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Corporate tax changes and credit costs

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Corporate tax changes and credit costs

Abstract

We examine changes in the corporate tax rate across the U.S. and their implications on the pricing and quantity of loans. We find that the cost of credit decreases (increases) by approximately ten (nine) basis points in response to a one percentage tax cut (hike). The estimates are more pronounced for large tax decreases and are relatively uniform across loan types. Our findings mainly originate from the demand side, with large and more profitable firms being able to mitigate the effects of the decrease in the corporate tax rate. The effect on the equilibrium loan amount is statistically and economically insignificant, consistent with a weak supply effect and an inelastic loan supply curve.

Keywords: Corporate taxation; Cost of credit; Syndicated loans; Loan demand; Loan supply
JEL classification: G21; F31; F33; F34

1. Introduction

Corporate taxation is an important government policy tool, affecting investment, consumption, government spending, and real outcomes. A large theoretical and empirical tax literature suggests that firms' investment and capital structure decisions are sensitive to corporate taxes (e.g., Modigliani and Miller, 1963; Stiglitz, 1973; King, 1974; Mayer, 1986; Heider and Ljungqvist, 2015, Ağca and Igan, 2019). In this paper, we identify the effect of corporate tax changes on lending terms (mainly credit costs) and the supply-demand mechanisms through which this effect is transmitted.

Theoretically, the effect of corporate taxes on lending terms can originate either from loan demand by firms or loan supply by banks. Specifically, a decrease (increase) in corporate tax rates increases (reduces) firm profitability, reducing (increasing) their risk premium, which can lead banks to decrease (increase) credit costs unless other bank characteristics counteract this effect (e.g., the bank is unwilling to lose clients or the banking sector is well capitalized and can absorb a tax increase). This is a standard credit-supply effect.

On the demand side, we theoretically identify two contrasting effects. In line with traditional Keynesian theory, we expect that a change in taxation affects the demand for investment. For example, a decrease in corporate tax rates increases firm profitability and investment, leading to higher credit demand. A standard loan-supply/loan-demand model in this economic environment implies higher lending rates and loan amounts, consistent with a rightward shift in the loan-demand curve. However, an opposite credit-demand effect might also be at work via debt restructuring to reap the benefits of the reduced tax. The usual case is that firms replace loans with other non-credit sources of financing, implying a leftward shift in the loan-demand curve and lower lending rates. Overall, distinguishing between these effects of corporate taxes on bank lending becomes an interesting empirical question.

The intersection between classical theory and new-Keynesian theory on the credit market (e.g., Stiglitz and Greenwald, 2003) guides most of our empirical analysis toward examining the responses on lending rates (and secondarily on the loan amount). A key reason for focusing on lending rates is that the loan-supply curve is more inelastic than the loan-demand curve, especially in the short run and when lending to new, riskier firms (see Figure 1). Thus, any demand effect (or any combined demand and supply effects) might cause larger and easier-to-identify fluctuations in lending rates compared to the loan amount. However, we also examine changes in the loan amount and the loan syndicate structure, especially when aiming to pinpoint any supply effects.

[Insert Figure 1 about here]

Our empirical analysis employs a quasi-natural experiment around the 174 staggered changes in corporate tax rates levied by the United States from 1987 to 2019 (51 tax increases in 26 states and 123 tax decreases in 34 states).[1] This leads to the estimation of a staggered difference-in-differences (DID) model. We match the tax-rate changes with loan-level data from DealScan and firm-level and bank-level data from Compustat. Our key outcome variable is the all-in spread drawn (AISD), which is the loan spread over LIBOR plus any facility fee.

We first identify the baseline responses of loan spreads to changes in corporate tax rates and find that tax decreases bear a statistically and economically significant negative effect on loan spreads. According to our baseline results, a one-point decrease in the corporate tax rate shaves approximately 10.1 basis points from the AISD. Economically, this is a sizeable effect, equal to a 4.7% lower AISD compared to the average in our sample. To put this number into perspective, for a loan of average size and maturity, the treated firm experiences a USD 1.48 million of reduced interest payments. In contrast, the effect of tax increases is marginally

[1] Due to differences in the start and end dates of the calendar and fiscal years, our sample covers the fiscal years from 1987 to 2020.

statistically insignificant. In contrast, when we examine changes in the corporate tax rate, we find more symmetric effects, with a 1 percentage point increase (decrease) in the tax rate being associated with a 9.2 basis points (10.5 basis points) increase (decrease) in loan spreads.

These baseline results are robust to several tests. First, the loan-level data allows the use of a mix of fixed effects, which control for several sources of unobserved heterogeneity. Most notably, state × year fixed effects control for relevant within-state and across-year confounding effects and imply identification from the six-month periods before and after the fiscal years on which the tax changes occur. Several other high-dimensional fixed effects limit the possibility of omitted-variable bias along the staggered DID model. Our DID model is also robust to several placebo tests, which show that our results are not spuriously led by unobserved characteristics changing simultaneously as corporate tax rates or an expectations channel.

Other notable robustness tests include (i) considering the frequency of changes across states; (ii) distinguishing between different loan types; (iii) the evolution of loan spreads in a 2-year window surrounding the tax change to control for treatment heterogeneity in the presence of variation in treatment timing (the potential problem with staggered DID identified by, e.g., Baker, Larcker and Wang, 2022); (iv) a Heckman-type model, which considers the probability of a firm self-selecting in the syndicated loan market; (v) controlling for the presence of bank subsidiaries in the firm's state as well as of firm subsidiaries in the bank's state; and (vi) explicitly examining the role of political and economic conditions (after dropping the state × year fixed effects) to show that the easing effect of tax cuts is independent of the macroeconomic environment and political conditions in the borrower's state and the various economic growth and tax relief acts adopted at the federal level.

The second step of our analysis aims to identify the channels at work. The initial evidence that the strongest effect is demand-side originates from the sequential exclusion / inclusion of bank × year fixed effects, which saturate the model from supply-side forces (e.g.,

Jiménez, Ongena, Peydró and Saurina, 2012; 2014; Delis, Hong, Paltalidis and Philip, 2022). These effects imply identification from the repeated participation of banks in syndicated loan deals within the same year. The inclusion of these fixed effects leaves the baseline results largely unaffected, suggesting that the credit-supply effect is less relevant than credit demand. Moreover, interaction terms between the tax variables and bank capital and liquidity, which are generally used to identify supply effects, do not reveal heterogeneity in the estimates of tax changes across banks. Heterogenous effects with bank capital are stronger when considering equations on the number of lenders, which shows that the equilibrium positive effect of a tax decrease on the number of lenders is moderated by well-capitalized banks.

Considering the relevance of demand effects, and aside from the saturation of the model with high-dimensional fixed effects, we look at the importance of heterogeneity stemming from firm size and profitability. We first show that the less potent effect of the tax increase is due to large firms buffering the increase, consistent with our theoretical premise that large firms face better lending terms and have wider funding options, so that banks do not wish to lose their business. Second, we find that the easing effect of corporate tax cuts on loan spreads is concentrated in less profitable firms. Intuitively, these firms have reduced capacity to borrow at competitive lending terms before the tax cut, whereas after the policy they see a significant reduction in their spreads.

Turning to the loan amount (as opposed to loan spread) our analysis does not produce the expected negative effect of tax changes (the effect is statistically insignificant), implying that the loan supply curve is relatively inelastic. Asymmetric effects with bank capital are stronger when considering equations on the number of lenders, which shows that the equilibrium positive effect of a tax decrease on the number of lenders is moderated by well-capitalized banks. Overall, considering the theoretical implications summarized in Figure 1, our results are consistent with a strong effect of changes in the corporate tax on loan spreads

stemming primarily from the demand side and a considerably weaker credit-supply effect. Consistent with an inelastic loan supply curve and the opposing demand and supply forces, the equilibrium loan amount remains largely unaffected.

The studies closest to ours are Ağca and Igan (2019) and Heider and Ljungqvist (2015). The former uses data from non-U.S. OECD banks and shows that fiscal consolidations and associated tax increases (including changes in corporate taxes) aimed at reducing government debt cause a significant increase in loan spreads. Our focus is on both increases and decreases in the corporate tax rate (i.e., not directly relating to fiscal consolidations). Moreover, and equally important, we identify the mechanisms, distinguishing between the supply-side and demand-side effects.

Heider and Ljungqvist (2015) examine long-term book leverage specifications, suggesting that long-term leverage responds positively only to tax increases but not to tax cuts. In their analysis, this is partly because an increase in corporate taxation causes firms to readjust their leverage to benefit from the tax shield. In contrast to this study, we focus on the cost of new loans, not leverage. Interestingly, consistent with Heider and Ljungqvist (2015), we find that the effect of a tax increase is positive and significant but reverses for the largest firms in our sample. However, we also identify a strong effect also for tax cuts, affecting mostly the pricing and not the loan amount.

Our paper is naturally related to an extensive line of work on the effects of corporate taxation (see Hanlon and Heitzman, 2022, for a recent review). This literature is still inconclusive about the effect of corporate taxes on firm leverage, with most studies documenting economically small effects (e.g., Van Binsbergen, Graham and Yang, 2010; Fleckenstein, Longstaff and Strebulaev, 2020; Graham, Leary and Roberts, 2015). More consistent with our findings, Faccio and Xu (2015) examine changes in country-level tax rates between 1981 and 2009 and find that leverage responses to tax reforms are strongest and most

immediate for decreases in tax rates (in contrast to Heider and Ljungqvist, who find more relevant the tax increases). Kang, Li and Lin (2021) examine bank income tax changes (as opposed to corporate income tax changes) and find a positive effect on loan spreads. Several other studies examine MNEs and international taxation (e.g., Faulkender and Smith, 2016; Graham and Leary, 2018) and intrafirm lending (e.g., Huizinga, Laeven and Nicodème, 2008; Arena and Roper, 2010). A common denominator of almost all these studies is the focus on leverage. In contrast, we highlight the bank-lending channel of changes in corporate tax rates and find effects mostly on loan pricing.

The rest of the paper proceeds as follows. Section 2 augments the discussion on the theoretical mechanisms that explain the effects of taxation on lending rates. Section 3 describes the data. Section 4 discusses the empirical identification strategy. Section 5 presents and discusses the main empirical results, showing the impact of corporate tax changes on the firm cost of credit. Section 6 explicitly separates the loan demand and loan supply effects. Section 7 concludes the paper. The Internet Appendix provides several additional summary statistics and robustness tests.

2. Demand and supply effects of corporate taxation on credit costs

We identify two forces that theoretically support a relation between corporate taxation and the cost of credit: the first is driven by supply-side decisions of banks and the second by demand-side decisions of firms. We analyze the effect of these forces on bank lending with the help of the loan-demand/loan-supply model of Stiglitz and Greenwald (2003). Figure 1 shows the shape of the curves, merging information from the classical model, where loan demand is negatively sloped and loan supply is positively sloped, and from Stiglitz and Greenwald (2003), where loan supply is relatively inelastic and backward-bending because borrower risk increases

at higher lending rates.[2] We assume in the figure that equilibrium is at the "classical" part; however, the backward-bending supply curve has implications for our theory and findings.

On the supply side, a change in corporate tax rate might affect banks' profit-maximizing behavior. Specifically, a decrease in corporate taxation leads to an increase in firms' profitability, a reduction in their risk of default, and an expansion of their investment opportunities. Thus, banks might be willing to release more loanable funds, implying a rightward shift in the loan-supply curve. Without a concomitant shift in the loan-demand curve and under a positively sloped loan-supply curve, this mechanism implies the release of larger loan amounts at lower lending rates. Opposite effects should prevail for an increase in corporate tax rates. This is a standard credit-supply effect.

Implications for the demand side can be more interesting when focusing on taxation policy (as opposed to, e.g., monetary policy). In line with traditional Keynesian theory, a change in taxation affects firm investment and credit. Specifically, a decrease in corporate tax rates increases firm profitability by lowering the risk premium and increasing investment and credit demand. If firms do not (or cannot) turn to alternative sources of financing (e.g., debt restructuring, use of retained earnings), and without a concomitant shift in the loan-supply curve, this mechanism implies a rightward shift in the loan-demand curve. Thus, loan amounts and lending rates increase, *ceteris paribus*. Again, opposite effects should prevail for an increase in corporate tax rates.

However, and perhaps most importantly, a change in taxation also alters firm incentives to restructure their debt and reassess their tax shields, potentially resulting in a credit-demand effect that is opposite to the Keynesian. For example, and as a matter of accounting, a tax cut increases after-tax profits, allowing firms to input more own funds (as opposed to external debt)

[2] For simplicity, we do not show a credit rationing equilibrium, as in Stiglitz and Greenwald (2003), as this does not affect our theoretical considerations.

into their investments. This implies firms potentially substituting external debt (including bank credit) for own funds, which yields a decrease in the cost of credit. Specific firm characteristics, such as firm size and market power, may also be important because they imply better access to alternative sources of finance and firm-bank relationships working in favor of firms. This might especially hold when firms are more capable of substituting debt for own funds.

We expect, under these mechanisms, a leftward shift in the loan-demand curve, a decrease in the loan amount, and a reduction in loan spreads, *ceteris paribus*. This demand effect is consistent with the literature on taxation-driven debt restructuring and leverage (e.g., DeAngelo and Masulis, 1980; Stiglitz and Weiss, 1981; Auerbach, 2002; Heider and Ljungqvist, 2015), as well as the literature on alternative forms of financing (e.g., Becker and Ivashina, 2014).

A notable element in the supply and demand effects discussed above is that the loan supply curve becomes relatively inelastic as firm risk and lending rates increase, which intensifies in the short run after a change in corporate taxes due to the increased availability of loanable funds. Furthermore, it is possible that these effects could work simultaneously, thereby rendering the mechanisms leading to a new equilibrium more complex. For example, as shown on Figure 1, a simultaneous leftward shift in loan demand and rightward shift in loan supply might imply a significantly larger reduction in the lending rate compared to a change in the loan amount. Our empirical analysis aims to disentangle and separately identify these effects.

3. Data

We obtain data from three sources. First, syndicated loan deals (at the facility level) from 1987 to 2019 are collected from DealScan, which includes the most comprehensive and historical loan-deal information available on the U.S. syndicated loan market. Second, we identify all

state corporate income tax changes in the U.S. Third, we match the resulting dataset with bank-specific and firm-specific characteristics from Compustat.

Table A1 defines all variables used in our empirical analysis and Table 1 reports summary statistics. The number of loan facilities in our baseline specifications ranges from 42,210 to 43,481, depending on the controls and the set of fixed effects used. These 43,481 loans are granted by 830 lead lenders headquartered in 24 states to 6,929 borrowers in 51 states.[3] We observe 51 tax increases in 26 states that are associated with 701 firms receiving 1,376 loans from 206 lead banks. We further observe 123 tax decreases in 34 states affecting 1,525 firms that received 3,774 loans from 303 lead banks. Appendix Tables A2 and A3 list all corporate tax increases and decreases, respectively in the U.S. during our sample period; Table A4 presents the borrower's states in our sample and the corresponding number of observations.

[Insert Table 1 about here]

3.1. Measures of tax changes and the cost of borrowing

Our key explanatory variables reflect corporate tax changes. *Tax increase* is a binary variable equal to one for a corporate tax increase in the borrower's state in the current fiscal year, and zero otherwise. Similarly, *Tax decrease* is a binary variable equal to one for a corporate tax decrease in the borrower's state in the current fiscal year, and zero otherwise. We mainly use binary tax measures because tax changes across states are different in terms of structure and/or inclusion of credits, thus not all changes can be quantified in terms of changes in marginal tax rates, although the direction of the tax changes is unambiguous. Among these, are the California 2002 and New Jersey 2002 tax increases (concerning the suspension of state net operating loss deduction and the introduction of Alternative Minimum Assessment tax,

[3] The maximum loan spread equals 1,125 basis points (11.25%) and refers to four different loan facilities to four different firms in 2010, 2012 (two loan facilities), and 2016.

respectively), the Texas 2006 introduction of tax on net taxable earned surplus, the Oklahoma 2010 introduction of business activity tax, or the reduction in Single Business Tax (SBT) rate in Michigan every year from 1999 to 2002 (see Appendix Tables A2 and A3). In alternative specifications, we use the actual rates to capture the size of these changes, as well as large, medium, and small tax changes, states with frequent tax changes, and low vs. high initial tax rates.

Our key outcome variable reflecting lending rates is the all-in spread drawn (*AISD*), defined as the spread over the LIBOR plus any facility fee. Moreover, lenders generally use a menu of spreads and fees rather than a single price measure (Berg, Saunders and Steffen, 2016). Thus, we also use the all-in spread undrawn (*AISU*), which is defined as the sum of the facility fee and the commitment fee. We find that other loan fees do not respond to tax-rate changes and thus exclude them from our analysis.

We focus on loan pricing, given our theoretical considerations suggesting that changes in corporate tax rates are more likely than the quantity of loans to significantly affect lending rates (predominantly due to the shape of the loan-supply curve as in Figure 1). We also estimate alternative specifications using as outcome variables the loan facility amount (*Loan amount*), the number of lead lenders in the loan (*Number of lenders*) or the concentration of holdings within the syndicate constructed from the member's share in the loan (*Herfindahl*). Tax-rate changes affecting the loan-demand/loan-supply model should also affect the equilibrium loan rate, largely depending on the shape of the loan-supply curve and the location of the initial equilibrium (see the discussion above in Section 2).

