THE IMPACT OF BANK FINANCING ON MUNICIPALITIES' BOND ISSUANCE AND THE REAL ECONOMY

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ABSTRACT

I document the role of bank financing in the municipal bond market. Using a unique institutional feature of the municipal market – the bank qualification – I show that a significant mass of local governments are willing to substantially downsize their bond issuance to be able to place their debt with a bank. Exploiting a regulatory change in the tax code, I estimate the open-economy fiscal multiplier when government spending is financed by a bank. The results in the paper contribute to the current debate on cross-sectional fiscal multipliers and on the local public debt crowding out of private investment.

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Whether government purchases do stimulate the economy is one of the long-standing questions in economics. Arriving at a conclusive answer to this question however has been a path riddled with identification challenges. The earlier estimates of fiscal multipliers have come largely from VARs and evidence from wars. However estimates from these studies have been met with criticism, due to the key role of expectations as well as to the large-scale confounding effects associated with war-time spending. Crucial among those would be the presence of concomitant rationing and price controls, as well as forms of patriotism, biasing the coefficients in opposing directions. Making it even more difficult to interpret these estimates has been the fact that a large portion of war spending was financed through taxes rather than deficit; this has been a source of criticism since taxes and deficit give rise to vastly different multipliers (even negative under distortionary taxes), hence estimates that average across the two prove difficult to interpret.

The aftermath of the crisis has seen a revived interest in and attempts to tackle the question of fiscal multipliers. For the large part, the estimates in this new wave of research have come from cross-sectional variation in windfall spending (i.e. transfers) across small geographical areas. The focus on regional variation has allowed researchers to borrow the empiricist toolkit typical of the microeconomist researcher, in search for better identification. This has come at the cost, however, of having to estimate a *redistribution* multiplier, rather than a traditional government spending multiplier. There is substantial disagreement on how to interpret transfer-financed estimates, and on whether these windfall-multipliers can be informative of the ultimate object of interest, that is the deficit-financed multiplier (Chodorow-Reich (2017), Ramey (2011)).

In this paper I show that the municipal bond market can provide a particularly interesting setting to address this question. I exploit a unique institutional feature of the municipal market – the *bank qualification*. I show that this feature allows me to ask two questions: what is the open economy *deficit*-financed multiplier? And is a dollar of privately placed debt equivalent to a dollar of publicly placed debt? First of all, bank-qualified municipal bonds are bonds issued by local governments and paid back with future local taxes, so they constitute a source of internal and deficit-financed spending, rather than windfall spending. Interestingly, these are bonds that allow to pin down exactly which type of investor holds the debt of the government. Bank qualified bonds are in fact, as the name suggests, held by banks. This is especially interesting since the impact of government spending on the economy plausibly depends not only on how the spending is financed (transfer vs. taxes vs. deficit), but also on the type of investor that is financing the debt. To the extent that there is no balance sheet expansion, it is reasonable to think that a dollar of government debt that is financed by borrowing from high net-worth retail investors will not have the same implications of a dollar of debt that is financed via bank credit. This is particularly true if one considers the role of banks in (re-) allocating resources in the economy. Then, who finances the debt should matter just as much as how the debt is financed, when estimating and interpreting fiscal multipliers.

Understanding the bank-financed open economy multiplier is also quantitatively relevant. First, the municipal bond market is both large and central to the provision of public services in the U.S. Municipal bonds are in fact used by local governments and States to finance infrastructure, education, health care, and public safety. In the years between 2000 and 2014, nearly two million bonds were issued. The aggregate municipal debt outstanding is worth about \$3.7 trillion, roughly 25% of the U.S. GDP. Second, banks are an important player in this market: while common wisdom has it that local government debt in the U.S. is held primarily by retail investors, in this paper I actually document that a large mass of local governments do instead rely on bank financing. To the best of my knowledge this is the first paper that documents the role of banks in the municipal market.

My first contribution is therefore to document the presence of bank financing in the municipal market. My second contribution is to show that local governments have a strong preference for borrowing from banks, to the point of reducing their debt issuance not to lose access to bank-financing. My third contribution is to be able to estimate the policy-relevant open economy *deficit-financed* fiscal multiplier, rather than a transfer multiplier as in the recent literature.

I start by documenting the presence of a tax code discontinuity in banks' treatment of municipal bonds – the *bank qualification*. This provision allows banks to receive a favorable tax treatment when holding bonds issued by local governments whose new indebtedness remains within a fixed limit (specifically, \$10M). I show that the taxation discontinuity generates ownership segmentation: banks' purchases of municipal bonds are concentrated and are 10 times larger in the qualified segment where tax privileges are the highest. The discontinuous taxation thus generates shifts in the marginal investor in the municipal bonds market, with bank investors disappearing just over the \$10M bank-qualification threshold.

I then show that this ownership segmentation influences municipalities' decision to take on new debt. If bank financing were to be equivalent to financing through mutual funds or households, local governments should not respond to the ownership discontinuity around the \$10M threshold. I document that spreads exhibit a significant upward jump to the right of the bank taxation discontinuity and municipal issuers appear to bunch at the bank-qualification debt-raising limit of $10M, beyond which banks are subject to heavier taxation.

Using the techniques recently developed in the field of public finance (Saez (2010), Kleven and Waseem (2013)), I estimate the behavioral response of the marginal bunching municipality due to the presence of the bank-lender discontinuity. My estimation allows for the presence of reference point fixed effects and is robust to the inclusion of extensive margin responses. I estimate that roughly 29% of the issuers that would have issued a bond larger than $10M were induced to downsize to below the bank qualification cut-off, with municipalities reducing their debt issuance by up to 28% as a result. These estimates indicate that a sizable mass of local governments are willing to adjust and scale down their debt issuance in order not to lose the access to bank financing.

I then exploit a regulatory change in the municipal tax code to estimate the value of a marginal dollar of privately placed debt (i.e. debt placed with a bank). Specifically, I exploit the temporary amendment to the bank-qualification provision in Section 265 of the Internal Revenue Code. The modified provision raised the bank-qualification limit from $10M to $30M, thereby affecting the attractiveness of local government bonds to banks.

Using the results from the bunching estimation, I identify two regions in the distribution of bank-financed municipal issuers that were differentially affected by the regulatory change. Specifically, for some local governments the change in the bank qualification relaxed a financing constraint. For another set of governments instead, the regulatory shock simply moved a non-binding constraint to a further away non-binding constraint. I exploit the cross-sectional heterogeneity across municipalities to estimate a 2SLS, where the first stage is the impact of the regulatory shock on local governments' bank-financed issuance, and the second stage estimates the effect of a marginal dollar of (instrumented) bank-financed debt on local employment and wages.

The validity of the estimation rests on the assumption that sorting municipalities in these two groups, that is sorting them along their distance to the constraint, is *not* akin to sorting them along a differential economic trajectory, so that the assignment can generate a variation that is, plausibly, as good as random. The intuition behind this assumption rests on the peculiarity of the bank-qualification limit. In fact, the bank-financing limit applied in levels equally to any local government, irrespective of its budget or population size (i.e. $10M limit for each city, regardless of its size or population). To check the plausibility of this assumption, I match issuers to the Census of States and local governments, and I look at the pre-treatment economic trends as well as local governments' budgets, both at the issuer and the the county-aggregate level. The affected municipalities appear larger in size than the control ones. However, their budget per-capita are both economically and statistically comparable. In particular, both groups appear to rely equally on property taxes as their major source of tax revenues, and importantly, there appears to be no economic or statistical difference in the amount of inter-governmental transfers they receive per-citizen from the State or Federal government. The two groups also appear to follow similar economic paths in terms of both employment and wages. Given the reliance of property taxes, I also look at house prices, which again appear both statistically and economically comparable. I also investigate whether their ability to raise bank financing differed in the pre-treatment period: the two groups appear similar as regards the growth in their issuance, as well as the underlying ratings and average spreads of the bonds issued.

I find that every million dollars of extra bank-financed spending generates around 14 jobs per year in the private sector, while there is no impact on job creation for public servants. The employment multiplier implies a cost per job of $44,500, while the estimated wage bill multiplier is 0.8. The effects are somewhat larger for the subset of urban counties (22.5 jobs per each extra million dollar of bank-financed debt). I carry a number of robustness tests. Importantly, I show that the increase in bank financing following the relaxation of the financing constraints was not used as a substitute to offset a possibly declining tax base, which has instead been a source of concern in the transfer multiplier literature (Conley and Dupor (2013)).

This paper contributes to the recent literature on geographic cross-sectional multipliers (Suarez-Serrato and Wingender (2017), Chodorow-Reich et al. (2012), Dube et al. (2014), Feyrer and Sacerdote (2012), Wilson (2012), Shoag (2015), Dupor and McCrory (2018), Corbi et al. (2018), Nakamura and Steinsson (2018), Cohen, Coval, and Malloy (2011)). Many of the papers in this literature have studied transfers as a source of government spending, which has given rise to a substantial debate over the interpretation of their results. Ramey (2011) provides a simple but illustrative example of such debate: if the federal government transfers $1 to Mississippi and finances it by raising lump-sum taxes across all U.S. states, then, given a marginal propensity to consume of 0.6, the estimated cross-sectional multiplier (such as the one estimated in the recent literature) would be 1.5 (= mpc/(1-mpc)). However, the actual national multiplier would be zero. While this example is stark and there is an understanding that the presence of liquidity constraints might soften this conclusion, it still clarifies much of the limitations surrounding windfall or transfer cross-sectional multipliers. Clemens and Miran

(2011) also provide an insightful discussion on many of the open issues in this cross-sectional literature. My paper contributes to this literature by identifying a source of *internal* and *deficit*-financed spending: as the ultimate object of interest is the deficit-financed multiplier, the estimates in this paper are therefore more informative for fiscal intervention. Moreover, this is a particularly interesting form of deficit-financed spending since this debt is mainly financed through a specific intermediary, that is, through bank credit. One difference in the estimates is worth highlighting in particular. The results in this paper show that relaxing access to finance constraints through banks has no impact on government job creation. In contrast, the papers in the transfer multiplier literature find substantial employment effects in the government sector, sometimes even materially larger than the estimates for the private sector (Conley and Dupor (2013)). Critically, the recent literature has not devoted much attention to what the government actually purchases with the funds that become available. However how the money is put to use clearly affects the fiscal multiplier estimates. In particular, over one-hundred billion dollars of transfers studied in the literature were used to pay public servants' salaries and to avoid them being laid-off. Municipal bonds are instead used to finance public infrastructure, and their use of proceeds is clearly detailed in the issuance prospectus. Comparing cross-sectional multipliers should therefore take into account also the nature of the spending.

Within the geographic cross-sectional multiplier literature the paper closest to mine is Adelino et al. (2017). The cost per job estimate in this paper is about twice as large as the one obtained in Adelino et al., which reports a cost per job in the range of \$20,000 compared to \$44,500 in this paper. This paper and Adelino et al. analyze different sources of financing. Adelino et al. examine the impact of government spending when such spending is financed by households (*publicly placed debt*). This paper instead estimates the (open economy) fiscal multiplier when spending is financed by banks (*privately placed debt*). Specifically, Adelino et al. rely on variation arising from credit ratings upgrades of municipal bonds. Municipalities responding to ratings upgrades are large municipalities that raise financing predominantly through retail investors, who typically would use ratings to infer information on the issuers. On the contrary, municipalities that rely on bank financing are substantially less responsive to rating upgrades. In fact, for banks credit ratings of municipal bonds do not matter: even under Basel III, any general obligation bond receives a 20% risk weight, even when unrated or with a speculative rating. While caution should be used in directly comparing local estimates arising from different sources of variation, the results in this paper seem to suggest that the fiscal multiplier appears substantially smaller when the debt is financed by banks. This is in line with recent findings in the literature pointing to local public debt crowding out credit to private firms (Huang, Pagano and Panizza (2019)).

Finally, this paper is related to the literature on financial constraints and the impact of credit shocks on the real economy (Paravisini (2008), Chodorow-Reich (2014), Greenstone et al. (2014), Bentolila et al. (2017), Nguyen (2014), Almeida and Campello (2007), Mian and Sufi (2011, 2014), Mian, Sufi and Rao (2013)).

This paper is organized as follows. Section I describes the data used in the analysis. Section II discusses the bank-qualification and municipalities' borrowing constraints; it also provides a simple model of local governments' debt financing and discusses the bunching estimates. Section III covers the real effects of relaxing municipalities' access to finance constraints and provides the multiplier estimates. Section V concludes. The Appendix provides more robustness tests and further details on the municipal market institutional set-up.

I. Data

This paper relies on multiple sources of data. Municipal bond issuance data comes from Ipreo MuniIC. Ipreo is a leading provider of municipal bonds data. The MuniIC platform covers every municipal bond issued since the year 2000. The dataset contains information on the issuer, issue and bond-level size, the offering type and type of bid, the sale date, dated date and maturity date, as well as coupon value and coupon frequency, yield, and tic details, ratings from S&P, Moody and Fitch, information on the tax status of the bond and its bank-qualification, the full redemption call description (first and last call date, and type of call price, e.g. at par), refunding information, the use of funds description as extracted from the issue prospectus, details on the presence of insurance or credit enhancements, names and details of the obligor, financial advisor, bond counsel and paying agent, and finally details on the type of bond (e.g. general obligation, revenue, BAB, bank-qualified).

Data on banks' holdings and income statements comes from Call Reports. Aggregate holding statistics come from the Federal Reserve Flow of Funds. Employment data comes from the BLS QCEW; this is census data, it is collected under the Unemployment Insurance (UI) programs of the United States, and represents around 99.7% of civilian employment in the country. Population data comes from Census. House price data comes from the Federal Housing Finance Agency.

II. Bank Qualification and Municipalities' Access-to-Finance Constraints

A. *Institutional Setting*

Municipal bonds are the instrument through which States and local governments finance the nation's needs, such as infrastructure, education, health care, and public safety. In the years between 2000 and 2014, nearly two million bonds were issued. The municipal debt outstanding is worth about $3.7 trillion.

Over 93% of the bonds issued are exempt from federal taxation. The tax-exempt status was first established by the Revenue Act of 1913, in recognition of States' sovereignty and separation of powers.[1] Its tax-exempt status has historically made the municipal market a refuge asset class for high wealth individuals.[2] Retail investors hold about 70% of the market either directly or through funds and pass-through intermediaries. The remaining part of the market is held by banks and insurance companies.[3]

Not all types of investors benefit equally from the tax exemption. If a bank purchases a tax-exempt municipal bond, the bank cannot deduct the expense or interest incurred to acquire or carry such tax-exempt asset. Roughly speaking, what this means is that the bank *de facto* loses the tax-shield on the investment and has to pay federal taxes of an amount proportional to the value of the municipal bonds on its balance sheet (this is known as the pro-rata disallowance). This general provision offers an exception: any municipal issuer raising no more than $10M in a calendar year is able to designate its bonds as *bank-qualified*; when a bank purchases a bank-qualified tax-exempt municipal bond, the bank receives the full tax-exemption on the

[1] Selling a municipal bond in the secondary market however entails a taxation of capital gains, whose specific value depends on the bond's price and yield at issuance and maturity. When the bond is purchased at discount, the capital gain is taxable either as income tax (35%) or capital tax (15%). In determining which tax applies, the investor has to calculate whether the discount falls within a *de minimis* exemption: when the discount is low the capital tax applies, otherwise trading profits are taxed as income tax. When computing the discount the investor needs to take into account the price of the bond at issuance and the presence of any original issue discount.

[2] In fact, the top 0.5% of wealthiest individuals appear to hold over 40% of all (State and Local) municipal bonds outstanding (Bergstresser and Cohen (2015))

[3] There are other minor holders of municipal claims: corporations and the rest of the world. Corporations hold on average less than 0.6% of the municipal market, since they are subject to AMT, so do not benefit from the tax-exemption, making tax-exempt muni claims unattractive to them. Foreign investors also have historically constituted less than 1% of ownership. Foreign investors do not pay US taxes and therefore do not benefit from the tax-exemption either, hence they are not active in the tax-exempt muni market. Pension funds hold less than 0.1% of the market.

investment, i.e. the coupon payments are tax-exempt and the bank can deduct the interest expense incurred. This discontinuous tax treatment is unique to banks. Section A.II explains the details of the tax code for banks in the context of municipal bonds.

