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**Claim Dilution in the Municipal Debt Market**

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# Claim Dilution in the Municipal Debt Market\*

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## Abstract

Using loan-level municipal bank lending data, we examine the debt structure of municipalities and its response to exogenous income shocks. We show that small, more indebted, low-income, and medium credit quality counties are particularly reliant on private bank financing. Low income counties are more likely to increase bank debt share after an adverse permanent income shock while high income counties do not shift their debt structure in response. In contrast, only high income counties draw on their credit lines after adverse transitory income shocks. Overall, our paper highlights the issue of bondholder claim dilution and the importance of municipal disclosure of private debt.

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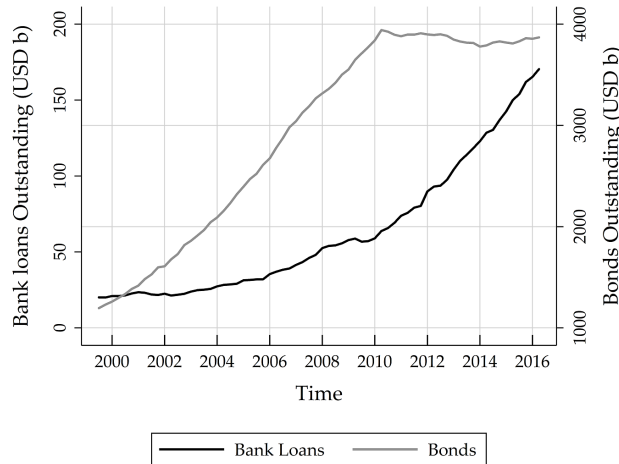
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# 1 Introduction

A fundamental question in financial economics at least since Jensen and Meckling (1976) has been the conflict of interest among different types of claimholders to the cash flow of the same economic entity. While this question has been studied thoroughly for publicly-traded corporations facing timely and comprehensive disclosure requirements for all cash flow claims,<sup>1</sup> empirically we know little about the extent of such conflicts in the absence of disclosure. In this paper we study the claim dilution problem in the municipal debt market. The muni market presents a unique opportunity to investigate this question because even though public debt claims have to be disclosed in a timely manner no disclosure requirements exist for private debt claims and voluntary disclosure is virtually nonexistent.<sup>2</sup> Bank financing of local governments has also experienced a tremendous increase since the Financial Crisis (see Figure 1), making the municipal debt market a particularly relevant empirical setting:



**Figure 1:** Volumes of bank loans and municipal bonds outstanding over time

<sup>1</sup>For instance, see Smith and Warner (1979), Barclay and Smith (1995b), and Rauh and Sufi (2010) for conflicts between different classes of debt or equity claims; how such conflicts could be alleviated contractually (Smith and Warner (1979), Smith (1993)); and the role disclosure in alleviating these problems (Healy and Palepu (2001), Leuz and Wysocki (2016)).

<sup>2</sup>For example, only less than a 100 issuances of bank loans have been reported as compared to the 44,000 state and local issuers (see <https://www.sec.gov/rules/proposed/2017/34-80130.pdf> and <https://www.sec.gov/news/studies/2012/munireport073112.pdf>). In addition, a substantial fraction of those documents are so heavily redacted that no information on bank loan interest rates, commitment amounts, maturities, or fees could be obtained.

Using confidential loan-level data on bank lending to municipal governments in the United States, we are the first to document substantial cross-sectional variation in municipal debt structure. Specifically, small, more indebted, low income, and medium credit quality counties are particularly reliant on bank debt. These summary statistics indicate that bank debt is a particularly relevant portion of total debt financing exactly in the municipalities where informational asymmetry problems are likely to be most severe.

We also show that small, low-income, and medium credit quality counties are also more likely to rely on term loans rather than on credit lines. Given the substitutability of public bonds and term loans (see, e.g., Gustafson (2013)), this finding suggests higher informational asymmetry counties may be more reliant on bank debt to obtain financing that is similar in structure to public bonds. This could explain the higher bank debt reliance of these types of municipalities.

We then use these data to investigate the extent of potential conflicts that could arise between two classes of claimholders – public and private debtholders of municipal entities. In this setting, the claimholder conflict is the potential for dilution of public bond claims by private debt claims (bank loans) that are not disclosed. The conflict can be severe in this setting because bank debt generally has higher priority in terms of both explicit contractual provisions (see, Barclay and Smith (1995b)) and higher effective priority in time than public bonds (see, e.g., Ho and Singer (1982); Barclay and Smith (1995a)). Therefore, issuing bank loans by municipal entities after the public bonds have been issued dilutes the cash flow claims of existing bond holders.

In order to understand the potential for such claim dilution, we empirically investigate the response of municipal debt structure to permanent and transitory income shocks that are exogenous to the prospects or investment opportunities of municipal entities. Corporate finance theory offers a rich set of predictions on how entities will respond to such exogenous income shocks. Specifically, adverse income revisions increase the credit risk of municipal entities necessitating more bank monitoring and therefore a shift in capital structure towards

more senior debt claims (see, Diamond (1991); Bolton and Freixas (2000)). Even though bank loans impose an array of costly limitations on borrowers (see, Smith and Warner (1979), Smith (1993), Gilson and Warner (1998)), bank loans may be the only way to effectively raise additional financing after increases in credit risk.

We construct permanent income shocks as in Suárez Serrato and Wingender (2016). Specifically, these authors argue that a large share of federal spending and transfer programs to counties depend on population estimates. With every decennial census, these population estimates get revised and reset to the actual population counts. Importantly, the magnitude of these unexpected revision differs across counties and, as the authors demonstrate, it is not geographically or serially correlated. We extend their approach to the most recent census of 2010, and use the difference between the Census Bureau’s population estimate and the actual census count as a shock to local spending. While Suárez Serrato and Wingender (2016) consider the effect on local employment, we consider the implications for municipal financing.

We find that counties increase bank borrowing following adverse permanent income shocks. A one standard deviation unexpected decrease in federal funding, on average, increases the bank loan share by approximately one percentage point. We also show this finding is driven by low-income counties while high-income counties experience no capital structure shift in response to such shocks. This is consistent with additional reductions in credit quality among counties with an already low level of pledgeable income leading to an increase in demand for senior claims to counter the higher potential for informational asymmetry problems. Given the absence of private debt disclosure requirements, the additional issuance of bank debt following adverse income shocks has the potential to dilute existing bondholders. While the finance literature has demonstrated a similar empirical patterns for corporate borrowers (see, e.g., Rauh and Sufi (2010)),<sup>3</sup> the mandatory disclosure requirements for all debt claims of corporate borrowers make claim dilution unlikely.

One caveat here is that following adverse income shocks low-income counties may be

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<sup>3</sup>These authors show that the fraction of both high priority and high seniority claims in the capital structure of corporate borrowers increases following adverse revisions in credit quality.

repaying bonds to reduce debt burden and potentially debt overhang, while leaving bank debt obligations unchanged. Such capital structure adjustments could also generate an overall reduction in bank debt share that does not involve actively increasing the issuance of private debt claims. While this alternative would still imply a preference for bank debt following adverse permanent income shocks, it is not consistent with claim dilution of bondholders by bank lenders. We account for this possibility by investigating the separate responses to permanent income shocks of the dollar volume of bank debt and bond financing. Doing so, we find that after negative shocks, municipal financing in low income counties is characterized by an increase in bank financing and a decrease in bond financing, which in turn leads to an increase in the bank debt share as seen previously. This result provides further support to the idea that municipalities actively rebalance their capital structure towards more senior debt claims following adverse permanent income revisions consistent with corporate finance theory (see, Diamond (1991) and Bolton and Freixas (2000)).

We next investigate how transitory shocks to municipal income impact municipal debt structure, shedding light on whether transitory shocks may also lead to claim dilution. We use unexpected adverse winter weather as a transitory shock to municipal income. A number of academic studies have demonstrated the adverse impact of winter weather on corporate cash flow.<sup>4</sup> To the extent that businesses in the municipality lose revenues because of unexpected adverse winter weather, the municipality will collect less in tax revenues, leading to reductions in total income. Similarly, unexpected adverse winter weather could increase the operating costs of municipal entities through lost employee wages and increased inefficiencies, further reducing municipal income.

We find that only high-income counties are able to use credit lines to buffer adverse transitory income shocks. Consistent with the transitory nature of these shocks, credit line size as well as the outstanding drawn amounts increase both contemporaneously and in

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<sup>4</sup>For example, Gustafson et al. (2017) shows that unexpected winter weather substantially and significantly reduces annual corporate cash flow in a number of key sectors such as manufacturing, transportation, wholesale trade, and construction.

the following calendar quarter but experience no significant change in subsequent quarters. This finding is consistent with Sufi (2009) who shows that the reliability of credit lines for corporate borrowers depends on profitability – only profitable borrowers can ensure continued access to lines of credit. Overall, our results suggest that even though bank debt increases following transitory shocks to municipal income, only issuers that are well positioned to sustain these short-term challenges increase private debt thereby having a limited impact on potential claim dilution.

## 2 Municipal debt structure

### 2.1 Data

Our municipal financing data come from two sources. We obtain information on bank loans to municipalities from the Federal Reserve’s Y-14Q data, collected on a quarterly basis to support the Dodd-Frank Act Stress Tests and the Comprehensive Capital Assessment and Review. The reporting panel starts in Q3 of 2012 and includes bank holding companies with at least US \$50 billion in total assets. The panel has grown over time and as of 2016:Q2 includes 35 bank holding companies. Schedule H1 of these data contains detailed information on all outstanding commercial and industrial bank loans with commitment amounts exceeding \$1 million.

