The Impact of Bank Financing on Municipalities' Bond Issuance and the Real Economy

Ramona Dagostino*

Latest Version: **Website**

11 November 2017

ABSTRACT

I document the role of bank financing in the municipal bond market. I show that banks can play a substantial role in relaxing municipalities' borrowing constraints. Using a unique institutional feature of the municipal market – the bank qualification – I show that a significant mass of local governments are willing to downsize their bond issuance to be able to place their debt with a bank. To meet the bank qualification threshold, the affected municipalities reduce the size of their municipal bond issuance by up to 28 percentage points. Exploiting a regulatory change in the municipal tax code, I show that relaxing bank credit rationing to municipalities translates into a sizable employment growth. I estimate that every additional million dollars of bank-financed debt generates over 30 jobs per year in the private sector. My results contribute to the literature on the real effects of financial constraints, and add to the current debate on the heterogeneous impact of fiscal policy across different states of the economy. Bank-qualified bonds being a source of deficit-financed rather than windfall spending, I find the implied local output multiplier to be around 1.6.

*I would like to thank my supervisors, Francisco Gomes and Anna Pavlova, as well as my committee members, Christopher Hennessy and Stephen Schaefer, for their guidance and support. I also would like to thank Daniel Bergstresser, Joao Cocco, James Dow, Alex Edmans, Peter Feldhutter, Ralph Koijen, Stefan Lewellen, Anton Lines, Elias Papaioannou, Tarun Ramadorai, Helene Rey, Scott Richardson, Rui Silva, Vikrant Vig, and Emily Williams for their comments on the paper. For numerous discussions on the institutional details, I would like to thank Michael Decker, Michael Foux, William Fox, Tracy Gordon, Michael McPherson, Shane Parker, and Missaka Warusawitharana. For sharing data, I would like to thank Mike Schwert and Bill Dupor. Finally, I thank the AQR Asset Management Institute for generous financial support. All remaining errors are my own. Find the latest version of the paper at: https://sites.google.com/site/ramonadagostinophd/

The U.S. Municipal Bond market lies at the core of the nation's public services provision. Municipal bonds are in fact used by state and local governments 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. A smooth functioning of the municipal market is therefore paramount to maintain and operate public projects in the U.S.

A deeper understanding of the role that each type of investor plays in this market is an important, yet largely unexplored, research question. Common wisdom has it that local government debt in the U.S. is held primarily by retail investors, and that therefore banks, by virtue of constituting a smaller slice of the investor base, are likely to play a secondary role. In this paper I provide strong evidence that bank financing matters for local governments and can play a substantial role in relaxing local governments' borrowing constraints.

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. The discontinuous taxation thus has the potential to create shifts in the marginal investor in the municipal bonds market. Indeed, I show that yields 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-qualification notch ($10M). 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 17% 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 under-issue in order to be able to place their debt with a bank.

I then exploit a regulatory change in the municipal tax code, and show that relaxing *bank credit rationing* to municipalities translates into a sizable employment growth. 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 four regions in the distribution of municipal issuers that were differentially affected by the regulatory change. I rely on this classification to propose two alternative identification strategies, with the aim of estimating the impact of an additional dollar of government spending on the real economy. In the first specification, I focus on issuers in what I call the *constrained region*. I follow the estimation proposed in the recent literature on geographical multipliers (Chodorow-Reich (2017)), using a similar instrumental variable approach to identify a plausibly exogenous source of cross-sectional variation. I then discuss an alternative identification strategy. Specifically, I show evidence that a segment of municipal issuers were not affected by the regulatory shock. Given comparable trends across the two groups of affected and unaffected local governments, the latter set of issuers is used to isolate the amount of extra funds raised in the post-reform period as a result of the policy shock, over and above business cycle considerations. I use this quantity as an instrument to estimate the effect of government purchases on employment growth. Both specifications yield very similar results. In particular, I find that every million dollars of extra bank-financed spending generated around 32 jobs per year in the private sector, while there was no impact on job creation for public servants. Job creation was larger in the service sector, and smaller yet still significant in the goods (tradable) sector. These results can be understood in light of the fact that municipal bonds are typically issued to finance capital spending, with proceeds being channeled toward building schools and other public projects such as sewage and pipelines. Additionally, the funds are typically not intended to pay public-sector employees' wages. The null impact on government employment thus suggests that municipal bond proceeds are not fungible, but rather effectively deployed for their declared use.