We identify each lender's and borrower's state using the location of their headquarters. However, the presence of borrowing subsidiaries makes this matching more labor intensive. Specifically, should a loan be provided by an affiliate or subsidiary that operates in a different state from a parent bank, we hand-match the lender's state with that of the affiliate/subsidiary.

Similarly, for firms receiving loans through their subsidiaries, we hand-match the borrower's state with that of the affiliate/subsidiary.[4]

3.2. Control variables

We use several control variables at loan, firm, bank, state, and federal levels (definitions are provided in Table A1 and summary statistics in Table 1). Following the relevant literature (e.g., Ivashina, 2009; Hasan, Hoi, Wu and Zhang, 2017; Kim, 2019; Delis, Hasan and Ongena, 2020), we control for loan characteristics such as the log of the loan amount (*Loan amount*), loan maturity in months (*Maturity*), the number of lenders in the syndicate (*Number of lenders*), and dummies for loans being secured (*Collateral*) or having performance-pricing provisions (*Performance provisions*) and covenants (*Covenants*). We also use loan-type fixed effects, which are very important as loan facilities include credit lines and term loans that are fundamentally different in their contractual arrangements and pricing (Berg, Saunders and Steffen, 2016), as well as loan-purpose fixed effects (e.g., corporate purposes, working capital, takeovers or acquisitions, debt repayment, etc.).

We also include firm-year variables to identify demand-side channels specifically. These variables include size (*Firm size*) and return on assets (*Firm return on assets*), since these proxy for firm power and overall soundness. Also, we use leverage (*Firm leverage*) to isolate the effect of capital structure and indebtedness on the relationship between tax changes and loan-pricing decisions. At the bank level, we control for the willingness and capacity of

[4] In addition to the presence of subsidiaries, we further adopt this approach in cases of mergers. A complete example is that of Paramount Petroleum Corporation, headquartered in the State of California, that was acquired in 2006 by Alon USA Energy Inc., headquartered in the State of Texas (the U.S.-based refining and marketing subsidiary of Alon Israel Oil Co. Ltd.). For loans received by Paramount Petroleum, we set the borrower's state as California, whereas for those received by Alon we set the borrower's state as Texas. Alon merged in 2017 with Delek US Holdings, Inc., headquartered in the State of Tennessee. In sensitivity tests, we further examine cases of cross-state loans, where the borrowing firm has an affiliate or subsidiary in the bank's state. To accomplish this, we identify all firms' subsidiaries in the bank's state. Similarly, we identify all banks' subsidiaries in the firm's state. In either case, the number of these cases is small. We discuss this further in Section 4.

banks to supply loans. Thus, we introduce *Bank capital* (the ratio of total bank capital over total assets), which is the most widely used measure of bank agency problems (Holmstrom and Tirole, 1997; Dell'Ariccia, Laeven and Marquez, 2014).

We further employ various state- and federal-level controls to capture any unobservable fiscal and monetary policy characteristics, such as gubernatorial elections indicators in the borrower's state and the governor's political affiliation. Furthermore, since corporate income taxes at the federal level constitute the primary tax burden for corporations relative to those at the state level, we control for the former by including the change in the federal corporate income tax rate. Finally, we consider the stance of monetary policy to avoid attributing our findings to the credit channel of monetary policy. On the supply side, the commitment of central bank to lower (future) interest rates induces banks to assume greater risk, thereby expanding lending supply (Maddaloni and Peydró, 2011; Altunbas, Gambacorta and Marques-Ibanez, 2014; Jiménez, Ongena, Peydró and Saurina, 2014; Delis, Hasan and Mylonidis, 2017; Paligorova and Santos, 2017). On the demand side, a low-interest rate environment induces borrowers to demand more credit due to their higher asset and collateral values (Kashyap and Stein 2000); in this regard, we estimate alternative specifications that include the quarterly shadow rate.

4. Empirical methodology

4.1. Empirical specification

Findings in Table 2 provide the first indication of a significant and asymmetric effect of corporate tax changes on loan pricing. In Panel A of Table 2, we report summary statistics for key loan characteristics for firms not experiencing a state corporate tax change. Panel B reports their differences vs. firms experiencing an increase or a decrease in state corporate tax rates. Evidence shows that loans to firms in states with a corporate tax increase carry a 17.67 basis

points higher *AISD* than loans to firms with unchanged corporate tax rates. In the case of a tax decrease, the difference is 9.83 basis points and is statistically significant at the 1% level. Moreover, we observe a statistically significant lower *AISU* in the unchanged vs. tax-decrease group.

[Insert Table 2 about here]

We observe additional differences in other loan characteristics depending on the direction of the corporate tax change. Specifically, loans granted to firms in states implementing a tax increase (decrease) in the current year have a lower (higher) maturity relative to those granted in states where no tax change occurs. Moreover, loans to firms in states with tax increases are typically smaller and granted from syndicates with fewer members and carry fewer provisions and covenants. We examine whether these correlations translate to causal effects, as well as pinpointing the channels.

Our main regression equation is:

$$AISD_{lbft} = a_0 + a_1 Tax\ increase_{st} + a_2 Tax\ decrease_{st} + a_3 Controls_{lbft} + u_{lbft} \qquad (1)$$

In equation (1), $AISD_{lt}$ measures the all-in spread drawn (AISD) of loan facility *l* granted by lead bank *b* to firm *f* in year *t*. We use several additional dependent variables to pinpoint the channels driving our results, namely *AISU*, *Loan amount*, *Maturity*, *Number of lenders* and *Herfindahl*. The variables $Tax\ increase_{st}$ and $Tax\ decrease_{st}$ are the binary indicators discussed previously and carry the coefficients of main interest in our analysis. We expect that a_1 and a_2 are positive and negative, respectively, if corporate tax changes significantly affect loan spreads. $Controls_{lfbt}$ is a vector of loan, firm, and bank characteristics used as control variables; the vector a_0 denotes a set of fixed effects discussed below; and u_{lbft} is the stochastic disturbance.

An empirical model very similar to (1) is adopted by Heider and Ljunqvist (2015), who use binary indicators on state corporate income tax increases and decreases to examine the response of firms' leverage ratio in states adopting corporate tax changes. Moreover, Farre-Mensa and Ljungqvist (2016) evaluate how well five popular measures (paying dividends, having a credit rating, and the Kaplan-Zingales, Whited-Wu and Hadlock-Pierce indices) identify financially constrained U.S. firms. They use several tests, among them state corporate tax rate changes affecting banks that lend in the state where the firm is headquartered.

4.2. Empirical identification

In this section, we discuss how we tackle the "more basic" identification problem, namely distinguishing the effect of corporate tax changes in equation (1) from other confounding (unobserved) effects, which potentially lead to omitted-variable bias. Considering the identification of changes in loan supply from changes in loan demand, we conduct tests in the following sections.

Our identification strategy directly follows Heider and Ljunqvist (2015), a key issue being comparing borrowing costs between firms located in a state with a corporate tax-rate change in a given year and firms in other states without such a tax change. *Ceteris paribus*, and given firm fixed effects, the level of borrowing costs among firms in states without tax changes provides a counterfactual estimate of how the borrowing costs of firms in the state with a tax change would have evolved absent the tax change. The staggered difference in differences (DID), i.e., the difference across firms in different states of the within-firm change in borrowing costs following the tax change (which occurs in different fiscal years), provides an estimate of the tax sensitivity of firm credit costs.[5]

[5] The main and interaction terms are omitted, given the respective fixed effects.

The key assumption for a valid DID is violated if state corporate tax changes coincide systematically with state-year variation in the business cycle, with labor-market conditions, or with changes in other taxes or state-year policies that affect bank supply and firm demand for debt regardless of the corporate tax change. For example, if states raise taxes in economic downturns, and downturns induce firms to borrow more (Korajczyk and Levy, 2003), we may observe a spurious correlation between taxes and loan spreads.

Table 3 relates borrower states' tax policies to their economic and political conditions to obtain a sense of the scope of such confounds. In columns 1-3 we report state-level summary statistics for certain explanatory variables reflecting political and economic conditions in the borrower's state (for all observations and for observations pertaining to tax increases and tax decreases, respectively) and in column 4 we report the difference between values for tax increases and decreases. We observe that most states implementing tax changes are more often governed by Republicans, although there is no systematic difference when distinguishing between tax hikes and cuts. Moreover, compared to states that increase taxes, those that cut taxes tend to run budget surpluses. However, as a general result, economic and political conditions play a very limited role in states' tax policies, leading us to believe that the role of omitted variables in equation (1) might also be limited.

[Insert Table 3 about here]

To receive a better reflection of this issue, we next estimate linear-probability models of borrower states' decisions to raise or cut corporate taxes. The models include year and state fixed effects and cluster the standard errors at the state level. Column 5 shows that taxes are slightly more likely to increase in states with lower growth and unemployment rates, and when the previous year's tax rate exceeds the maximum tax rate in neighboring states (tax competition); however, the relevant coefficients are below conventional levels of statistical significance, while the economic significance is also small). In column 6, we observe that states

under Republican administration are 7.6% more likely to cut taxes (10% level of statistical significance). We obtain similar results in columns 7-9, where we model the magnitude (rather than the likelihood) of tax changes.[6]

We can conclude that observed political and economic factors have, if anything, a small role in the probability of tax changes. However, it might be the case that corporate tax changes coincide with other unobserved state-year fiscal changes that could affect loan pricing, such as state taxes on personal income, capital gains, or banks, as well as changes in state investment-incentive programs (i.e., tax credits for investment, R&D, and job creation). Even though Heider and Ljungqvist (2015) show no systematic relevant effects, we decided to do more to insulate our model from such possibilities.

Specifically, including borrowers' state × year fixed effects in our baseline specification isolates the effect of relevant within-year political or economic factors. Our tax change variables can still be estimated because the fiscal year does not coincide with the calendar year. This is because, in the U.S., the federal fiscal year runs from October 1 to September 30. Apart from a few discretionary measures, federal fiscal policy changes occur at the beginning of each fiscal year. In 46 states, the fiscal year begins on July 1 and ends on June 30. The exceptions are as follows: in New York, the fiscal year begins on April 1; in Texas, on September 1; and in Alabama and Michigan on October 1. The length of the budget cycles varies among states, with more than half of the states budgeting annually and the remainder enacting biennial budgets. On the other hand, several of the corporate tax changes are pre-announced more than a year in advance. The above suggests that controlling for state-year effects control for the business cycle and any macroeconomic/fiscal changes occurring at the federal level.

[6] Using this first-stage analysis more formally in a Heckman two-stage model to estimate equation (1) produces results very similar to our baseline. The inverse Mills ratio enters with an insignificant coefficient, reflecting no selection bias in this analysis. These results are available on request.

Moreover, industry × year fixed effects control for time-varying, industry-wide developments. Essentially, all these fixed effects imply identification by comparing loans originated within-year but before the fiscal change, to respective loans within-year but after the fiscal change, and all that on top of using firm fixed effects and industry-year fixed effects. Given the above, it is unlikely that our results are systematically driven by other unobserved events. In all cases, we corroborate our baseline findings with placebo tests and a large battery of robustness tests.

An additional identification challenge stems from staggered DID regressions often being susceptible to bias introduced by treatment effect heterogeneity (Barrios, 2021; Goodman-Bacon, 2021; Baker, Larcker and Wang, 2022). This bias arises because two-way fixed effects DID regressions may not be appropriate in settings with multiple treatment periods or where homogeneous treatment effects cannot be assumed unless there is a relatively small percentage of never-treated units. In our context, the possibility of this bias is small for two reasons. First, we do not employ a panel dataset; the unit of our analysis is at the loan level, as firms often receive more than one loan per year (i.e., we do not follow the same loan over time). Second, we have a large group of never-treated units as controls, that places less weight on the DID estimator (Sun and Abraham, 2021): from a total of 6,929 borrowers in our sample, 4,828 are not subject to a tax change (never-treated units).

Still, we implement robustness tests using an event study where we group all loans in a (-2, +2) year window around the corporate tax change (increase or decrease). This follows from Sun and Abraham (2021), especially for cases with a large group of non-treated units. Baker, Larcker and Wang (2022) call this the "stacked regression estimator." We then conduct a DID, where we examine the evolution of loan spreads of firms subject to a tax change (treated firms) relative to those of firms not subject to a change (control firms). We conduct this study separately for firms subject to a tax increase and a tax decrease and discuss the results in Section

5.[7] To further enhance our results, we conduct the same exercise by excluding the financial crisis, as this may be a period where lending terms change, thereby affecting the DID weights.

Our final identification challenge relates to a selection issue, namely the possibility that firms with certain characteristics self-select in or out of the syndicated loan market following corporate tax changes. Given that the syndicated loan market is not accessed by the universe of U.S. firms, this activity might imply that unobserved firm characteristics could correlate with corporate tax changes. We overcome this challenge by employing Heckman's (1979) two-stage regression model where, in the first stage, we estimate the probability that all firms listed in Compustat access the syndicated loan market. We discuss the details below in the relevant section.

5. Empirical results

5.1. Baseline results

Table 4 reports the results (coefficient estimates and t-statistics) from the estimation of equation 1. We cluster standard errors by borrower's state (the cross-sectional unit of *Tax increase* and *Tax decrease*).[8] We report the number of banks and firms from which we obtain identification in the corresponding estimations in the lower part of each table.

As shown in each column, we sequentially introduce different fixed effects. Column 1 includes loan type, loan purpose, year, bank, firm, as well as borrower's industry × year and borrower's state × year fixed effects to control for time-varying developments that affect all firms in each industry and each state, respectively. As per our discussion in section 4, the

[7] Baker, Larcker and Wang (2022) review the literature on the issue and highlight another two relevant solutions, from respective models by Callaway and Sant'Anna (2021) and Sun and Abraham (2021). Both models cannot be effectively applied in our setting because they assume a panel dataset and only one change in the cross-section, while for some states (and thus treated firms), we observe more than one. Moreover, the first model cannot accommodate multiple fixed effects, which are very important in our analysis.

[8] We further estimate specifications with double or triple clustering, such as borrower's state *and* firm, borrower's state *and* firm *and* year, borrower's state *and* industry, or borrower's state *and* industry *and* year. We conduct this analysis because some corporate tax changes may cluster around specific states, industries, and years. Results reported in Table A11 of the Appendix are similar to those from specifications with simple clustering.

borrower's state × year fixed effects in particular are important to saturate the model from other year-varying within-state confounding effects and allow identification from the comparison of loan spreads within the fiscal year (as opposed to the calendar year). This specification allows both the loan demand channel and the loan supply channel to be operative.

In column 2, we add bank × year fixed effects, which is a first important control for time-varying supply-side explanations of the findings. The bank × year fixed effects essentially saturate the model for bank-year changes in loan-pricing decisions, leaving the equivalent firm-year decisions to be operative. In column 3, we replicate specification 1, by replacing our binary tax-change indicators with actual (numerical) changes in corporate income tax rates.

Across the first three specifications, the coefficients on *Tax increase* are statistically insignificant. In contrast, the coefficients on *Tax decrease* are consistently negative and statistically significant at conventional levels, indicating that the effects of corporate tax changes on the price of loans are asymmetric. There are two potential explanations for this finding. First, competitive loan markets (e.g., the syndicated loan market) can mitigate the effects of a tax increase if banks avoid losing established relationship lending, especially for large firms with access to alternative sources of financing (e.g., use of retained earnings, low leverage, access to the bond market).[9] Similar implications can emerge if banks are largely heterogeneous in their levels of capital and liquidity. For example, high-capital and/or -liquidity banks can more easily mitigate the effects of contractionary fiscal policy (whereas the effect of a tax decrease should be negative). Our finding is distinct from that analyzed by Heider and Ljungqvist (2015), where tax increases (as opposed to tax decreases in our study) are the key policy change affecting firm leverage (as opposed to credit costs in our study).

Importantly, the large estimate on *Tax decrease* in column 3, which includes bank × year fixed effects that control for the supply-side effect, vis-à-vis column 1 shows that our

[9] In contrast, after a tax decrease all banks in competitive loan markets will most likely reduce lending rates.

results are predominantly driven by the demand side: we identify a leftward shift in the loan demand curve following a tax decrease (e.g., a movement from point A to point B on Figure 1) that corresponds to a lower lending rate. We further disentangle and analyze the mechanisms in Section 6.

According to the results in column 1, the coefficient on *Tax decrease* shows that a corporate tax cut in the borrowing firm's state decreases *AISD* by an average of 10.1 basis points or 4.7% (= 10.1 basis points ÷ 215.9 basis points for the average loan in our sample). Given that the average loan size is USD 365.0 million, firms in states with tax cuts save approximately USD 0.37 million (= USD 365.0 million × 10.1 basis points) per year in reduced interest payments, which represents approximately USD 1.48 million in interest savings over the loan's duration for an average loan maturity of 4.0 years. Moreover, each borrowing firm in our sample receives, on average, 1.7 loans per year, thereby raising the overall savings realized from the average firm's total borrowing operations to a substantial USD 2.52 million (= USD 1.48 million × 1.7 loans).