We identify observations corresponding to municipal borrowers in the Y-14 data by using string search techniques identified in Appendix A and supplement this algorithm with a complete list of municipalities from the Census website. Specifically, we identify four types of municipal entities: 1) “cities”, 2) “counties”, 3) “states”, and 4) “special districts”. Panel (a) of Figure 2 shows that total outstanding municipal bank debt in our sample has grown from approximately \$75 billion in Q3 of 2012 to about \$110 billion in Q2 of 2016.<sup>5</sup>

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<sup>5</sup>This trend in our sample does not appear to be driven by the addition of new institutions to the Y-14Q collection over time since the initial collection already included the largest banks in the United States. Restricting the sample to the institutions that were in the 2012Q3 collection and re-calculating the figure

Overall, we capture the vast majority of municipal bank borrowing in the United States. Comparing the volumes to Figure 1, municipal bank loans in the Y-14 data represent approximately 70% of the total outstanding balances of municipal bank debt from the Call Reports. Another important benefit of our data set as indicated in panel (a) of Figure 2 is that we also capture the dollar amount of unused lines of credit – over our sample period this figure is as large as outstanding bank debt.

We obtain data on municipal bond issuance from Mergent’s Municipal Securities Database. We track the identity of the issuer (city, county or state government) and separate issuance into general obligation (GO) bonds that are backed by the full faith of the municipal government and revenue bonds that are backed by project-specific revenues. We arrive at the quarterly outstanding amount of bond financing for each municipality by using comprehensive information on new bond issuance, repayment, refinancing, and bond calls. Specifically, for each municipality-quarter we sum the dollar amount of new bonds associated with new issues and refinancings to the existing balance as of the end of the previous quarter and subtract the amount of direct repayments as well as those associated with bond calls and refinancings.

As shown in Figure 1 in Section 1, the total amount of outstanding municipal bonds increased sharply until around 2010 but has leveled off since then, a development that is not yet fully understood but that is often related to local governments pursuing more austere policies in face of declining revenues after the financial crisis of 2008-2009. In 2016, the total amount of municipal bonds outstanding was approximately \$3.8 trillion.

Panel (b) of Figure 2 shows the evolution of the average bank debt share for cities, counties, and states. Even though the average share of bank loans across municipalities is only between about 7% and 11.5% at the beginning of the sample period, the bank debt share has grown over the sample period for cities and counties. The growing bank debt share potentially suggests an expansion of bank borrowing of the average municipality in the United States.

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results in a very similar trend of utilized exposure increasing from about \$75 billion in 2012Q3 to just above \$100 billion in 2016Q2. The same applies for commitment exposure increasing from just above \$150 billion in 2012Q3 to more than \$190 billion in 2016Q2.



Given that the income shocks we study in this paper are at the county level, we restrict attention to all counties/parishes in the United States. In our dataset, we identify 1,145 unique counties that have bank financing over our sample period running from Q3 of 2012 through Q2 of 2016. We also have a total of 2,559 counties that have revenue or general obligation bonds in at least one quarter during the same period.

We merge the debt data with county-level economic data from the websites of the US Census and the Bureau of Labor Statistics (BLS). Specifically, we obtain quarterly data on employment, wages, and establishments from the Quarterly Census of Employment and Wages via the BLS website. In addition, we use data on unemployment rates and median and average household income for each county from the 5-year estimates of these variables, available from the US Census website. This leaves us with 1,064 counties using bank debt and 2,392 counties using bond financing with available information on key economic variables.

## 2.2 Summary statistics

Table 1 provides summary statistics of the debt structure of counties in our sample. The average bank debt share over the entire sample period is 13%. Among loan types, counties borrowing consists of term loans and demand loans and, to a lesser extent, of credit lines. On average, a county utilizes about half of committed credit line volume. Rates for credit lines exceed rates for term loans on average. In terms of banks' internal credit ratings, most counties in our sample have a rating in the BBB-BB-B rating categories (corresponding to numerical categories 3, 4, and 5), with few observations above AA (numeric group 2) and almost no observations below CCC (numeric group 7).

Figure 3 depicts scatter plots of the association between the mix of bank loans and public bonds and county characteristics such as the number of households, median household income, debt-to-income, as well as bank loans' credit rating. Specifically, Panel (a) shows that less populated counties are more reliant on bank financing than larger counties. This is intuitive as smaller issuers are less likely to have access to public bond markets due to economies of

scale in bonds issuance (see, e.g., Smith (1986)). In addition smaller issuers are typically characterized by greater risk, suggesting that the fraction of arms length debt such as bank loans will be higher (see Diamond (1991); Denis and Mihov (2003)).

In Panels (b) and (c) of Figure 3, we also observe a negative association between the share of bank loans and county median household income or county total debt to income. In other words, lower-household-income and lower debt-to-income counties have a larger share of bank loans in their capital structure. Both of these associations are consistent with issuers with higher pledgeable income raising more of their financing through public bonds. These patterns are also consistent with the previously observed association between bank loan share and county size as smaller counties are more likely to be characterized by lower household income and debt-to-income.

Panel (d) of Figure 3 shows that initially as credit quality decreases bank loan share increases and as credit quality decreases further to below-investment grade territory bank loan share decreases rapidly. It is important to note that this association is consistent with theory (Diamond (1991)) in that the highest quality borrowers rely primarily on public debt markets and we do not observe many of these borrowers receiving bank loans. Furthermore, issuers in the middle of the spectrum tend to rely significantly on bank loans but moving further towards the high risk rating categories attenuates this association.<sup>6</sup>

In Figure 4, we investigate the relation between key county characteristics and the share of terms loans relative to total bank borrowing. While term loans are shorter in maturity they are more likely to be substitutable with public bonds than lines of credit (see, e.g., Gustafson (2013)). In this setting, we expect to find similar associations between the share of term loans and key county characteristics as for the level of bank debt in county capital structure. As figure 4 shows, smaller counties and those with lower median household income are characterized by a larger share of term loans. These patterns are consistent with smaller

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<sup>6</sup>The ratings results are consistent with the previously observed patterns of larger, higher median income, higher debt to income counties having a lower bank share as these are likely to be rated above the A category in the public bond markets.

issuers or those with lower pledgeable income being less likely to have access to public bonds markets due to economies of scale or otherwise higher costs in bonds issuance (see, e.g., Smith (1986)). Similar to the previous patterns, we observe an inverse association between risk and the share of term loans once again consistent with Diamond (1991) and Denis and Mihov (2003).

Table 2 analyzes the association between bank loan/term loan share and the key county characteristics in an OLS multivariate regression setting to determine the factors that are most relevant. Column (1) of this table shows that we observe the same associations between county size, median household income, debt-to-income and bank debt share even after controlling for county unemployment and major demographic factors such as the share of home ownership and residents age. Column (2) shows that these associations are once again statistically and economically significant when we restrict the sample to counties that have some bank debt in their capital structure. Last, column (3) indicates that in the multivariate setting the only statistically important determinant of term loan share is county size.

### **3 Municipal debt structure and income shocks**

Using our newly constructed database of municipal debt structure, we turn to the question of how municipalities respond to permanent and transitory cash-flow shocks. We describe the construction of shocks first, discuss the empirical strategy afterwards and show results in sections 3.3 and 3.4.

#### **3.1 Constructing permanent and transitory income shocks**

##### **3.1.1 Permanent income shock**

We construct permanent cash flow shocks as in Suárez Serrato and Wingender (2016). Specifically, Suárez Serrato and Wingender (2016) argue that a large share of federal spending and transfer programs to counties depend on population estimates. With every decennial

census, these population estimates get revised and reset to the actual population counts. Importantly, the magnitude of the revision differs across counties and, as the authors demonstrate, it is not geographically or serially correlated. The difference between the Census Bureau’s population estimate and the actual census count can thus be used as a shock to local spending. While Suárez Serrato and Wingender (2016) consider the effect on local employment, we consider the implications for municipal financing.

Suárez Serrato and Wingender (2016) construct the shock for 1980, 1990 and 2000, so we follow their idea to calculate the corresponding county-level shocks for the 2010 census. Since the Census Bureau does not provide population estimates for census years, we estimate the following regression on county-level data within the 2001–2009 period:

$$\Delta Pop_{ct} = \gamma_1 Births_{ct} + \gamma_2 Deaths_{ct} + \gamma_3 Net\ Migration_{ct} + u_{ct} \quad (1)$$

In equation (1),  $\Delta Pop_{ct}$  denotes the change in the population of county  $c$  in year  $t$ , and all data series come from the Census Bureau. When we estimate the equation on data from 2001 to 2009, we find that the coefficients are very close to expectations, that is,  $\hat{\gamma}_1$  and  $\hat{\gamma}_3$  are close to 1 and  $\hat{\gamma}_2$  is close to -1, and the regressors explain roughly 96% of the variation in population changes as reported by the Census Bureau. We predict population in 2010 from the estimated model, and contrast it to the actual population counts from the census in that year. We define the census shock as

$$CS_c = \log(Pop_c^{Census}) - \log(\widehat{Pop}_{2010}), \quad (2)$$

where the first component is the census count and second component is the predicted value for 2010 from the model in equation (1).

Panel (a) of Figure 5 shows the distribution of the census shock. The shock is slightly positive on average, meaning that population was, on average, underestimated before the 2010 census. There is considerable variation across counties, with some counties having their

population counts reset by more than 20% (positive or negative). Most shocks are smaller than that, however: A county at the 10th percentile of the distribution has a census shock of around -3%, and a county at the 90th percentile of the distribution has a census shock of around 6%. The standard deviation across counties is roughly 5 percentage points.

As discussed in detail in Suárez Serrato and Wingender (2016), final census numbers are not released until up to two years after the decennial census, and local budgets should therefore not be affected immediately. Even after that, federal transfers might only adjust partially in each subsequent year as some federal agencies use a past moving average of population data to allocate transfers. Our financing data start in 2012 which is the first year in which we might see an effect on local budgets.

Note that the decennial census resets local population levels, permanently, that is, even though the population count is again estimated in years after the decennial census, the new estimates start from a different level. Hence, the entire path of expected population estimates is affected by the decennial census, making the effect on municipal budgets a permanent one. That motivates our interpretation of the census shock as a permanent cash flow shock.