It is worth repeating that the issuance limit falls on the municipal issuer and not on the investor. That is, in order to obtain the *bank-qualified* status, the issuer must issue *in aggregate* a maximum of $10M within the calendar year. If a city issues anything over that limit, all of the bonds issued lose the bank-qualified status, not just the marginal ones.[4]

Additionally, a municipal issuer that has acquired the status of bank-qualified has the option to place (all or part of) the bonds with a bank, but is not under the obligation to do so. In fact, a local government would be free to place a qualified issuance with retail investors, for instance. Remember that non-bank investors receive the tax-exemption across the entire range of issuance. In practice, however, municipalities tend to place qualified bonds almost exclusively with banks. In other words, the discontinuous tax treatment is such that the municipal market is split in two segments – qualified and not-qualified –, with banks concentrating their holdings in the qualified segment, and holding almost the entirety of such segment. Figure (I) shows banks' holdings of municipal bonds across the segments: before the financial crisis, non-qualified municipal bonds made up less than 1% of banks' assets on average, compared to a figure of 3.5% for bank-qualified bonds.[5]Figure (II) reports the estimated bank-qualified bonds outstanding against banks' holdings of such bonds: banks also appear to hold the vast majority of the qualified segment (around 80%).[6]

With the financial crisis Congress raised the cutoff for the bank-qualified designation to $30M, covering a much larger portion of debt issuance (almost 90% of municipal issuers). This regulatory change went into effect in February 2009, but the extended bank-qualification provision reverted to the $10M threshold after December 31, 2010.

The temporary change in the tax code ignited a debate on the appropriateness of the

[4]Net of emergencies, such as natural calamities, municipalities would not tap the bond market more than once per year. The decision to raise financing is tied to the budget lay-out, moreover most general obligation bonds need voters approval before the book-building process can start. Hence municipalities would know at the beginning of the calendar year whether their issuance needs lay within the qualification limits.

[5]It is worth noting that municipal loans up until the financial crisis constituted a trivial amount. Bank loans to municipalities made less than 1% of total assets, similar to non-qualified holdings. This is in part a legal consequence of the Dillon rule. The loan market is however expanding post-crisis (Ivanov and Zimmermann (2019)), as reported by the SEC (https://www.sec.gov/news/press-release/2018-158).

[6]Data comes from the Flow of Fund. Bank-qualified bonds outstanding are estimated as reflecting the share of qualified bonds at issuance. The FOF data has been adjusted to account for the 2004 Federal Reserve's change in methodology (see Bergstresser and Orr (2014)).

value of the bank-qualification cap. Specifically, the Municipal Bond Market Support Act was introduced in the Senate in 2011, culminating in H.R. 2229, a bill introduced in the House in 2015 to permanently amend the Internal Revenue Code provision for bank-qualification limits. All attempts at change have however consistently been voted down, with the current cut-off still standing at $10M.

B. Are Banks Special? Evidence from Municipal Issuance

A municipality hence knows that when choosing its issue size, it is also choosing the type of investor: below $10M the municipality can place the bond with a bank, above $10M instead the issuer loses the access to bank financing (as explained in Section II.A). Above the qualification limit, a municipality would need to tap the broader municipal market, that is households (directly or through funds) and insurance companies.

A natural question to ask is therefore whether this ownership segmentation influences municipalities' bond issuance decision. If bank financing were to be equivalent to financing through mutual funds or households, local governments should not respond to the ownership discontinuity around the $10M threshold. It is worth highlighting that what is changing around the qualification limit is just the investor type, however all bonds, *both* below and above the $10M limit, are tax-exempt and *all* investors (albeit different ones) receive the tax-exemption[7]. Moreover the use of funds stays the same across qualified and non-qualified bonds. Then, the question becomes: is a dollar of privately financed debt equivalent to a dollar of publicly placed debt?

Figure III plots the distribution of issuers for the years 2000-2008, before the regulatory change. The x-axis reports the size of the debt issuance (within the calendar year) by local governments, broken down in $500k increments, while the y-axis reports the number of municipal issuers in each size bin. Given similar use of funds and given that the tax-exemption treatment holds across all issuance sizes, if local governments were indifferent between borrowing from a bank and borrowing from a non-bank investor, we should expect to see a smooth density. Instead, Figure III shows a large spike in the mass of issuers just below the qualification limit. This significant excess mass is accompanied by a sizable region of missing mass

[7]Below the $10M limit banks are present and they benefit from the tax exemption; above the limit HH, banks virtually disappear and mutual funds and insurance would be the largest players, and they all receive the tax-exemption.

to the right of the regulatory limit of \$10M.[8] To put it simply, municipalities bunch at the bank-qualification limit. Also note that the use of bank-financing is pervasive across local governments: the mass of bank-qualified issuance corresponds to just about 60% of all general obligation issuance across the 2000-2008 period. Across the same time period, 70% of local governments have accessed bank financing (through bank-qualified bonds) at least once.

As a side note, the issuance distribution also exhibits small spikes at round numbers. These round numbers are *not* associated with a discontinuity. Rounding is a known behavior also within corporate bonds, as issuers have a tendency to raise financing in round-number sizing, e.g. a city would issue a \$20M bond rather than a \$19.3M one. The bunching occurring at the \$10M discontinuity however largely overshadows any rounding behavior.[9]

Local governments' decision to bunch below the bank-qualification limit strongly suggests that bank financing is not equivalent to public financing (that is, financing through households and mutual funds), and that municipalities internalize that by passing the \$10M threshold they will lose access to the bank and prefer not to do so.

Figure IV plots the distribution of issuers for the years 2009-2010 corresponding to the period when the regulatory change was in place, that is when the bank-qualification limit was moved to \$30M. The excess mass at \$10M virtually vanishes during this period.[10] Section II.D formalizes these findings.

Municipalities' preference for bank financing could be driven by banks' ability to offer better pricing on the bonds. I check this in Figure V. The figure reports the average issuance spread around the qualifying limit, calculated as the municipal bond yield minus a maturity- and coupon-matched synthetic treasury:[11] average spreads on bank-qualified bonds appear around 10bp smaller than those on non-qualified issuances.[12]

[8]Figure III aggregates issuers across 2000-2008, however the same large bunching behavior appears if one plots the distribution for each year separately.

[9]In section II.D, the bunching estimation takes into account and nets out the rounding behavior.

[10]Interestingly, there appears to be no significant bunching at the \$30M cutoff. Partly this is simply because over 88% of municipalities regularly issue below the \$30M limit.

[11]Section A.IV details how to obtain the synthetic treasury. Issuance below \$10M are only bank-qualified tax-exempt bonds; above the policy cutoff are issuance not bank-qualified. All bonds are general obligations, this is so to compare the same type of bond with same public-purpose use of funds. In fact there can be issuances, both larger or smaller than \$10M, that are not entitled to qualification, e.g. a taxable issuance or a revenue issuance with a private-purpose. Such issuances are clearly excluded, as yields on taxable bonds and private-purpose funds are not comparable to tax-exempt public issuances. Issuances are pooled across the pre-crisis period, years 2000-2006.

[12]Before the crisis, municipal bonds traded at quoted yields (not adjusted for tax-exemption) below (pre-tax) treasuries, hence the negative spread. Banks' ability to offer lower yields is in part linked to the fact that in addition to offering tax-free income, qualified bonds allow banks to deduct interest expense in an amount

When considering the jump in the spread, it is worth to remark the following, however: the bunching response of municipalities at the bank-qualification limit implies a self-selection, this means that the yields offered on bonds issued by governments above the \$10M limit might not be a clean counterfactual for the issuance costs that the bunching municipalities would face on their own specific issuance. Another point worth highlighting is that placing a bond with a bank entails lower book-building costs than when tapping the general municipal market. Issuance costs include the underwriter discount, the advisor and bond counsels fees, as well rating agencies fees, all of which are reduced in the absence of an extended book-building process. The Government Finance Officers Association (GFOA) estimates these costs to be in the range of 25-40 bps.[13] As a back of the envelope calculation, each extra dollar of financing over the bank-qualification limit would entail an increase in borrowing costs in the range of \$200,000 to \$300,000.[14]

In sum, the bunching behavior of local governments around the \$10M limit is a strong evidence that municipalities are willing to limit, scale down or simply adjust their issuance decision, in order to be able to borrow from a bank. Borrowing costs appear to play a role in municipalities credit rationing at and below \$10M. However, while a notch in issuance costs exists around the bank-qualification cutoff, I do not take the stand that borrowing costs are the only driver of municipalities' strong preference for bank financing.

C. A Simple Model of Local Debt Financing

Section II.B provided prima facie evidence of municipalities' elasticity to bank financing. In next Section II.D, I formally estimate the behavioral response of local governments to the bank discontinuity. In order to guide intuition, in this Section I present a simple one period model of local debt financing. The model draws on the seminal work of Saez (2010) and Chetty et al. (2011).

Consider a myopic politician in municipality i who derives utility from maximizing government expenditures, while bearing a cost of debt issuance:

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proportional to the cost incurred to enter the tax-exempt position. See Section A.II for details.

[13] http://www.gfoa.org/bank-qualified-municipal-bonds-resource-center.

[14] Consider a 15 year \$10M bond at a 3.5% rate. At pre-crisis rates, the present value of a 20bps spread would be in the range of \$250k.

$$U_i(G, B) = G - \frac{\zeta_i}{1+\frac{1}{\alpha}} \left(\frac{B}{\zeta_i}\right)^{1+\frac{1}{\alpha}} \tag{1}$$

Local government expenditure is denoted by G, while the cost of issuing a bond of size B is represented by the second term, where ζ_i captures the financing needs of municipality i, and α is the elasticity of the cost of issuance. The larger the bond issuance the higher the cost of issuance; this cost can be broadly intended as book-building expenses, which increase with the size and complexity of the issue, or political costs of approving a large debt issuance, as well as reputational cost of incurring extensive debt.[15] The choice of a quasi-linear specification and the parametrization of the cost of issuance are motivated by tractability and by the attempt to remain close to the work of Saez (2010), albeit in a different context.

The politician faces the following budget constraint:

$$G = B + \Pi - rB \tag{2}$$

In words, local government expenses are sustained by bond issuance – net of end-of-period interest repayment, rB, – and taxes, Π. This set-up can be interpreted as a reduced form for a multi-period budget constraint where rB would show up next period. The amount of taxes levied in the period is assumed to be exogenous. While municipalities are not technically constrained by balanced budget provisions, there are statutory limits on tax hikes.[16] Moreover local government rely mainly on property taxes, and given the high degree of mobility and commuting, it is challenging for a single municipality to raise property taxes without driving out tax-payers.

From the F.O.C. for maximization of equation (1) subject to (2) we obtain the optimal bond supply:

$$B^S = \zeta_i(1 - r)^\alpha \tag{3}$$

that is, bond issuance depends on the debt needs of municipality i and on the equilibrium interest rate, r, with elasticity, α. Heterogeneity across municipalities is driven by the financing needs, ζ_i, which are assumed to be distributed smoothly and with density $f(\zeta)$.

[15] Majority voting is occasionally required before issuing a General Obligation bond.

[16] The National League of Cities reports that since the mid-1990s, irrespective of the economic cycle, and even during the financial crisis, the net percentage of city finance officers reporting increases in property taxes has been stable at around 15%, reflecting the challenges and limitations imposed by Statutes and voters on taxing authorities.

Demand is aggregated across two types of investors: households and banks.[17] Both households and banks have a simple demand function for local government bonds, specifically demand is linear in the after-tax interest rate. For households the return is tax-free, so the after-tax and the pre-tax interest rates coincide.

$$B^H = \beta\, r \tag{4}$$

On the contrary, bank demand is proportional to the taxation schedule they face: any bond of size smaller than B^* is subject to tax rate t, whereas a bond of size $B > B^*$ is taxed at rate $t + \Delta t$:

$$B^B = [1 - (t + \Delta t\, \mathbb{1}\{B > B^*\})]\, r \tag{5}$$

Equating bond demand and supply, the interest rate on the municipal bond issued solves:

$$\frac{(1-r)^\alpha}{r} = \frac{1 - t + \beta}{\zeta_i} \tag{6}$$

As ζ,α, and β are fixed parameters, this implies that when there is a jump in the taxation schedule of banks, which increases from t to $t + \Delta t$ on the entirety of the bond issue, then the interest rate on the bond increases. In other words, defining $t = t_0$, and $t_1 = (t_0 + \Delta t_0)\, \mathbb{1}\{B > B^*\}$, it follows that:

$$r(t_1) > r(t_0) \tag{7}$$

The budget constraint that the politician in municipality i faces (equation (2)), can then be rewritten as

$$G = \begin{cases} \Pi + B(1 - r(t_0)), & \text{if } B \leq B^* \\ \\ \Pi + B(1 - r(t_1)), & \text{otherwise} \end{cases} \tag{8}$$

The budget constraint thus exhibits a jump at B^*, as represented in Figure VI Panel A. When faced with the notch, the municipality that would have otherwise issued $B^* + \Delta B^*$, is indifferent between locating at B^I and B^*, and chooses to bunch at the threshold. Consider the case of quadratic issuance costs, then the distribution of debt issuance in the presence of a

[17] Since the primary focus of this model is to highlight bunching behavior coming from jumps in taxation schedules, I abstract from modeling the funding structure of a bank, and only focus on reduced form demand for municipal bonds.

notch, $H_1(B)$, is such that:

$$B = \begin{cases} \zeta_i(1-r(t_0)) & \text{if } \zeta_i < \frac{(1-t_0+\beta)B^*}{1-t_0+\beta-B^*} \\ B^* & \text{if } \zeta_i \in \left[\frac{(1-t_0+\beta)B^*}{1-t_0+\beta-B^*}, \frac{(1-t_1+\beta)B^*}{1-t_1+\beta-B^*}\right] \\ \zeta_i(1-r(t_1)) & \text{if } \zeta_i > \frac{(1-t_1+\beta)B^*}{1-t_1+\beta-B^*} \end{cases} \tag{9}$$

In words, under a smooth distribution of financing needs, ζ_i, aggregating across municipalities generates an excess mass at B^*, as well as a missing mass of municipalities to the immediate right of the qualification limit. Panel B in Figure VI shows the effect of the notch on the density of issuance, with the dotted line representing the counterfactual distribution, $h_0(B)$. The mass of municipalities bunching at the limit is therefore given by

$$D = \int_{B^*}^{B^*+\Delta B^*} h_0(B)dh \approx h_0(B^*)\Delta B^* \tag{10}$$

where the approximation follows from the assumption of a constant counterfactual distribution in the interval $[B^*, B^* + \Delta B^*]$. ΔB^* represents the quantity of interest, that is the behavioral response of municipalities generated by the bank-qualification rule.

The model can be extended along many dimensions, such as allowing for heterogeneity. The theoretical take-away remains valid also under the extensions: in such case, the mass of bunching municipalities would estimate the *average* response across marginal bunching cities associated with each elasticity and demand parameters.[18] In the framework of the extended model, this would be:

$$\int_\alpha \int_\beta \int_{B^*}^{B^*+\Delta B^*_{(\beta,\alpha)}} h_0(B)dh\, d\beta\, d\alpha \approx h_0(B^*)\mathbb{E}[\Delta B^*_{\alpha,\beta}]$$

It is important to note that the assumptions and simplifications presented in the model are not necessary for the empirical estimation of the behavioral response, but are only used to guide the theoretical discussion and intuition.[19] The empirical estimation leaves room for flexibility and robustness– I allow for curvature in the counterfactual density, as well as for the presence of salient points and reference numbers.

[18] Kleven and Waseem (2013) provide an in-depth theoretical discussion in the context of income tax notches.

[19] Moving from the bunching mass, ΔB^* – an empirical estimate– to *elasticities* estimates, α_i, does instead require model dependency. However this paper focuses on estimating the behavioral response, which is model free.

D. Bunching Estimation

In this Section, I start from the visual evidence presented in Section II.B and formally address the question: what would have been the distribution of municipal bond issuance if the bank discontinuity had not been present? In other words, if access to bank financing was not rationed at \$10M, what would be the density of local government borrowing? To answer this question, I need to be able to trace a counterfactual density. From that, I can estimate local governments' behavioral response to losing access to bank financing at the \$10M cut-off. To do so, I follow the methodology developed in Kleven and Waseem (2013).