To the best of my knowledge this is the first paper that documents the role of bank financing in the municipal market. My first contribution is therefore to document the market segmentation induced by the banks' tax code in the municipal market. My second contribution is to show that this market segmentation affects municipalities' bond issuance decisions, and induces a sizable mass of local governments to under-issue so as to place their debt with a bank. My third contribution is to quantify the effects of relaxing bank credit rationing for U.S. local

governments.

This latter result contributes to the broader important debate on what the fiscal multiplier on government spending is. The answer to this question is at the heart of determining optimal fiscal policy and fiscal interventions. Arriving at a conclusive answer to this question has, however, been a path riddled with identification challenges. First, macro and public finance theory demonstrate that the way spending is financed, specifically whether government purchases are financed through taxes or deficit, matters. Most of the estimates on fiscal multipliers in the literature have been obtained using evidence from wars. However, war-time spending was financed concomitantly by deficit as well as taxes, which limits the informativeness of the estimates.

The outburst of the financial crisis accompanied by the extended period of zero lower bound rates revived interest in the fiscal multiplier debate. Much of the literature on fiscal multipliers developed in the past few years has 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), all use variation in allocation of federal aid money across U.S. regions. Shoag (2015) relies on variation arising from windfall money from states' defined-benefit pension plans, Suarez-Serrato and Wingender (2017) look at federal spending revisions due to errors in population estimates, while Nakamura and Steinsson (2014) use regional variation in military buildups. All of these papers find large multipliers, usually in the range of 2, with a low cost per job, between $26,000 and $35,000.

Windfall spending is, however, an *external* source of public finance. Since windfall, aid, or transfer money do not affect the future stream of taxes, they can potentially give rise to significantly different multipliers with respect to the traditionally internally financed ones (e.g. taxes and deficit). Ramey (2011) and Clemens and Miran (2011) provide an insightful discussion on many of the open issues in this cross-sectional literature.

Differently from the above-mentioned papers, 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. Bank-qualified municipal bonds are in fact issued by local governments and paid back with future local taxes. 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.

The estimate of the cost per job in this paper is in the range of $32,000. This result can be mapped into an output multiplier of around 1.6. The findings in this paper compare well with the emerging literature on state-dependent fiscal multipliers. Auerbach and Gorodnichenko (2011) note that multipliers might be different depending on whether the economy is in recession or expansion. Using a regime switching model, they find that fiscal multipliers in booms are well below unity and even negative, whereas government purchases during recessions give rise to very large multipliers, as high as 3.6. The results in this paper are obtained using variation during the crisis, and are thus in line with the recent theoretical contributions on asymmetric multipliers.

This paper also contributes to the literature on measuring financial constraints and the impact of credit shocks on the real economy (Paravisini (2008), Chodorow-Reich (2014), Mian and Sufi (2011, 2014), Mian, Sufi and Rao (2013), Greenstone et al. (2014), Bentolila et al. (2017), Nguyen (2014), Aghion et al. (2010, 2014), Almeida and Campello (2007), Gomes (2001), Hennessy and Whited (2007), Rauh (2006) and many others). The paper closest to mine is Adelino et al. (2017), which estimates a cost per job in the range of $20,000, which is about one-third smaller than the estimate in this paper, and hence finds a larger multiplier. As any estimated multiplier depends on the source of exogenous variation, the different results can be explained in light of the fact that Adelino et al. rely on variation arising from upgrades in municipal bond credit ratings, while this paper exploits variation arising from the relaxation of banks' credit-rationing constraints to municipalities.

The paper proceeds 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. Section IV discusses the contribution, as well as the magnitude and the interpretation of results within the context of the literature. Section V concludes. The Appendix provides extensive details on the municipal market institutional set-up, as well as additional robustness estimations.

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 (almost) the full tax-exemption on the investment, i.e. the coupon payments are tax-exempt and the bank can deduct the interest expense incurred. Section A.II explains the details of the municipal tax code for banks.