### **3.1.2 Transitory income shocks**

We use unexpected adverse winter weather as a transitory shock to municipal income. A number of academic studies have demonstrated the adverse impact of winter weather on corporate profits. For example, Gustafson et al. (2017) shows that unexpected winter weather substantially and significantly reduces annual corporate profitability in a number of sectors such as manufacturing, transportation, wholesale trade, and construction. In addition, it negatively impacts sectors that constitute a major fraction of economic activity such as retail trade, business services, real estate, and accomodation and food although these effects are not statistically significant. Similarly, Tran (2016) finds that adverse weather decreases in-store retail sales by an economically large amount. Finally, Bloesch and Gourio (2015) find that the abnormally cold and snowy winter of 2013-2014 had a temporary but significant effect on

the U.S. economy.

The strong empirical evidence of adverse effects of winter weather on corporate profitability implies that municipal income is also likely to be impacted. For instance, if businesses in the municipality lose revenues because of unexpected adverse winter weather, the municipality will collect less in tax revenues. Similarly, unexpected adverse winter weather could increase the operating costs of municipal entities through lost employee wages and increased inefficiencies.

Importantly, adverse winter weather constitutes a plausible transitory shock because it is likely to affect current income but unlikely to influence the long-run prospects of a municipality. For example, using a comprehensive sample of small, middle market, and large corporate borrowers Gustafson et al. (2017) show that even though unexpected adverse winter weather significantly affects profitability, it does not have any effect on corporate investment.

Following Gustafson et al. (2017), our measure of abnormal winter weather relies on the average snow cover in a given county during the first calendar quarter of each year. As the authors point out this measure combines the intuitive negative effects that both snowfall and cold weather may have on municipal revenues and operating costs. We use daily data on snow cover (in inches) from NOAA to construct this measure. Specifically, for each day and county, we first compute the median value of snow cover across weather stations.<sup>7</sup> We then calculate the average snow cover for each county for each year from 2002 to the present. Finally, we compute abnormal snow cover by subtracting the average snow cover from the time series average of snow cover for each county-year using the previous 10 years worth of data.

Panel (b) of Figure 5 shows the distribution of abnormal snow cover in our sample (for the sake of presentation the measure is scaled by 1000). The distribution of abnormal weather shocks in our sample looks very similar to that in Gustafson et al. (2017) – Figure 1 (b) in their paper, even though the shocks in our sample exhibit slightly higher dispersion. This is likely because fewer firms located in counties with high volatility of weather conditions.

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<sup>7</sup>Using the median mitigates concerns that the effect of weather in high elevation geographic areas may not have much of an effect on municipal outcomes.

## 3.2 Empirical Strategy

Our strategy for estimating the effects of permanent or transitory income shocks is reminiscent of the direct projections approach in Jorda (2005), but differs slightly for each type of shock and we describe each implementation in turn.

Equipped with the census shock from the 2010 census, we run the following regression for each quarter  $t$ :

$$y_{c,t_0+t} - y_{c,t_0} = \beta_0^{(t)} + \beta_1^{(t)} CS_c^+ + \beta_2^{(t)} CS_c^- + X_c' \gamma^{(t)} + \alpha_s^{(t)} + \epsilon_{c,t_0+t}. \quad (3)$$

In equation (3), the outcome  $y_{c,t_0+t}$  is one of the following variables: bank loan share, bank or bond debt per capita relative to its level  $y_{c,t_0}$  in 2012:Q3. We separate the positive and negative components of the census shock (such that, e.g.  $CS_c^+ = \max(CS_c, 0)$ ) in order to allow for an asymmetric response, in line with recent papers in the fiscal policy domain (see, e.g. Ljungqvist and Smolyansky (2014); Jones et al. (2015)).

We include state-level fixed effects to account for co-movement of counties within the same state. For instance, it is possible that counties within the same state receive census shocks that are correlated because population estimates are off by more for the entire state. Including state-fixed effects assures that estimates rely on cross-county variation within states.

Census shocks might also be correlated with local economic conditions if, say, a booming local economy attracts more workers to the region, potentially resulting in a larger population projection error and a larger census shock. This would bias our estimates since census shocks and debt levels might display correlation because they both rely on economic conditions. We therefore include county-level annual employment growth and wage growth, debt-to-income, unemployment rate, median household income, homeowner share, share of the population under 18 years of age or over 60 years of age ( $X_c$ ) to control for economic and demographic conditions at the county-level.

We estimate equation (3) for each quarter  $t > t_0$ , and report the coefficient estimates  $\hat{\beta}_1^{(t)}, \hat{\beta}_2^{(t)}$  below.

To obtain an initial idea about the effect of transitory income shocks on financing outcomes, we first estimate regressions over all quarters in the sample to arrive at the average effect. These regressions take the form:

$$\Delta y_{c,t} = \beta_0 + \beta_1 \text{Snow Cover}_{c,t} + X'_c \gamma + \alpha_s + \alpha_t + \epsilon_{c,t}. \quad (4)$$

Coefficient  $\beta_1$  in equation (4) gives the average effect of abnormal snow in county  $c$  at time  $t$  (where the shock occurs only in the first quarter of each year) on debt growth. As before, we run regressions for bank and bond debt per capita, separately.

Our main strategy for estimating the effect of transitory shocks mirrors equation (3) but differs in that the transitory weather shock occurs in the first quarter of each calendar year. To estimate the effect of the shock throughout quarters of the year, we estimate regressions of the form:

$$y_{c,Qk} - y_{c,Q1} = \beta_0^{(k)} + \beta_1^{(k)} \text{Snow Cover}_{c,Q1} + X'_c \gamma^{(k)} + \alpha_s^{(k)} + \alpha_t^{(k)} + \epsilon_{c,Qk}. \quad (5)$$

Here, all variables are defined as above, except that  $k \in \{1, \dots, 4\}$  denotes the quarter of the calendar year and we pool observations over all county observations in the same calendar quarter. Since each regression pools over quarters in several calendar years, we include time fixed effects,  $\alpha_t^{(k)}$ , to control for common trends that would affect all counties.

### 3.3 Response to permanent income shocks

Figure 6 shows the response of municipalities bank loan share to our measure of permanent income revisions – the census shock. Consistent with the delayed nature with which the census shock affects federal transfers to municipalities, effects are small and not statistically significant up to two and a half years after Q4 of the census year (the 2010 census). After that,



we find that the bank loan share increases after negative shocks only. A one standard deviation decrease in the census shock, on average, increases the bank loan share by approximately one percentage point. These results are consistent with existing literature in corporate finance – Rauh and Sufi (2010) show that the fraction of both high priority and high seniority claims in corporate capital structure increases following adverse revisions in credit quality. We do not find a corresponding change in debt structure after positive income shocks.

To better understand the debt structure response of municipal issuers to permanent income shocks, we investigate how the response varies with pledgeable income. Reductions in credit quality of counties with already a low level of pledgeable income may lead to an increase of senior claims in their capital structure to counter the higher potential for informational asymmetry problems. These effects are more likely to be muted for counties with high levels of pledgeable income. We therefore split the sample into two groups, based on county median household income.

Figure 7 indicates that, consistent with this idea, low-median income counties substantially increase their bank debt share after a negative income shock. In contrast, high-median income municipal entities do not experience a significant change following adverse income shocks. In addition, both high- and low-income counties experience no change in bank debt share following positive income revisions.

One caveat here is that following adverse income shocks low-income counties may be repaying bonds to reduce debt burden and potentially debt overhang, while leaving bank debt obligations unchanged. Such capital structure adjustments could also generate an overall reduction in bank debt share that does not involve actively increasing the issuance of private debt claims. We account for this possibility by investigating the separate responses to permanent income shocks of bank debt and bond financing.

Figure 8 decomposes our previous results in Panels (a) and (b) of Figure 7 into bank and bond financing responses. We find that after negative shocks, municipal financing in low-median income counties is characterized by an increase in the dollar volume of bank

financing and a decrease in the dollar volume of bond financing, with bank financing increases at an approximately 4 times faster pace than the reduction in bond financing. Overall, this leads to an increase in the bank debt share as seen previously. This result provides further support to the idea that municipalities actively rebalance their capital structure towards more senior debt claims following adverse permanent income revisions consistent with Diamond (1991) and Bolton and Freixas (2000).

After positive permanent revision to expected income, low-median income counties decrease their amounts of outstanding bonds and slightly increase the issuance of bank loans, leading to no change in the fraction of bank debt claims. In effect, low-median income municipal entities repay outstanding bonds, possibly to substitute more expensive previous issues following the upward adjustment in permanent income.

Last, Figure 9 investigates the responses of high-median income municipalities to permanent revisions in income, and demonstrates a lack of sensitivity to permanent income shocks. Specifically, high-income counties tend to repay both bonds and bank loans following adverse revisions in permanent income, but effects are generally weak and not statistically significant.

### **3.4 Response to transitory income shocks**

Finally, we analyze the debt structure response of municipalities to transitory income revisions. While these shocks do not affect the fundamentals of a given county, they may elevate the the riskiness of a county in the short and the intermediate term. Therefore, it is important to understand if the capital structure of municipalities is tilted towards more senior debt claims to accommodate these types of income shocks.

In Table 3, we present how the quarterly change in credit line commitments, utilized amounts under credit lines, term loans, as well as bonds varies with transitory income shocks as proxied by the abnormal snow cover in the first calendar quarter of the year. We show that abnormal snow cover is positively and statistically significantly correlated with the quarterly change in drawn amount under credit lines but statistically unrelated to all other

debt structure outcomes. These results indicate that municipalities buffer transitory income shocks with increasing bank borrowing, thereby adding relatively more senior debt to their capital structure.