Focusing on the pool of municipal bonds issued during the 2000-2008 period, that is before the regulatory change, I express issuance size (per calendar year) in logs and center the distribution around the 10M limit (in logs), B^*.[20] I group the normalized bond issuances in buckets centered at values b_j, where $j = -J, ..L, ..0, .., U, ..J$, and L and U index the limits of the excluded region around the notch. Defining n_j as the number of municipalities per bin, the estimation follows:

$$n_j = \sum_{i=0}^{p} \beta_i (b_j)^i + \sum_{k=L}^{U} \gamma_k \mathbb{1}\{b_k = b_j\} + \sum_{r \in R} \eta \mathbb{1}\{r \in R\} + e_j \tag{11}$$

The term b_j represents the average percentage distance (logs) within bucket j between the bond issuance size in bin j and the cut-off limit for bank-qualification. The first term in the regression is a p-order polynomial that fits the observed distribution in the data. The second term instead excludes the region $[b_L, b_U]$ around the notch, which is distorted by the bunching behavioral response. Finally, the third term fits fixed effects for a set of bond issuance sizes.[21]

The estimate of the counterfactual distribution is hence defined as the predicted bin counts $\hat{n}_j$ omitting the contribution of the dummies in the excluded region, but clearly not omitting

[20] I focus on tax-exempt General Obligation bonds and exclude Revenues, since many Revenue bonds are not allowed to be qualified regardless of their size (with only few exceptions, serving a public-purpose). For similar reasons, these bonds are not a good counterfactual for the no-notch density: these bonds are not backed by the full faith and credit of the government, and are repaid by a pre-specified stream of fees, hence their issuance distribution is substantially different from bonds that can be bank-qualified.

[21] From the observed distribution it is evident that municipalities have a tendency to have bond issuances of a round-number size, e.g. a county would issue a 20M bond rather than a 19.3M one. The rounding is evident at multiples of 5M, which are then used to constitute the set R. The bank-qualification threshold (\$10M) falls within the set R of multiples. This implies that estimating the counterfactual density without controlling for rounding, would overstate the behavioral response at the notch. The latter term in the specification hence serves the purpose of disentangling the behavioral response from the round-number bunching. This is possible since the other round numbers, $r \in R$, are not points of salience for regulatory purposes; in other words, they do not constitute a notch. Specifically, $R = \{\{5, 10\}, \{15, 20, 25, 30\}\}$.

the contribution of the round-number fixed effects:

$$\hat{n}_j = \sum_{i=0}^{p} \hat{\beta}_i (b_j)^i + \sum_{r \in R} \hat{\eta} \mathbb{1}\{r \in R\} \tag{12}$$

Excess bunching due to the bank-qualification notch is estimated as the difference between the observed and the counterfactual bin counts within the excluded range to the left of the cut-off:

$$\hat{D} = \sum_{j=L}^{0} (n_j - \hat{n}_j) = \sum_{j=L}^{0} \hat{\gamma}_j \tag{13}$$

It is possible to define an estimate of missing mass to the right of the limit as

$$\hat{M} = \sum_{j>0}^{U} (\hat{n}_j - n_j) = -\sum_{j>0}^{U} \hat{\gamma}_j. \tag{14}$$

The estimated excess and missing masses, $\hat{D}$ and $\hat{M}$, need not be identical: the policy might have had both intensive and extensive margin effects, that is it might have induced some municipalities to under-issue (intensive margin), but it might also have pushed some out of the market, preventing them to borrow (extensive margin). The estimate of the excess bunching, $\hat{D}$, provides the intensive margin response, in terms of the number of resized bonds, while the extensive margin effects are captured by the difference $\hat{M} - \hat{D}$.

The core quantity of interest is then ΔB^*, that is the behavioral response of the marginal bunching municipality measured as the percentage reduction in the municipal bond size given the bank-qualification policy limit. Following the theory, it is calculated as:

$$\Delta B^* = \frac{\hat{D}}{\hat{h}_0(B^*)} \tag{15}$$

with $\hat{h}_0(B^*) = \sum_{j=L}^{0} \hat{n}_j / |\frac{b_0 - b_L}{L}|$ being the counterfactual density of municipality-bond pair in the bunching region.

I calculate standard errors using the bootstrap procedure presented in Chetty et al (2011): I draw with replacement from the estimated errors from equation (11) and generate a new set of bin counts, which I use to re-estimate the bunching, and proceed by iteration. The standard errors are estimated as the standard deviation of the estimated parameter in the kiterations. I set k to 10,000. The preferred specification uses a 13-degree polynomial, although results are robust to different values of p. I set the bin width to 5%, corresponding to \$500k steps. Finally, the estimation requires to specify the limit of the exclusion region. I choose the limits to minimize the difference between the bunching mass and the missing mass, in line with Kleven and Waseem (2013). This is akin to estimating a specification where extensive margin responses are minimized. I consider this to be a reasonable specification, given that over 80% of municipalities consistently enjoy credit ratings higher than A-, making it unlikely for an issuer to be driven out of the market altogether. Specifically, I estimate (11) on a grid of all possible combinations of L and U, respectively in $[-J, ..j.., 0)$ and $(0, .., j, .., J]$; the limits of the excluded region are such that $|\hat{M} - \hat{D}|$ is minimized. I explore robustness to include the possibility of sizable extensive margin effects, which still returns very similar and significant estimates of ΔB^* as in the preferred specification.

E. *Bunching Results*

Before discussing the main results, I present evidence validating the counterfactual density estimated in Section II.D. The estimation described did not make use of data in the 2009-2010 range. In 2009-2010, the bank-qualification cutoff was moved to \$30M, *de facto* covering almost 90% of the issuers given the historical density. The distribution of issuance in this two-year window then provides a good placebo against which to check the estimated counterfactual density, albeit acknowledging the presence of potential time effects. In Figure VII, I plot the standardized distribution of issuers for the period before the regulation change (estimated) and after (observed). The two distributions are remarkably similar, providing evidence that the estimation in Section II.D correctly captured the distribution of municipal bond issuance had the bank-financing rationing at \$10M not been in place.

Having validated the counterfactual, I proceed to present the results of the estimation. Figures VIII and IX plot both the empirical and the counterfactual size distribution, respectively for the full sample, and zooming in around the \$10M cut-off. Figure IX also reports results of the estimation, along with bootstrapped standard errors in parentheses. The x-axis reports the muni bond issuance size, while the y-axis reports the number of municipalities in each bin.[22] Each bin represents a 5% incremental deviation from the cut-off, corresponding to \$500k steps. The dashed vertical lines indicate the region affected by bunching, indexed by b_L and b_U. The

[22] The term municipalities is used to refer to counties, parishes, boroughs, independent cities, special districts, school districts, and statistically equivalent areas or authorities.

observed distribution exhibits non-smooth mass at multiples of \$5M, in line with the idea that municipalities tend to issue bonds of round-number sizes. The fitted polynomial appears to do a good job of capturing no-notches spikes in the distribution. Bunching is especially sharp, even after accounting for round-number issuance. There is considerable excess mass to the left of the cutoff, and missing mass to the right of the threshold. In particular, the estimated behavioral response, ΔB^*, suggests that the average marginal bunching issuer reduces the size of its municipal bond issuance by 3.4 percent, in the presence of the policy limit on bank-qualification. Translating this behavioral response into an intensive margin estimate, $\hat{D}/\hat{N}^+$, implies that 29% of issuers that would have otherwise been to the right of the cut-off interval, have been shifted below the policy threshold. In other words, 29% of the local governments that would have raised funds for over \$10M, had they been allowed to get such financing from a bank, were induced to scale down their issuance at or below the qualification limit. Both estimates are significant at the one-percent level. The upper limit of the exclusion region, b_U, also provides an upper bound on the behavioral response of the affected issuers. It suggests that the largest affected municipality would have issued a bond roughly 28% larger had the limit on bank financing not existed.

These results are obtained under the scenario in which extensive margin responses are minimized. As explained in Section II.D, the limits of the exclusion region are chosen so as to minimize the mass of municipalities dropping out of the market as a result of the bank-qualification policy. As noted, I consider this to be a reasonable specification, given that over 80% of municipalities consistently enjoy credit ratings higher than A-. Additionally, the estimated counterfactual appears to track closely the actual distribution during the 2009-2010 period, when the threshold was moved to \$30M, which gives strong evidence in support of the validity of the estimation.

Table I presents a variety of robustness tests: I allow for the presence of extensive margins responses by varying the boundaries of the exclusion region, and I vary the degree of the polynomial. Across different specifications, the behavioral response, ΔB^*, remains robust around 3%, and significant.[23] One might wonder whether municipalities by-pass the \$10M limit by deciding to delay investment and split their bond issuance across the years. In that case the probability of issuing bonds again at $t + 1$ should be higher for municipalities who appeared

[23] While one may think that a government adjusting its issuance size to the bank-qualification limit would just scale down to exactly \$10M, in practice reducing the funds raised means foregoing a part of a project or scaling down, which entails an integer problem. Given this, it is reasonable that the affected municipalities are not only bunching exactly at \$10M, but rather in a small interval below and at the bank limit.

in the bunching region at time t than for those who were far below the \$10M constraint.[24] In other words, municipalities in the constrained region (i.e. the bunching area) should be more likely to raise funds again the year after having hit the bank qualification limit, if they were trying to by-pass the law. I do not find evidence of that happening: conditional on having issued at time t, 35.5% of *non*-bunching municipalities issue again at time $t+1$, compared to 34.7% of issuers that were bunching at time t.[25] Another concern might be that municipalities might be maxing out their credit line. That is, a government that needs financing for, say, \$6M, would rather issue a \$10M bond and store the remaining funds for the next available project. If that happens, there could be bunching both from the right (for simplicity, call it the under-issuing governments), and from the left (for simplicity, the maxing-out governments). This is unlikely to happen since governments are tied by law to spending rules, that is 100% of the bond proceeds need to be spent within two or three years, with clearly set spending milestones. Failure to meet any of the spending tests, subjects the government to a penalty fee, that is a transfer to the federal government proportional to the spending gap. Also note that under the IRS Tax Code, the use of funds of municipal bonds is generally restricted to capital expenditures (i.e. building infrastructure), and cannot be used to finance working capital or operating expenditures. Hence a government would not be able to use the excess funds to meet its operating budget. And finally, as shown, it is reassuring that the estimated counterfactual does closely track the observed distribution during the period when the bank-financing limit was relaxed.

III. Relaxing Access to Bank-Financing Constraints

A. *Identification Strategy*

As shown in Section II.B and Section II.E, the municipal market is heavily segmented, with banks dominating the qualified portion of the market, making up around 60% of all general obligation issuance. Additionally, given the constraints on bank financing, a large mass of local governments are willing to adjust and scale down their issuance so not to lose access to bank

[24]Specifically, the non-bunching municipalities are the *qualified* issuers that have never issued in the constrained region.

[25]While this evidence strongly suggests that governments are not trying to by-pass the law, I do not claim that I can completely rule out the possibility that some municipalities might occasionally split their issuances across years. However, to the extent that this might occasionally happen, it would actually go against me finding a result, when investigating the effect of relaxing the bank financing constraint.

financing.

The bank-qualification discontinuity hence provides an interesting setting to study the value of relaxing financial constraints for a government. While surely these are *local* governments and while of course the Federal government does matter, it is worth noting that the actual organizational structure of the government is pyramid-like, with sub-national governments being a large and legally independent building block.[26] Local governments alone constitute a substantial portion of the overall spending in the US; in fact local (non-State) spending is on average just over 40% the size of Federal spending each year.

The qualification policy also provides a unique setting where the holder of the government debt is known and is a bank lender. This gives the opportunity to compare the marginal value of one dollar of bank financed debt versus one dollar of publicly placed debt or transfer money. As a matter of fact, not only how the spending is financed, but also who finances the spending should matter. Specifically, the recent literature has been debating whether the value of a marginal dollar of government spending is the same whether that dollar is deficit-financed or transfer-financed. Yet, even when the spending is deficit financed, from whom the government is borrowing, i.e. the source of financing, should matter – whether that is a bank or a wealthy household.[27] A privately placed dollar (with a bank) need not be equivalent to a publicly placed dollar (with the high-net worth individuals). This is particularly true if one considers the role of a bank in (re-) allocating resources.[28]

To address these questions and estimate the value of a marginal dollar of privately placed debt, I rely on a shock to the bank-qualification provision. On February 2009 Section 265 of the Internal Revenue Code of 1986 was amended to allow for a temporary increase in the bank-qualification threshold – specifically, the limit on bank-financing was moved from $10 million to $30 million per year. The amended provision was intended to last (and did in fact last) for a temporary period of two years.

Recall that the bank-financing limit applies to every local government, irrespective of its budget or population size. In other words, the $10M (before 2009) and $30M limit (after 2009), apply equally and in absolute terms to any issuer. This means that while this law

[26]Sub-national governments are given substantial independence in the US. This is a product of the history of the formation of the federal government and is embedded in the 10th amendment of the Constitution.

[27]As mentioned, the households buying municipal bonds are for the most part those in the top 0.5% of the wealth distribution (Bergstresser et al. (2016))

[28]Particularly, in a different way than when financing through high-net worth individuals, when relying on banks government debt might potentially crowd out bank credit to households. This plausibly affects the value of a marginal dollar of government spending.

change applies to every municipality, *de facto* this shock affects issuers differently. Following the results in Section II.D, municipalities can be grouped into four regions *pre-shock* (Figure X): municipalities whose financing needs were well below the $10M limit (*region (1)*); municipalities whose financing needs were up against the bank financing constraint (*region (2)*, i.e. the bunching interval); municipalities that were able and willing to issue non-qualified bonds for a value higher than $10M and lower than $30M (*region (3)*); and finally municipalities whose issuance needs go past $30M (*region (4)*).

Focus on region (1) and region (2). Municipalities in region 1 had the extra slack to raise additional financing with the banks, but chose not to do so. Municipalities in region 2 on the contrary were running up against the constraint, and could not borrow any more funds. Those are the municipalities in the bunching region. This implies that for local governments in region 1, the regulatory change is moving a non-binding constraint to a further away non-binding constraint. For municipalities in region (2) instead, the shock is relaxing a financing constraint.

I can therefore exploit the heterogeneity across municipalities to estimate the value of an extra dollar of bank-financed debt. And I can do it at the following condition: specifically this is valid as long as sorting municipalities along their distance to the constraint does *not* imply sorting them on characteristics. Put simply, the two groups of municipalities should be on similar economic trends.[29]

A.1. Specification

I exploit the cross-sectional heterogeneity across municipalities to estimate a 2SLS, where the first stage is the impact of the regulatory shock on local governments' bank-financed issuance, and the second stage estimates the effect of a marginal dollar of (instrumented) bank-financed debt on local employment and wages. As explained above, the cross-sectional heterogeneity comes from the differential impact that the regulatory shock had on municipalities across issuance regions. The treated municipalities are defined as the bank-financed local governments that have bunched (region (2)) at least once in the five years preceding the policy change. The control municipalities are defined as those governments who have *never* been bunching and whose average issuance in the pre-treatment period falls below the bunching region, i.e.

[29] I focus on region 1 and region 2, rather than looking at region 3 municipalities, for a very similar reason, as I want to compare municipalities that both have a revealed preference for bank financing and whose source of financing is the same. In this way I can isolate the value of an extra dollar of bank-financed debt, rather than picking up endogenous differences between two groups of municipalities.

governments that belong to region (1).[30] I estimate the following 2SLS:

$$Issuance_{i,t} = b_1 Intensity_i * Post_t + b_2 X_{i,t} + a_i + a_{size,t} + e_{i,t} \tag{16}$$

$$Y_{i,t} = \beta_1 \widehat{Issuance}_{i,t} + \beta_2 X_{i,t} + a_i + a_{size,t} + \xi_{i,t} \tag{17}$$

The effects on employment and on wages are estimated at the county level, therefore the unit of observation i is the county. The aggregation at the county level is needed because an extra dollar of spending likely has spillover effects in the neighboring areas, with the spending leakage being larger the smaller the municipality is. A municipality can in fact be thought of as a small open economy, therefore the impact of an extra dollar of spending will be affected by expenditure switching as well as by migration forces. Forcing the impact of government spending to be circumscribed within the boundaries of a town is therefore likely to result in uninformative estimates. Employment data are also available at the county-level. For these reasons, I aggregate municipalities at the county level. $Intensity$ is therefore the fraction of treated municipalities in a county, where treated is defined as in the preceding paragraph. It follows that the treated counties are those counties where there exists at least one bunching issuer, $Intensity > 0$. The control counties are those where $Intensity$ takes value zero. $Issuance$ is the aggregate bank-financed debt raised by region (1) and region (2)-type municipalities in each county. I focus on counties where at least one (treated or control) government has issued bonds at any given year. I address possible concerns with aggregation in Section III.C.