The tax code thus embeds a discontinuity in the tax treatment of municipal bonds for the banking sector. The implied taxation of non-qualified municipal bonds is sizable, so much so that banks have historically shied away from non-qualified municipal debt. 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 (Figure (1)). With the financial crisis Congress raised the cutoff for the bank-qualified designation to $30M, covering a much larger portion of debt issuance. This regulatory change went into effect in February 2009, but 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 the municipal bonds outstanding (Bergstresser et al. (2016))

[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.

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 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 on Segmentation

The market segmentation brought on by the tax code discontinuity brings up the question of whether bank financing is special for municipalities and local governments. Researchers traditionally think of banks as special in the context of corporate and household debt, with banks providing relationship loans and monitoring ability in a market ridden by information asymmetries. Small and medium enterprises in particular tend to lack the ability to issue bonds, and find in banks a core source of financing.

Due to the nature of the tax-exemption, municipal bonds have historically largely been purchased by retail investors, particularly high net-worth individuals. In fact, since the late 1990s, over 70% of municipal debt has been held by households. In this light, it is hard to imagine that banks would be special for local governments and their ability to raise financing. Still, banks might play an important role if the costs of raising the bonds were to be significantly reduced in the presence of bank investors. The Government Finance Officers Association (GFOA) has in fact estimated that bank-qualified bonds entail savings in the range of 25-40 bps for municipalities, stemming from the ability of the government to bypass the traditional book-building process by placing the bonds directly with the banks, and hence reducing the costs associated with the bond sale. Banks might be special for other reasons too: municipal bonds are loan-like assets, with non-standard characteristics, redemption provisions, and repayment schedules, which together would make banks an ideal candidate investor.

Figure 2 plots the distribution of issuers for the years 2000-2008, and Figure 3 for the years 2009-2010 corresponding to the regulatory change.[4] The x-axis reports the size of the debt

[4]Municipalities were affected by the crisis only later on in 2009, when the drop in house prices fed into their

issuance by local governments, broken down into bins of $500k, while the y-axis reports the number of municipalities in each size bin. The figure shows a significant amount of excess mass at the bank-qualification cut-off of $10M, which almost washes out in 2009 when the limit is brought to $30M.[5] This is accompanied by a sizable region of missing mass to the right of the regulatory limit. In other words, municipalities appear to bunch at the bank tax discontinuity ($10M). The issuance density thus appears to give strong evidence that bank debt might be special for local governments, and that the market segmentation induced by the tax code has the potential to affect municipalities' bond issuance decisions.

In Figure 4, I plot the issuance spread around the qualifying limit, calculated as the municipal bond yield minus a maturity- and coupon-matched synthetic treasury[6]: the figure shows that average spreads are higher for bonds just above the policy cutoff.[7] Although this jump appears on the lowest end of the GFOA estimates, it is important to note that the issuance yield does not represent the total interest costs on bond sales. Issuance costs in fact include the underwriter discount, advisor and bond counsels fees, as well rating agencies fees, all of which are substantially reduced in the absence of an extended book-building process.[8]

Consistent with these notions of direct and implicit costs, the bank-qualification policy creates a notch in the budget constraint of the municipality; such a jump in issuance costs at the discontinuity induces some municipalities that would otherwise have issued bonds of size above the $10M limit to instead bunch at the constraint. In the following sections, I exploit this striking non-linearity at the bank-qualification cutoff, to quantify the extent to which local municipalities are credit rationed. I then use the 2009 regulatory change to estimate the value of relaxing financial constraints for municipalities' real economies.

tax collection. Property taxes are the major component of local governments taxes and their assessment is a function of lagged property values.

[5]Interestingly, there appears to be no significant bunching at the $30M cutoff. I will discuss this in Section III.A.

[6]Issuances below $10M are only bank-qualified tax-exempt bonds; above the policy cutoff are issuances not bank-qualified. There can be issuances that are smaller than $10M and are not entitled to qualification, e.g. a taxable issuance or a private-purpose issuance. Such issuances are clearly excluded. Issuances are pooled across the pre-crisis period, 2000-2006.

[7]Before the crisis, municipal bonds traded at quoted yields (unadjusted for tax-exemption) below (pre-tax) treasuries, hence the negative spread.