Even though the results in Table 3 are informative about debt structure changes following transitory income shocks, these results show the overall average quarterly effects. In other words, the regressions do not consider the timing dynamics of credit lines and other debt around and following the transitory income shock occurring in the first calendar quarter.

Figure 10 addresses this shortcoming by considering these quarterly changes in each calendar quarter. We show that both credit line size and drawn amounts increase in the quarter of the shock (Q1) as well as in the subsequent quarter with the credit line size increase being twice as large as changes in drawn amount. This indicates not only that municipalities access credit lines to buffer transitory shocks but also that banks accommodate borrowers following such shocks. We also show that bond financing decreases in the quarter of the shock, primarily driven by a reduction in revenue bonds. This is likely because adverse weather delays the initiation of municipal investment projects.

Last, we consider whether the level of pledgeable income affects the debt structure response of municipal issuers to transitory income shocks. For example, Sufi (2009) shows that the reliability of credit lines for corporate borrowers depends on cash flow – only high cash flow borrowers can ensure continued access to lines of credit. In Figures 11 and 12, we investigate this by splitting the response of credit line size and credit line drawn amount to transitory cash flow shocks by above- and below-median income counties. We find that high-median income counties experience larger increases in both credit line size and drawn amounts in the first two calendar quarters. In contrast, the sensitivity of changes in line size and drawn amounts are low and statistically insignificant for low-median income counties. This shows that similar to the case of corporate borrowers, credit line access of municipal entities is mostly restricted to high income borrowers. Importantly, this finding suggests that the addition of higher seniority debt mostly happens for municipal entities with higher pledgeable income.

## 4 Conclusion

In this paper we examine the debt structure of municipalities as well as their debt structure response to exogenous income shocks. We show that small, more indebted, low-median income, and medium credit quality counties are particularly reliant on private bank financing. Low income counties are more likely to increase bank debt share after an adverse permanent income shock while high income counties do not shift their debt structure in response. In contrast, only high income counties draw on their credit lines after adverse transitory income shocks, suggesting that counties with less pledgeable income are in a worse position to weather short-term funding challenges.

Overall, our study has implications for the role of regulation in alleviating market imperfections and failures. For example, Leftwich (1980), Watts and Zimmerman (1986), and Beaver (1998) argue that investors may free ride on voluntary disclosure leading to entities disclosing too little. In our setting this implies that claim dilution of bond holders could be substantially alleviated by mandatory disclosure of private debt.

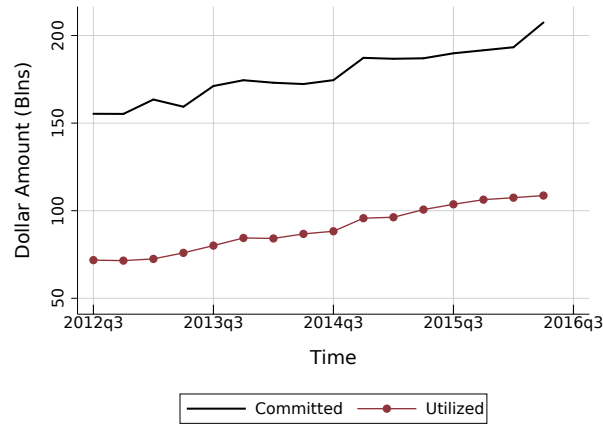
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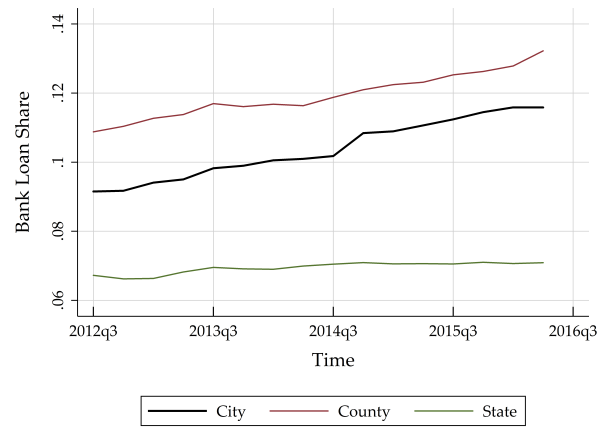
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## A Figures and Tables



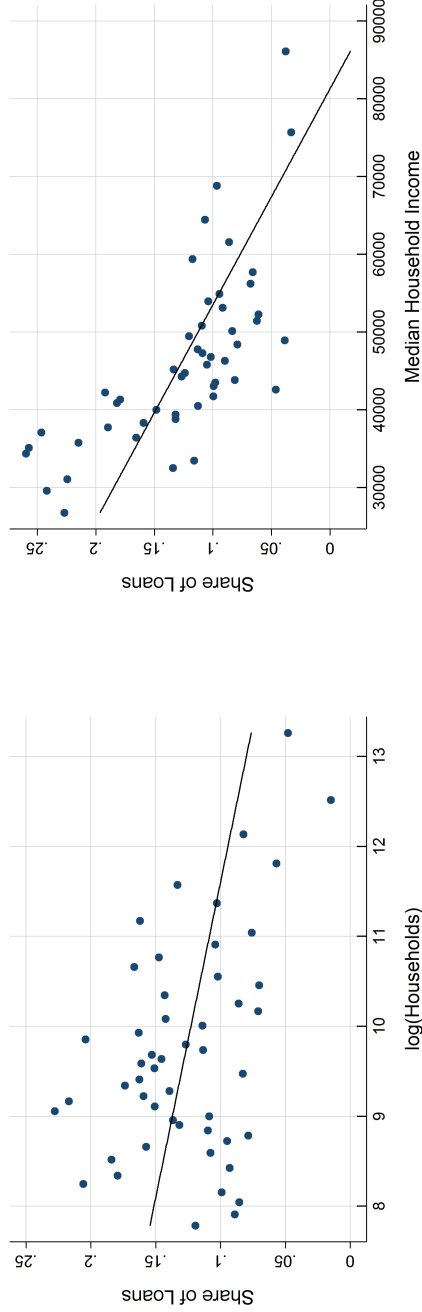
(a) Bank debt over time



(b) Average share of bank debt by subdivision

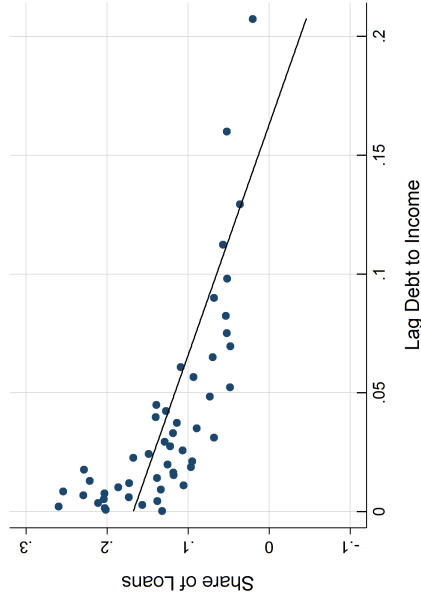
**Figure 2: Municipal Bank Debt:** Panel A presents the total dollar amount of utilized and committed bank loan exposure of Y-14 banks to municipalities during our sample period. Panel B presents the average fraction of bank debt to total debt for different groups of municipal issuers over the sample period (both bank debt represents utilized outstanding amounts under all types of bank loans to municipalities).