The time window considered is 2004 to 2010. The variable $Post$ takes value of one during the regulatory change (2009-2010), and zero otherwise.[31] I include county fixed effects, a_i. In some specifications I also include county-size decile per year fixed effects, $a_{size,t}$. The dummies $Intensity$ and $Post$ are subsumed by respectively the county fixed effects and the size-by-year fixed effects. In the specifications where I do not include the size-by-year f.e., $Post$ is not absorbed and will be present in the regressions. $X_{i,t}$ represents a set of extra controls, that is the HPI and the number of households in the county. The instrument for bank-financed debt is given by $Intensity_i * Post_t$. I cluster standard errors at the county level. The tables in

[30] Recall the bunching region is the area to the left of the \$10M limit (with the \$10M limit included) that is affected by the bank-financing discontinuity. The lower boundary of the bunching region , b_L, is obtained following the methodology in Section II.D and Section II.E. Specifically, the lower boundary b_L comes from Table I column (3), as the most conservative specification. Results are qualitatively unchanged if I further partition the bank-qualified local governments into three regions, and exclude the "buffer region" between the treated and control municipalities.

[31] The law change was first proposed in January 2009 and officially passed in February 2009.

the main paper report the estimation from the 2SLS; the reduced-form estimates are instead reported in the Appendix. Figure A2 shows the map of bunching issuers across the US.

The validity of the estimation rests on the assumption that sorting municipalities in region (1) and region (2), that is sorting them along their distance to the constraint, is *not* akin to sorting them along a differential economic trajectory, so that the assignment can generate a variation that is, plausibly, as good as random. To check the plausibility of this, I look at the pre-treatment economic trends as well as local governments' budgets, both at the issuer and the the county-aggregate level. I first hand match issuers to the Census of States and local governments. All local governments are present during census years, while only a small subset is sampled for the survey in non-census years. Smaller municipalities are sampled at a much smaller frequency. For this reason, when inspecting government finances I focus on the latest census year before the regulatory shock in 2007. Table II shows local governments' budgets across bunching (region (2)) and non-bunching (region (1)) municipalities, both in level and in per capita terms. Treated municipalities are larger than the control ones. However, their budget per-capita are both economically and statistically comparable. In particular, both groups appear to rely equally on property taxes as their major source of tax revenues, and importantly, there appears to be no economic or statistical difference in the amount of inter-governmental transfers they receive per-citizen from the State or Federal government.[32]

I then inspect the pre-treatment economic trajectory across the two groups in Table III. I show results for all counties, as well as just for the subset of urban counties, defined as those with at least 25,000 inhabitants. The two sets of counties appear to follow similar economic paths in terms of both employment and wages. Given the reliance of property taxes, I also look at house prices, which again appear both statistically and economically comparable. I then investigate whether their ability to raise bank financing differed in the pre-treatment period: I inspect the growth in their issuance, and the underlying ratings and average spreads of the bonds issued, where the spreads are calculated against a maturity- and coupon-matched synthetic treasury.[33]

Table II and Table III provide supportive evidence in favor of the validity of the identification assumption. The bunching municipalities appear to be running up against the bank-financing constraint due to their size – recall that the bank-financing limit applies in level (i.e. $10M) to every local government, irrespective of its budget or population size. However the two groups appear to be following a similar economic trajectory.

[32] I address transfers in detail in Section III.C.

[33] Section A.IV details how to obtain the synthetic treasury.

B. Results

Figure XI shows the aggregate bank-financed debt raised across treated and control counties as at the end of the calendar year. The figure shows that the two groups of counties exhibited a similar trajectory in their bond issuance before the regulatory change, however the qualified issuance in the treated counties spikes during 2009 and 2010.

Table IV reports the results from the first stage regression, as in Equation 16, and formalizes the evidence in the figure. From column (1), relaxing the bank-financing constraints generated an increase in the issuance of bank-qualified bonds in the constrained counties compared to the control group for a value of \$3.7M for one standard deviation increase in the fraction of bunching municipalities in the county ($Intensity$). The effect is both economically and statistically significant, and is robust across specifications, both in the panel including all counties as well as for the subset of urban counties. Table A1 in the Appendix additionally reports results using the log of issuance: from column (1), relaxing limits on bank-financing leads to an average increase of 7.3% in the qualified issuance of treated relative to control counties for a one standard deviation increase in $Intensity$. It is worth noting here that since the change in regulation was only for a period of two years, this might have led governments to, loosely speaking, over-react, so to use the window of opportunity given by the amended regulation.

Table V and Table VI report the results for the 2SLS for employment and wages respectively. The dependent variables are expressed in logs, so the estimated coefficient is an elasticity. $Issuance$ is the instrumented bank-financed debt flow, as explained in Section III.A.1. The F-stat are large and confirm that the first stage is strong. The 2SLS results show that one marginal million dollar of bank financing generates (or saves) 14.7 jobs across all sectors. The effects are somewhat larger for the subset of urban counties (22.5 jobs per each extra million dollar of bank-financed debt). The employment multiplier is obtained transforming the estimated elasticity (the coefficient in column (1) Table V) into number of jobs by multiplying the elasticity for the average ratio of employment to government debt in the county. The employment effect comes entirely from the private sector (14.3 jobs), while I find no impact on government employment. The null impact on government employment is in some ways reassuring: municipal bonds shall be used to finance infrastructure and the funds are not intended to pay public-sector employees' wages.[34] This hence gives some reassurance both on the specification and on the fact that the

[34] Specifically, after raising funds, municipalities tender the project to one or multiple private companies that act in the capacity of contractors and provide the design, engineering, construction and overall execution of the project.

proceeds from issuance are not fungible.

The impact on total wages is obtained multiplying the estimated coefficient by the average ratio of total wages to government debt. For the set of urban counties this implies a wage bill multiplier of 0.8. The job multiplier implies a cost per job of $44,500 ($1M/22.5). Combining the cost per job with the wage bill multiplier implies a compensation of $35,600 (=0.8*$44,500).[35]

Table A2 in the Appendix reports results for the reduced form estimation. For the subset of urban counties, a one standard deviation increase in the fraction of affected municipalities within a county raises local government employment and wages by about 0.7% (Column (1) and Column (5) for employment and wages respectively). Before providing a discussion of the results and their interpretation, I first show in the next Section III.C that these results are robust to addressing possible concerns with the identification.

C. *Robustness*

As detailed in Section III.A.1, the endogenous variable in the specifications is the bank-financed debt raised by bunching and non-bunching municipalities, aggregated at the county level. Focusing on the bank-qualified debt as endogenous variable is key for the interpretation of the results and the bank channel. The aggregation at the county level, however, might give rise to a possible concern. Remember there are broadly three types of local governments, classified as before the change in regulation: the ones that raise financing through banks, which in turn can be split into bunching (treated) and non-bunching (controls), and those municipalities who issue non-qualified bonds, that is bonds that are placed with non bank investors (other cities). If spending by *other cities* were to be correlated with the instrument, I would mis-estimate the coefficient on the bank financed debt. This is not the case, however. Regressing the total issuance of the other cities on the instrument (Table VII) shows that the two are uncorrelated. This is reasonable given the nature of the regulatory shock.

Another possible concern might be that municipalities used bonds as a substitute for declining taxes. If the treated municipalities were experiencing a deteriorating tax collection and as a result increased their bond financing to offset the decline in taxes, then the specification would

[35] One can compare the estimated remuneration of the jobs created/saved by the extra dollar of bank-financed debt with the average compensation in the industry. At the end of 2010, the total employee compensation (including wages and benefits, such as insurance) amounted to $27.75 per hour; at an average of 34-hours of work per week in the private industry and a 52-week work year, the annual cost per employee to a private employer was $49,000. This implies an output multiplier less than one.

mis-estimate the government spending stimulus component. Figure XII shows that this was not the case. The figure shows the growth of total taxes for treated and control municipalities, measured as the log difference in total taxes with respect to the base year 2004. The figure covers the subset of local governments that are sampled every year (outside Census years) in the annual survey of State and local government finances.[36] The growth in local tax revenues is remarkably similar across treated and control municipalities; moreover, local taxes actually increased during 2009-2010, indicating that bond financing was *not* used to offset declining tax revenues. This is explained by the nature of tax revenues for local governments: over 80% of tax revenue for local governments comes from property taxes. Property tax collection is based on lagged property assessment values (up to a 10-year lag). This means that in the 2009-2010 period, tax collection was reflecting the increased property values from the housing boom, which hence allowed municipalities to sustain high tax revenues.

A related concern might arise with inter-governmental transfers. If the two sets of treated and control counties are sorting on a different trajectory of federal or state transfers, then I would be mis-estimating the coefficient of interest. This seems unlikely given the evidence just presented in Figure XII. In addition, Table II shows that in per-capita terms, as of 2007, the two set of counties appear to receive the same amount of Federal and State transfers. To further address this concern, Figure XIII shows the pattern of aggregate federal transfers in the post-treatment period across treated and control counties. Data is only available from 2010.[37] While Figure XIII does not constitute a formal test, the combined evidence does seem to suggest that the treated and control counties are not sorting along transfers.

A final note regards the use of issuance, rather than expenditures, of local governments in the specifications. As mentioned, focusing on the bank-financed debt is important for the interpretation of results. However, also note that for any practical purpose, issuance and capital expenditures would be observationally equivalent given the accounting practices in place. In fact, municipalities report aggregate issuance as capital expenditure in its entirety at the moment of issuance, regardless of when the spending actually takes place.

[36]The entire set of local governments is present only during Census years. Outside Census years, only a sample of local governments is surveyed. There are 911 control municipalities, and 309 treated municipalities, that are present every year in the 2004-2010 time window.

[37]I thank Bill Dupor for sharing the county-level ARRA Federal transfer data.

IV. Discussion

Most of the estimates on fiscal multipliers in the recent literature have relied on *windfall* spending as a source of plausibly exogenous regional variation across U.S. states and sub-regions. Chodorow-Reich et al. (2012), Dube et al. (2014), Conley and Dupor (2013), Dupor and McCrory (2017), Feyrer and Sacerdote (2012), and Wilson (2012), used variation in allocation of federal aid spending across U.S. regions to estimate a geographical open-economy multiplier. Shoag (2015) relied on variation arising from windfall money from states' defined-benefit pension plans; Suarez-Serrato and Wingender (2017) looked at federal spending revisions due to errors in population estimates. Windfall spending however is an *external* source of public finance. And external sources of public finance can differ substantially from *internal*-based spending, as they do not affect the future stream of taxes.

In this paper, I am able to analyze a source of *internal* and *deficit*-financed spending, and I am therefore able to provide estimates that are more informative for fiscal intervention. Moreover, this is a particularly interesting form of deficit-financed spending since this debt is mainly financed through a specific intermediary, that is, through bank credit.[38] The fiscal multiplier estimated in this paper is broadly consistent with the more conservative estimates (that is, higher cost per job) in the transfer literature. However, the employment creation is markedly different. In fact, the results in this paper show that relaxing access to finance constraints through banks has no impact on government job creation. In contrast, the papers in the transfer multiplier literature find substantial employment effects in the government sector, sometimes even materially larger than the estimates for the private sector (Conley and Dupor (2013)). Critically, the recent literature has not devoted much attention to what the government actually purchases with the funds that become available. However how the money is put to use clearly affects the type of employment created (or saved). [39]

[38]One can argue that extending the bank qualification also implies a cost to the federal government. As per Section A.II, extending the bank-qualification implies extending the ability of banks to deduct interest expense, which results in lower taxable base for the federal government. The interest expense is a function of the fed funds rates; the latter being virtually zero for the period of the extended bank-qualification, the cost to the federal government should plausibly be low. It is nonetheless possible to do a back of the envelope calculation to estimate the cost to the federal government to generate a job, to be added to the local cost per job. Given low secondary market trading, a muni bond remains on a bank's balance sheet plausibly till maturity or call. To estimate the portion of taxes shielded, one needs an estimate of the future expected interest expense of the bank for the lifetime of a bond. Since banks hold a small fraction of non-qualified munis, I use the spread between yields on qualified and non-qualified similar bonds (given maturity, rating and type) as a measure of compensation for the expected future stream of taxes. This quantity can be intended as the shadow cost to the federal government in terms of foregone taxation. I estimate the federal cost to be less than $10k for each $1M spent by the local government, implying a negligible federal cost per job.

[39]In particular, over one-hundred billion dollars of transfers studied in the literature were used to pay public

The cost per job estimate in this paper is larger than the one reported in Adelino et al. (2017), which estimates a cost per job in the range of $20,000 compared to $44,500 in this paper. Adelino et al. examine the impact of government spending when such spending is financed by households (*publicly placed debt*). This paper instead estimates the (open economy) fiscal multiplier when spending is financed by banks (*privately placed debt*). Specifically, Adelino et al. rely on variation arising from credit ratings upgrades of municipal bonds. Municipalities responding to ratings upgrades are municipalities that raise financing largely through retail investors, who typically would use ratings to infer information on the issuers. On the contrary, municipalities that rely on bank financing are substantially less responsive to rating upgrades. In fact, credit ratings of municipal bonds do not matter for banks: even under Basel III, any general obligation bond receives a 20% risk weight, even when unrated or with a speculative rating. While caution should be used in directly comparing local estimates arising from different sources of variation, the results in this paper seem to suggest that the fiscal multiplier appears substantially smaller when the debt is financed by banks. This is in line with recent findings in the literature pointing to local public debt crowding out credit to private firms (Huang, Pagano and Panizza (2019)).

V. Conclusion

In this paper I show that the municipal bond market can provide a particularly useful setting to address the debate on cross-sectional multipliers. I start by documenting the presence of a tax code discontinuity in banks' treatment of municipal bonds – the *bank qualification*. I show that the taxation discontinuity generates market segmentation: banks' purchases of municipal bonds are concentrated and are 10 times larger in the qualified segment where tax privileges are the highest. I show that local governments have a preference for bank investors and that a sizable mass of municipalities are willing to scale down their debt issuance in order not to lose the access to bank financing.

I then exploit a regulatory change in the tax code to estimate the value of a marginal dollar of privately placed debt (i.e. debt placed with a bank). I find that every million dollars of extra bank-financed spending generated around 14 jobs per year in the private sector, while there was no impact on job creation for public servants. The employment multiplier implies a cost

servants' salaries and to avoid them being laid-off. Municipal bonds are instead used to finance public infrastructure, and their use of proceeds is clearly detailed in the issuance prospectus. Comparing cross-sectional multipliers should therefore take into account also the nature of the spending.

per job of $44,500, while the estimated wage bill multiplier is 0.8.

The findings in this paper suggest that a dollar of privately placed debt might not be equivalent to a dollar of publicly placed debt. Specifically, the impact of fiscal policy appears smaller when the spending is financed by a bank. These results are consistent with a credit reallocation channel for banks and with public debt crowding out credit to private firms. The strong preference of local mayors for bank financing at the expense of credit to private firms suggests the presence of potential political economy frictions in the municipal bond market. I leave this topic to future research.

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Table I: BUNCHING

This table reports the results of the bunching estimation. Reported in the table are: the behavioral response (ΔB^*), the intensive margin effect (D/N^+), the extensive margin effect ($(\hat{M} - \hat{D})/\hat{N}^+$), the lower and upper limits of the affected issuance region, and the polynomial specification, p. Bootstrapped standard errors in parenthesis.

