merge the issue-level information with fiscal year-end financial information data of public U.S. firms using the CRSP/Compustat Merged—Fundamentals Annual database obtained from WRDS. The merge is completed for the Dealscan dataset using the 2017 version of the link file from Chava and Roberts (2008) which matches individual loan facilities to the corresponding borrowing firm's unique company identifier (variable *gvkey*) on Compustat. For the SDC dataset, I use the DSENAMES database from WRDS to merge unique historical identifiers specific to each issuer in SDC (first 6 digits of variable *cusip*) to unique identifiers in Compustat (variable *gvkey*).

Appendix A presents the sample's descriptive statistics for debt issues' properties and financial characteristics of issuing firms, as well as macroeconomic conditions at issuance.

Maturity-matching on stocks and flows of debt

Table G.2: Outstanding corporate debt maturity and investment duration

The table presents the regression estimates based on linear models of outstanding debt maturity where the dependent variable is the share of debt with residual maturity above five years (pp of debt). The sample for outstanding debt maturity is the yearly panel of Compustat firms for 1975-2007. Details for variable definition in Appendix A. Standard errors reported in parentheses are clustered by firm.

	LT debt share (5y)					
	(1)	(2)	(3)	(4)	(5)	(6)
AssetMat (firm)	3.242***	2.962***	2.962***	2.368***	1.405***	1.545***
	(0.088)	(0.087)	(0.087)	(0.090)	(0.078)	(0.105)
Profitability				9.165***	1.368***	1.383***
				(0.675)	(0.323)	(0.318)
M/B Ratio				-0.179**	0.161***	0.161***
				(0.088)	(0.061)	(0.060)
Sales Growth				0.014***	0.002	0.003
				(0.002)	(0.002)	(0.002)
Book Leverage				23.018***	22.578***	22.277***
				(1.038)	(0.902)	(0.893)
log(Assets)					5.615***	5.458***
					(0.117)	(0.118)
constant	14.990***	16.113***	16.113***	12.447***	-9.778***	-9.540***
	(0.413)	(0.403)	(0.403)	(0.473)	(0.537)	(0.600)
No FE	✓	–	–	–	–	–
Time FE	–	✓	✓	✓	✓	✓
Industry FE	–	–	–	–	–	✓
Observations	80942	80942	80942	80942	80942	80942
Adjusted R^2	0.090	0.128	0.128	0.164	0.288	0.302

Table G.3: Maturity of new issuances and investment duration

The table presents the regression estimates based on linear models of new debt issuance maturity where the dependent variable is the maturity of the average firm-year issuance (years). The investment duration measure is the firm-level average asset maturity (AssetMat, in years). The sample for issuance is detailed in Appendix G. Covariates are measured at first preceding year-end. Details for variable definition in Appendix A. Standard errors reported in parentheses are clustered by firm.

	Issuance Maturity					
	(1)	(2)	(3)	(4)	(5)	(6)
AssetMat (firm)	0.336***	0.250***	0.239***	0.239***	0.149***	0.177***
	(0.028)	(0.023)	(0.023)	(0.023)	(0.021)	(0.030)
Issuance amount			0.000***	0.000***	0.000	0.000
			(0.000)	(0.000)	(0.000)	(0.000)
Profitability				2.786***	1.430***	1.516***
				(0.336)	(0.271)	(0.282)
M/B Ratio				0.020	0.030	0.027
				(0.037)	(0.033)	(0.034)
Sales Growth				0.001	0.005***	0.004***
				(0.001)	(0.001)	(0.001)
Book Leverage				-0.511*	0.126	-0.029
				(0.273)	(0.243)	(0.241)
log(Assets)					0.755***	0.718***
					(0.040)	(0.038)
constant	6.134***	6.535***	6.451***	6.395***	1.622***	1.793***
	(0.146)	(0.122)	(0.120)	(0.167)	(0.250)	(0.263)
No FE	✓	–	–	–	–	–
Time FE	–	✓	✓	✓	✓	✓
Industry FE	–	–	–	–	–	✓
Observations	9967	9929	9929	9929	9929	9929
Adjusted R^2	0.038	0.276	0.284	0.292	0.351	0.358

H. UK demand shock

Table H.1: UK demand shock: DiD estimates for investment

The panel presents the event-study coefficients on the interactions of period dummies and firm-level *Asset Maturity* in the regression where the dependent variable is capital expenditures normalized by lagged total assets based for the yearly panel of Compustat Global UK firms for 2001-2008. The year 2003 acts as the baseline period. Standard errors clustered by firm. Lower-level interactions not reported for ease of presentation. Details for variable definition in Appendix A.