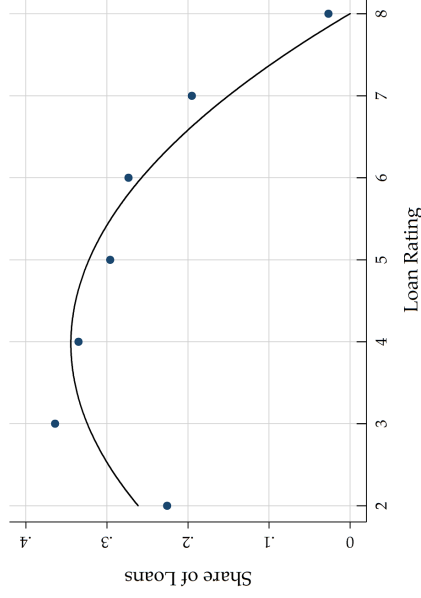


(a) Population

(b) Median household income

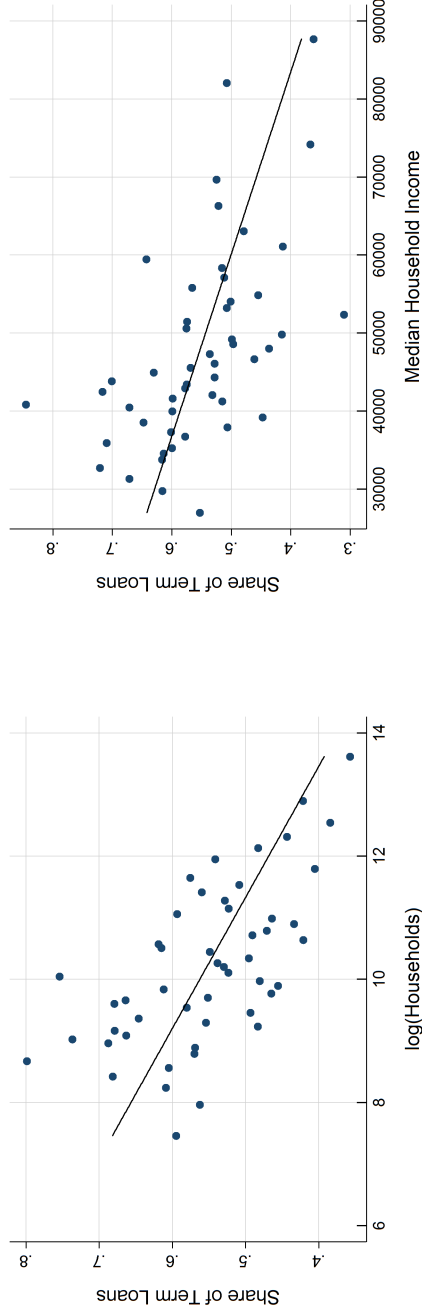


(c) Debt to income

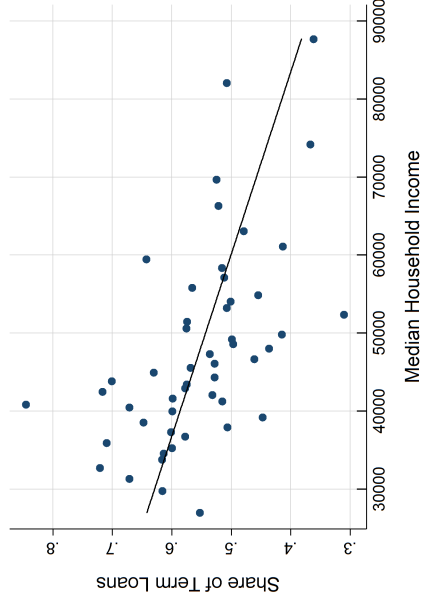


(d) Credit rating

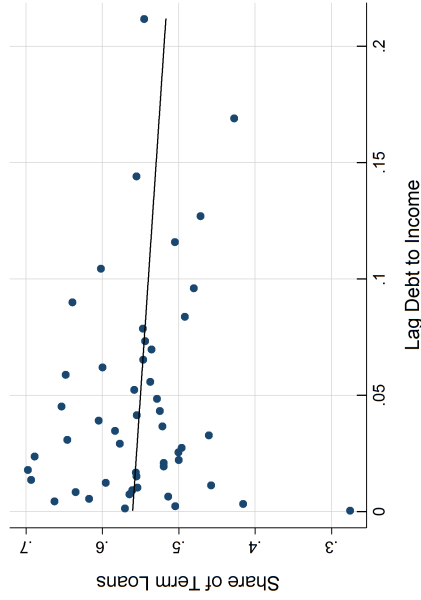
**Figure 3: Municipal bank debt share and county characteristics:** This figure presents scatter plots of the relation between bank debt share of municipalities and key county characteristics. The bank debt share is defined as the total dollar amount of bank loans (utilized exposure) divided by the dollar value of total debt (utilized outstanding amounts of bank debt and revenue and general obligation bonds). For the sake of presentation the scatter plot points are aggregated into 50 bins or less. The Debt-to-Income variable is defined as total debt per household divided by the average household income, the credit rating variable comes from the Y-14 data and represents a bank-generated mapping from the bank internal rating of the borrower to an external 10-bucket S&P scale.



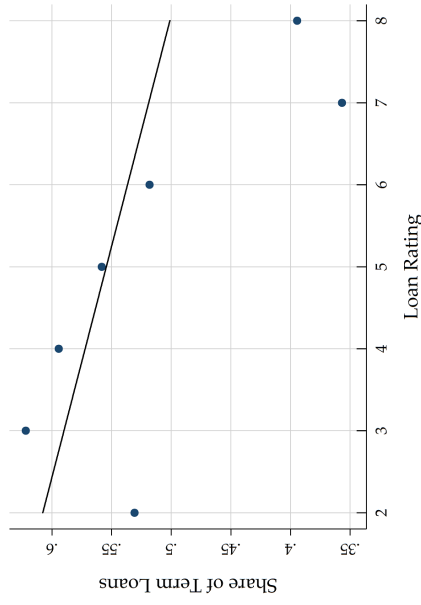
(a) Population



(b) Median income

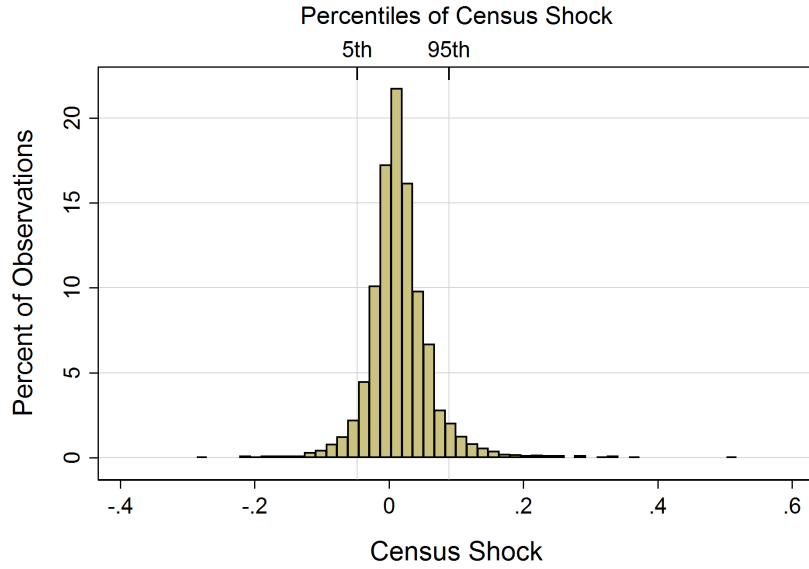


(c) Debt to income

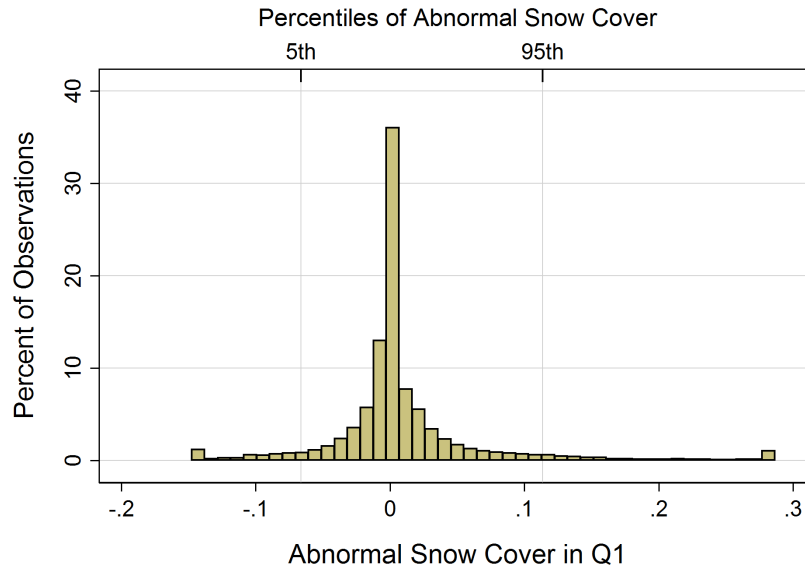


(d) Credit rating

**Figure 4: Municipal term loan share and county characteristics:** This figure presents scatter plots of the relation between term loan share of municipalities and key county characteristics. The term loan share is defined as the total dollar amount of term loans divided by the dollar value of bank debt (committed exposure). For the sake of presentation the scatter plot points are aggregated into 50 bins or less. The Debt-to-Income variable is defined as total debt per household divided by the average household income, the credit rating variable comes from the Y-14 data and represents a bank-generated mapping from the bank internal rating of the borrower to an external 10-bucket S&P scale.

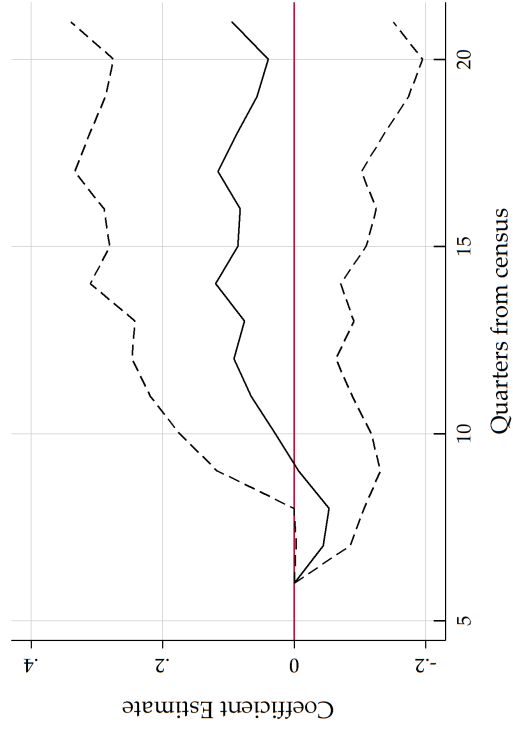


(a) Census shock

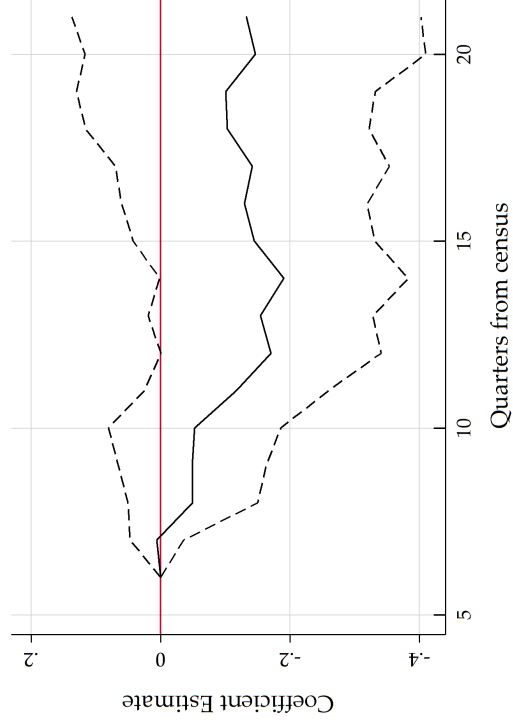


(b) Weather shock

**Figure 5: Permanent and transitory income shocks:** This figure presents the distributions of permanent and transitory income shocks for the counties in our sample. We construct permanent income shocks in Panel A as in Suárez Serrato and Wingender (2016) as the difference between the Census Bureau’s population estimate and the actual census count. We follow Gustafson et al. (2017) to construct the transitory income shock, relying on abnormal winter weather (snow cover). Specifically, we compute abnormal snow cover by subtracting the average snow cover during the first calendar quarter from the time series average of snow cover for each county-year in Q1 using the previous 10 years worth of data.