	(1)	(2)	(3)	(4)	(5)
Behavioral Response (ΔB^*)	0.0338	0.0330	0.0275	0.0264	0.0367
	(0.0028)	(0.0028)	(0.0025)	(0.0025)	(0.0024)
Intensive Margin Effect ($\hat{D}/\hat{N}^+$)	0.2565	0.2272	0.2006	0.1797	0.1917
	(0.0160)	(0.0143)	(0.0135)	(0.0127)	(0.0098)
Extensive Margin Effect ($(\hat{M} - \hat{D})/\hat{N}^+$)	0.0308	0.0596	0.0156	0.0649	0.0083
	(0.0160)	(0.0085)	(0.0135)	(0.0127)	(0.0098)
Exclusion Limits ($M)	(9,14.5)	(9,15)	(8.5,17.5)	(8.5,18)	(9,17)
Polynomial	p=13	p=13	p=13	p=13	p=6

Table II: PRE-TREATMENT MUNICIPAL BUDGET CHARACTERISTICS

This table shows the local governments' budgets for treated (bank-financed, bunching) and control (bank-financed, non-bunching) municipalities, as of the 2007 Census. Values are in thousands of dollars. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

Treated						
	N	*mean*	*sd*	*p25*	*p50*	*p75*
Total Revenue	1354	44352.61	46651.81	16330	29579	56862
Total Taxes	1351	18970.94	21974.23	5343	11803	24441
Property Tax	1347	15705.15	19475.14	3851	9003	19826
Property Tax (% Tot tax)	1347	0.82	0.25	1	1	1
Inter-Gvt Revenue	1347	16293.02	22605.02	3974	10016	18813
Per-Capita						
Total Revenue	607	1.810	1.535	0.858	1.322	2.285
Total Taxes	607	0.760	0.786	0.340	0.517	0.786
Property Tax	603	0.540	0.711	0.158	0.303	0.539
Inter-Gvt Revenue	600	0.349	0.465	0.095	0.198	0.409

Controls						
	N	*mean*	*sd*	*p25*	*p50*	*p75*
Total Revenue	6611	17838.48	29956.40	3841	9325	20408
Total Taxes	6587	6573.88	10931.89	1041	2979	7458
Property Tax	6547	5179.15	9244.04	711	2176	5708
Property Tax (% Tot tax)	6547	0.81	0.26	1	1	1
Inter-Gvt Revenue	6556	6525.78	12403.59	657	2592	7490
Per-Capita						
Total Revenue	4126	1.658	5.871	0.710	1.169	1.891
Total Taxes	4123	0.656	3.732	0.246	0.393	0.611
Property Tax	4083	0.459	2.109	0.132	0.248	0.421
Inter-Gvt Revenue	4071	0.324	1.826	0.091	0.182	0.341

	Difference (s.e.)
	Treat minus Control
Total Revenue	26514.13*** (1456.7)
Total Taxes	12397.06*** (837.3)
Property Tax	10526 *** (759.6)
Property Tax (% Tot tax)	0.01 (0.01)
Inter-Gvt Revenue	9767.24*** (712.6)
Per-Capita	
Total Revenue	0.152 (0.124)
Total Taxes	0.104 (0.076)
Property Tax	0.081 (0.057)
Inter-Gvt Revenue	0.025 (0.038)

Table III: PRE-TREATMENT TRENDS

This table shows the pre-trends for treated ($Intensity > 0$) and control ($Intensity = 0$) counties, for the period 2004-2008. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

	All				**Urban**			
	Treated	**Control**	**Difference (s.e.)**	**Obs.**	**Treated**	**Control**	**Difference (s.e.)**	**Obs.**
Total Employment (growth)	0.006	0.004	0.002	2016	0.007	0.004	0.002	1756
			(0.002)				(0.002)	
Private Employment (growth)	0.006	0.004	0.002	2006	0.006	0.004	0.001	1750
			(0.002)				(0.002)	
Gvt Employment (growth)	0.011	0.006	0.005**	2006	0.012	0.005	0.006***	1750
			(0.002)				(0.002)	
Total wages (growth)	0.044	0.044	0.000	2016	0.045	0.043	0.001	1756
			(0.002)				(0.003)	
Private wages (growth)	0.044	0.046	-0.001	2007	0.045	0.045	0.000	1750
			(0.003)				(0.003)	
Gvt wages (growth)	0.044	0.042	0.002	2007	0.044	0.039	0.005	1750
			(0.003)				(0.002)	
Issuance (growth)	0.000	0.002	-0.002	2016	0.004	0.007	-0.003	1756
			(0.027)				(0.033)	
HPI (growth)	0.027	0.026	0.002	1668	0.028	0.028	0.000	1508
			(0.002)				(0.003)	
Ratings	12.538	12.319	0.218	69891	12.540	12.443	0.097	67699
			(0.221)				(0.230)	
Spreads (%, no tax adj)	-0.493	-0.486	-0.007	117764	-0.494	-0.534	0.041	112170
			(0.033)				(0.034)	

Table IV: FIRST STAGE: ISSUANCE

This Table reports first stage results from the 2SLS specification in Eq. 16. *Intensity* is the fraction of bunching municipalities in a county. *Post* takes value of one during the regulatory change (2009-2010), and zero otherwise (2004-2008). *Issuance* is the bank-financed debt raised in a county each year. *Issuance* is instrumented using $Intensity_i \, x \, Post_t$. Extra controls include HPI and number of households. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

First Stage - Issuance

	All				Urban			
Intensity x Post	32.446***	33.430***	25.515***	24.701***	31.992***	32.565***	26.549***	25.078***
	(7.318)	(7.642)	(6.794)	(7.009)	(7.940)	(8.275)	(7.406)	(7.598)
Post	2.167***	2.535***			2.618***	3.117		
	(0.763)	(0.8158)			(0.954)	(1.018)		
Extra Controls	No	Yes	No	Yes	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Decile by Year FE	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.054	0.057	0.105	0.115	0.060	0.060	0.111	0.123
Observations	3,528	3,180	3,528	3,180	3,073	2,825	3,073	2,825
Counties	504	504	504	504	439	439	439	439

Table V: SECOND STAGE: EMPLOYMENT

This Table reports second stage results from the 2SLS specification in Eq. 16. The dependent variable is the log of employment. *Intensity* is the fraction of bunching municipalities in a county. *Post* takes value of one during the regulatory change (2009-2010), and zero otherwise (2004-2008). *Issuance* is the instrumented bank-financed debt raised in a county each year. Extra controls include HPI and number of households. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

2SLS												
All Counties	Employment (all)				Private Employment				Government Employment			
Issuance	0.14813*	0.130*	0.2157**	0.170*	0.176**	0.157*	0.252**	0.200*	0.127*	0.101	0.138	0.108
	(0.0785)	(0.0725)	(0.099)	(0.092)	(0.087)	(0.087)	(0.111)	(0.103)	(0.074)	(0.065)	(0.095)	(0.085)
Extra Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Decile by Year FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
F-stat first stage	19.66	19.13	14.10	12.42	19.59	19.08	14.19	12.50	19.59	19.08	14.19	12.50
Observations	3,528	3,180	3,528	3,180	3,515	3,169	3,515	3,169	3,515	3,169	3,515	3,169
Counties	504	504	504	504	503	503	503	503	503	503	503	503

2SLS												
Urban Counties	Employment (all)				Private Employment				Government Employment			
Issuance	0.207**	0.165**	0.225**	0.183*	0.239**	0.196**	0.256**	0.208*	0.155*	0.117*	0.152	0.125
	(0.089)	(0.082)	(0.104)	(0.098)	(0.098)	(0.090)	(0.115)	(0.109)	(0.081)	(0.071)	(0.100)	(0.093)
Extra Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Decile by Year FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
F-stat first stage	16.23	15.48	12.85	10.89	16.23	15.47	12.94	10.97	16.23	15.47	12.94	10.97
Observations	3,073	2,825	3,073	2,825	3,064	2,816	3,064	2,816	3,064	2,816	3,064	2,816
Counties	439	439	439	439	438	438	438	438	438	438	438	438

Table VI: SECOND STAGE: WAGES

This Table reports second stage results from the 2SLS specification in Eq. 16. The dependent variable is the log of wages. *Intensity* is the fraction of bunching municipalities in a county. *Post* takes value of one during the regulatory change (2009-2010), and zero otherwise (2004-2008). *Issuance* is the instrumented bank-financed debt raised in a county each year. Extra controls include HPI and number of households. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

2SLS												
Urban Counties												
	Wages (all)				Private Wages				Government Wages			
Issuance	0.187*	0.134	0.237*	0.168	0.214*	0.156	0.277*	0.195	0.144*	0.117	0.119	0.103
	(0.110)	(0.100)	(0.127)	(0.117)	(0.122)	(0.110)	(0.143)	(0.132)	(0.081)	(0.076)	(0.096)	(0.088)
Extra Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Decile by Year FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
F-stat first stage	16.23	15.48	12.85	10.89	16.23	15.47	12.94	10.97	16.23	15.47	12.94	10.97
Observations	3,073	2,825	3,073	2,825	3,064	2,816	3,064	2,816	3,064	2,816	3,064	2,816
Counties	439	439	439	439	438	438	438	438	438	438	438	438

Table VII: ROBUSTNESS: OTHER SPENDING

This Table reports results of regressing non-qualified issuance (*OtherSpending*) on the instrument. *Intensity* is the fraction of bunching municipalities in a county. *Post* takes value of one during the regulatory change (2009-2010), and zero otherwise (2004-2008). Extra controls include HPI and number of households. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

Non-Qualified Spending

	Other Spending - All				Other Spending - Urban			
Intensity x Post	-125.95	-146.534	-112.226	-101.564	-144.67	-146.400	-122.764	-107.784
	(103.21)	(107.287)	(118.141)	(92.240)	(131.56)	(115.429)	(130.406)	(100.231)
Post	14.688	-3.137			18.545	-4.150		
	(27.437)	(11.089)			(34.574)	(13.891)		
Extra Controls	No	Yes	No	Yes	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Decile by Year FE	No	No	Yes	Yes	No	No	Yes	Yes
p-value	0.222	0.172	0.342	0.271	0.272	0.205	0.347	0.283
F-first stage	1.49	1.87	0.90	1.21	1.21	1.61	0.88	1.16
Observations	3,528	3,180	3,528	3,180	3,073	2,825	3,073	2,825
Counties	504	504	504	504	439	439	439	439
R^2	0.0006	0.018	0.024	0.036	0.0007	0.018	0.027	0.037

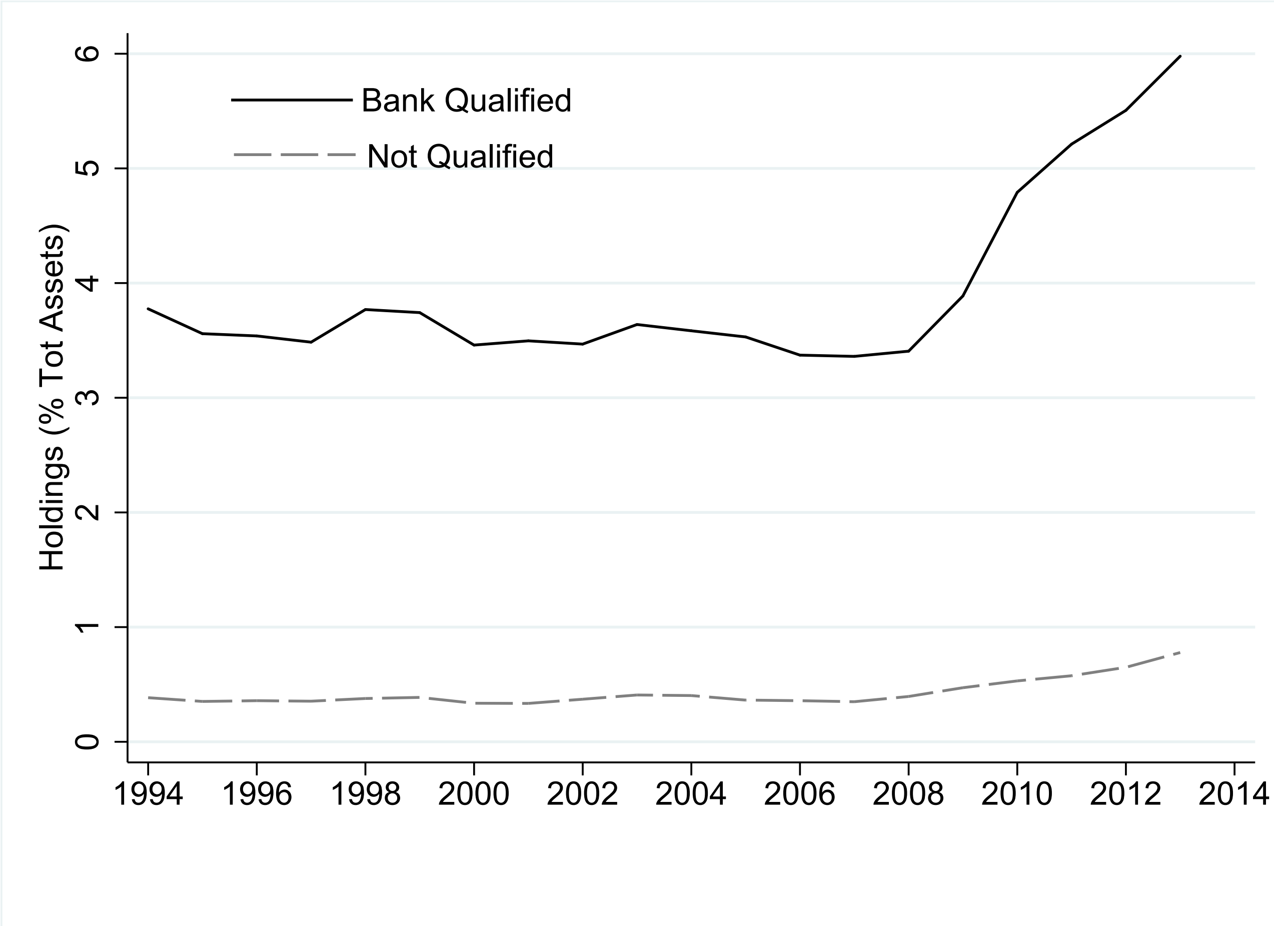

Figure I

Banks' Holdings of Municipal Securities.

This figure plots average banks' holdings of bank-qualified (solid line) and non-qualified (dashed line) municipal securities, as of December of the calendar year. Holdings are expressed as percentage of total assets. Data comes from Call Reports.

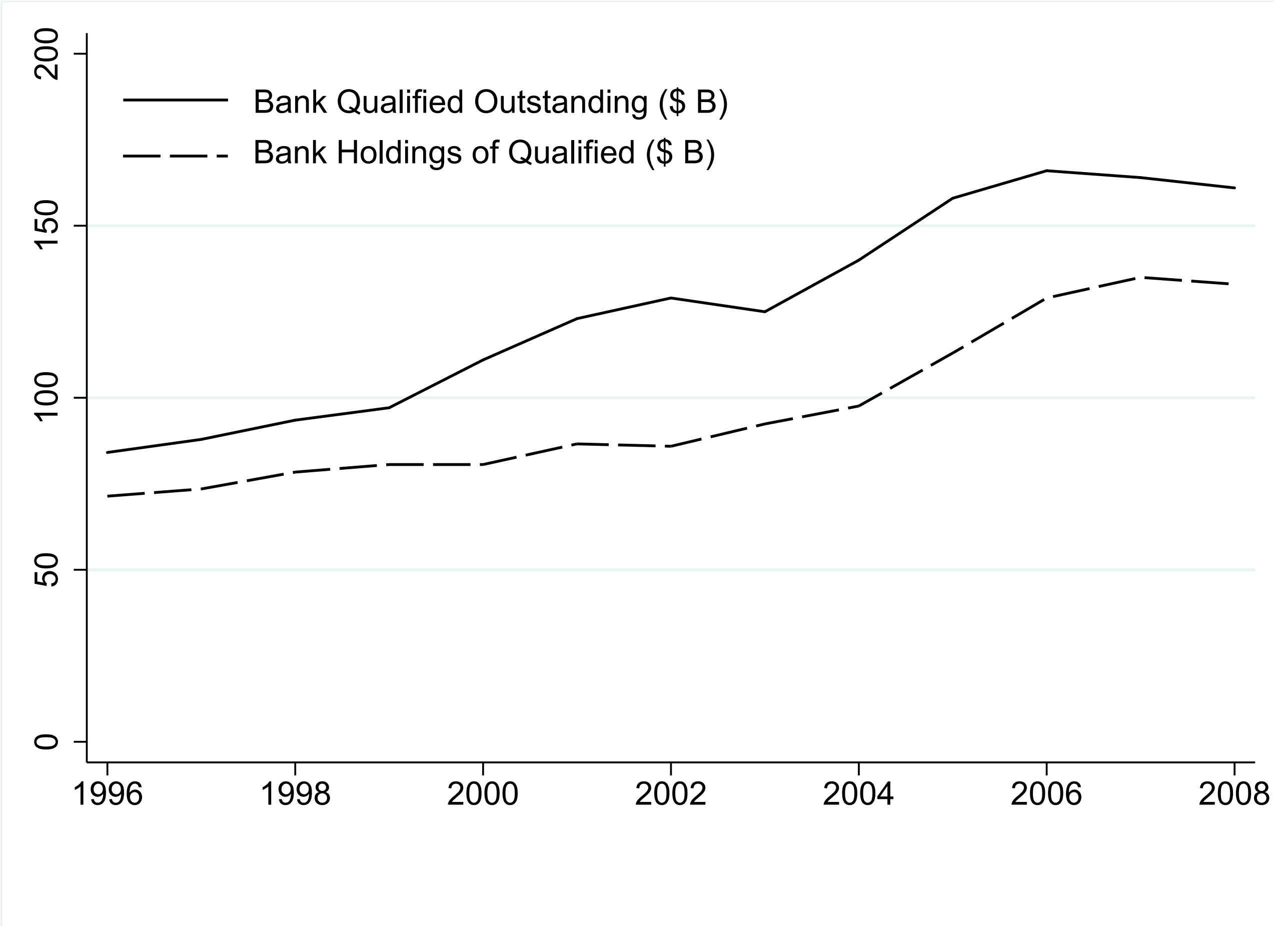

Figure II

Bank-Qualified Bonds.