[Insert Table 4 about here]

These effects do not consider the size of the change in the corporate tax rate, which is usually small from one year to the next. The results in column 3 are perhaps more illuminating in that respect and show that a one percentage point decrease in the corporate tax rate, decreases the loan spread by a substantial 10.5 basis points. Moreover, an increase of equal magnitude in the corporate tax rate is associated with a 9.2 bps increase in *AISD*, pointing to a more symmetric effect.

The size and magnitude of coefficients on the control variables in specifications 1-3 of Table 4 are in line with expectations and relevant studies by Ivashina (2009), Cai, Saunders and Steffen (2018), and Delis, Hasan and Ongena (2020). Loan spreads decrease with loan amount and maturity. Imposition of collateral causes an increase in *AISD*, as these loans are

generally deemed to be riskier. Loans are also more competitively priced when more performance provisions are included. Estimates on firm-level variables are largely anticipated, i.e., larger firm size and returns on assets are associated with decreasing *AISD*, while leverage increases loan spreads.

Finally, in columns 4 and 5 we estimate specification 1 (our baseline) by replacing *AISD* as dependent variable with loan amount and maturity, respectively (and including *AISD* in our set of control variables); this allows us to examine the effect of tax changes on additional elements of credit expansion/contraction.[10] Results from column 4 show no effect on *Loan amount*, as the coefficient on either tax indicator is statistically insignificant. However, column 5 shows that the asymmetric effect of tax changes also extends to loan maturity. Specifically, a tax cut increases *Maturity* by approximately 3.4% (= 1.64 ÷ 47.82 months), while tax hikes are insignificant. This inverse relationship is consistent with our baseline findings.

5.2. Treatment heterogeneity

In this section, we address possible issues arising from treatment heterogeneity in the presence of variation in treatment timing in the context of staggered DID models, such as the one estimated so far (Barrios, 2021; Goodman-Bacon, 2021; Baker, Larcker and Wang, 2022). Specifically, we conduct an event study where we group all loans in a (-2, +2) year window around each tax change. We then estimate a DID, where we examine the evolution of *AISD* for firms subject to a tax change (treated firms) relative to those of firms not subject to a change (control firms).

[10] The effects of tax-rate changes on other loan characteristics are statistically insignificant, and thus do not add to our theoretical considerations. Therefore, we include them in Table A12 of the Appendix.

We report results in columns 6 and 7 of Table 4, where we conduct this exercise separately for corporate tax increases and tax decreases.[11] According to our estimates, loan spreads remain unresponsive to tax hikes (the insignificant coefficient on *Treated firm (increase)* × *Post-tax increase* in column 6). Importantly, *AISD* falls by approximately 15.0 bps in response to tax cuts (the negative and statistically significant coefficient on *Treated firm (decrease)* × *Post-tax decrease* in column 7). Taken together, these results are fully consistent with our baseline, reflecting that treatment heterogeneity is not an important problem in our sample. If anything, our baseline estimates on the easing effect of tax cuts on loan spreads are conservative.

5.3. Alternative tax change measures

We also consider alternative tax change indicators, based on the magnitude and frequency of tax changes, as well as the level of initial corporate tax rates. These indicators either replace or are employed along with our baseline tax change measures. A natural question is whether loan spreads respond more strongly to larger tax changes. In the first two specifications of Table 5, we distinguish between small, middle and large tax changes by including separate indicators for tax changes in the top, middle and bottom terciles of our sample, respectively. Not surprisingly, the *AISD* responds strongly following the largest tax rate cuts, as well as the largest tax hikes.

In column 3, we examine whether loan spreads respond differently in states with more frequent vs. less frequent tax changes, while in column 4 we compare states with low vs. high initial levels of tax rates; in either case, we confirm the generic response of *AISD* to tax cuts,

[11] The sample for this exercise includes the construction of non-overlapping 5-year windows for each state, each with a unique tax change (states with multiple tax changes within the 5-year window are excluded); this results in a drop in the number of observations relative to our baseline specification. We separate tax increases from tax decreases, because comparing windows for opposite tax changes is obviously wrong.

which is uniform across states. This is also verified in column 5, where we consider only changes in the top corporate income tax rate, excluding other tax changes, such as surtaxes.

[Insert Table 5 about here]

5.4. Different loan types

We subsequently perform a subsample analysis by distinguishing between different loan types. In specifications 1 and 2 of Table 6, we separately use term loans and credit lines, respectively (dropping other loans for e.g. M&As, which are more closely linked to the general economic activity and overall credit conditions). We expect that our results are stronger for term loans for at least two interrelated reasons. First, credit lines are often not used by firms and thus a change in the terms of credit after the policy shock is less likely compared to term loans. Second, credit lines and term loans have different pricing mechanisms; most notably, credit lines usually bear higher spreads but lower fees than term loans (e.g., Berg, Saunders and Steffen, 2016). Since borrowers often draw down their credit lines much more in bad times, when either market sources of funding dry up or when they are doing poorly, lenders may increase the cost of drawn funds to provide disincentives for firms to draw down a credit line (see Berg, Saunders, Steffen and Streitz, 2017).

The results are consistent with our expectations: the effect of the tax decrease on the spread of term loans is approximately equal to 23 basis points, while the equivalent on the spread of credit lines is 9 basis points (both coefficients are statistically significant at conventional levels). This is further verified in columns 4 and 5, where we consider the interactions of our tax change indicators with the relevant binary indicators for term loans and lines of credit respectively. We perform a similar analysis in columns 3 and 6, where we distinguish the noticeably small number of M&A loans in our sample; we do not find marked

evidence that the spread on these loans responds differently to tax cuts relative to other loans (columns 3 and 6).

[Insert Table 6 about here]

However, studying new loans is also important. Consider, for example, the role of expansionary fiscal policy. Given our conceptual framework, new firms might decide to enter the syndicated loans market or firms previously accessing this market but without a current loan might decide to re-enter also because of potentially more favorable credit terms. Similarly, banks can be less reluctant to lend to more opaque firms or in general offer better lending terms. This framework is very similar to the literature on expansionary monetary policy (see, e.g., Dell'Ariccia, Laeven and Marquez, 2014; Jiménez, Ongena, Peydró and Saurina, 2012; 2014; Delis, Hong, Paltalidis and Philip, 2022).

Given this, in columns 7 and 8 of Table 6, we consider different subsamples based on new loans and refinanced loans, respectively. Estimates from either specification reveal that although both loan types respond to tax cuts, our sample is dominated by loans to new firms. Moreover, these loans do not appear to carry a different spread relative to refinanced loans, as the coefficient on the relevant double interaction in column 9 is statistically insignificant.

5.5. Placebo tests

We conduct three placebo tests to examine that our results are not spuriously led by unobserved characteristics changing at the same time as corporate tax rates.[12] First, we estimate our baseline regression by changing the timing of tax changes by replacing our tax-change indicators with their lagged values, i.e., indicators for tax changes in the year prior to the loan facility year. This constitutes an alternative placebo test to show that the period when tax

[12] We thank one of the referees for the suggestions in constructing the placebo tests.

changes go into effect is what matters and that anticipation effects do not drive our results. We indeed find that both our lagged tax-change indicators are statistically insignificant.

[Insert Table 7 about here]

We obtain similar results in column 2, when we move our baseline tax change indicators one year backwards, hypothesizing that the tax rate change (either increase or decrease) takes place in the year before the actual implementation year. In our final test in column 3, we allocate randomly tax hikes and tax cuts in each borrower's state. This constitutes a falsification test that the results are not driven by other state-year factors evolving simultaneously with corporate income tax changes. The statistically insignificant coefficients on the random tax change indicators show that the effect of these factors (if any) is not confounded in our baseline results.

5.6. Sample-selection bias

In this section, we address the possibility of selection bias because firms affected by a tax decrease are more likely to access the syndicated loan market. We follow Dass and Massa (2011) and employ Heckman's (1979) two-stage model. In the first stage, we estimate a probit model (at the firm-year level) of firms' loan-taking decisions within a fiscal year. During this stage, our sample includes all U.S. companies in Compustat. In the second stage, we include Heckman's lambda (inverse mills ratio) as an additional control variable.

We assume that a company's decision to access the syndicated loan market is a function of the main determinants of the decision to borrow (Dass and Massa, 2011). Consequently, our probit regression includes firm-level characteristics and variables reflecting macroeconomic and general economic conditions in the firm's state. We report results from this exercise in columns 1-4 of Table 8. Probit estimates in Panel A indicate that larger, more profitable, and financially dependent firms are more likely to seek syndicated loan financing. Moreover, firms

are more likely to access the syndicated loan market when they are headquartered in states with a Republican administration, although they may do so in any phase of the political cycle. Such access is further driven by macro and fiscal conditions at the state level, as reflected in the gross product level and unemployment rate, respectively. Most importantly, estimates from the second-stage regressions in Panel B confirm the strong negative impact of *Tax decrease* on *AISD*.[13]

[Insert Table 8 about here]

6. Loan demand and loan supply

In this section, we delve more deeply into identifying key mechanisms that drive our results, further distinguishing between demand and supply channels. In addition to the use of high-dimensional fixed effects, one method to distinguish between loan demand and loan supply effects on bank lending is via the introduction of interaction terms between the policy instrument (here the tax variables) and firm and bank characteristics, respectively. If the interaction terms with the firm (bank) characteristics are statistically significant, then the demand (supply) effects dominate the findings.

6.1. The loan-demand channel

Given the potential dominance of demand-side effects in the previous section, the first point of interest on the demand side is to explain why the effect of a tax increase is insignificant. Theoretically, and consistent with our discussion in section 2, an important firm characteristic

[13] Our results are also robust to several additional robustness tests, the results of which we report and discuss in the Appendix. Specifically, we test for alternative explanations of our findings by considering firms' financial constraints and geographic diversification. We further control for political and general economic conditions in the borrower's state, for pipeline risk in the syndication process and for the role of monetary policy. Additional tests include the estimation of regressions with different controls and different standard-error clustering. Finally, we control for bank and firm subsidiaries in borrower and lender states, and for firms headquartered in states with special corporate tax treatment.

pinpointing the asymmetric effect between tax increases and tax decreases might be firm size (see Ivanov, Pettit and Whited, 2022). Large firms might possess market power, making an increase in loan spreads by banks less likely, as these firms might seek credit elsewhere more easily. Moreover, managers of large firms have greater incentives (and ways) to lower firms' taxable income (Holland, 1998). One such way is to exploit the debt tax shield and increase their loan demand in response to tax hikes.

To enable the comparison with our baseline estimates, the first column of Table 9 replicates specification 2 of Table 4, where we control for supply-side forces with the inclusion of bank × year fixed effects, allowing only for the operation of the demand channel. In columns 2 and 3 of Table 9, we introduce interaction terms of our tax change variables with *Firm size* and *High firm size*, respectively (definitions in Table A1). The results are most interesting concerning the effect of the tax increase, which is positive and statistically significant but reverses for the largest firms in our sample. Specifically, a tax hike raises *AISD* by approximately 28 basis points in column 3, but this effect more than reverses for the largest firms in our sample. Thus, we can explain the asymmetric effect of tax increases vs. tax decreases identified in our analysis from the fact that the syndicated loan market mostly includes large multinational firms that potentially shift profit to other states / abroad to avoid higher taxes. Besides our focus on the cost of credit and not on leverage, this finding also provides an explanation for the somewhat different results compared to Heider and Ljungqvist (2015), who use all listed companies (that are on average considerably smaller) and show an effect on leverage mostly from tax increases.

[Insert Table 9 about here]

Turning to the dynamics behind the negative effect of a tax decrease, we look into the role of firm profitability as a proxy for overall firm soundness.[14] Consistent with our discussion

[14] Using other measures of firm soundness confirm these findings.

in section 2, less profitable firms are more likely to benefit from the tax decrease, which frees up net profits, whereas more profitable firms would have had relatively low spreads regardless of corporate taxation policies (within reasonable limits). To examine this conjecture, we interact our corporate tax-change indicators with the firm's return on assets. Estimates from specification 4 point to a smaller (larger) decrease in spreads for more (less) profitable firms in response to tax cuts (the positive and statistically significant coefficient on *Tax decrease* × *Firm return on assets*). Economically, a one-standard-deviation (or 8.9%) lower return on assets reduces *AISD* by 7.8 bps (= 8.9 × 0.88).

The difference in the loan demand between more profitable and less profitable firms is further confirmed in specifications 5 and 6 of Table 9, where we replace *AISD* with *Loan amount* as dependent variable. Although the loan amount does not significantly respond to tax cuts (consistent with a relatively inelastic loan supply curve), we do observe that profitable firms somewhat demand less loans compared to less profitable firms after tax increases (the negative and statistically significant coefficient on *Tax increase* × *Firm return on assets* in column 6).

Finally, in Table A5 of the Appendix, we replicate the analysis of Table 9 by replacing the binary tax change indicators with the continuous measures of actual changes in the state corporate income tax rate. Results from the alternative tax change indicators generally provide similar results.

6.2. The loan supply channel

Next, we examine the potency of supply-side forces.[15] In column 2 of Table 10, we control for the operation of the loan demand channel by including firm × year fixed effects, while leaving

[15] To enable the comparison with our baseline estimates, column 1 of Table 10 replicates specification 2 of Table 4, where we employ bank × year fixed effects to control for the operation of the loan supply channel.

the loan supply channel operative (through using simple bank fixed effects and dropping the bank × year ones). The estimates show that none of the tax indicators come with a statistically significant coefficient, pointing to a limited effect of supply-side forces.

[Insert Table 10 about here]

We next turn to identifying supply-side effects via the interaction of tax changes with bank capitalization. The fact that well-capitalized banks buffer policy shocks (Thakor, 1996; Gambacorta and Mistrulli, 2004; Ivashina and Scharfstein, 2010; Cornett, McNutt, Strahan and Tehranian, 2011) allows us to further assess whether the credit-supply effect is contingent on the ability of banks to provide loans. Based on the theoretical implications of a relatively inelastic credit supply (Figure 1), and combined with the credit-demand effect, any rightward shift in the loan-supply curve should produce an even lower loan spread, leaving the equilibrium loan quantity relatively unchanged.

Estimates in column 3 confirm the lower *AISD* in response to corporate tax cuts (the negative and statistically significant coefficient on *Tax decrease*). We further observe that the coefficient on *Tax decrease* × *Bank capital* has the expected negative sign (well-capitalized banks aiming to increase loan supply following the tax cut) but this effect is not statistically significant. This finding supports that the credit-supply effect is indeed weak and any rightward shift in the loan supply curve is small.

To complete the picture, in columns 4 and 5 we examine the effect of tax changes on the quantity of loans, by replacing *AISD* with loan amount as the dependent variable. We find that the coefficients on our tax indicators remain below the conventional levels of statistical significance either when controlling for loan demand (through firm × year fixed effects in specification 4) or when distinguishing between lenders with different capital adequacy levels (specification 5).

We draw further inferences on this issue by looking at the structure of loan syndicates. Specifically, we conjecture that if the loan amount remains relatively unchanged, banks may only adjust their position in each loan syndicate; in this case, better-capitalized banks would be more inclined to finance the loan at the expense of less-capitalized ones, leading to a more concentrated syndicate. We investigate this possibility in the next specifications, by employing as dependent variables the number of lead lenders (columns 6 and 8) and the degree of concentration within the syndicate (columns 7 and 9). Estimates show that tax cuts generally lead to a larger and less concentrated syndicate. However, this effect is contingent on bank capital adequacy, as better-capitalized banks form a smaller and more concentrated syndicate for a given cut in the corporate income tax rate (the negative and positive coefficients on *Tax decrease* × *Bank capital* in columns 8 and 9, respectively).

In our context, this differential effect of tax cuts for banks with different capital levels might point to a moderate credit-supply effect. While the credit-supply effect is less potent than is the credit-demand effect, it has the potential to further decrease the loan spread, while counterbalancing the negative pressure of the demand side on the loan quantity, as reflected by, e.g., point C in Figure 1. This conclusion is further supported by the analysis in Table A6, where we replicate the analysis of Table 10 by employing the actual change in the corporate income tax rate as our main explanatory variable.

7. Conclusions

This study examines the sensitivity of firm borrowing costs to corporate income tax changes. We consider a quasi-natural experiment consisting of 174 changes in corporate income tax rates across U.S. states. By distinguishing between increases and decreases in the corporate tax rate we examine their asymmetric effects on the pricing of more than 43,400 syndicated loans during the 1987-2019 period.

We find that loan spreads decrease by approximately 10.1 basis points in response to a cut in the corporate tax rate in the borrowing firm's state but are insensitive to corporate tax increases. This spread decrease represents USD 1.48 million of interest savings for the average loan or USD 2.52 million for the average firm's total borrowing operations. Our results remain strong in an array of robustness tests and are mostly due to demand-side forces. We identify the source of the insignificant effect of tax increases on loan spreads to be large firms (prevalent in the syndicated loan market) being able to insulate themselves. Thus, the economic significance of the results is potentially even larger for smaller and more opaque firms that do not have access to the syndicated loans market or the corporate bonds market.

We further show the prevalence of a weak credit-supply effect that works primarily via bank capital. This effect places further downward pressure on loan spreads and potentially reverses the negative demand-driven effect on the equilibrium quantity of loans. Overall, and consistent with the theoretical premise that the loan-supply curve is relatively inelastic, tax cuts have a negative and significant effect on bank lending rates but leave the equilibrium quantity of loans largely unaffected.