	(1)	(2)	(3)	(4)	(5)	(6)
	Capex	Capex	Capex	Capex	Capex	Capex
[2001; 2002] × AssetMat	0.00845	0.0249	0.0321	0.00277	0.0215	0.0283
	(0.0322)	(0.0308)	(0.0277)	(0.0446)	(0.0437)	(0.0423)
[2004; 2008] × AssetMat	0.0678*	0.0714*	0.0494	0.138**	0.130**	0.101*
	(0.0300)	(0.0301)	(0.0298)	(0.0450)	(0.0453)	(0.0427)
[2006; 2008] × AssetMat	0.171***	0.165***	0.122***	0.199***	0.188***	0.155***
	(0.0367)	(0.0352)	(0.0341)	(0.0505)	(0.0478)	(0.0455)
AssetMat	0.199***	0.126**		0.208***		
	(0.0376)	(0.0437)		(0.0481)		
constant	4.331***	4.674***	5.382***	4.044***	5.118***	5.221***
	(0.173)	(0.218)	(0.106)	(0.215)	(0.210)	(0.163)
Year FE	✓	✓	✓	✓	✓	✓
Industry FE	–	✓	–	–	✓	–
gvkey	–	–	✓	–	–	✓
Observations	7019	7019	7017	7019	7019	7017
Adjusted R^2	0.087	0.187	0.539	0.067	0.164	0.539

Table H.2: UK demand shock: DiD estimates for the term spread

The panel presents the event-study coefficients on the period dummies in the regression where the dependent variables are different definitions for the term spread on the UK yield curve for 2001-2008. The year 2003 acts as the baseline period. Robust standard errors. Details for variable definition in Appendix A.

	(1)	(2)	(3)
	TS (10y-1y)	TS (20y-1y)	TS (25y-1y)
[2001; 2002]	-0.450***	-0.707***	-0.786***
	(0.100)	(0.133)	(0.142)
[2004; 2005]	-0.812***	-1.013***	-1.043***
	(0.0642)	(0.0951)	(0.106)
[2006; 2008]	-1.002***	-1.289***	-1.409***
	(0.134)	(0.188)	(0.195)
constant	0.922***	1.038***	0.998***
	(0.0444)	(0.0843)	(0.0965)
Observations	96	96	96
Adjusted R^2	0.275	0.253	0.280

I. QE Programs

For each QE program, I define the initial QE portfolio as a long-short portfolio with net worth 0, which consists of asset purchases funded by interest paying reserves. Purchases associated with each QE program are computed using data for SOMA portfolio holdings available on the Fed's website. Table **I.1** reports total face value, total payments (face value + coupon) and maturity-weighted debt payments. I compute total payments for MBS by extrapolating the term structure of coupon payments of Treasuries. Specifically, I multiply the total face value purchases for MBS by the ratio of payments to face value for Treasuries.

Table I.1: The Fed's Quantitative Easing programmes

	QE1	QE2	MEP	QE3	QE4
Face Value (Treasuries+Agency) (USD bn)	455.60	746.23	-35.27	774.66	3,285.97
Face Value (MBS) (USD bn)	1,061.32	-142.18	-41.35	874.29	1,343.41
Face Value (All) (pp of GDP)	9.74	3.77	-0.48	9.17	17.64
FV+Coup. (T+A) (pp of GDP)	3.70	5.62	1.03	5.72	14.15
FV+Coup. (All) (pp of GDP)	12.31	4.55	2.24	12.17	19.94
MWD (T+A) (pp of GDP)	22.51	36.65	49.17	66.38	118.28
MWD (All) (pp of GDP)	74.95	29.67	106.83	141.30	166.63