[8]Placing a municipal issuance with retail investors customary requires at least two credit ratings. Banks' ability to purchase municipal bonds is instead orthogonal to the presence of a credit rating: unrated issuances are treated equally to highly rated municipal bonds for capital regulation purposes. This allows the municipality to have the option to save on rating costs.

C. A Simple Model of Local Debt Financing

In order to guide the empirical analysis, I consider a simple one period model of local debt financing. The model and analysis draw on the seminal work of Saez (2010) and Chetty et al. (2011), and follow closely the techniques developed in Kleven and Waseem (2013) and Best and Kleven (2016).

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

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

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 debt issuance 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 bond issuance voting[9], as well as reputational cost of incurring extensive debt. 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 constrained by balanced budget provisions, there are statutory limits on tax hikes.[10] Moreover local government

[9] Majority voting is required for General Obligation bond issues.

[10] 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.

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 issuance needs, ζ_i, which are assumed to be distributed smoothly and with density $f(\zeta)$.

Demand is aggregated across two types of investors: households and banks.[11] 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

[11] 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.

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 5 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 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 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 limit. Panel B in Figure 5 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.

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. In fact, while the theoretical framework is presented under the assumption of homogeneous elasticities and demand parameters across municipalities, 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.[12] In the framework of the extended model, this would be:

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

As mentioned above and discussed in detail in the next section, the estimation of the behavioral response is not dependent on the theoretical specifications.[13] 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. The regulatory change in the bank-qualification limit also provides a natural density to validate the estimated counterfactual.

D. *Bunching Estimation*

The behavioral response of municipalities to the bank-qualification limit is estimated using the empirical distribution with the observed bunching, and the counterfactual density. Following Kleven and Waseem (2013), the counterfactual is estimated fitting a flexible polynomial, outside the range of the notch, and allowing for reference point fixed effects.

Focusing on the pool of municipal bonds issued during the 2000-2008 period – before the regulation change[14] – I express issuance size (per calendar year) in logs and center the distribution around the 10M limit (in logs), B^*. 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:

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

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

[13] Moving from the bunching mass, ΔB^* – an empirical estimate– to *elasticities* estimates, α_i, does instead require model dependency. However the focus of this section is to estimate the mass of municipalities who are affected by credit rationing and thereby are credit constrained and under-issue, i.e. bunch.

[14] I focus on tax-exempt General Obligation bonds and exclude Revenues, since Revenue bonds are not allowed to be qualified regardless of their size (with only few exceptions). In other words a municipality issuing in a calendar year 2M worth of Revenue private-use bonds is still not allowed to qualify the issue for bank holding. Such Revenue bonds hence do not exhibit a notch. 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– they fail the 'public purpose" test–, hence their issuance distribution is substantially different from bonds that can be bank-qualified.

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.[15]

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 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

[15] 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 saliency for regulatory purposes; in other words, they do not constitute a notch.

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 k-iterations. 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 6, 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 $10M limit on bank-qualification not been in place.

Having validated the counterfactual, I proceed to present the results of the estimation. Figures 7 and 8 plot both the empirical and the counterfactual size distribution, respectively for the full sample, and zooming in around the $10M cut-off. Figure 8 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[16] in each bin. 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 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. As clear from the plot, 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 3.2 percentage points, 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 17.3% of issuers that would have otherwise been to the right of the cut-off, have been shifted below the policy threshold. In other words, roughly 17% of the issuers that would have issued a bond larger than $10M were forced to under-invest and downsized to below the policy 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 given the $10M threshold, the largest affected municipality would have issued a bond roughly 28% larger had the bank-qualification discontinuity not existed.

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

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-; moreover, debt roll-over makes up a large portion of the issuance,[17] making it difficult for municipalities to choose not to tap the primary market when debt comes due. 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. However, results are robust when relaxing this assumption and allowing for extensive margin responses. Columns (2)-(3) in Table I present results under alternative specifications: first I allow for the presence of extensive margins by varying the exclusion region, and then I vary the degree of the polynomial. Across different specifications, the behavioral response, ΔB^*, remains in the 2% to 3.5% range, and significant at least at the five-percent level. Additional robustness specifications are reported in the Appendix.