This figure plots the estimated bank-qualified bonds outstanding (solid line) and banks' holdings of bank-qualified bonds (dashed line). Data is from the Flow of Funds.

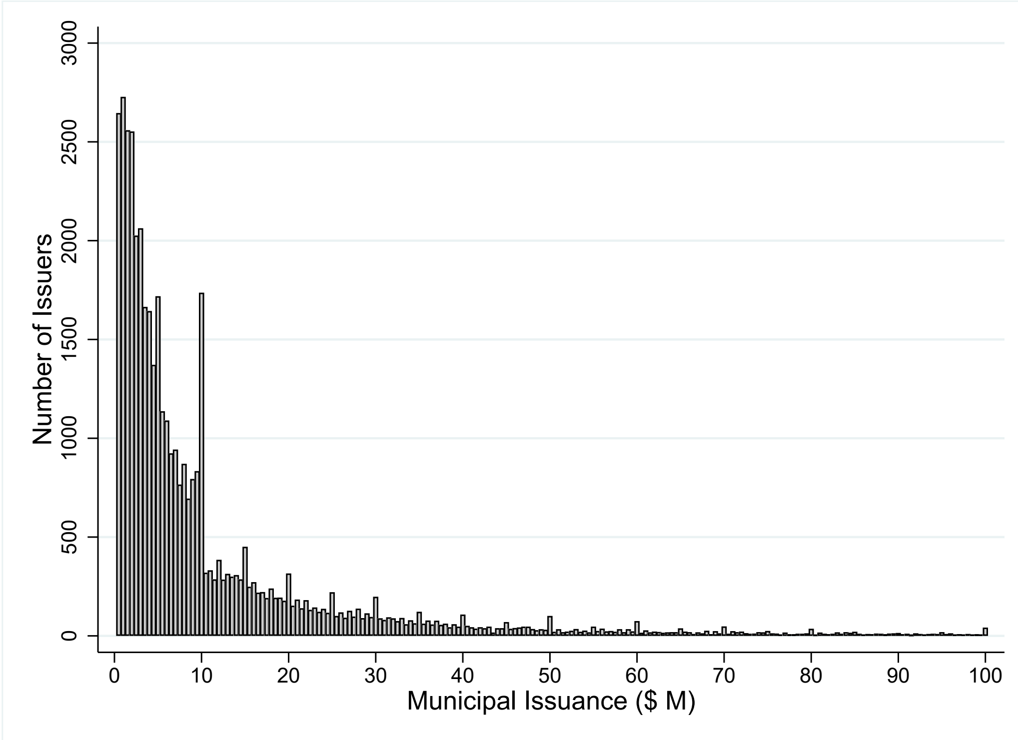

Figure III

Bunching

This figure plots the distribution of issuers for the years 2000-2008. The x-axis reports the size of municipal issuance in bins of $500,000. Every bar corresponds to the number of issuers within the size bin. Data is pooled across years. Municipal bonds are issued in round-numbers, as evidenced by the spikes in mass at multiples at $5M. However, the figure shows a significant and disproportionate amount of excess mass at the bank-qualification cut-off of $10M.

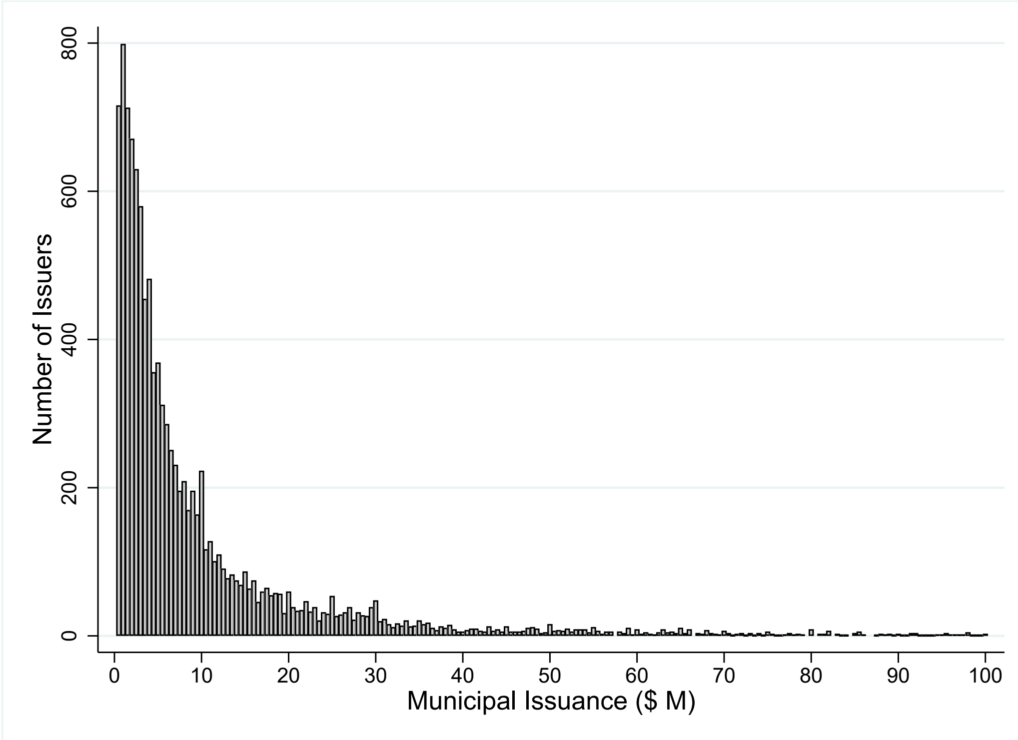

Figure IV

Post-Regulatory Change Distribution.

This figure plots the distribution of issuers for the years 2009-2010. The x-axis reports the size of municipal issuance in bins of $500,000. Every bar corresponds to the number of issuers within the size bin. Data is pooled across years. In this period, the bank-qualification limit was moved from $10M to $30M. The distribution appears significantly smoother than in the pre-2009 period.

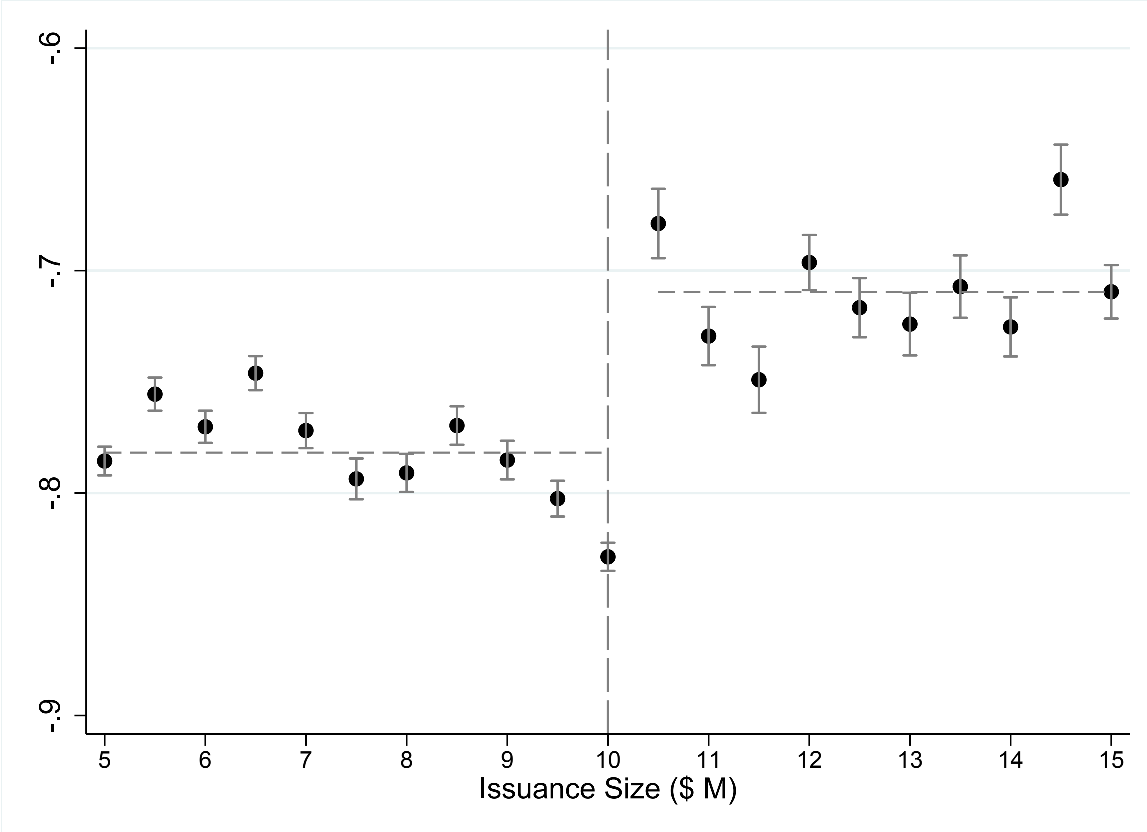

Figure V

Spread Notch.

This figure plots the spread over a maturity- and coupon-matched synthetic treasury, for municipal issuances around the policy threshold ($10M). The horizontal dashed lines are averages for the binned data for the region below and above the policy cut-off. Vertical lines indicate 95% confidence intervals. Issuances below $10M are bank-qualified. All bonds are tax-exempt general obligations. Data covers the pre-crisis period, before 2007, when muni bonds traded at quoted yields below (pre-tax) treasuries.

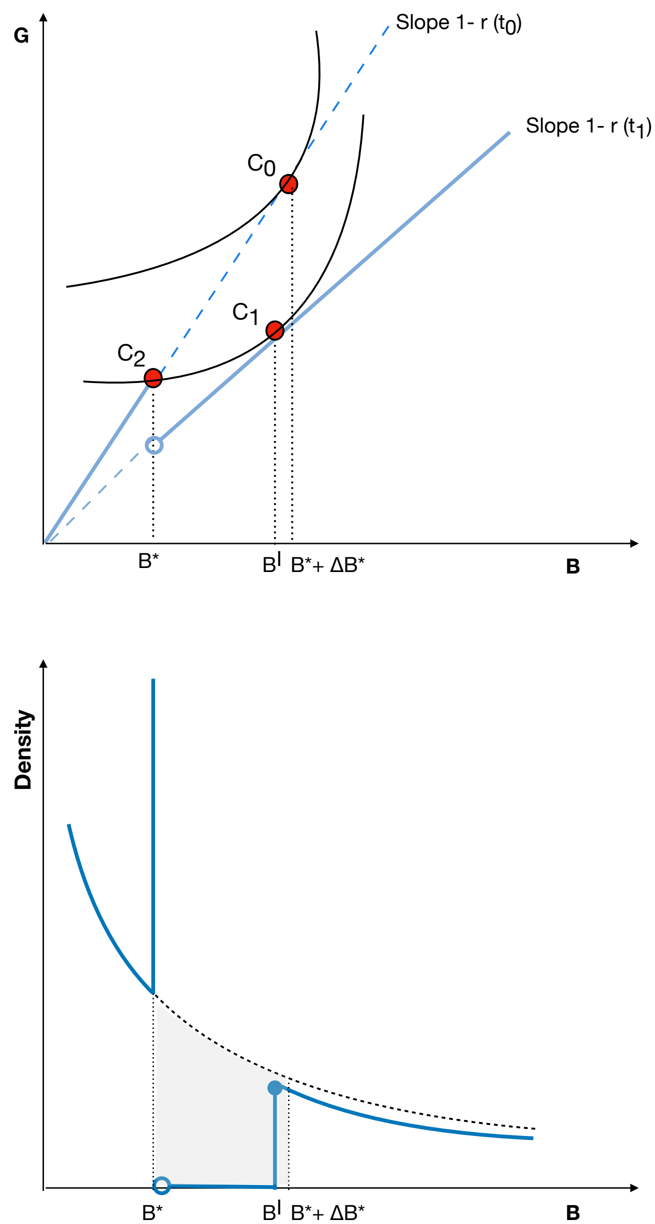

Figure VI

Notch Theory.

This figure shows the impact of a notch on a municipality's budget set. The notch represents a discrete jump in the average tax rate from t_0 to $t_1 = t_0 + \Delta t$ in the bank's taxation schedule. When faced with the notch, a municipality that would have otherwise issued $B^* + \Delta B^*$, is indifferent between locating at B^I and B^*, and chooses to bunch at the threshold (top panel). All issuers initially located on $(B^*, B^* + \Delta B^*)$ bunch at the notch. The figure in the bottom panel shows the corresponding post-notch density distribution, which exhibits sharp bunching at B^* and zero mass in (B^*, B^I) (homogeneous elasticities case).

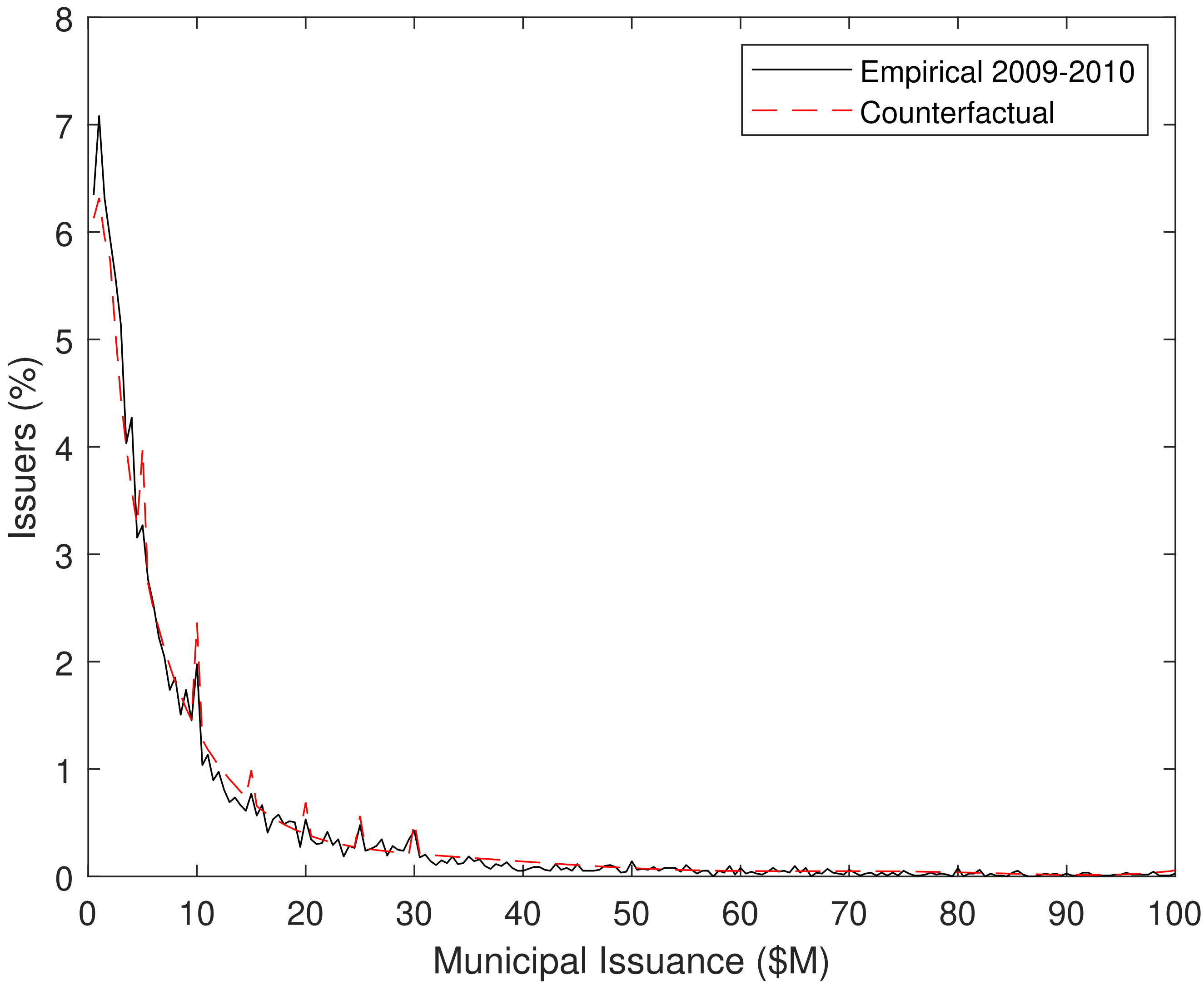

Figure VII

Counterfactual Validation.