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Figure 1. Loan demand and loan supply curves

The figure shows the shape of the loan demand and loan supply curves and possible respective shifts following tax rate decreases.

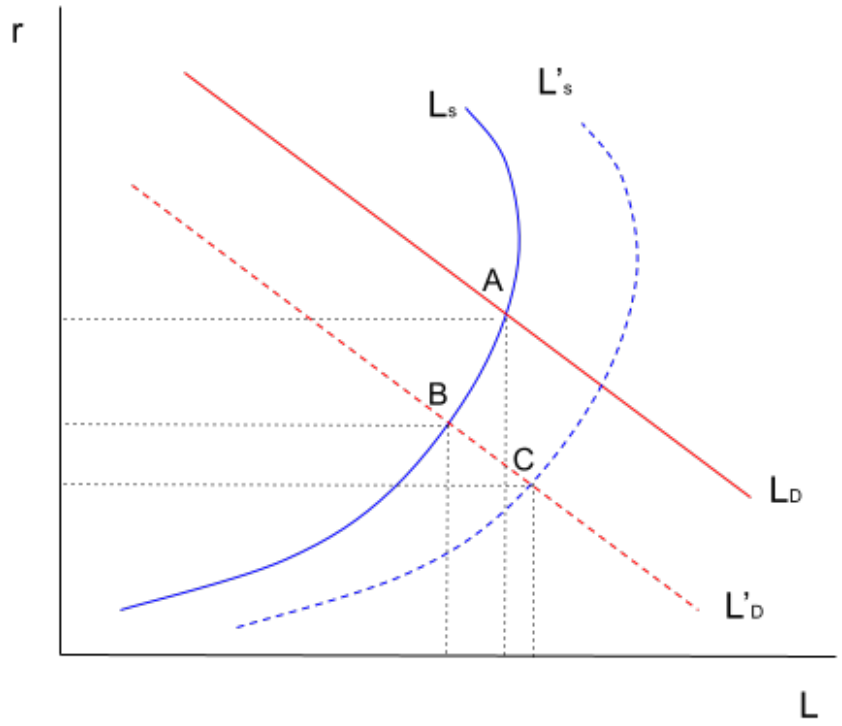

Table 1. Summary statistics

The table reports summary statistics (number of observations, mean, standard deviation, minimum and maximum values) for all variables used in the estimations of the main text. All variables are defined in Table A1.

	Obs.	Mean	Std. dev.	Min.	Max.
AISD	43,481	215.90	143.78	0.70	1,125.00
AISU	24,953	31.28	21.70	0.35	250.00
Tax increase	43,481	0.03	0.18	0.00	1.00
Tax increase (rate)	43,481	0.03	0.22	0.00	3.76
Tax decrease	43,481	0.09	0.28	0.00	1.00
Tax decrease (rate)	43,481	0.04	0.20	0.00	3.50
Loan amount	43,481	18.45	1.79	9.21	24.62
Loan amount (USD million)	43,481	365.00	895.00	0.01	49,000.00
Maturity	43,481	47.82	24.19	0.00	396.00
Collateral	43,481	0.56	0.50	0.00	1.00
Number of lenders	43,481	7.66	8.42	1.00	162.00
Performance provisions	43,481	0.37	0.48	0.00	1.00
General covenants	43,481	0.53	0.50	0.00	1.00
Herfindahl	43,481	7.74	1.05	1.64	9.21
Firm size	43,481	6.73	2.02	1.53	12.84
Firm return on assets	43,481	7.85	8.85	-60.26	39.27
Firm leverage	43,481	34.49	23.66	0.00	146.04
Bank capital	29,096	12.92	1.82	8.70	31.90
Shadow rate	32,883	2.41	3.24	-5.20	6.54

Table 2. Summary statistics for corporate tax changes and non-changes

The table reports summary statistics for key price and non-price loan terms. All variables are defined in Table A1. Panel A includes observations with no change in the corporate tax rate in the borrower's state. Panel B includes observations with an increase in the corporate tax rate in the borrower's state. Panel C includes observations with a decrease in the corporate tax rate in the borrower's state. Panel B reports results from the mean-comparison test for differences in the mean and standard error between observations with no change in the corporate tax rate in the borrower's state and observations with an increase in the corporate tax rate (No change vs. tax increase) and between observations with no change in the corporate tax rate in the borrower's state and observations with a decrease in the corporate tax rate (No change vs. tax decrease). The*** mark denotes statistical significance at 1% level.

	Obs.	Mean	Std. dev.	Min.	Max.
		Panel A: No change in state corporate tax rate			
AISD	38,331	216.19	144.14	0.70	1,125.00
AISU	22,085	31.34	21.66	0.35	250.00
Loan amount	38,331	18.45	1.78	10.60	24.62
Maturity	38,331	47.77	24.10	0.00	396.00
Collateral	38,331	0.56	0.50	0.00	1.00
Number of lenders	38,331	7.67	8.43	1.00	162.00
Performance provisions	38,331	0.37	0.48	0.00	1.00
General covenants	38,319	0.53	0.50	0.00	1.00
Herfindahl	38,319	7.73	1.05	1.64	9.21

Panel B: Mean-comparison test for the mean and standard error

	No change vs. tax increase		No change vs. tax decrease	
	Mean	Std. error	Mean	Std. error
AISD	-17.67***	4.36	9.83***	2.29
AISU	-0.76	0.90	0.98**	0.48
Loan amount	0.18***	0.05	-0.03	0.03
Maturity	4.03***	0.70	-2.01***	0.41
Collateral	0.02*	0.01	0.01	0.01
Number of lenders	0.79***	0.21	-0.16	0.15
Performance provisions	0.07***	0.01	0.01	0.01
General covenants	0.08***	0.01	0.02*	0.01
Herfindahl	-0.10***	0.03	0.02	0.02

Table 3. Determinants of state corporate income tax changes

The table reports summary statistics for variables reflecting political and economic conditions at the borrower's state level and estimates from regressions on the determinants of corporate income tax changes in the borrower's state. All variables are defined in Table A1. The sample covers 51 U.S. states (including Washington D.C.) during the 1987-2020 fiscal years for a maximum 1,413 state-year observations (depending on the variable employed). Columns (1)-(3) report summary statistics for the explanatory variables, showing fractions or means (with standard deviations shown in italics underneath the means). Column (4) compares conditions in borrower states that increase tax rates to those in borrower states that decrease tax rates. Columns (5)-(6) present estimates from OLS regressions at the state-year level for the probability that a borrower's state increases or decreases corporate income tax rates. Column (7)-(9) present estimates from OLS regressions at the state-year level for the determinants of the magnitude of the tax rate changes (in percentage points). Specifications (5)-(9) include year and state fixed effects and standard errors are clustered by state. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Summary statistics			Difference	Probability of …		Magnitude of …		
	Full sample	Tax increases	Tax decreases	(Tax inc. – Tax dec.)	Tax increase	Tax decrease	Tax change	Tax increase	Tax decrease
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Political conditions in year t-1									
Republican governor	0.54	0.52	0.63	-0.11	0.006	0.076*	-0.069*	-0.006	0.054*
	0.50	*0.50*	*0.49*	*0.08*	[0.309]	[1.914]	[-1.760]	[-0.307]	[1.772]
1 year to election					-0.030	-0.048	0.018	-0.010	0.021
					[-1.324]	[-0.850]	[0.304]	[-0.911]	[0.408]
2 years to election					-0.026	-0.066	0.040	-0.010	-0.020
					[-1.208]	[-1.314]	[0.683]	[-0.692]	[-0.738]
3 years to election					-0.027	-0.072	0.044	-0.003	-0.033
					[-1.417]	[-1.435]	[0.920]	[-0.199]	[-0.914]
Economic conditions in year t-1									
State budget balance	0.03	-0.01	0.04	-0.05*			-0.122		
	0.08	*0.06*	*0.09*	*0.02*			[-0.355]		
State budget deficit	-0.01	-0.02			0.044			-0.445	
	0.03	*0.04*			[0.086]			[-0.463]	
State budget surplus	0.04		0.05			-0.136			-0.739
	0.07		*0.07*			[-0.445]			[-1.183]
State gross product growth	0.02	0.01	0.03	-0.01	-0.166	-0.362	0.342	-0.325	0.062
	0.03	*0.02*	*0.03*	0.00	[-0.739]	[-0.695]	[0.558]	[-1.007]	[0.119]
State unemployment rate	0.06	0.05	0.06	0.00	-1.251	0.276	-1.586	0.108	-0.887
	0.02	0.02	*0.02*	0.00	[-1.521]	[0.246]	[-1.172]	[0.128]	[-0.922]
Tax competition	-0.02	-0.02	-0.02	0.00	-1.671	-0.742	-0.979	-5.603*	2.619
	0.02	*0.02*	*0.02*	0.00	[-1.564]	[-0.305]	[-0.385]	[-1.734]	[1.157]
Adj. R-squared					0.056	0.164	0.131	0.050	0.118

Table 4. Baseline results

The table reports coefficients and t-statistics (in brackets). Specifications (1) to (5) report estimates from staggered DID regressions and specifications (6) and (7) report estimates from an event study, with a (-2, +2) year window around each corporate tax change. The dependent variable is noted in the second line of the table and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specifications (1) and (2), *Tax increase* and *Tax decrease* are binary variables that are equal to one for an increase and decrease respectively in the corporate income tax rate in the state of the borrower during the year of the loan, and zero otherwise. In specification (3), *Tax increase (rate)* and *Tax decrease (rate)* include the actual changes in the corporate income tax rate. Specifications (4) and (5) replicate the estimations in specification (1), by replacing *AISD* as dependent variable with *Loan amount* and *Maturity* respectively. In specification (6), *Treated firm (increase)* is a binary variable equal to one if the borrower belongs to the treatment group (i.e., is subject to a corporate tax increase), and zero otherwise, and *Post-tax increase* is a binary variable equal to one for the period after the corporate tax increase [i.e., when the window assumes values of 0 (the year of the tax change), +1 or +2], and zero otherwise. In specification (7), *Treated firm (decrease)* is a binary variable equal to one if the borrower belongs to the treatment group (i.e., is subject to a corporate tax decrease), and zero otherwise, and *Post-tax decrease* is a binary variable equal to one for the period after the corporate tax decrease [i.e., when the window assumes values of 0 (the year of the tax change), +1 or +2], and zero otherwise. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) AISD	(2) AISD	(3) AISD	(4) Loan amount	(5) Maturity	(6) AISD	(7) AISD
Tax increase	7.276	9.623		0.045	0.142		
	[1.501]	[1.469]		[1.104]	[0.155]		
Tax decrease	-10.090***	-9.740***		-0.019	1.636**		
	[-3.336]	[-3.394]		[-0.825]	[2.248]		
Tax increase (rate)			9.155**				
			[2.193]				
Tax decrease (rate)			-10.457***				
			[-2.752]				
Treated firm (increase)						14.975**	
						[2.420]	
Post-tax increase						12.891***	
						[5.432]	
Treated firm (increase) × Post-tax increase						-10.341	
						[-1.226]	
Treated firm (decrease)							-9.763
							[-1.326]
Post-tax decrease							2.225
							[0.774]
Treated firm (decrease) × Post-tax decrease							-14.840***
							[-3.259]
AISD				-0.001***	-0.006***		
				[-12.675]	[-3.270]		
Loan amount	-10.679***	-10.264***	-10.679***		2.116***	-16.376***	-16.726***
	[-12.927]	[-12.273]	[-12.888]		[16.142]	[-10.397]	[-7.945]
Maturity	-0.165***	-0.138**	-0.166***	0.006***		-0.539***	-0.308***

	[-3.371]	[-2.100]	[-3.363]	[18.206]		[-6.020]	[-3.062]
Collateral	30.029***	29.750***	30.022***	-0.038**	1.579***	70.432***	67.419***
	[13.702]	[15.268]	[13.515]	[-2.025]	[3.826]	[22.339]	[14.473]
Number of lenders	0.023	0.017	0.023	0.021***	0.097***	-0.540**	-0.484**
	[0.160]	[0.124]	[0.161]	[15.965]	[3.049]	[-2.538]	[-2.175]
Performance provisions	-20.014***	-19.900***	-19.950***	0.133***	1.851***	-32.484***	-37.058***
	[-13.243]	[-13.297]	[-13.360]	[11.360]	[4.246]	[-9.712]	[-9.930]
General covenants	0.833	0.966	0.778	0.014	-0.679*	3.075	-3.946
	[0.337]	[0.357]	[0.313]	[0.569]	[-1.713]	[0.677]	[-0.875]
Firm size	-11.417***	-12.476***	-11.441***	0.441***	-0.364	-2.697	-1.588
	[-6.169]	[-6.480]	[-6.213]	[38.364]	[-1.039]	[-1.562]	[-0.773]
Firm return on assets	-2.096***	-2.195***	-2.097***	0.005***	0.103***	-2.402***	-2.324***
	[-10.293]	[-8.819]	[-10.232]	[5.882]	[3.344]	[-15.865]	[-7.523]
Firm leverage	0.708***	0.727***	0.710***	0.000	-0.030***	0.906***	0.710***
	[15.749]	[12.873]	[15.764]	[0.419]	[-3.771]	[17.210]	[5.780]
Constant	480.329***	478.420***	480.033***	15.178***	10.626***	509.503***	533.332***
	[33.860]	[26.751]	[33.854]	[187.721]	[4.124]	[22.441]	[20.513]
Observations	43,481	42,210	43,481	43,481	43,481	15,066	8,277
Adj. R-squared	0.719	0.738	0.719	0.825	0.652	0.481	0.475
Loan type	Y	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y	Y
Bank effects	Y	N	Y	Y	Y	N	N
Firm effects	Y	Y	Y	Y	Y	N	N
Industry × year effects	Y	Y	Y	Y	Y	N	N
Borrower's state × year effects	Y	Y	Y	Y	Y	N	N
Bank × year effects	N	Y	N	N	N	N	N
Number of banks	830	736	830	830	830	566	447
Number of firms	6,929	6,754	6,929	6,929	6,929	3,691	2,075

Table 5. Alternative tax change measures

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of alternative corporate income tax change indicators. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specifications (1), (2) and (3), the baseline tax increase and tax decrease indicators are replaced by binary variables that are equal to one if the actual change in the corporate income tax rate (either increase or decrease) is in the top, middle or bottom tercile of the sample, and otherwise zero. In specification (4), *Tax increase* and *Tax decrease* are interacted with *State with frequent tax hikes* and *State with frequent tax hikes* respectively, i.e., binary variables that are equal to one if the borrower's state implements frequent tax increases and decreases respectively, and otherwise zero. The states implementing frequent tax increases (at least 3 hikes) are Connecticut, Illinois, Montana, New Jersey, and Oklahoma. The states implementing frequent tax decreases (at least 5 cuts) are Arizona, Colorado, Connecticut, Indiana, Kansas, New Hampshire, New Mexico, New York, North Carolina, North Dakota, and West Virginia. In specification (5), *Tax increase* and *Tax decrease* are interacted with *Low initial tax rate* and *High initial tax rate* respectively, i.e., binary variables that are equal to one if the corporate tax income rate in the borrower's state is in the bottom and top tercile respectively of the sample, and otherwise zero. In specification (6), *Tax increase* and *Tax decrease* include only changes (either increases or decreases) in the top corporate income tax rate and exclude all other types of changes. All specifications include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Tax increase				9.507	6.028	9.973
				[1.085]	[0.979]	[1.058]
Tax decrease				-6.679**	-16.100**	-7.374*
				[-2.192]	[-2.506]	[-1.804]
Large tax increase	14.195*	14.107*	15.879*			
	[1.688]	[1.694]	[1.680]			
Medium tax increase		13.166				
		[0.932]				
Small tax increase	0.595	0.484	1.557			
	[0.092]	[0.075]	[0.250]			
Large tax decrease	-15.035***	-15.531***				
	[-3.511]	[-3.556]				
Medium tax decrease		-7.817				
		[-1.372]				
Small tax decrease	-6.377	-6.382				
	[-1.426]	[-1.444]				
Tax increase × State with frequent tax hikes				-4.822		
				[-0.563]		
Tax decrease × State with frequent tax cuts				-7.815		
				[-1.568]		
Tax increase × Low initial tax rate					1.261	
					[0.096]	
Tax decrease × High initial tax rate					9.182	
					[1.156]	
Observations	43,481	43,481	43,481	43,481	43,481	43,481
Adj. R-squared	0.719	0.719	0.719	0.719	0.719	0.719
Fixed effects	Y	Y	Y	Y	Y	Y
Number of banks	830	830	830	830	830	830
Number of firms	6,929	6,929	6,929	6,929	6,929	6,929