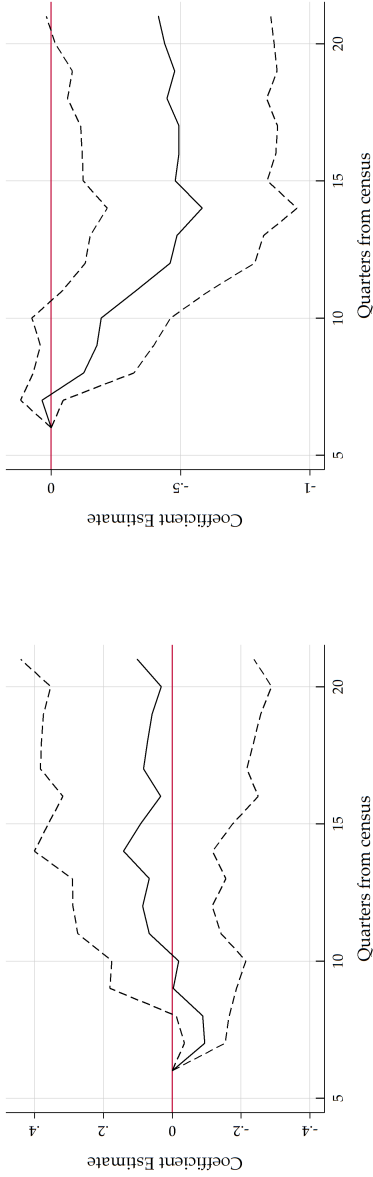


(a) Positive shock

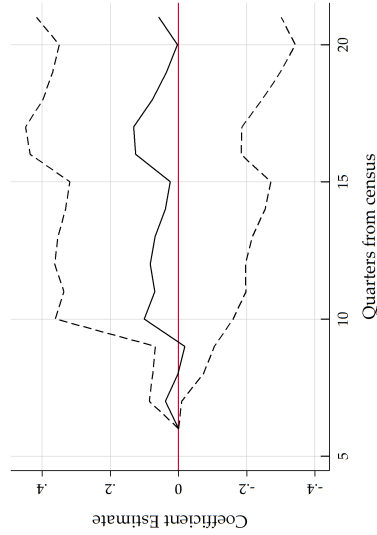


(b) Negative shock

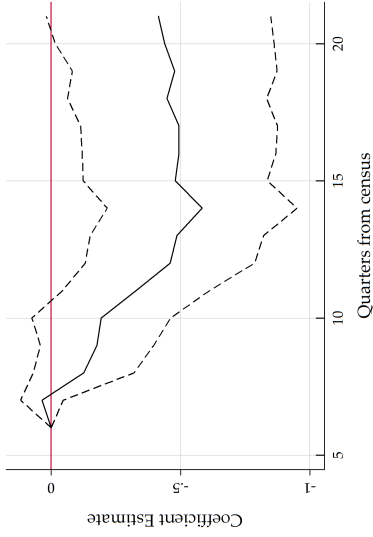
**Figure 6: Response of bank loan share: All counties** This figure presents the time series evolution of the sensitivity of bank debt share to positive (Panel A) and negative (Panel B) permanent income shocks in event time. To obtain these sensitivities for every quarter in our sample we estimate cross sectional regressions of the change in bank debt share of municipalities since 2012Q3 on the positive and negative part of permanent income shocks and controls. Bank debt share is defined as in Appendix B, while the regression used to estimate the sensitivity is discussed in Section 3.2. The dashed lines represent the 90% confidence interval for these estimates and the x-axis measures the number of quarters after 2010Q4 (quarter 4 of the census year).



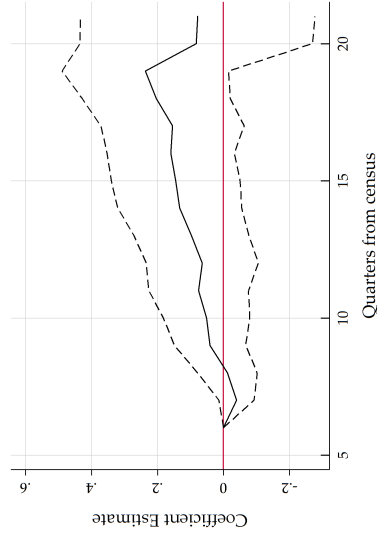
(a) Positive shock, Low income



(c) Positive shock, High income

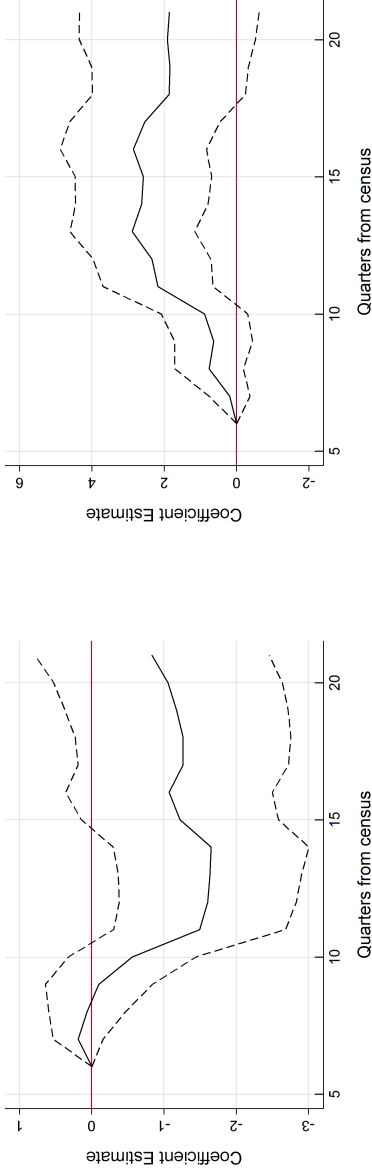


(b) Negative shock, Low income



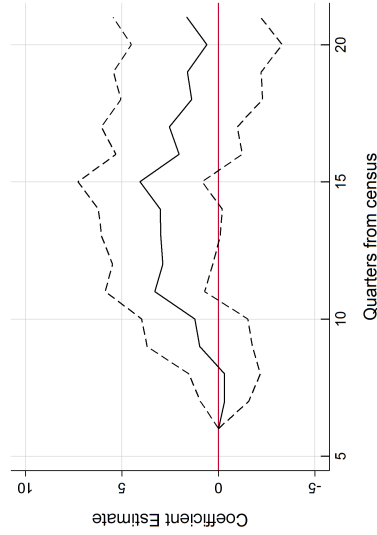
(d) Negative shock, High income

**Figure 7: Response of bank loan share and median county income.** This figure presents the time series evolution of the sensitivity of bank debt share to positive and negative permanent income shocks splitting the sample into counties with low median household income (Panels a) and b)) and counties with high median income (Panels c) and d)). Low/high income is defined as being below or above the sample median. Similar to Figure 6 we obtain the sensitivities for every quarter in our sample by estimating cross sectional regressions of the change in bank debt share of municipalities since 2012Q3 on the positive and negative part of permanent income shocks and controls. Bank debt share is defined as in Appendix B, while the regression used to estimate the sensitivity is discussed in Section 3.2. The dashed lines represent the 90% confidence interval for these estimates.