This Figure compares the estimated counterfactual distribution for the years 2000-2008 against the observed distribution in the post-regulatory change years (2009-2010). The two distributions appear remarkably similar, providing support in favour of the ability of the estimation to capture the distribution of municipal issuance had the $10M policy not been in place.

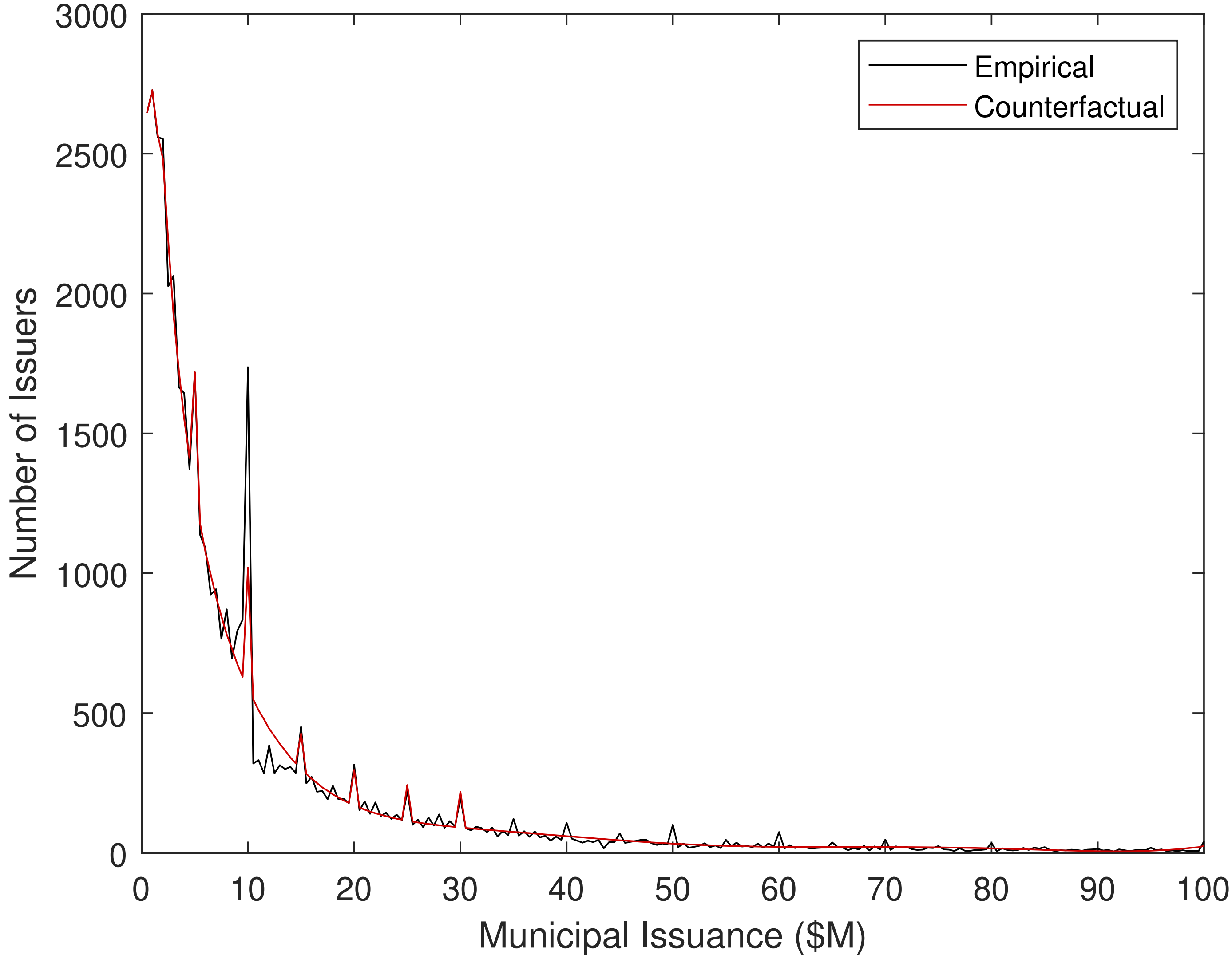

Figure VIII

Estimated Counterfactual.

This figure plots the observed distribution of issuers (black) alongside the estimated counterfactual (red) for the years 2000-2008.

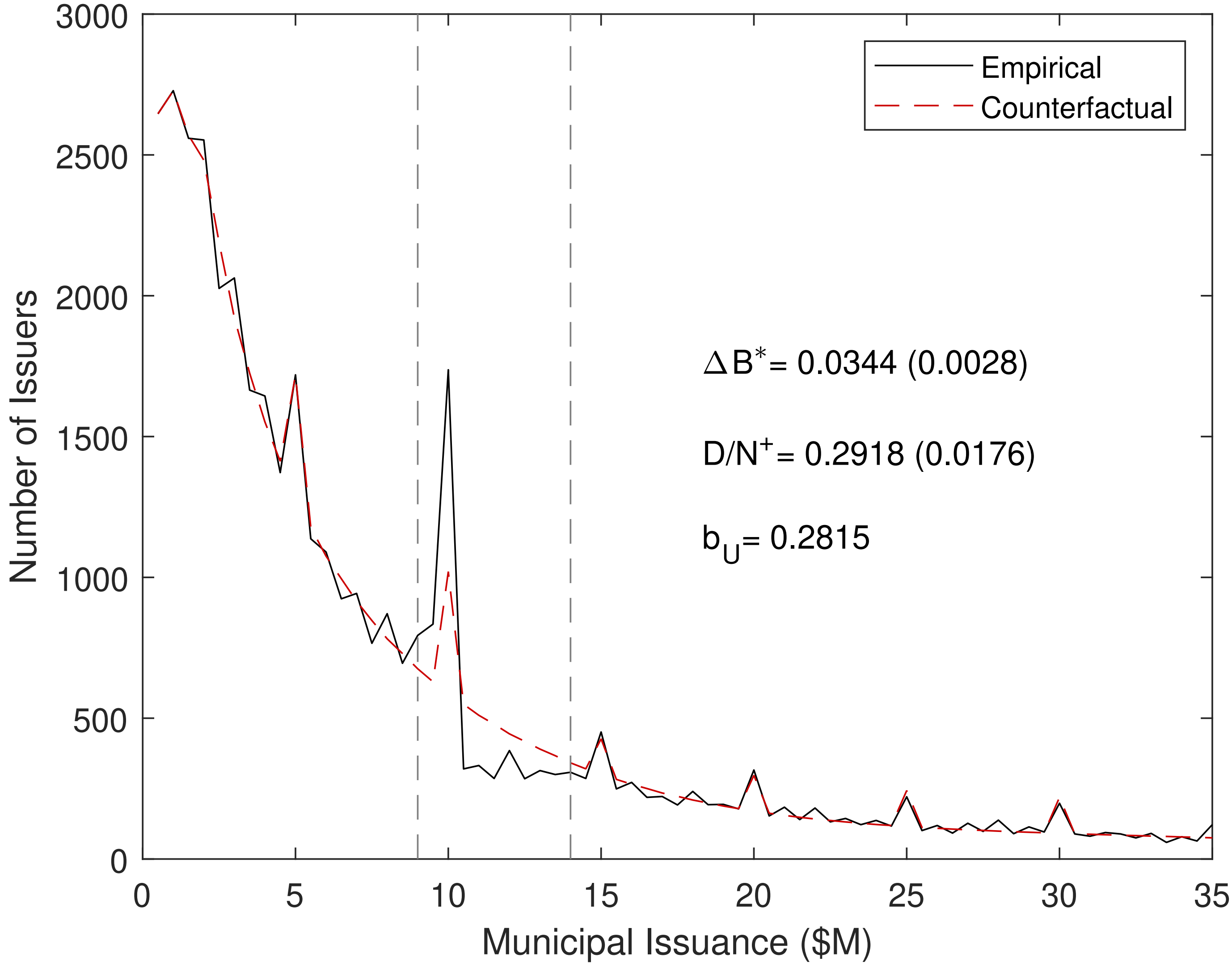

Figure IX

Estimation Results.

This figure plots the observed distribution of issuers (solid black line) alongside the estimated counterfactual (dashed red line) for the years 2000-2008, and zooms in around the policy cut-off. Each point represents the count of issuers in each 5% issuance size bin. The vertical dashed line marks the region of exclusion as obtained by fitting a 13-th degree polynomial and minimizing the extensive margin responses. The figure also reports the results of the estimation: the behavioral response (ΔB^*), the intensive margin effect (D/N^+), and the upper limit in deviation from the threshold (logs), b_U. Bootstrapped standard errors in parenthesis.

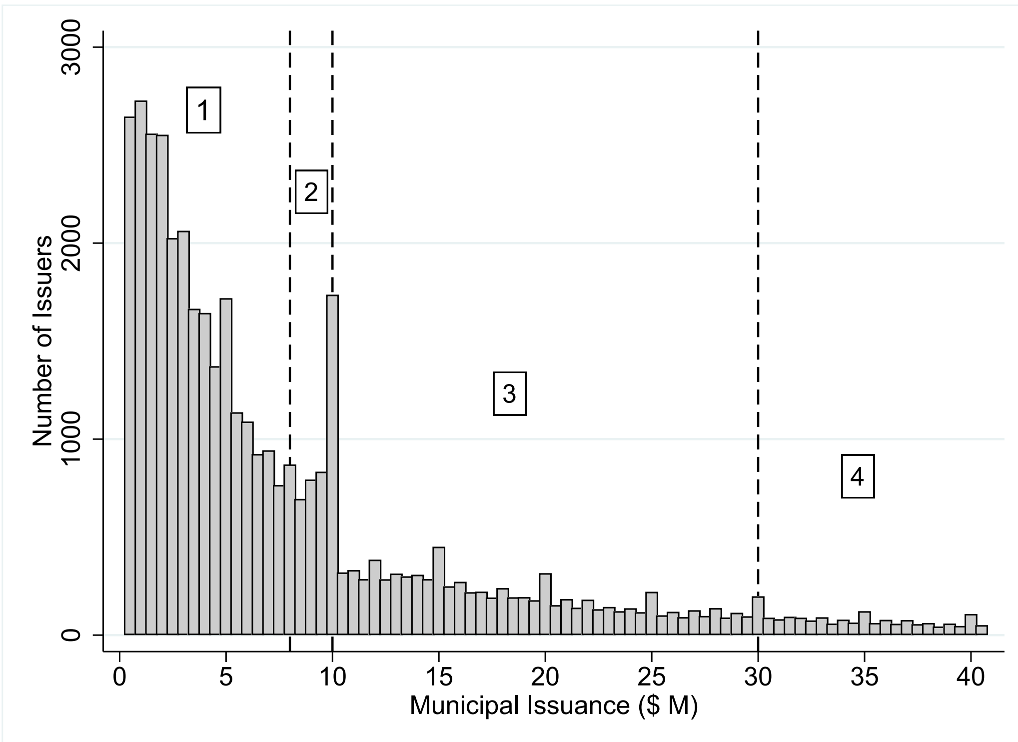

Figure X

Issuers Classification.

This figure exemplifies the classification of municipalities across regions of the issuance distribution: municipalities whose financing needs were well below the $10M limit (*region (1)*); municipalities whose financing needs were up against the bank financing constraint (*region (2)*, i.e. the bunching interval); municipalities that were able and willing to issue non-qualified bonds for a value higher than $10M and lower than $30M (*region (3)*); and finally municipalities whose issuance needs go past $30M (*region (4)*).

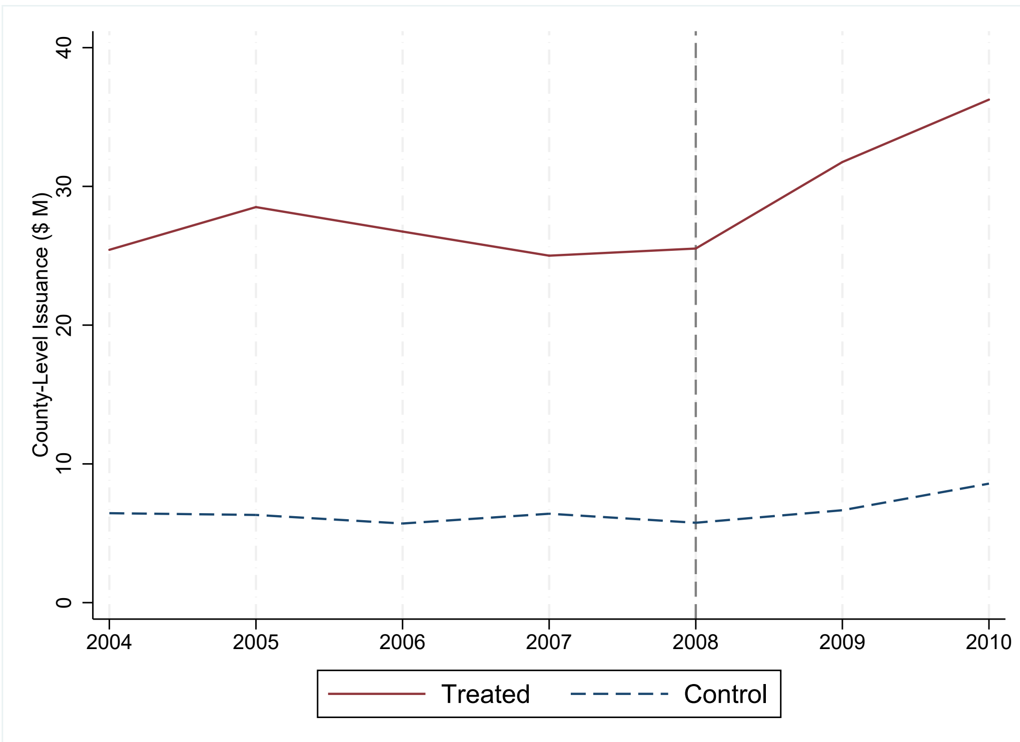

Figure XI

Bank-Financed Issuance.

This figure compares the bank-financed debt raised within treated ($Intensity > 0$) and control ($Intensity = 0$) counties as at the end of the calendar year.

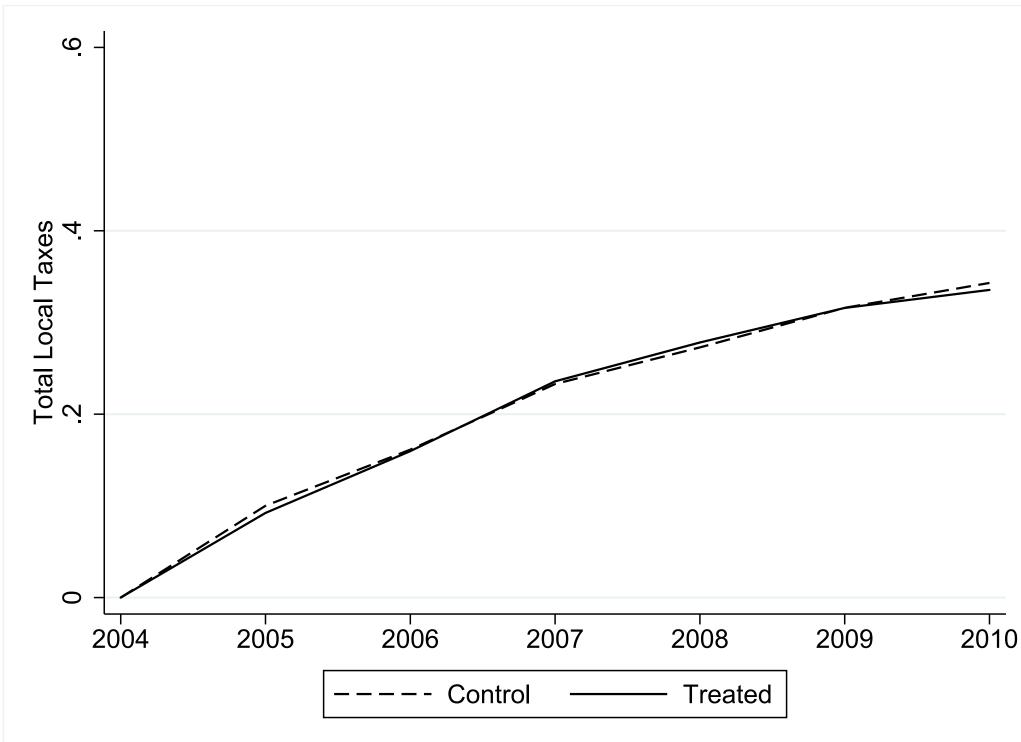

Figure XII

Growth of Local Taxes.