Table 6. Different loan types

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the consideration of different loan types. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. Specifications (1), (2) and (3) estimate the baseline regression of equation (1) for the subsample of term loans, lines of credit, and M&A loans respectively. In specification (4), *Tax increase* and *Tax decrease* are interacted with *Term loan*, i.e., a binary variable equal to one if the loan facility is a term loan, and zero otherwise. In specification (5), *Tax increase* and *Tax decrease* are interacted with *Credit line*, i.e., a binary variable equal to one if the loan facility is a credit line, and zero otherwise. In specification (6), *Tax increase* and *Tax decrease* are interacted with *M&A loan*, i.e., a binary variable equal to one if the loan facility is an M&A loan, and zero otherwise. Specifications (7) and (8) estimate the baseline regression of equation (1) for the subsample new loans and refinanced loans respectively. In specification (9), *Tax increase* and *Tax decrease* are interacted with *Refinanced loan*, i.e., a binary variable equal to one if the loan facility is refinanced or amended, and zero otherwise. All specifications include loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. Specifications (7)-(9) additionally include loan type fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) Term loans	(2) Credit lines	(3) M&A loans	(4) Full sample	(5) Full sample	(6) Full sample	(7) New loans	(8) Refinanced loans	(9) Full sample
Tax increase	-15.827	6.707	-637.854***	7.168	13.777***	7.688*	10.400	-7.714	9.491
	[-1.406]	[1.261]	[-4.301]	[1.118]	[2.835]	[1.735]	[1.404]	[-1.049]	[1.382]
Tax decrease	-23.429**	-8.894***		-7.841**	-12.256**	-10.681***	-7.949*	-16.292**	-8.628***
	[-2.034]	[-3.621]		[-2.473]	[-2.533]	[-3.049]	[-1.954]	[-2.630]	[-2.750]
Tax increase × Term loan				0.301					
				[0.032]					
Tax decrease × Term loan				-7.077*					
				[-1.713]					
Tax increase × Credit line					-9.962				
					[-1.653]				
Tax decrease × Credit line					3.199				
					[0.710]				
Tax increase × M&A loan						-20.966			
						[-1.232]			
Tax decrease × M&A loan						3.408			
						[0.147]			
Tax increase × Refinanced loan									-8.416
									[-0.872]
Tax decrease × Refinanced loan									-4.813
									[-1.183]
Observations	11,066	26,506	1,567	43,481	43,481	43,481	31,103	10,839	43,404
Adj. R-squared	0.682	0.745	0.296	0.704	0.709	0.695	0.743	0.723	0.695
Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of banks	451	608	131	830	830	830	768	260	829
Number of firms	2,837	5,275	529	6,929	6,929	6,929	6,174	2,364	6,925

Table 7. Placebo tests

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the conduct of different placebo tests. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), the baseline tax increase and tax decrease indicators are replaced by their lagged values, i.e., binary variables that equal one for an increase and decrease respectively in the corporate income tax rate in the state of the borrower in the year before the loan, and zero otherwise. In specification (2), the baseline tax increase and tax decrease indicators are moved one year backwards, hypothesizing that the tax change (either increase or decrease) is implemented in the previous year than its actual implementation year. In specification (3), we allocate randomly tax rate increases and decreases in each borrower's state and construct the relevant binary indicators. All specifications include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
Tax increase	0.238		
	[0.041]		
Tax decrease	0.132		
	[0.051]		
Tax increase (t-1)		-6.149	
		[-1.536]	
Tax decrease (t-1)		6.888	
		[1.654]	
Tax increase (random)			-1.189
			[-1.165]
Tax decrease (random)			0.913
			[0.880]
Observations	43,481	42,754	41,806
Adj. R-squared	0.718	0.720	0.720
Fixed effects	Y	Y	Y
Number of banks	830	827	821
Number of firms	6,929	6,888	6,848

Table 8. Heckman sample-selection model

The table reports the estimates from Heckman's (1979) sample-selection model. The dependent variable is in the second line of each panel and all variables are defined in Table A1. Panel A reports estimates from the first-stage probit model to estimate the determinants of the borrower's decision to access the syndicated loan market. The probit model is estimated at the firm-year level and includes observations for all companies included in Compustat. The dependent variable in the first stage is Syndicated lending, i.e., a binary variable equal to one if the company obtains a syndicated loan in the year, and zero otherwise. Panel B reports estimates from the second-stage OLS model to estimate the effect of corporate tax changes on loan spreads. The OLS model is estimated at the loan level. The dependent variable in the second stage is AISD. Each of the specifications in the second stage includes the inverse mills ratio (Lambda) from the corresponding first-stage specification. The estimation method in the first stage is maximum likelihood and in the second stage is OLS with standard errors clustered by borrower's state. The lower part of panel B denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. All specifications in Panel A include year, company and state fixed effects. All specifications in Panel B include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: The syndicated loan-taking decision by the firm

	(1) Syndicated lending	(2) Syndicated lending	(3) Syndicated lending	(4) Syndicated lending
Financial dependence	0.032***	0.032***	0.037***	0.037***
	[21.497]	[20.671]	[21.810]	[18.875]
Firm size	0.201***	0.200***	0.218***	0.249***
	[110.203]	[108.047]	[92.114]	[63.290]
Firm return on assets	0.859***	0.848***	0.988***	1.003***
	[32.317]	[31.564]	[28.547]	[27.580]
Firm leverage	0.784***	0.801***	0.907***	0.782***
	[50.659]	[50.871]	[46.433]	[34.938]
Firm Tobin's Q				0.000
				[0.368]
Firm tangibility				0.256***
				[12.298]
Firm return on equity				0.000
				[0.920]
Firm cash				-0.038***
				[-11.890]
Firm retained earnings				-0.000
				[-0.002]
Republican governor		0.050***	0.034***	0.017*
		[6.843]	[3.619]	[1.738]
1 year to election		0.024**	0.004	0.010
		[2.410]	[0.347]	[0.756]
2 years to election		0.027***	-0.003	0.001
		[2.624]	[-0.259]	[0.082]
3 years to election		-0.003	0.020	0.017
		[-0.341]	[1.595]	[1.294]
State gross product growth			-0.014***	-0.001
			[-2.618]	[-0.166]
State unemployment rate			3.176***	2.948***
			[12.086]	[10.720]
Constant	26.741***	22.483***	42.597***	39.855***
	[27.050]	[21.792]	[26.182]	[23.321]
Observations	183,120	176,431	116,259	108,373

Panel B: The effect of corporate tax changes on syndicated loan spreads

	(1) AISD	(2) AISD	(3) AISD	(4) AISD
Tax increase	0.676	1.828	-0.741	-0.634
	[0.118]	[0.315]	[-0.104]	[-0.087]

Tax decrease	-11.291***	-10.870***	-15.684***	-16.382***
	[-3.992]	[-3.616]	[-4.524]	[-4.720]
Loan amount	-10.621***	-10.562***	-9.664***	-9.719***
	[-14.255]	[-14.946]	[-12.772]	[-12.603]
Maturity	-0.177***	-0.170***	-0.019	-0.036
	[-3.341]	[-3.226]	[-0.289]	[-0.531]
Collateral	28.247***	28.147***	23.599***	23.645***
	[12.646]	[12.110]	[7.602]	[7.530]
Number of lenders	0.036	0.021	-0.056	-0.061
	[0.293]	[0.177]	[-0.425]	[-0.461]
Performance provisions	-17.686***	-17.971***	-19.162***	-18.687***
	[-8.989]	[-8.857]	[-9.511]	[-8.937]
General covenants	2.190	2.325	3.321	3.903
	[0.845]	[0.881]	[1.203]	[1.341]
Firm size	-15.256***	-15.124***	-13.216***	-13.068***
	[-6.823]	[-6.640]	[-5.580]	[-5.412]
Firm return on assets	-2.203***	-2.212***	-2.405***	-2.390***
	[-10.108]	[-9.881]	[-9.414]	[-8.837]
Firm leverage	0.678***	0.670***	0.723***	0.755***
	[11.989]	[11.819]	[7.825]	[8.088]
Lambda	-35.728***	-33.269***	-42.545***	-35.044***
	[-4.005]	[-3.895]	[-3.387]	[-3.042]
Constant	541.142***	536.416***	523.954***	514.987***
	[22.651]	[22.372]	[16.134]	[16.927]
Observations	37,053	36,113	26,037	24,884
Adj. R-squared	0.730	0.730	0.732	0.732
Number of banks	779	775	478	469
Number of firms	5,934	5,850	4,221	4,045

Table 9. Identifying the mechanisms: The demand side

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of various firm-level characteristics to examine potential demand-side explanations of our findings. The dependent variable is noted in the second line of the table and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we re-estimate specification (2) of Table 4. In specification (2), *Tax increase* and *Tax decrease* are interacted with *Firm size*. In specification (3), *Tax increase* and *Tax decrease* are interacted with *High firm size*, i.e., a binary variable equal to one if *Firm size* is above the sample median, and zero otherwise. In specifications (4) and (5) we replicate specification (1) for the subsample of large firms (where *High firm size* is equal to 1) and small firms (where *High firm size* is equal to 0) respectively. In specification (6), *Tax increase* and *Tax decrease* are interacted with *Firm return on assets*. Specifications (7) and (8) replicate the estimations in specifications (1) and (6) respectively, by replacing *AISD* as dependent variable with *Loan amount*. All specifications include loan type, loan purpose, firm, bank times year, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) AISD Full sample	(2) AISD Full sample	(3) AISD Full sample	(4) AISD Large firms	(5) AISD Small firms	(6) AISD Full sample	(7) Loan amount Full sample	(8) Loan amount Full sample
Tax increase	9.623	69.711***	28.381**	-6.029	35.977**	13.368	0.009	0.081*
	[1.469]	[4.145]	[2.294]	[-0.969]	[2.502]	[1.662]	[0.182]	[1.811]
Tax decrease	-9.740***	-18.897	-14.592**	-7.598*	-3.474	-17.456***	-0.032	-0.017
	[-3.394]	[-1.562]	[-2.648]	[-1.888]	[-0.593]	[-4.149]	[-1.269]	[-0.473]
Tax increase × Firm size		-8.178***						
		[-5.023]						
Tax decrease × Firm size		1.282						
		[0.846]						
Tax increase × High firm size			-30.304***					
			[-2.717]					
Tax decrease × High firm size			7.888					
			[1.165]					
Tax increase × Firm return on assets						-0.438		-0.009
						[-1.165]		[-1.505]
Tax decrease × Firm return on assets						0.881***		-0.002
						[3.135]		[-0.540]
Observations	42,210	42,210	42,210	20,661	20,119	42,210	42,210	42,210
Adj. R-squared	0.738	0.738	0.738	0.769	0.705	0.738	0.823	0.823
Full set of controls	Y	Y	Y	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Number of banks	736	736	736	259	666	736	736	736
Number of firms	6,754	6,754	6,754	2,833	4,553	6,754	6,754	6,754

Table 10. Identifying the mechanisms: The supply side

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of various bank-level characteristics to examine potential demand-side explanations of our findings. The dependent variable is noted in the second line of the table and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we re-estimate specification (2) of Table 4. Specification (2) replicates the estimation in specification (1) by replacing bank times year fixed effects with firm times year fixed effects (and further replacing firm fixed effects with bank fixed effects). Specification (3) replicates the estimation in specification (1) by replacing bank times year fixed effects with bank fixed effects and further interacting *Tax increase* and *Tax decrease* respectively with *Bank capital*. Specification (4) replicates the estimation in specification (2) by replacing *AISD* as dependent variable with *Loan amount*. Specification (5) replicates the estimation in specification (4) by replacing firm times year fixed effects with firm fixed effects and further interacting *Tax increase* and *Tax decrease* respectively with *Bank capital.* Specification (6) replicates the estimation in specification (4) by replacing firm times year fixed effects with firm fixed effects and further replacing *Loan amount* as dependent variable with *Number of lenders*. Specification (7) replicates the estimation in specification (6) by replacing *Number of lenders* as dependent variable with *Herfindahl*. Specification (8) replicates the estimation in specification (6) by interacting *Tax increase* and *Tax decrease* respectively with *Bank capital*. Specification (9) replicates the estimation in specification (7) by interacting *Tax increase* and *Tax decrease* respectively with *Bank capital*. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) AISD	(2) AISD	(3) AISD	(4) Loan amount	(5) Loan amount	(6) Number of lenders	(7) Herfindahl	(8) Number of lenders	(9) Herfindahl
Tax increase	9.623	9.983	9.048	-0.068	-0.003	-0.186	-0.007	1.139	0.002
	[1.469]	[0.517]	[1.543]	[-0.757]	[-0.051]	[-0.486]	[-0.164]	[0.477]	[0.008]
Tax decrease	-9.740***	3.557	-14.320***	0.006	-0.036	0.633	-0.072*	5.135***	-0.405**
	[-3.394]	[0.411]	[-3.975]	[0.075]	[-0.917]	[1.509]	[-1.728]	[2.700]	[-2.271]
Tax increase × Bank capital			0.431		0.035			-0.125	0.002
			[0.146]		[1.420]			[-0.709]	[0.074]
Tax decrease × Bank capital			-0.785		-0.009			-0.336**	0.025**
			[-0.446]		[-0.603]			[-2.655]	[2.153]
Observations	42,210	28,238	28,403	28,238	28,403	43,481	43,466	28,403	28,397
Adj. R-squared	0.738	0.769	0.731	0.796	0.809	0.535	0.696	0.529	0.680
Full set of controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Loan type	Y	Y	Y	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank effects	N	Y	Y	Y	Y	Y	Y	Y	Y
Firm effects	Y	N	Y	N	Y	Y	Y	Y	Y
Borrower's state effects	N	N	N	N	N	N	N	N	N
Industry × year effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Borrower's state × year effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank × year effects	Y	N	N	N	N	N	N	N	N
Firm × year effects	N	Y	N	Y	N	N	N	N	N
Number of banks	736	726	295	726	295	830	830	295	295
Number of firms	6,754	5,527	4,922	5,527	4,922	6,929	6.928	4,922	4,922

Internet Appendix
Corporate tax changes and credit costs

Abstract

This appendix includes additional information on the sample and additional empirical results. The first section includes variable definitions, information on the state corporate tax changes by year, and the replication of the analysis on mechanism identification with actual corporate tax rates. The second section includes the discussion of additional results and robustness checks. The third section reports (i) specifications considering the role of borrower's financial constraints and geographic diversification, (ii) the examination of political and economic conditions in the borrower's state, (iii) specifications with different sets of controls, (iv) results for other loan characteristics, and (v) additional robustness tests.

Table A1. Variable definitions and sources

Variable	Description	Source
A. The dependent variables in main specifications		
AISD	All-in spread drawn, defined as the sum of the spread over LIBOR plus any facility fee.	DealScan
Loan amount	Log of the loan facility amount in USD.	DealScan
Maturity	Loan duration in months.	DealScan
Number of lenders	The number of banks involved in the syndicated loan.	DealScan
Herfindahl	The Herfindahl index of the syndicate (a measure of the concentration of holdings within a syndicate). The Herfindahl index is calculated using each syndicate member's share in the loan. It is the sum of the squared individual shares in the loan, and varies from zero to 10,000, with 10,000 being the Herfindahl when a lender holds 100% of the loan. The variable is transformed into logarithmic form.	DealScan
B. Main explanatory variables: State corporate tax changes		
Tax increase	A binary variable equal to one for an increase in the corporate income tax rate in the state of the borrower during the year of the loan, and zero otherwise. The variable includes changes in the state corporate income tax, in the tax surcharge on tax liability, and in state tax deductibility, and excludes changes in the service rates (e.g., B&O service rates) in the capital stock/foreign franchise tax, and in the corporation franchise tax.	Sources listed in Appendix Table A1
Tax increase rate (rate)	The actual (numerical) increase in the corporate income tax rate in the state of the borrower during the year of the loan. This is the continuous version of the binary indicator *Tax increase*.	Sources listed in Appendix Table A1
Tax decrease	A binary variable equal to one for a decrease in the corporate income tax rate in the state of the borrower during the year of the loan, and zero otherwise. The variable includes changes in the state corporate income tax, in the tax surcharge on tax liability, and in state tax deductibility, and excludes changes in the service rates (e.g., B&O service rates) in the capital stock/foreign franchise tax, and in the corporation franchise tax.	Sources listed in Appendix Table A1
Tax decrease rate (rate)	The actual (numerical) decrease in the corporate income tax rate in the state of the borrower during the year of the loan. This is the continuous version of the binary indicator *Tax decrease*.	Sources listed in Appendix Table A1
C. Explanatory variables: Loan characteristics		
AISU	All-in spread undrawn, defined as the sum of the facility fee and the commitment fee.	DealScan
Collateral	A binary variable equal to one if the loan is secured with collateral, and zero otherwise.	DealScan
Performance provisions	A binary variable equal to one if the loan has performance pricing provisions, and zero otherwise.	DealScan
General covenants	A binary variable equal to one if the loan has covenants, and zero otherwise.	DealScan
Loan type	A series of binary variables indicating loan type (e.g., term loans, revolvers, etc.).	DealScan
Loan purpose	A series of binary variables indicating loan purpose (e.g., corporate purpose, debt repay, etc.).	DealScan
Term loan	A binary variable equal to one if the loan facility is a term loan, and zero otherwise.	DealScan
Credit line	A binary variable equal to one if the loan facility is a credit line, and zero otherwise.	
M&A loan	A binary variable equal to one if the loan facility finances mergers and acquisitions (M&A) activity, and zero otherwise.	DealScan
Refinanced loan	A binary variable equal to one if the loan facility is refinanced or amended, and zero otherwise.	DealScan
Institutional term loan	A binary variable equal to one if the loan facility is a non-amortizing term loan (Term Loan B or higher), and zero otherwise.	DealScan
D. Explanatory variables: Lender characteristics		
Bank capital	The ratio of capital to total assets (%).	Compustat
Bank subsidiary	A binary variable equal to one if the bank operates an establishment in the borrower's state, and zero otherwise.	DealScan and own estimations