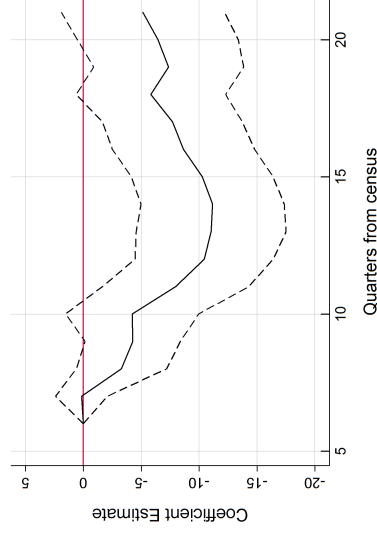


(a) Bond Financing, Positive shock

(b) Bond Financing, Negative shock

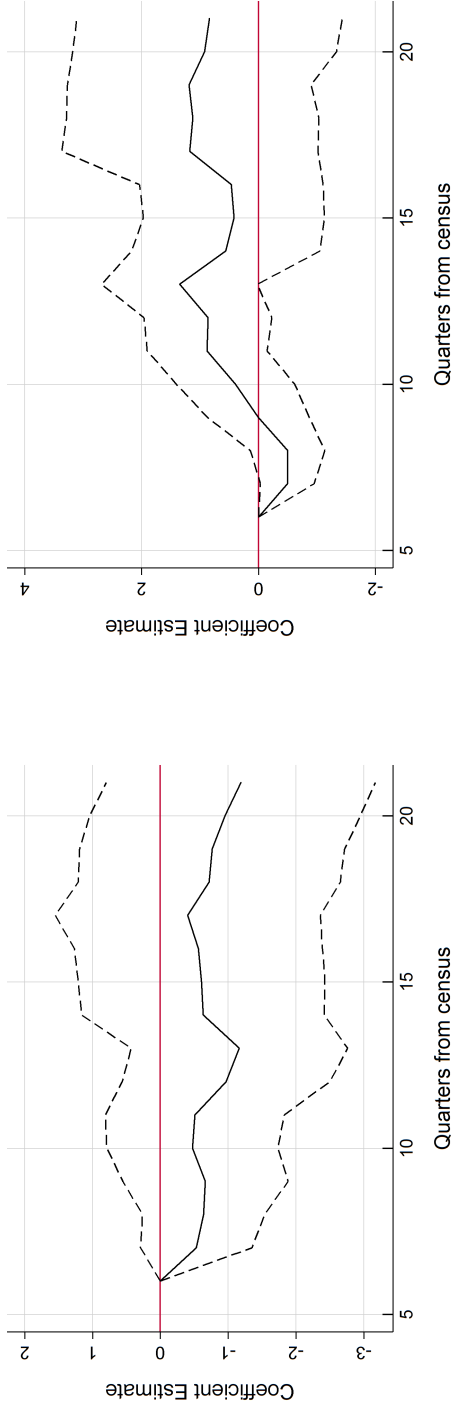


(c) Bank Financing, Positive shock



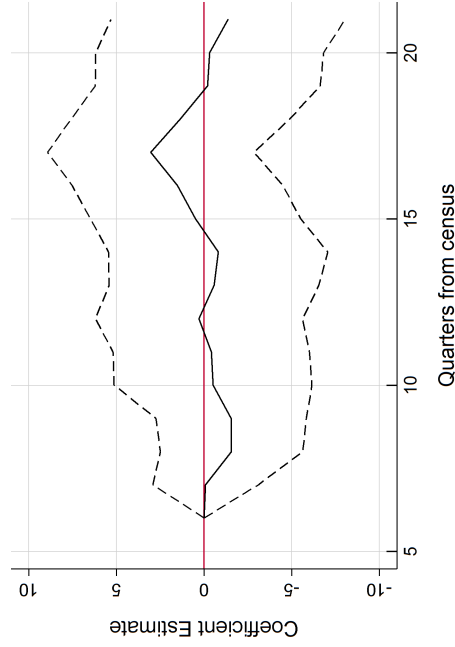
(d) Bank Financing, Negative shock

**Figure 8: Response of Bank and Bond Financing in low income counties.** This figure presents the time series evolution of the sensitivity of bond and bank financing per capita in low income counties to positive (Panels A and C) and negative (Panels B and D) permanent income shocks in event time. To obtain these sensitivities for every quarter in our sample we estimate cross sectional regressions of the change in dollar value of bonds/bank debt per capita of municipalities since 2012Q3 on the positive and negative part of permanent income shocks and controls. Bank debt and bonds per capita are defined as in Appendix B, while the regression used to estimate the sensitivity is discussed in Section 3.2. The dashed lines represent the 90% confidence interval for these estimates.

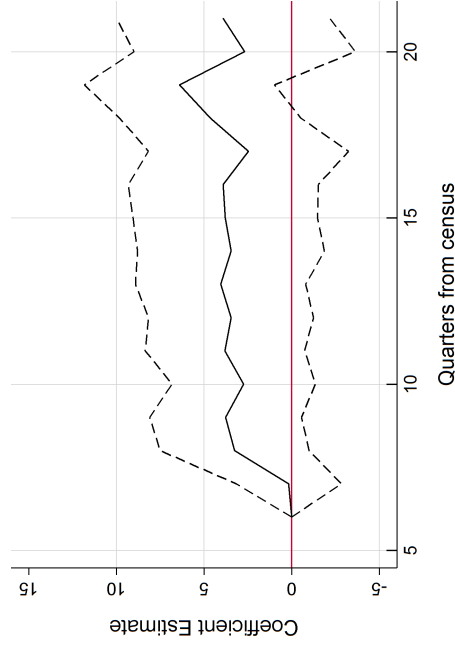


(a) Bond Financing, Positive shock

(b) Bond Financing, Negative shock

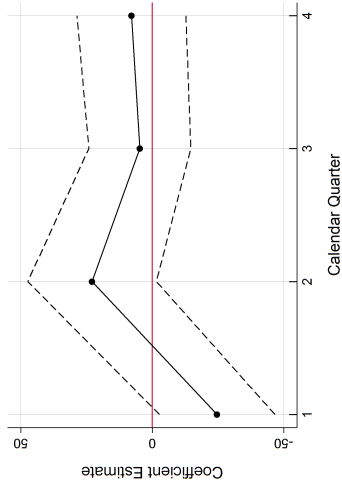


(c) Bank Financing, Positive shock

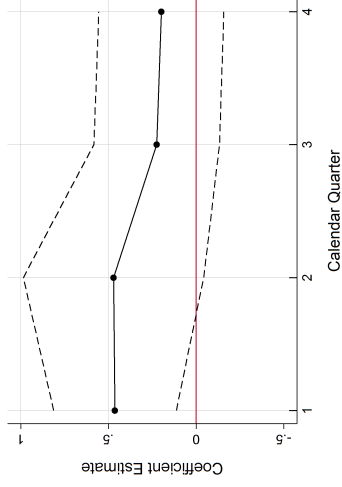


(d) Bank Financing, Negative shock

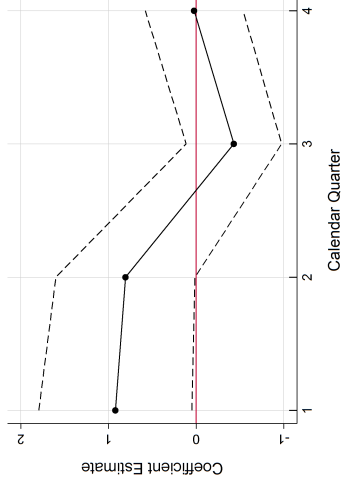
**Figure 9: Response of Bank and Bond Financing in high income counties.** This figure presents the time series evolution of the sensitivity of bond and bank financing per capita in high income counties to positive (Panels A and C) and negative (Panels B and D) permanent income shocks in event time. To obtain these sensitivities for every quarter in our sample we estimate cross sectional regressions of the change in dollar value of bonds/bank debt per capita of municipalities since 2012Q3 on the positive and negative part of permanent income shocks and controls. Bank debt and bonds per capita are defined as in Appendix B, while the regression used to estimate the sensitivity is discussed in Section 3.2. The dashed lines represent the 90% confidence interval for these estimates.



(a) Effect on bond financing



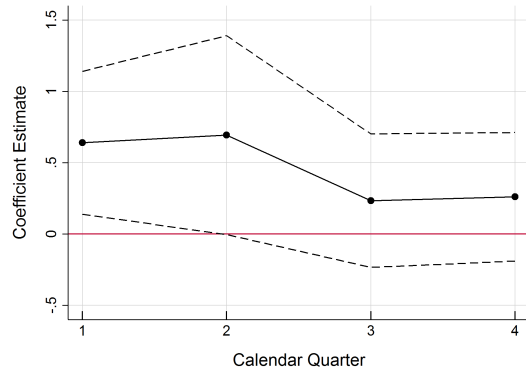
(b) Effect on credit line utilization



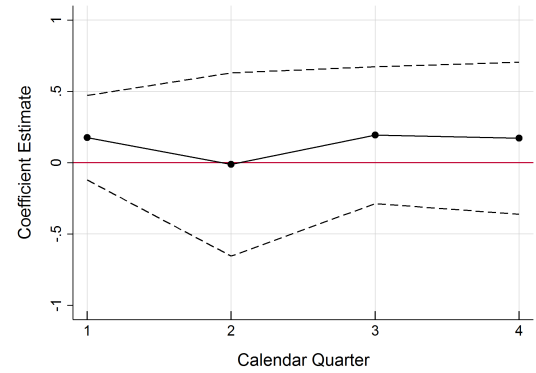
(c) Effect on credit line commitments

**Figure 10: Financing dynamics following transitory income shocks.** This figure presents the quarterly response of bank and bond financing per capita to transitory income shocks. Specifically, each point on the solid line in the figure represents the estimated effect of abnormal first quarter snow cover on quarterly change in financing during the calendar quarter indicated on the x-axis (for example, Q1 represents the change in financing between the end of Q4 of the previous year and the end of Q1 of the current year). The dashed lines represent the 90% confidence interval for these estimates.



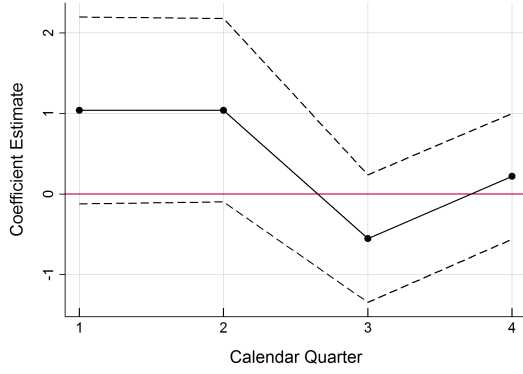


(a) High income counties

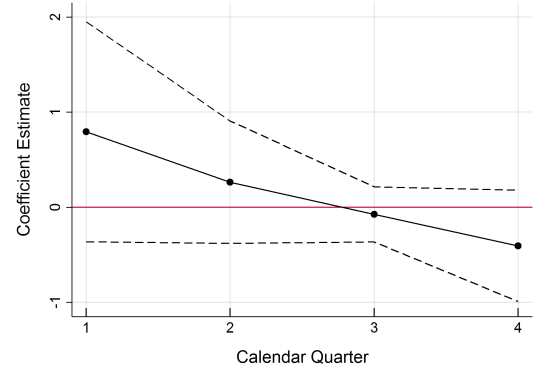


(b) Low income counties

**Figure 11: Credit line drawn amount following transitory income shocks.** This figure presents the quarterly response of utilized dollar amount of credit lines per capita to transitory income shocks for both high and low income counties. Specifically, each point on the solid line in the figure represents the estimated effect of abnormal first quarter snow cover on quarterly change in credit line drawn amounts during the calendar quarter indicated on the x-axis (for example, Q1 represents the change in credit line drawn amount between the end of Q4 of the previous year and the end of Q1 of the current year). The dashed lines represent the 90% confidence interval for these estimates.