This figure plots the growth of total taxes for treated (dashed line) and control (solid line) municipal issuers, measured as the log difference in raised taxes with respect to the base year 2004.

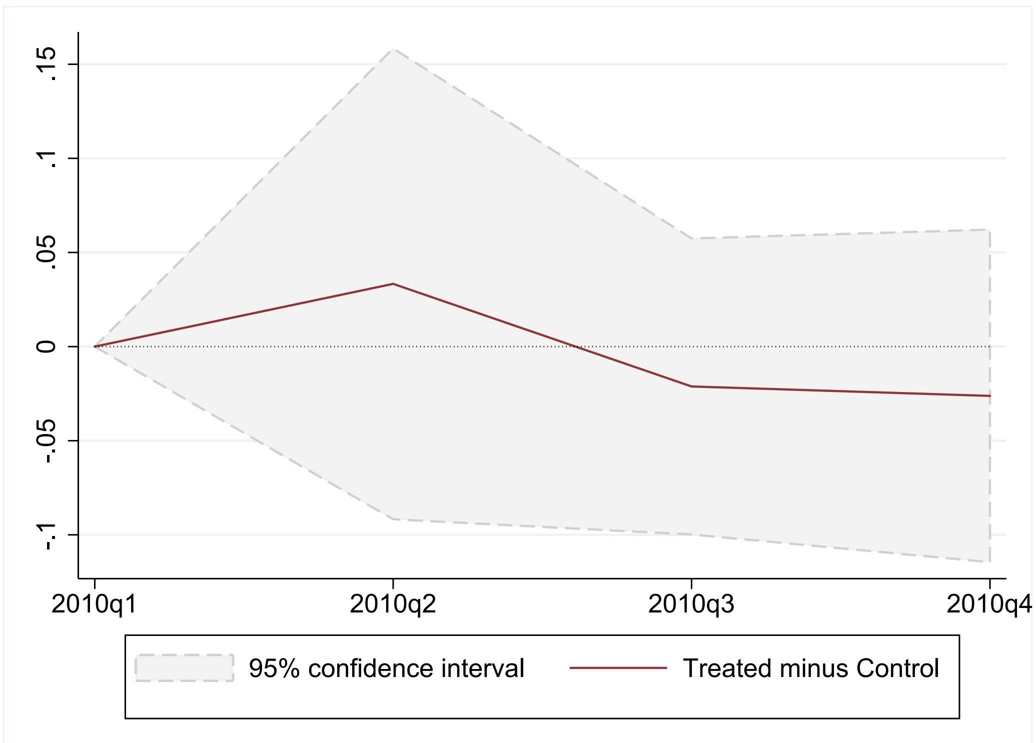

Figure XIII

Federal Transfers.

This figure plots the difference in the growth of federal transfers, measured as the log difference in total transfers by county with respect to the base quarter 2010q1, across treated and control counties.

Appendix

I. Qualified Small Issuer

A municipality receives the qualified small issuer designation if it can reasonably expect to issue within the calendar year tax-exempt obligations within the limit of $10M. This limit was extended to $30M in 2009-2010. Private activity bonds, that is bonds that do not pass the public purpose test, are excluded from being designated as qualified regardless of size. Exceptions are provided for 501(c)(3) types under the Internal Revenue Code Section 145.

Conduit bonds under 501(c)(3) count towards the qualification limit of the borrower that issued them. In other words, a municipality and the entities or authorities that issue on its behalf count as one issuer, and their aggregate issuance needs to remain within the 10$ limit (aggregation).

Refunding obligations that do not exceed the obligation they purport to refund are generally not qualifiable, unless acting in the form of advanced refunding. However, a refunding obligation issued to refund a designated qualified obligation outstanding is allowed to be designated as qualified itself, to the extent that the average maturity date of the refunding obligation does not exceed the average maturity of the bonds it stands to refund.

II. Banks' Taxation of Municipal Bonds

Banks deduct interest expense in their income statement, and pay taxes on the profits which are calculated as net of the deductions. Higher deductions hence imply a lower taxable base. The Tax Reform Act of 1986 however provides that "no deduction shall be allowed for interest on indebtedness incurred or continued to purchase or carry obligations the interest on which is wholly exempt from tax" (§265(a)).This means that 100% of a bank's interest expense incurred to enter a position into tax-exempt income, is not allowed to be deducted. The bank is hence penalized for acquiring a position in a tax-exempt asset though this deduction disallowance, also known as pro-rata disallowance.

The Act, §265(b)(3), however also provides an exception for *qualified* tax-exempt obligations, also known as *bank qualified* bonds. Bank Qualified municipal bonds are subject to a lenient treatment: only 20% of the interest cost incurred cannot be deducted (compared to 100% for non-qualified bonds). In other words, banks can shield from taxation 80% of the carrying cost of a Bank Qualified obligation.

The end-of-year pro-rata disallowance is so calculated:

$$\frac{\text{Tax Exempt Obligations}}{\text{All Assets}} \times \text{Year-to-Date Interest Expense} \times \text{D}$$

where D is the percentage disallowed: 20% for Bank-Qualified bonds, and 100% for non-Bank qualified bonds.

It is worth noting that the Tax Reform Act of 1986 also affected insurers. However, the tax treatment of insurance companies does *not* embed a discontinuity. Specifically, the insurance sectors is subject to a proration provision that adds 15% of tax-exempt income back into their regular taxable income. In other words, the effective after tax yield, adjusted for proration, that an insurance company earns on a tax-exempt municipal bond is equivalent to the unadjusted yield multiplied by a factor of: $(1 - 15\%\tau)$, where τ is the insurer tax rate. This is important to note since it implies that the $10M cutoff uniquely identifies segmentation at the level of *bank* financing.

III. Backing out Banks' Qualified Holdings from Call Reports

Banks' balance sheets report the aggregate holdings of municipal securities available for sale or held to maturity. Holdings of municipal securities include both qualified obligations and non-qualified obligations. Loans and leases to States and Local governments are also reported on Call Reports.

The memorandum item to the income statement 4513, however, requires banks to file interest expenses incurred to carry tax-exempt municipal securities and loans, with the exclusion of bank-qualified tax exempt obligation. The item requires banks to report the following dollar value, as of end of December for the entire calendar year:

$$\frac{\text{Non-Qualified Tax Exempt Securities + Loans \&Leases}}{\text{Total Assets}} \times \text{Year-to-Date Total Interest Expense}$$

Total Assets and Total Interest Expenses are reported in the balance sheets, as well as loans and leases to municipalities. It is therefore possible to calculate the bank's exposure to non qualified municipal securities, and then in turn from aggregate municipal securities holdings, the exposure to qualified obligations.

IV. Synthetic Treasuries

The dataset contains information on the sale date and the dated date, that is the date interest starts to accrue. I have detailed information on the date when the first coupon is paid and the frequency of coupons, and I know the maturity of the bond. To match the coupon and principal payment schedules, I first estimate a monthly off-the-run curve for treasuries. I follow Gurkaynack et al. (2006) and use the estimated parameters from the Svensson (1994) curve to fit a riskless curve with maturity horizon ranging 1 month to 60 years. For each municipal claim, I compute the price of its matched synthetic treasury by discounting the coupons and principal of the municipal bond at the estimated riskless off-the-run curve. The price of the synthetic treasury matching municipal claim j with dated date t is: $P_t^j = \sum_{n=1}^{N} C_n^j D_n$ where C_n^j is the payment (coupons and principal) at time n and D_n is the discount factor: $D_n = \exp\{-Y_n n\}$. Y_n is the estimated off-the-run yield for a riskless zero coupon bond with maturity n and dated date t. From the price of the synthetic coupon- and maturity-matched treasury, I then solve for its implied yield to maturity. The final step is to calculate the spread for each municipal obligation, which is the yield minus the matched synthetic treasury.

Table A1: FIRST STAGE: LOG ISSUANCE

This Table reports first stage results from the 2SLS specification in Eq. 16. *Intensity* is the fraction of bunching municipalities in a county. *Post* takes value of one during the regulatory change (2009-2010), and zero otherwise (2004-2008). *Issuance* is the bank-financed debt raised in a county each year expressed in logs. *Issuance* is instrumented using $Intensity_i\, x\, Post_t$. Extra controls include HPI and number of households. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

First Stage - Issuance (log)								
	All				Urban			
Intensity x Post	0.655**	0.789***	0.700**	0.754***	0.834***	0.955***	0.728**	0.777**
	(0.279)	(0.273)	(0.300)	(0.291)	(0.307)	(0.294)	(0.323)	(0.314)
Post	0.043	0.043			0.010	0.012		
	(0.047)	(0.048)			(0.001)	(0.054)		
Extra Controls	No	Yes	No	Yes	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Decile by Year FE	No	No	Yes	Yes	No	No	Yes	Yes
$R\hat{2}$	0.010	0.013	0.028	0.041	0.01	0.015	0.032	0.047
Observations	3,528	3,180	3,528	3,180	3,073	2,825	3,073	2,825
Counties	504	504	504	504	439	439	439	439

Table A2: REDUCED FORM ESTIMATION

This Table reports the reduced form results for specification in Eq. 16. The dependent variables are the log of employment and wages. *Intensity* is the fraction of bunching municipalities in a county. *Post* takes value of one during the regulatory change (2009-2010), and zero otherwise (2004-2008). Extra controls include HPI and number of households. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

Reduced Form								
All counties								
	Employment				Wages			
Intensity x Post	0.048**	0.043*	0.055**	0.042*	0.026	0.033	0.054*	0.035
	(0.024)	(0.023)	(0.024)	(0.021)	(0.032)	(0.030)	(0.029)	(0.026)
Post	-0.037***	-0.037***			0.057***	0.045***		
	(0.003)	(0.003)			(0.005)	(0.005)		
Extra Controls	No	Yes	No	Yes	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Decile by Year FE	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.141	0.297	0.297	0.409	0.120	0.365	0.648	0.680
Observations	3,528	3,180	3,528	3,180	3,528	3,180	3,528	3,180
Counties	504	504	504	504	504	504	504	504

Urban counties								
	Employment				Wages			
Intensity x Post	0.066***	0.054**	0.060**	0.046*	0.060*	0.044	0.063**	0.042
	(0.025)	(0.024)	(0.025)	(0.023)	(0.032)	(0.031)	(0.032)	(0.029)
Post	-0.041***	-0.039			0.050***	0.042***		
	(0.003)	(0.003)			(0.005)	(0.005)		
Extra Controls	No	Yes	No	Yes	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Decile by Year FE	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.156	0.307	0.300	0.400	0.117	0.381	0.662	0.695
Observations	3,073	2,825	3,073	2,825	3,073	2,825	3,073	2,825
Counties	439	439	439	439	439	439	439	439

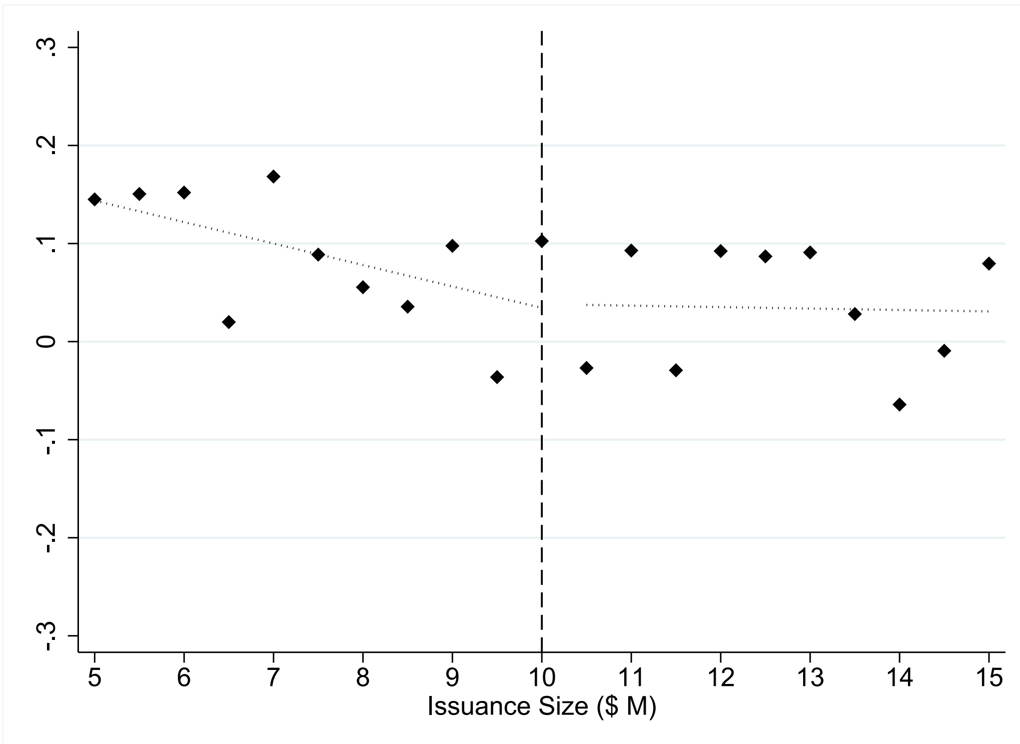

Figure A1

Spread Notch Counterfactual.

The figure plots the spread over a maturity- and coupon-matched synthetic treasury, for municipal issuances around the old policy cutoff ($10M). All bonds are tax-exempt general obligations issued in 2010, when the bank-qualification threshold was moved to $30M.The dotted lines are predicted values from a regression to fit the binned data for the region below and above the old policy cutoff. The figure shows there is no jump at $10M.

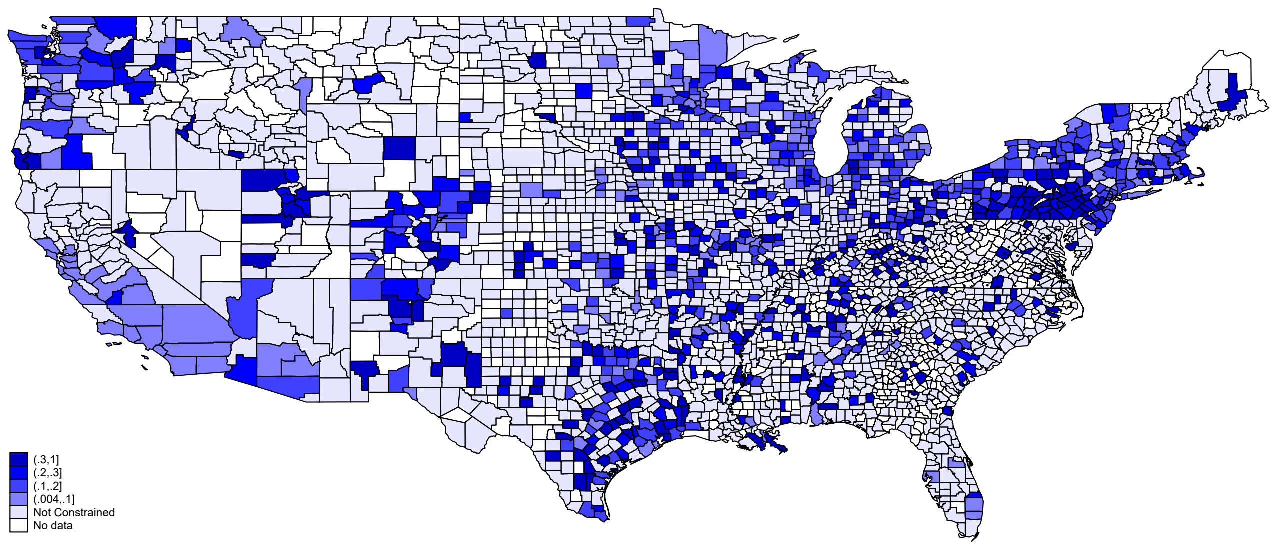

Figure A2

Map of Bunching Issuers.

This figure shows the geographical distribution of bunching issuers across the US. Darker shades represent higher fractions of bunching issuers in the county.