E. Explanatory variables: Borrower characteristics

Firm size	The log of total assets.	Compustat
Firm return on assets	The return on total assets (%).	Compustat
Firm leverage	The ratio of total debt to total assets (%).	Compustat
Firm Tobin's Q	The log of firm's Tobin's Q.	Compustat
Firm retained earnings	The ratio of retained earnings to total equity (%).	Compustat
Firm return on equity	The return on total equity (%).	Compustat
Firm tangibility	The ratio of tangible assets to total assets (%).	Compustat
Financial dependence	The ratio of the difference between firm's total investments and cash flow from operations to cash flow from operations.	Compustat
Investment grade	A binary variable equal to one if the firm's credit rating is within the investment grade category (i.e., with credit rating from AAA+ to BBB−), and equal to zero if it is below the investment grade category.	S&P credit ratings
High firm leverage	A binary variable equal to one if the firm's leverage (i.e., the ratio of total debt to total assets) is in the top tercile of the sample, and equal to zero if it is in the bottom tercile.	Compustat and own estimations
Geographic diversification	The number of firm's geographic segments.	Compustat
Same state	A binary variable equal to one if the lender and the borrower are headquartered in the same state, and zero otherwise.	DealScan and own estimations
Firm subsidiary	A binary variable equal to one if the firm operates an establishment in the lender's state, and zero otherwise.	DealScan and own estimations

F. Explanatory variables: State level

State budget balance	The government budget balance in the borrower's state in the year before the loan facility origination year (the variables *State budget deficit* and *Stage budget surplus* refer to the state's budget deficit and surplus respectively).	Own estimations
State gross product growth	The growth in the borrower's state gross product in the year before the loan facility origination year.	Own estimations
State unemployment rate	The unemployment rate in the borrower's state in the year before the loan facility origination year.	Own estimations
Tax competition	The difference between the corporate income tax rate in the borrower's state and the maximum corporate income tax rate in the region in the year before the loan facility origination year.	Own estimations
Election year	A binary variable equal to one if a gubernatorial election is held in the borrower's state during the loan facility origination year, and zero otherwise. The variables *1 year to election*, *2 years to election* and *3 years to election* respectively, are binary variables equal to one if the next gubernatorial election in the borrower's state is held in one year, two years and three years respectively, and zero otherwise.	Own estimations
Republican governor	A binary variable equal to one if during the loan facility origination year, the governor in the borrower's state is Republican and equal to zero if the governor is Democratic.	Own estimations

G. Explanatory variables: Federal level

Federal tax change	The change in the federal corporate income tax rate.	Tax Foundation
Shadow rate	The quarterly shadow short rate (Krippner, 2016).	Krippner (2016)

Table A2. List of state corporate income tax increases

The table lists all U.S. state corporate income tax rises in fiscal years 1987-2020. In states with more than one tax bracket, we report the change to the top bracket. Tax changes are identified from the Tax Foundation (an abbreviated version of which is available at http://www.taxfoundation.org), the Book of the States, a search of the "Current Corporate Income Tax Developments" feature published periodically in the Journal of State Taxation, state tax codes accessed through Lexis-Nexis, and other official state legislative information and documentation.

State	Year	Description
IL	1989	Increase in top corporate income tax rate from 4% to 4.8%
KY	1989	Increase in top corporate income tax rate from 7.25% to 8%
MN	1989	Enactment of alternative minimum tax at 7% rate
NJ	1989	Introduction of 0.375% tax surcharge on tax liability
RI	1989	Increase in top corporate income tax rate from 8% to 9%
CT	1990	Introduction of 20% tax surcharge, increasing top marginal tax rate from 11.5% to 13.8%
MN	1990	Increase in corporate income tax rate from 9.5% to 9.8%
MO	1990	Increase in top corporate income tax rate from 5% to 6.5%
MT	1990	Introduction of 5% tax surcharge on tax liability
NJ	1990	Introduction of 0.417% tax surcharge on tax liability
OK	1990	Increase in top corporate income tax rate from 5% to 6%
AR	1991	Increase in top corporate income tax rate from 6% to 6.5%
NC	1991	Increase in top corporate income tax rate from 7% to 7.75% and introduction of 4% tax surcharge on tax liability
PA	1991	Increase in top corporate income tax rate from 8.5% to 12.25%
KS	1992	Increase in top corporate income tax rate (including surcharge) from 6.75% to 7.35%
KY	1992	Increase in top corporate income tax rate from 8% to 8.25%
MT	1992	Re-introduction of tax surcharge on tax liability at 2.3% rate
WI	1992	Introduction of a temporary recycling surcharge on regular corporations at a 5.5% rate of gross tax liability and on tax-option corporations at a 0.4345% rate of net Wisconsin business income
MO	1993	Increase in top corporate income tax rate from 5% to 6.25% and reduction in federal income tax deductibility from 100% to 50%
MT	1993	Increase in tax surcharge on tax liability from 2.3% to 4.7%
WA	1993	Introduction of 6.5% temporary tax surcharge to most B&O classifications
DC	1994	Introduction of additional 2.5% surcharge on tax liability
VT	1997	Increase in top corporate income tax rate from 8.25% to 9.75%
NH	1999	Increase in top corporate income tax rate from 7% to 8%
WI	2000	Introduction of a permanent surcharge for regular corporations at a 3% rate of gross tax liability and at a 0.2% rate of net income for other business entities
AL	2001	Increase in top corporate income tax rate from 5% to 6.5%
NH	2001	Increase in top corporate income tax rate from 8% to 8.5%
CA	2002	Suspension of state net operating loss (NOL) deduction, affecting profitable firms that have tax loss carry-overs for California state income tax purposes
KS	2002	Increase in tax surcharge on taxable income from 3.35% to 4.5%
NJ	2002	Introduction of Alternative Minimum Assessment tax, under which firms pay the greater of a gross receipts tax and the corporate franchise (net income) tax; suspension of NOL deduction
TN	2002	Increase in top corporate income tax rate from 6% to 6.5%
AR	2003	Introduction of 3% tax surcharge on tax liability
CT	2003	Introduction of 20% tax surcharge on tax liability
IN	2003	Repeal of gross income tax (based on revenue rather than profits) and of supplemental income tax; effective adjusted gross income tax rate (on profits) increased from 7.75% to 8.5%
CT	2004	Increase in tax surcharge on tax liability to 25%
CT	2006	Introduction of 20% tax surcharge on tax liability, repealed in the previous year.
NJ	2006	Introduction of 4% tax surcharge on tax liability

MD	2008	Increase in top corporate income tax rate from 7% to 8.25%
MI	2008	Introduction of corporate income tax with a top rate of 4.95%; replaces a gross-receipts tax without interest deductibility
TN	2008	Introduction of franchise tax at a rate of 0.25% of the greater of net worth or real and tangible property
CT	2009	Introduction of 10% tax surcharge on tax liability for companies with revenues > $100m
NC	2009	Introduction of 3% tax surcharge on tax liability
OR	2009	Increase in top corporate income tax rate from 6.6% to 7.9%
OK	2010	Introduction of business activity tax (BAT)
IL	2011	Increase in top corporate income tax rate from 4.8% to 7%
CT	2012	Unscheduled two-year extension of tax surcharge on tax liability and increase to 20%
MI	2012	Increase in top corporate income tax rate from 4.95 % to 6%
OK	2013	Introduction of franchise tax on all corporations or associations
NV	2015	Introduction of Commerce Tax on businesses with a gross revenue exceeding $4,000,000 in the taxable year
IL	2018	Increase in top corporate income tax rate from 7.75% to 9.5%
NJ	2019	Introduction of temporary tax surcharge for businesses with income of over $1 million, increasing top corporate income tax rate to 11.5%

Table A3. List of state corporate income tax cuts

The table lists all U.S. state corporate income tax cuts in fiscal years 1987-2020. In states with more than one tax bracket, we report the change to the top bracket. Tax changes are identified from the Tax Foundation (an abbreviated version of which is available at http://www.taxfoundation.org), the Book of the States, a search of the "Current Corporate Income Tax Developments" feature published periodically in the Journal of State Taxation, state tax codes accessed through Lexis-Nexis, and other official state legislative information and documentation.

State	Year	Description
CO	1988	Reduction in top corporate income tax rate from 6% to 5.5%
NH	1988	Reduction in top corporate income tax rate from 8.75% to 8.0%
CO	1989	Reduction in top corporate income tax rate from 5.5% to 5.4%
AZ	1990	Reduction in top corporate income tax rate from 10.5% to 9.3%
CO	1990	Reduction in top corporate income tax rate from 5.4% to 5.3%
WV	1990	Reduction in top corporate income tax rate from 9.45% to 9.3%
CO	1991	Reduction in top corporate income tax rate from 5.3% to 5.2%
MN	1991	Reduction in the legislated tax increase of 0.4%
MT	1991	Repeal of 5% tax surcharge
NJ	1991	Reduction in tax surcharge from 0.417% to 0.375%
WV	1991	Reduction in top corporate income tax rate from 9.3% to 9.15%
CO	1992	Reduction in top corporate income tax rate from 5.2% to 5.1%
CT	1992	Reduction in tax surcharge from 20% to 10%
MO	1992	Reduction in top corporate income tax rate from 6.5% to 5%
NC	1992	Reduction in tax surcharge from 4% to 3%
WV	1992	Reduction in top corporate income tax rate from 9.15% to 9%
CO	1993	Reduction in top corporate income tax rate from 5.1% to 5.0%
CT	1993	Repeal of 10% tax surcharge
NC	1993	Reduction in tax surcharge from 3% to 2%
NE	1993	Repeal of 15% tax surcharge
NH	1993	Reduction in top corporate income tax rate from 8% to 7.5%
AZ	1994	Reduction in top corporate income tax rate from 9.3% to 9%
NC	1994	Reduction in tax surcharge from 2% to 1%
NH	1994	Reduction in top corporate income tax rate from 7.5% to 7%
NJ	1994	Repeal of 0.375% tax surcharge
PA	1994	Reduction in top corporate income tax rate from 12.25% to 11.99%
RI	1994	Repeal of 11% tax surcharge
CT	1995	Reduction in top corporate income tax rate from 11.5% to 11.25%
NC	1995	Repeal of 1% tax surcharge
PA	1995	Reduction in top corporate income tax rate from 11.99% to 9.99%
WA	1995	Reduction in the B&O tax surcharge from 6.5% to 4.5%
CT	1996	Reduction in top corporate income tax rate from 11.25% to 10.75%
CA	1997	Reduction in top corporate income tax rate from 9.3% to 8.84%
CT	1997	Reduction in top corporate income tax rate from 10.75% to 10.5%
NC	1997	Reduction in top corporate income tax rate from 7.75% to 7.5%
AZ	1998	Reduction in top corporate income tax rate from 9% to 8%
CT	1998	Reduction in top corporate income tax rate from 10.5% to 9.5%
NC	1998	Reduction in top corporate income tax rate from 7.5% to 7.25%
CO	1999	Reduction in top corporate income tax rate from 5% to 4.75%
CT	1999	Reduction in top corporate income tax rate from 9.5% to 8.5%
MI	1999	Reduction in Single Business Tax (SBT) rate from 2.3% to 2.2%
NC	1999	Reduction in top corporate income tax rate from 7.25% to 7%
NY	1999	Reduction in top corporate income tax rate from 9% to 8.5%

OH	1999	Reduction in top corporate income tax rate from 8.9% to 8.5%
WI	1999	Repeal of temporary recycling tax surcharge
AZ	2000	Reduction in top corporate income tax rate from 8% to 7.968%
CO	2000	Reduction in top corporate income tax rate from 4.75% to 4.63%
CT	2000	Reduction in top corporate income tax rate from 8.5% to 7.5%
MI	2000	Reduction in Single Business Tax (SBT) rate from 2.2% to 2.1%
NC	2000	Reduction in top corporate income tax rate from 7% to 6.9%
NY	2000	Reduction in top corporate income tax rate from 8.5% to 8%
AZ	2001	Reduction in top corporate income tax rate from 7.968% to 6.968%
ID	2001	Reduction in top corporate income tax rate from 8% to 7.6%
MI	2001	Reduction in Single Business Tax (SBT) rate from 2.2% to 2.1%
NY	2001	Reduction in top corporate income tax rate from 8% to 7.5%
MI	2002	Reduction in Single Business Tax (SBT) rate from 2.1% to 2.0%
KS	2003	Reduction in tax surcharge from 4.5% to 3.35%
ND	2004	Reduction in top corporate income tax rate from 10.5% to 7%
AR	2005	Repeal of 3% tax surcharge
KY	2005	Reduction in top corporate income tax rate from 8.25% to 7%
OH	2005	Tax reform phasing out corporate income tax while phasing in gross receipts tax over period of 5 years
CT	2006	Reduction in tax surcharge from 25% to 20%
VT	2006	Reduction in top corporate income tax rate from 9.75% to 8.9%
KY	2007	Reduction in top corporate income tax rate from 7% to 6%
ND	2007	Reduction in top corporate income tax rate from 7% to 6.5%
NY	2007	Reduction in top corporate income tax rate from 7.5% to 7.1%
VT	2007	Reduction in top corporate income tax rate from 8.9% to 8.5%
CT	2008	Repeal of 20% tax surcharge
KS	2008	Reduction in tax surcharge from 3.35% to 3.1%
KS	2009	Reduction in tax surcharge from 3.1% to 3.05%
ND	2009	Reduction in top corporate income tax rate from 6.5% to 6.4%
MA	2010	Reduction in top corporate income tax rate from 9.5% to 8.75%
NJ	2010	Repeal of 4% tax surcharge
KS	2011	Reduction in tax surcharge from 3.05% to 3%
MA	2011	Reduction in top corporate income tax rate from 8.75% to 8.25%
NC	2011	Repeal of 3% tax surcharge
ND	2011	Reduction in top corporate income tax rate from 6.4% to 5.4%
OR	2011	Reduction in top corporate income tax rate from 7.9% to 7.6%
ID	2012	Reduction in corporate income tax rate from 7.6% to 7.4%
IN	2012	Reduction in Adjusted Gross Income Tax (general corporations, non-financial Institutions) from 8.5% to 8%
MA	2012	Reduction in top corporate income tax rate from 8.25% to 8%
IN	2013	Reduction in Adjusted Gross Income Tax (general corporations, non-financial Institutions) from 8% to 7.5%
ND	2013	Reduction in top corporate income tax rate from 5.15% to 4.53%
OR	2013	Reduction in top corporate income tax rate from 7.6% to 6.6% through an increase in the taxable income for applying the top corporate income tax rate
WV	2013	Reduction in top corporate income tax rate from 7.75% to 7%
AZ	2014	Reduction in top corporate income tax rate from 6.968% to 6.5%
IN	2014	Reduction in Adjusted Gross Income Tax (general corporations, non-financial Institutions) from 7.5% to 7%
NC	2014	Reduction in top corporate income tax rate from 6.9% to 6%
NM	2014	Reduction in top corporate income tax rate from 7.6% to 7.3%

TX	2014	Temporary reduction in franchise tax rates from 0.5% to 0.4875% for retailers and wholesalers and from 1% to 0.975% for other entities
WV	2014	Reduction in top corporate income tax rate from 7% to 6.5%
AZ	2015	Reduction in top corporate income tax rate from 6.5% to 6%
IL	2015	Reduction in top corporate income tax rate (excluding S corporations) from 7% to 5.25%
IN	2015	Reduction in Adjusted Gross Income Tax (general corporations, non-financial Institutions) from 7% to 6.5%
NC	2015	Reduction in top corporate income tax rate from 6% to 5%
NM	2015	Reduction in top corporate income tax rate from 7.3% to 6.9%
RI	2015	Reduction in top corporate income tax rate from 9% to 7%
TX	2015	Temporary reduction in franchise tax rates from 0.4875% to 0.475% for retailers and wholesalers and from 0.975% to 0.95% for other entities
AZ	2016	Reduction in top corporate income tax rate from 6.0% to 5.5%
IN	2016	Reduction in top corporate income tax rate from 7.0% to 6.5%
NM	2016	Reduction in top corporate income tax rate from 6.9% to 6.6%
NY	2016	Reduction in top corporate income tax rate from 7.1% to 6.5%
NC	2016	Reduction in top corporate income tax rate from 5.0% to 4.0%
ND	2016	Reduction in top corporate income tax rate from 4.53% to 4.31%
AZ	2017	Reduction in top corporate income tax rate from 5.5% to 4.9%
IN	2017	Reduction in top corporate income tax rate from 6.5% to 6.25%
NH	2017	Reduction in top corporate income tax rate from 8.5% to 8.2%
NM	2017	Reduction in top corporate income tax rate from 6.6% to 6.2%
NC	2017	Reduction in top corporate income tax rate from 4.0% to 3.0%
CT	2018	Reduction in top corporate income tax rate from 9.0% to 8.25% through a reduction in tax surcharge on tax liability from 20% to 10%
IN	2018	Reduction in top corporate income tax rate from 6.25% to 6.0%
NM	2018	Reduction in top corporate income tax rate from 6.2% to 5.9%
CT	2019	Reduction in top corporate income tax rate from 8.25% to 7.5% through repeal of 10% tax surcharge on tax liability
GA	2019	Reduction in top corporate income tax rate from 6.0% to 5.75%
ID	2019	Reduction in top corporate income tax rate from 7.4% to 6.925%
IN	2019	Reduction in top corporate income tax rate from 6.0% to 5.75%
KS	2019	Reduction in top corporate income tax rate from 7.0% to 4.0%
KY	2019	Reduction in top corporate income tax rate from 6.0% to 5.0%
NH	2019	Reduction in top corporate income tax rate from 8.2% to 7.7%
NC	2019	Reduction in top corporate income tax rate from 3.0% to 2.5%
UT	2019	Reduction in top corporate income tax rate from 5.0% to 4.95% (retroactively effective for tax years beginning on or after January 1, 2018)
FL	2020	Reduction in top corporate income tax rate from 5.5% to 4.458% (retroactively effective for tax years beginning on or after January 1, 2019)
MO	2020	Reduction in top corporate income tax rate from 6.25% to 4.0%

Table A4. List of borrowers' states

The table presents the borrower's states in our sample and the number of observations included in the baseline regressions.