(a) High income counties



(b) Low income counties

**Figure 12: Credit line size following transitory income shocks.** This figure presents the quarterly response of the dollar amount of credit line size per capita to transitory income shocks for both high and low income counties. Specifically, each point on the solid line in the figure represents the estimated effect of abnormal first quarter snow cover on quarterly change in credit line size during the calendar quarter indicated on the x-axis (for example, Q1 represents the change in credit line size between the end of Q4 of the previous year and the end of Q1 of the current year). The dashed lines represent the 90% confidence interval for these estimates.

**Table 1: Summary statistics:** This table presents summary statistics (means, standard deviations, and percentiles) for key characteristics of the counties in our dataset. The total debt in *Total loan commitments to total debt* is defined as the sum of all loan commitments and the dollar value of outstanding revenue and general obligation bonds. The total debt in *Total loan utilization to total debt* is defined as the sum of all utilized outstanding debt and the dollar value of outstanding revenue and general obligation bonds. The variables in the *Loan types* subsection are defined in terms of loan commitments. The rates in the *Loan rates* subsection are weighted-average loan rates on credit lines, term loans, and demand loans where the weights are defined in terms of commitment amount. All other variables in this table are defined as in Appendix B.

	Mean	Std	p10	p25	p50	p75	p90
<i>Bank loan shares of total debt</i>							
Total loan commitments to total debt	0.13	0.29	0.00	0.00	0.00	0.08	0.60
Total loan utilization to total debt	0.13	0.28	0.00	0.00	0.00	0.06	0.52
<i>Loan types</i>							
Total term loans to total loans	0.28	0.20	0.00	0.03	0.33	0.50	0.50
Total credit lines to total loans	0.08	0.16	0.00	0.00	0.00	0.07	0.39
Total demand loans to total loans	0.14	0.18	0.00	0.00	0.06	0.21	0.50
Credit line utilization share	0.47	0.39	0.00	0.05	0.45	0.90	1.00
<i>Loan rates</i>							
Credit lines	0.04	0.03	0.01	0.02	0.03	0.04	0.06
Term loans	0.03	0.02	0.02	0.02	0.03	0.04	0.04
Demand loans	0.04	0.20	0.02	0.02	0.03	0.04	0.05
<i>Other</i>							
Credit rating	4.47	1.42	3	4	4	5	6
Households	41,438	119,585	2,980	5,850	12,521	30,718	87,074
Homeowner share	0.72	0.07	0.63	0.69	0.73	0.77	0.80
Median income	43605	10794	32555	36554	41654	48064	56206

**Table 2: The determinants of bank debt shares:** In columns (1) and (2) of this table we present cross sectional regression estimates of average bank debt share on key county characteristics. In column (3) we restrict the sample to counties with a positive amount of bank debt and present regression estimates of average term loan share on key county characteristics. For each county, average bank loan share and term loan share are defined as the time-series average of bank loan share and term loan share (see Appendix B for definitions of these variables).

Sample:	All counties	Counties with bank debt	
Dependent variable:	Total Loan share	Total Loan share	Term Loan share
Log(Households)	-0.021*** (0.007)	-0.095*** (0.011)	-0.058*** (0.012)
Median income	-0.002** (0.001)	-0.003** (0.001)	0.000 (0.002)
Debt to income	-0.472*** (0.061)	-1.025*** (0.136)	0.045 (0.142)
Unemployment rate	0.005 (0.003)	0.002 (0.005)	0.002 (0.006)
Homeowner share	0.206* (0.123)	0.216 (0.195)	-0.114 (0.252)
Share under 18	-0.491* (0.276)	-0.242 (0.453)	-0.199 (0.608)
Share over 60	-0.435** (0.205)	-0.387 (0.317)	-0.369 (0.397)
Constant	0.462*** (0.123)	1.417*** (0.180)	1.341*** (0.229)
$R_a^2$	.325	.435	.148
N	2392	1064	1064

Standard errors indicate significance at the 10%, 5% and 1% levels, respectively.

**Table 3: Changes in financing and temporary income shocks.** The table presents quarterly panel regression estimates of changes in financing (committed credit lines, utilized credit lines, term loans, and bonds) on temporary income shocks (abnormal snow cover). All variables are defined as in Appendix B.

Dependent variable:	$\Delta$ Committed lines	$\Delta$ Utilized lines	$\Delta$ Term Loans	$\Delta$ Bonds
Abnormal snow	0.306 (0.210)	0.317** (0.132)	0.421 (0.699)	3.571 (5.985)
Log(Households)	0.025 (0.015)	0.022* (0.012)	0.367*** (0.069)	0.580 (0.644)
Median income	0.000* (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Debt to income	-0.291 (0.215)	-0.055 (0.077)	-0.701 (1.039)	-76.126*** (15.497)
Wage growth	-0.092 (0.235)	-0.193 (0.144)	-1.684 (1.968)	0.526 (14.456)
Employment growth	-0.349 (0.249)	-0.214 (0.181)	2.110 (2.344)	-19.333 (15.761)
Homeowner share	0.120 (0.322)	0.250 (0.306)	0.918 (1.280)	20.021 (12.407)
Share under 18	-0.100 (0.781)	0.114 (0.742)	4.888 (3.047)	-3.523 (23.689)
Share over 60	0.600 (0.444)	0.380 (0.304)	3.272 (2.782)	-29.728 (22.283)
Constant	-0.434 (0.280)	-0.472** (0.223)	-5.774*** (1.462)	-9.002 (12.175)
$R_a^2$	.00353	.00157	.0234	.00779
N	30801	30801	30801	30801
State FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

Standard errors indicate significance at the 10%, 5% and 1% levels, respectively.

## Appendix A

We identify municipal entities in the Y14 data set by searching the borrower name field for the following key words:

- a) Cities/towns/townships/minor civil divisions: “CITY”, “TOWNSHIP”, ”TOWN OF”, “VILLAGE OF”, “BOROUGH”;
- b) Counties: “COUNTY”, “PARISH”;
- c) States: “STATE”, “COMMONWEALTH”, “DISTRICT OF COLUMBIA”;
- d) Fire/water/utility/school districts: “DIST”, “FIRE”, “WATER”, “UTILITY”, “SCHOOL”, “MUNICIPAL”, “AUTHORITY”, “METROPOLITAN”, “BRIGADE”;

We classify a borrower to be a “city” if the borrower name contains any of the keywords in a). We next classify a borrower to be a “county” if there are no keywords from a) in the borrower name but we identify at least one keyword from b). We then define a borrower to belong to the “state” category if the borrower name contains any of the words in c) but does not contain any words from a) and b). Last, we classify a borrower to be a “special district” if it contains any of the keywords in d).

One disadvantage with the classification algorithm so far is that we are likely to omit municipalities in the Y-14 data that do not contain any of the keywords above. Given that we supplement the identification procedure using the complete list of municipality names from the Census website. Specifically, we match all government and not-for-profit borrowers in the Y-14 to the list of municipalities in the Census using the zipcode of each borrower. We then apply the following sequence of steps:

- 1) If the Census City field and the borrower name field are an exact match, we define to entity to belong to a city government.
- 2) We next classify entities to belong to the county level if the Census City field is not an exact match with the borrower name but the Census County name field is.
- 3) If neither the Census City nor the Census County fields match exactly with the borrower name but the state is an exact match, we classify the entity into the “state” category.

Finally we update municipal categories a) through c) above with the Census match.

## Appendix B - Variable Definitions

Below we present variable definitions, the item numbers of data fields refer to Schedule H1 of the Y-14Q data on the Federal Reserve's website:

[https://www.federalreserve.gov/reportforms/forms/FR\\_Y-14Q20160930.i.pdf](https://www.federalreserve.gov/reportforms/forms/FR_Y-14Q20160930.i.pdf)

*Total Loan Share* – defined as the sum of utilized outstanding amounts under all banks loans (field #25) of a given municipality divided by the sum of all outstanding amounts under bank loans and all outstanding general obligation and revenue bonds for the same municipality.

*Term Loan Share* – defined as the committed amounts under the term loans of a given municipality (based on fields #20 and #24) divided by the total committed amounts under all banks loans (field #24) for the same municipality.

*Log(Households)* – The log of the number of households in a given county-year. For each year, information on the number of households comes from the American Community Survey at the Census reflecting 5-year Census estimates.

*Median Income* – The median household income in a given county-year. Information on the number of median household income come from the American Community Survey at the Census reflecting 5-year Census estimates.

*Debt to income* – This variable is defined as the total debt of a given municipality divided by the aggregate household income in the same municipality. Total debt represents the sum of all outstanding amounts under bank loans (field #25) and all outstanding general obligation and revenue bonds. Aggregate household income is defined as the average household income in a given county-year multiplied by the number of households in the same county-year. Data on the average household income and the number of households in a given county-year come from the American Community Survey at the Census reflecting 5-year Census estimates.

*Wage growth* – This variable is defined as the year-over-year percent change in quarterly wages in a given county. Data on county-level quarterly wages come from the Bureau of Labor Statistics website.

*Employment growth* – This variable is defined as the year-over-year percent change in quarterly employment in a given county. Data on county-level quarterly employment come from the Bureau of Labor Statistics website.

*Homeowner share* – The share of homeowners in a given county. This variable comes from the 2010 Census.

*Share under 18* – The share of the population in a given county that is under 18 years of age. This variable comes from the 2010 Census.

*Share over 60* – The share of the population in a given county that is over 60 years of age. This variable comes from the 2010 Census.

*Credit rating* – This variable is only defined for the counties with bank debt in Schedule H1 of the Y-14Q data. This is the internal rating assigned by the bank (field #10) converted to a 10-grade S&P ratings scale, with 1 denoting AAA and 10 denoting D.

*Abnormal snow* – We follow Gustafson et al. (2017) to construct the transitory income shock, relying on abnormal winter weather (snow cover). Specifically, we compute abnormal snow cover by subtracting the average snow cover during the first calendar quarter from the time series average of snow cover for each county-year in Q1 using the previous 10 years worth of data.