State	Observations	State	Observations
Alabama	275	Nebraska	191
Alaska	43	Nevada	429
Arizona	642	New Hampshire	196
Arkansas	251	New Jersey	1,616
California	4,563	New Mexico	51
Colorado	1,150	New York	3,128
Connecticut	1,295	North Carolina	1,162
Delaware	246	North Dakota	29
Florida	1,806	Ohio	1,874
Georgia	1,667	Oklahoma	522
Hawaii	58	Oregon	426
Idaho	158	Pennsylvania	2,072
Illinois	2,489	Rhode Island	153
Indiana	670	South Carolina	314
Iowa	208	South Dakota	47
Kansas	259	Tennessee	1,123
Kentucky	345	Texas	5,004
Louisiana	454	Utah	176
Maine	45	Vermont	53
Maryland	646	Virginia	1,319
Massachusetts	1,550	Washington	525
Michigan	1,146	Washington, D.C.	14
Minnesota	1,048	West Virginia	27
Mississippi	111	Wisconsin	824
Missouri	1,038	Wyoming	2
Montana	41		
		Total	41,384

Table A5. Identifying the mechanisms: The demand side. Actual corporate tax rates

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of various firm-level characteristics to examine potential demand-side explanations of our findings. The table replicates the estimations in Table 9 by replacing the binary indicators for changes in the corporate income tax rate with the actual changes in the corporate income tax rate. The dependent variable is noted in the second line of the table and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we re-estimate specification (3) of Table 4. In specification (2), *Tax increase* and *Tax decrease* are interacted with *Firm size*. In specification (3), *Tax increase* and *Tax decrease* are interacted with *High firm size*, i.e., a binary variable equal to one if *Firm size* is above the sample median, and zero otherwise. In specifications (4) and (5) we replicate specification (1) for the subsample of large firms (where *High firm size* is equal to 1) and small firms (where *High firm size* is equal to 0) respectively. In specification (6), *Tax increase* and *Tax decrease* are interacted with *Firm return on assets*. Specifications (7) and (8) replicate the estimations in specifications (1) and (6) respectively, by replacing *AISD* as dependent variable with *Loan amount*. All specifications include loan type, loan purpose, firm, bank times year, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	AISD	AISD	AISD	AISD	AISD	AISD	Loan amount	Loan amount
	Full sample	Full sample	Full sample	Large firms	Small firms	Full sample	Full sample	Full sample
Tax increase (rate)	9.315**	35.503**	19.935**	-1.746	25.290*	13.590**	0.002	0.034
	[2.264]	[2.571]	[2.285]	[-0.696]	[1.867]	[2.274]	[0.056]	[0.867]
Tax decrease (rate)	-9.079**	-17.196	-17.232**	-5.050	-5.337	-15.435**	-0.060	-0.048
	[-2.197]	[-1.150]	[-2.521]	[-0.929]	[-0.478]	[-2.251]	[-1.242]	[-0.777]
Tax increase (rate) × Firm size		-3.433**						
		[-2.213]						
Tax decrease (rate) × Firm size		1.127						
		[0.689]						
Tax increase (rate) × High firm size			-16.314*					
			[-1.907]					
Tax decrease (rate) × High firm size			12.506*					
			[1.723]					
Tax increase (rate) × Firm return on assets						-0.590**		-0.004
						[-2.118]		[-0.695]
Tax decrease (rate) × Firm return on assets						0.649		-0.001
						[1.659]		[-0.406]
Observations	42,210	42,210	42,210	20,661	20,119	42,210	42,210	42,210
Adj. R-squared	0.738	0.738	0.738	0.768	0.705	0.738	0.823	0.823
Full set of controls	Y	Y	Y	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Number of banks	830	736	736	259	666	736	830	736
Number of firms	6,929	6,754	6,754	2,833	4,553	6,754	6,929	6,754

Table A6. Identifying the mechanisms: The supply side. Actual corporate tax rates

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of various bank-level characteristics to examine potential supply-side explanations of our findings. The table replicates the estimations in Table 10 by replacing the binary indicators for changes in the corporate income tax rate with the actual changes in the corporate income tax rate. The dependent variable is noted in the second line of the table and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we re-estimate specification (3) of Table 4. Specification (2) replicates the estimation in specification (1) by replacing bank times year fixed effects with firm times year fixed effects (and further replacing firm fixed effects with bank fixed effects). Specification (3) replicates the estimation in specification (1) by replacing bank times year fixed effects with bank fixed effects and further interacting *Tax increase* and *Tax decrease* respectively with *Bank capital*. Specification (4) replicates the estimation in specification (2) by replacing *AISD* as dependent variable with *Loan amount*. Specification (5) replicates the estimation in specification (4) by replacing firm times year fixed effects with firm fixed effects and further interacting *Tax increase* and *Tax decrease* respectively with *Bank capital.* Specification (6) replicates the estimation in specification (4) by replacing firm times year fixed effects with firm fixed effects and further replacing *Loan amount* as dependent variable with *Number of lenders*. Specification (7) replicates the estimation in specification (6) by replacing *Number of lenders* as dependent variable with *Herfindahl*. Specification (8) replicates the estimation in specification (6) by interacting *Tax increase* and *Tax decrease* respectively with *Bank capital*. Specification (9) replicates the estimation in specification (7) by interacting *Tax increase* and *Tax decrease* respectively with *Bank capital*. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) AISD	(2) AISD	(3) AISD	(4) Loan amount	(5) Loan amount	(6) Number of lenders	(7) Herfindahl	(8) Number of lenders	(9) Herfindahl
Tax increase (rate)	9.315**	9.483	10.431**	-0.014	-0.001	-0.828***	0.042	-3.744**	-0.059
	[2.264]	[0.831]	[2.504]	[-0.213]	[-0.020]	[-4.240]	[1.477]	[-2.349]	[-0.328]
Tax decrease (rate)	-9.079**	1.716	-12.824**	-0.031	-0.079	-0.167	-0.026	3.707*	-0.524*
	[-2.197]	[0.214]	[-2.563]	[-0.337]	[-1.328]	[-0.516]	[-0.697]	[1.860]	[-1.823]
Tax increase (rate) × Bank capital			-1.250		0.003			0.198*	0.007
			[-0.594]		[0.177]			[1.852]	[0.524]
Tax decrease (rate) × Bank capital			-0.867		-0.008			-0.286*	0.037*
			[-0.380]		[-0.340]			[-1.966]	[1.970]
Observations	42,210	28,238	28,403	28,238	28,403	43,481	43,466	28,403	28,397
Adj. R-squared	0.738	0.769	0.731	0.796	0.809	0.535	0.696	0.529	0.680
Full set of controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Loan type	Y	Y	Y	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank effects	N	Y	Y	Y	Y	Y	Y	Y	Y
Firm effects	Y	N	Y	N	Y	Y	Y	Y	Y
Borrower's state effects	N	N	N	N	N	N	N	N	N
Industry × year effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Borrower's state × year effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank × year effects	Y	N	N	N	N	N	N	N	N
Firm × year effects	N	Y	N	Y	N	N	N	N	N
Number of banks	717	708	290	708	290	804	803	290	290
Number of firms	6,388	5,186	4,599	5,186	4,599	6,557	6,554	4,599	4,599

Additional sensitivity tests

This section includes the discussion of additional results and robustness checks presented in Tables A7-A14 of the Appendix.

A.1. Financial constraints and geographic diversification

Our first test includes the examination of alternative explanations of our findings related to borrowing firms' financial constraints and level of geographic diversification. We conduct this test in Table A7, where we interact the relevant variables with our baseline corporate tax change indicators. The first specification considers a measure of firm's financial dependence, defined as the difference between firm's total investments and cash flow from operations, divided by cash flow from operations. We observe that although *AISD* exhibits a negative and statistically significant response to tax cuts, none of the interactions including our financial dependence measure comes with a statistically significant coefficient.

This response is further confirmed in column 2, where we employ an indicator about the borrower's investment grade status, as well as in column 3, where we differentiate between more and less leveraged firms (depending on whether they are in the top or bottom tercile of our sample in terms of their debt-to-assets ratio). Moreover, in column 4, we employ a measure of geographic diversification, based on the number of firm's geographic segments; we observe that greater geographic dispersion of firm's operations leads to an additional decrease in *AISD* following a corporate tax cut, which is nevertheless only a fraction of the generic decrease attributed to the tax cut (the coefficients on the interaction term and main term respectively).

A.2. Macroeconomic and political conditions

In Table A8 we examine the role of political conditions and estimate specifications including the double interactions of our tax-change indicators with indicators for the timing and distance

of gubernatorial elections from the corporate tax change decision as well as for whether Republican or Democratic governors are in power. We first examine whether the effect of corporate tax changes is contingent on the phase of the political cycle (columns 1 to 5). As the first two specifications reveal, the effect of a corporate tax decrease on loan spreads is consistently negative regardless of whether the tax cut occurs in an election year (column 1) or the year after the election (column 2). Moreover, we find that corporate tax cuts are less effective when occurring towards the end of the political cycle (column 3); this is intuitive as cuts close to the elections are more predictable and likely to be adopted on the basis of electoral gain (see Bizer and Durlauf, 1990). On the same line, column 6, reveals no differential effect when we interact either tax change with an indicator for Republican or Democrat administration in the borrower's state.

Our last test concerns the role of federal corporate tax changes, as tax changes at the state level are centered around important tax changes at the federal level. As such, any leverage choices by firms may be in anticipation of, or in response to these federal tax changes rather than state tax changes. To examine this premise, we interact our state tax-change indicators with relevant indicators for changes in the federal corporate income tax rate. Results from specification 7 reveal that federal tax changes do not interact with state tax changes in shaping loan spreads (reflected in the non-statistically significant coefficient on *Tax decrease* × *Federal tax change*). Importantly, the coefficient on the main term of *Tax decrease* retains its negative and statistically significant sign, confirming the importance of state tax changes for firms' borrowing costs.

A.3. Pipeline risk, intra-state loans, and monetary policy

In column 1 of Table A9, we control for pipeline risk, i.e., the risk faced by lenders who must retain larger shares in loans in which investors are less willing to participate than expected

(Bruche, Malherbe and Meisenzahl, 2020). In fact, certain term loan facilities are structured specifically to appeal to institutional investors rather than to banks, i.e., within a loan package, the lending syndicates for Term Loans B, C, and higher usually include non-bank lenders (Lim, Minton and Weisbach, 2014; Nadauld and Weisbach, 2012). Importantly, these loans often feature weak covenants, longer maturities, and very low amortization, which would require high capital requirements if banks were to hold them. Given that, we interact our tax-change indicators with an indicator for non-amortizing loans (Term Loan B or higher). Results in column 1 confirm our baseline estimates, while providing no evidence of differential pricing of institutional term loans following the corporate tax cut (insignificant coefficient on *Tax decrease* × *Institutional term loan*).

A typical feature of the U.S. syndicated loan market is the participation of large banks, which are usually headquartered in different states than the borrowing firms. Moreover, although banks have branches in different states, due to their large size, syndicated loans are generally granted by the banks' headquarters. Given this, a corporate tax change in the firm's state is not expected to directly affect the bank's profits, as the latter is not subject to the tax change. This is further evident in our sample, where we observe 38,447 loans between lenders and borrowers headquartered in different states, approximately 88.4% of the total number of loans in our sample. Nonetheless, to alleviate any noise stemming from a change in the bank's after-tax profits, we interact our tax-change indicators with a binary variable that equals one if the bank and firm are headquartered in the same state. Estimates in column 2 confirm the easing effect of tax cuts on *AISD*, which is nevertheless independent of the location of the bank's headquarters (the negative and statistically significant coefficient on *Tax decrease* and the statistically insignificant coefficient on *Tax decrease* × *Same state* respectively).

In columns 3 and 4, we augment our baseline specification with variables reflecting the stance of monetary policy. The risk-taking channel of monetary policy predicts a positive

relation between expansionary monetary policy and bank risk taking (Jiménez, Ongena, Peydró and Saurina, 2014; Delis, Hasan and Mylonidis, 2017). If low interest rates entice banks to take greater risk, the asymmetric response of spreads to corporate tax changes might capture such risk differences induced by monetary-policy shocks. Moreover, low interest rates may increase firm credit demand through higher asset and collateral values (Kashyap and Stein 2000). To examine the role of monetary policy, we consider the shadow short rate (three-month average), which effectively measures the monetary policy stance when interest rates are near the zero-lower bound (e.g., Krippner, 2016). We observe that the estimate on the shadow rate is negative and statistically significant, consistent with the literature on the effect of monetary policy on loan spreads (Delis, Hasan and Mylonidis, 2017; Paligorova and Santos, 2017). In either specification, the coefficients on our indicators for tax changes are very similar to the baseline.

A.4. Other robustness checks

In Appendix Table A10, we examine the sensitivity of our estimates to the "bad controls" problem, by interchangeably excluding loan-level controls from our specifications. We initially omit all loan-level variables (column 1) and sequentially introduce quantitative information on the loan (*Loan amount*, *Maturity*, *Collateral*, *Number of lenders*, *Performance provisions* and *General covenants*) in columns 2-4. In the remaining specifications (columns 5-7) we include additional firm-level controls, such the firm's Tobin's Q, the ratio of retained earnings over total equity, the return on equity and the ratio of tangible assets to total assets.

In Appendix Table A11, we confirm the insensitivity of our inferences to the type of standard error clustering. In this respect, we initially cluster standard errors by firm, and subsequently by borrower's state *and* firm, and borrower's state *and* year (columns 1-3). Our next specifications adopt a more demanding clustering, as standard errors are clustered by

borrower's state *and* firm *and* year, borrower's state *and* industry, and borrower's state *and* industry *and* year (columns 4-6). Again, results confirm our baseline estimates.

An extension of our empirical analysis relates to the role of loan fees, since we might expect that corporate tax cuts would also reduce the cost of loans through lower fees. However, information on fees is generally limited since several loans are term loans that have limited fees. Nevertheless, in column 1 of Table A10 we replicate our baseline specification with *AISU* as the dependent variable and do not observe a statistically significant effect of either corporate tax indicator on *AISU*. Thus, it seems that corporate tax cuts are only priced in spreads. The subsequent columns examine the response of other loan characteristics. We observe that none of the remaining loan terms, namely collateral, performance provisions and general covenants, is responsive to corporate tax changes (columns 2-4). The effect of the tax decrease on the loan amount is interesting as it shows that there is a dominant loan demand effect and a secondary supply effect that together with the inelastic loan supply effect possibly renders the coefficient on tax decrease positive but insignificant (as in Figure 1). We pinpoint this effect in section 6.

In Appendix Table A13, we further examine the role of bank and firm subsidiaries in the borrower's state and the lender's state respectively. To the extent that banks operate a subsidiary in the borrower's state they are affected by corporate tax changes in that state. We find that loans from bank subsidiaries carry a higher loan spread in response to tax cuts (column 1); this is not surprising since the subsidiaries are now faced with a lower after-tax profit on their loans. Moreover, the operation of a firm's subsidiary in the lender's state partially reverses the reduction in loan spreads due to the corporate tax cut (column 2).

Finally, given that certain states attract corporations due to their favorable tax treatment, in Table A14 we estimate our baseline specification by excluding firms headquartered in the states of Delaware and South Dakota. The rationale for their exclusion is that being tax havens, firms might have purposely moved in these states to take advantage of preferential tax treatment

and strict confidentiality rules. This test leads to a negligible drop in the number of observations, with all specifications providing support to our baseline estimates.

Table A7. Financial constraints and geographic diversification

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of different firm-level accounting characteristics reflecting financial dependence, financial constraints, and geographic diversification. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), *Tax increase* and *Tax decrease* are interacted with *Financial dependence*, i.e., the ratio of the difference between firm's total investments and cash flow from operations to cash flow from operations. In specification (2), *Tax increase* and *Tax decrease* are interacted with *Investment grade*, i.e., a binary variable equal to one if the firm's credit rating is within the investment grade category (i.e., with credit rating from AAA+ to BBB−), and equal to zero if it is below the investment grade category. In specification (3), *Tax increase* and *Tax decrease* are interacted with *High firm leverage*, i.e., a binary variable equal to one if the firm's leverage (i.e., the ratio of total debt to total assets) is in the top tercile of the sample, and equal to zero if it is in the bottom tercile. In specification (4), *Tax increase* and *Tax decrease* are interacted with *Geographic diversification*, i.e., the firm's number of geographic segments. All specifications include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Tax increase	3.789	-2.617	-0.592	6.996
	[0.803]	[-0.285]	[-0.083]	[1.356]
Tax decrease	-10.402***	-15.571***	-13.571**	-9.214***
	[-3.472]	[-2.720]	[-2.126]	[-3.103]
Tax increase × Financial dependence	-0.775			
	[-1.107]			
Tax decrease × Financial dependence	-0.039			
	[-0.417]			
Tax increase × Investment grade		-12.601		
		[-1.126]		
Tax decrease × Investment grade		7.867		
		[0.965]		
Tax increase × High firm leverage			7.586	
			[1.098]	
Tax decrease × High firm leverage			-2.940	
			[-0.386]	
Tax increase × Geographic diversification				0.740
				[0.595]
Tax decrease × Geographic diversification				-1.322**
				[-2.557]
Observations	41,312	18,408	27,873	43,481
Adj. R-squared	0.720	0.765	0.721	0.719
Fixed effects	Y	Y	Y	Y
Number of banks	799	318	716	830
Number of firms	6,562	2,542	5,537	6,929

Table A8. Macroeconomic and political conditions

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of different indicators for macroeconomic and political conditions. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), *Tax increase* and *Tax decrease* are interacted with *Election year*, i.e., a binary variable equal to one if a gubernatorial election is held in the borrower's state during the loan facility origination year, and zero otherwise. In specification (2), *Tax increase* and *Tax decrease* are interacted with *Election year lag*, i.e., a binary variable equal to one if a gubernatorial election is held in the borrower's state in the year before the loan facility origination year, and zero otherwise. In specification (3), (4) and (5), *Tax increase* and *Tax decrease* are interacted with *1 year to election*, *2 years to election* and *3 years to election* respectively, i.e., binary variables equal to one if the next gubernatorial election in the borrower's state is held in one year, two years and three years respectively, and zero otherwise. In specification (6), *Tax increase* and *Tax decrease* are interacted with *Republican governor*, i.e., a binary variable equal to one if during the loan facility origination year, the governor in the borrower's state is Republican and equal to zero if he is Democratic. In specification (7), *Tax increase* and *Tax decrease* are interacted with *Federal tax change*, i.e., the change in the federal corporate income tax rate. All specifications include loan type, loan purpose, bank, firm, and borrower's state fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax increase	2.759	1.730	1.857	2.823	15.769	17.438*	3.991
	[0.236]	[0.178]	[0.169]	[0.244]	[1.518]	[1.889]	[0.762]
Tax decrease	-10.316**	-10.591**	-6.604	-10.262**	-4.883	-0.703	-9.927***
	[-2.187]	[-2.263]	[-1.200]	[-2.184]	[-0.660]	[-0.085]	[-3.421]
Tax increase × Election year	3.961						
	[0.279]						
Tax decrease × Election year	-1.350						
	[-0.149]						
Tax increase × Election year lag		-10.938					
		[-0.864]					
Tax decrease × Election year lag		4.981					
		[1.044]					
Tax increase × 1 year to election			6.807				
			[0.465]				
Tax decrease × 1 year to election			7.095				
			[1.242]				
Tax increase × 2 years to election				-0.022			
				[-0.001]			
Tax decrease × 2 years to election				-10.404			
				[-1.238]			
Tax increase × 3 years to election					-10.905		
					[-0.847]		
Tax decrease × 3 years to election					4.892		
					[1.028]		
Tax increase × Republican governor						-9.333	
						[-0.627]	
Tax decrease × Republican governor						-4.201	
						[-0.558]	
Tax increase × Federal tax change							73.627
							[0.481]
Tax decrease × Federal tax change							115.513
							[1.140]
Observations	43,467	43,467	43,467	43,467	43,467	43,023	43,481
Adj. R-squared	0.670	0.670	0.670	0.670	0.670	0.670	0.719
Full set of controls	Y	Y	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y	Y	Y
Number of banks	830	830	830	830	830	828	830
Number of firms	6,925	6,925	6,925	6,925	6,925	6,888	6,929

Table A9. Pipeline risk, intra-state loans, and monetary policy

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of different indicators for pipeline risk in the loan syndication process, same-state loans, and monetary policy as controls or as interactions with the tax-change indicators. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), *Tax increase* and *Tax decrease* are interacted with *Institutional term loan*, i.e., a binary variable equal to one if the loan facility is a non-amortizing term loan (Term Loan B or higher), and zero otherwise. In specification (2), *Tax increase* and *Tax decrease* are interacted with *Same state*, i.e., a binary variable equal to one if the lender and the borrower are headquartered in the same state, and zero otherwise. In specification (3), we include as an additional control variable *Shadow rate*, i.e., the quarterly shadow short rate. In specification (4), *Tax increase* and *Tax decrease* are interacted with *Shadow rate*. All specifications include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Tax increase	6.935	7.134	5.475	4.378
	[1.364]	[1.548]	[0.816]	[0.475]
Tax decrease	-10.992***	-11.545***	-12.664***	-12.631**
	[-3.869]	[-3.245]	[-3.627]	[-2.508]
Tax increase × Institutional term loan	2.742			
	[0.252]			
Tax decrease × Institutional term loan	7.149			
	[0.981]			
Tax increase × Same state		2.467		
		[0.145]		
Tax decrease × Same state		8.444**		
		[2.127]		
Shadow rate			-4.341***	-4.052***
			[-3.642]	[-3.357]
Tax increase × Shadow rate				0.774
				[0.304]
Tax decrease × Shadow rate				-0.007
				[-0.005]
Observations	43,481	43,481	32,438	32,438
Adj. R-squared	0.719	0.719	0.721	0.724
Full set of controls	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y
Number of banks	830	830	618	618
Number of firms	6,929	6,929	5,514	5,514

Table A10. Different loan and firm controls

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of different sets of loan-level and firm-level control variables. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. Different specifications include different loan and firm controls to show that the estimates on the term *Tax increase* and *Tax decrease* are not overly sensitive to the controls used. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. All specifications include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Tax increase	5.229	6.922	5.578	4.147	6.111	2.977
	[1.014]	[1.425]	[1.089]	[0.788]	[1.281]	[0.590]
Tax decrease	-9.673***	-9.713***	-9.780***	-11.418***	-11.274***	-12.940***
	[-3.058]	[-3.041]	[-3.225]	[-3.912]	[-3.803]	[-4.587]
Loan amount		-11.519***		-10.899***	-10.482***	-10.751***
		[-14.217]		[-13.105]	[-13.792]	[-13.905]
Maturity		-0.188***		-0.143***	-0.163***	-0.144***
		[-3.965]		[-3.173]	[-3.341]	[-3.088]
Collateral		27.716***		29.071***	30.210***	29.203***
		[12.399]		[12.841]	[13.768]	[12.764]
Number of lenders			-0.226	-0.007	0.008	-0.033
			[-1.596]	[-0.046]	[0.054]	[-0.211]
Performance provisions			-21.067***	-19.920***	-19.615***	-19.448***
			[-13.383]	[-13.404]	[-13.930]	[-13.651]
General covenants			5.587*	1.422	-0.027	0.690
			[1.991]	[0.503]	[-0.011]	[0.248]
Firm size	-19.112***	-11.398***	-18.295***	-12.023***	-11.697***	-12.295***
	[-10.987]	[-6.228]	[-10.142]	[-6.271]	[-6.345]	[-6.347]
Firm return on assets	-2.424***	-2.159***	-2.355***	-2.156***	-2.091***	-2.155***
	[-10.850]	[-10.337]	[-10.929]	[-9.877]	[-10.128]	[-9.609]
Firm leverage	0.790***	0.724***	0.779***	0.641***	0.721***	0.663***
	[16.755]	[16.226]	[16.560]	[10.614]	[16.711]	[11.290]
Firm Tobin's Q				4.857*		4.152
				[1.730]		[1.576]
Firm retained earnings				-0.001		-0.020
				[-0.066]		[-1.137]
Firm return on equity					-0.018	-0.020
					[-1.300]	[-1.300]
Firm tangibility					0.020	-0.071
					[0.171]	[-0.556]
Constant	337.027***	491.236***	337.925***	493.185***	477.362***	493.649***
	[28.117]	[36.396]	[27.182]	[31.778]	[31.160]	[29.429]
Observations	43,481	43,481	43,481	40,238	42,763	39,651
Adj. R-squared	0.708	0.716	0.711	0.717	0.718	0.717
Fixed effects	Y	Y	Y	Y	Y	Y
Number of banks	830	830	830	814	817	801
Number of firms	6,929	6,929	6,929	6,544	6,831	6,471

Table A11. Different clustering of standard errors

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS. The penultimate part of the table denotes the type of standard error clustering (BS & F refers to Borrower's state *and* Firm, BS & Y refers to Borrower's state *and* Year, BS & F & Y refers to Borrower's state *and* Firm *and* Year, BS & I refers to Bank *and* Industry, and BS & I & Y refers to Bank *and* Industry *and* Year). The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. All specifications include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Tax increase	7.276	7.276	7.276	7.276	7.276	7.276
	[1.524]	[1.524]	[1.524]	[1.524]	[1.524]	[1.524]
Tax decrease	-10.090***	-10.090***	-10.090***	-10.090***	-10.090***	-10.090***
	[-2.925]	[-2.925]	[-2.925]	[-2.925]	[-2.925]	[-2.925]
Loan amount	-10.679***	-10.679***	-10.679***	-10.679***	-10.679***	-10.679***
	[-15.687]	[-15.687]	[-15.687]	[-15.687]	[-15.687]	[-15.687]
Maturity	-0.165***	-0.165***	-0.165***	-0.165***	-0.165***	-0.165***
	[-3.990]	[-3.990]	[-3.990]	[-3.990]	[-3.990]	[-3.990]
Collateral	30.029***	30.029***	30.029***	30.029***	30.029***	30.029***
	[16.401]	[16.401]	[16.401]	[16.401]	[16.401]	[16.401]
Number of lenders	0.023	0.023	0.023	0.023	0.023	0.023
	[0.217]	[0.217]	[0.217]	[0.217]	[0.217]	[0.217]
Performance provisions	-20.014***	-20.014***	-20.014***	-20.014***	-20.014***	-20.014***
	[-12.084]	[-12.084]	[-12.084]	[-12.084]	[-12.084]	[-12.084]
General covenants	0.833	0.833	0.833	0.833	0.833	0.833
	[0.452]	[0.452]	[0.452]	[0.452]	[0.452]	[0.452]
Firm size	-11.417***	-11.417***	-11.417***	-11.417***	-11.417***	-11.417***
	[-7.682]	[-7.682]	[-7.682]	[-7.682]	[-7.682]	[-7.682]
Firm return on assets	-2.096***	-2.096***	-2.096***	-2.096***	-2.096***	-2.096***
	[-16.999]	[-16.999]	[-16.999]	[-16.999]	[-16.999]	[-16.999]
Firm leverage	0.708***	0.708***	0.708***	0.708***	0.708***	0.708***
	[14.514]	[14.514]	[14.514]	[14.514]	[14.514]	[14.514]
Constant	480.329***	480.329***	480.329***	480.329***	480.329***	480.329***
	[33.394]	[33.394]	[33.394]	[33.394]	[33.394]	[33.394]
Observations	43,481	43,481	43,481	43,481	43,481	43,481
Adj. R-squared	0.718	0.718	0.718	0.718	0.718	0.718
Fixed effects	Y	Y	Y	Y	Y	Y
Clustering	Firm	BS & F	BS & Y	BS & F & Y	BS & I	BS & I & Y
Number of banks	830	830	830	830	830	830
Number of firms	6,929	6,929	6,929	6,929	6,929	6,929

Table A12. Other loan characteristics

The table reports coefficients and t-statistics (in brackets). The dependent variable is denoted in the second line of the table and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. All specifications include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	AISU	Collateral	Performance provisions	General covenants
Tax increase	-0.224	-0.043	0.024	-0.015
	[-0.226]	[-1.573]	[1.493]	[-0.758]
Tax decrease	-0.997	0.023	-0.020	-0.007
	[-1.168]	[1.471]	[-1.046]	[-0.345]
AISD	0.108***	0.000***	-0.000***	0.000
	[24.804]	[13.576]	[-13.024]	[0.337]
Loan amount	-0.005	-0.006**	0.024***	0.002
	[-0.032]	[-2.080]	[11.287]	[0.567]
Maturity	0.023*	0.001***	0.001***	-0.000*
	[1.796]	[4.033]	[4.129]	[-1.706]
Collateral	3.342***		0.053***	0.144***
	[9.256]		[5.888]	[14.172]
Number of lenders	0.001	0.000	0.005***	0.005***
	[0.036]	[0.802]	[9.354]	[9.511]
Performance provisions	-0.180	0.047***		0.335***
	[-0.572]	[5.786]		[28.819]
General covenants	-0.574**	0.153***	0.406***	
	[-2.024]	[11.968]	[23.405]	
Firm size	-0.093	-0.049***	-0.007	-0.013
	[-0.295]	[-6.241]	[-1.159]	[-1.548]
Firm return on assets	-0.035	-0.004***	0.001***	0.001**
	[-1.659]	[-4.558]	[3.754]	[2.395]
Firm leverage	0.017	0.002***	-0.000*	-0.000*
	[1.132]	[7.719]	[-1.694]	[-1.818]
Constant	11.261***	0.743***	-0.280***	0.356***
	[3.457]	[8.636]	[-5.506]	[5.762]
Observations	23,067	43,481	43,481	43,481
Adj. R-squared	0.742	0.636	0.562	0.661
Fixed effects	Y	Y	Y	Y
Number of banks	509	830	830	830
Number of firms	4,615	6,929	6,929	6,929

Table A13. Controlling for bank and firm subsidiaries

The table reports coefficients and t-statistics (in brackets). The distinguishing feature is the inclusion of binary variables to control for the presence of bank and firm subsidiaries in the borrower's and lender's state respectively. The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we double-interact *Tax increase* and *Tax decrease* with *Bank subsidiary*, i.e., a binary variable equal to one if the lender operates a subsidiary in the borrower's state, and zero otherwise. In specification (2), we double-interact *Tax increase* and *Tax decrease* with *Firm subsidiary*, i.e., a binary variable equal to one if the borrower operates a subsidiary in the lender's state, and zero otherwise. All specifications include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
Tax increase	7.128	10.230*
	[1.547]	[1.905]
Tax decrease	-11.562***	-10.089***
	[-3.240]	[-2.761]
Tax increase × Bank subsidiary	2.555	
	[0.150]	
Tax decrease × Bank subsidiary	8.522**	
	[2.148]	
Tax increase × Firm subsidiary		-10.259
		[-0.540]
Tax decrease × Firm subsidiary		7.483*
		[1.948]
Bank subsidiary	-5.216	
	[-1.133]	
Firm subsidiary		-1.113
		[-0.263]
Observations	43,481	40,466
Adj. R-squared	0.719	0.721
Full set of controls	Y	Y
Fixed effects	Y	Y
Number of banks	830	814
Number of firms	6,929	6,726

Table A14. Controlling for onshore tax havens

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table A1. The estimation method is OLS with standard errors clustered by borrower's state. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we exclude all loans to borrowers headquartered in the state of Delaware. In specification (2), we exclude all loans to borrowers headquartered in the state of South Dakota. In specification (3), we exclude all loans to borrowers headquartered in the state of Delaware or the state of South Dakota. All specifications include loan type, loan purpose, bank, firm, industry times year, and borrower's state times year fixed effects. The *, **, and *** marks denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)
Tax increase	7.372	7.249	7.345
	[1.512]	[1.496]	[1.507]
Tax decrease	-10.095***	-10.096***	-10.102***
	[-3.264]	[-3.341]	[-3.269]
Loan amount	-10.631***	-10.666***	-10.617***
	[-12.760]	[-12.929]	[-12.761]
Maturity	-0.166***	-0.166***	-0.167***
	[-3.392]	[-3.382]	[-3.404]
Collateral	29.918***	30.043***	29.932***
	[13.558]	[13.722]	[13.578]
Number of lenders	0.022	0.018	0.017
	[0.156]	[0.123]	[0.119]
Performance provisions	-20.128***	-19.960***	-20.075***
	[-13.282]	[-13.221]	[-13.264]
General covenants	0.946	0.868	0.981
	[0.379]	[0.351]	[0.393]
Firm size	-11.504***	-11.408***	-11.495***
	[-6.180]	[-6.163]	[-6.174]
Firm return on assets	-2.086***	-2.095***	-2.085***
	[-10.251]	[-10.289]	[-10.247]
Firm leverage	0.701***	0.709***	0.702***
	[15.806]	[15.748]	[15.806]
Constant	480.055***	480.055***	479.778***
	[33.487]	[33.870]	[33.496]
Observations	43,228	43,433	43,180
Adj. R-squared	0.719	0.719	0.719
Fixed effects	Y	Y	Y
Number of banks	830	828	828
Number of firms	6,886	6,920	6,877

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