III. Real Effects of Relaxing Municipalities' Borrowing Constraints

A. *Identification Strategy*

On February 2009, Section 265 of the Internal Revenue Code of 1986 was amended to allow for a two-year long increase in the bank-qualification limit. As explained in Section A.II, depository institutions are allowed to deduct 80% of their carrying costs for tax-exempt public-purpose bond issuances of the size of no more than $10 million by issuer and calendar year. This provision was amended by increasing the $10 million annual cap to $30 million.[18]

The amended provision translated into a drop in the average implied tax rate on banks' holdings of municipal bonds, in turn raising banks' effective tax-adjusted yield on the invest-

[17] Over 35% of new issuance is debt rollover.

[18] Additionally,unlike under the aggregation rule, each beneficiary in a 501(c)(3) conduit borrower transaction was allowed to be treated as a separate entity for this purpose, effectively shifting a municipality's qualification limit even further.

ment. To understand the tax privilege, one can calculate the effective yield as under §265 of the Act (1986) for a representative bond: consider a bond previously non-qualified, under a 2% cost of funds and a 35% tax rate, the effective yield that a bank forgoes due to the disallowance (sometimes referred to as *TEFRA haircut*) is: 2%x 100% x 35%= 70 basis points. By contrast, when the bond is bank-qualified, the TEFRA haircut on the investment is only 2%x 20% x 35%= 14 basis points. This implies that for an otherwise *identical* bond, and given the same quoted yield, a bank would collect a yield 56 basis points higher on its municipal investment under the extended tax privilege.

Figure 9 shows the upward jump in bank-qualified bonds issued in 2009-2010, the years of the extended provision. The extended tax exemption in fact made previously dominated assets become relatively more attractive to banks, resulting in increased bank-demand both for previously constrained issuers and for municipalities that were traditionally on the far right of the bank-qualification limit. On the one hand, municipalities for which the $10M constraint was binding saw their issuance cap being relaxed; on the other hand, municipalities that were traditionally able to issue largely above the limit (e.g. a $20M bond issuance) – and thus were not constrained at the $10M limit or bunching– were given the choice to designate their new debt flows as qualified for bank holding, and hence enlarged their pool of investors.

In this section, I exploit the cross-sectional variation originated by the policy change to quantify the impact of relaxing bank credit rationing for municipalities. Following the results in Section II.D, municipalities can be classified into four groups: (1) municipalities whose historical issuance falls well below the $10M rule and for which the constraint was not binding in the first place; (2) municipalities whose historical issuance size is in the (left) interval of the $10M cap, and for which the original bank-qualification constraint is likely to bind (i.e. the area of excess bunching mass due to constrained municipalities, $[b_L, 0]$, as defined in Section II.D); (3) municipalities that are able to issue non-qualified bonds above the $10M limit and whose issuance needs lie below $30M; (4) municipalities that issue above $30M.

While the bank-qualification limit is the same for every municipality, the cap affects each issuer heterogeneously. Consider those local governments whose bond issuance lies in the proximity of the $10M cap (region (2)). From Section II.D, we know that, before 2009, this is the region where the constrained issuers lie, that is, the issuers for which the bank qualification constraint binds. These constrained issuers constitute the *bunching* mass. I call this

area the *constrained region*. Ceteris paribus, while the policy change applies to every issuer, the regulatory shock works as a trigger for those municipalities that were at their constrained optimum, that is, those issuers that would have issued a bond larger than \$10M, had the cap not been in place. Everything else equal, these are the municipalities for which access to financing constraints are relaxed by the positive regulatory shock, and that re-optimize to a new equilibrium issuance. In Section III.B I exploit the tax code change, to propose a simple instrumental variable approach to identify the employment multiplier associated with local government spending. This approach is chosen for its shared similarities with the current macro literature on geographical multipliers. Specifically, given this set of treated municipalities, I aim to obtain cross-sectional variation in issuance that is as good as random to estimate the effect of one extra dollar of bank credit.[19] In Section III.D I also propose an alternative approach to identification.

B. IV Estimation Specification

I focus on the impact that relaxing bank credit-rationing for municipalities has on local growth in employment. I choose to focus on the labor force since measures of output, as the equivalent of GDP or GSP data, are unavailable at the local level. The estimation follows:

$$\sum_{h=0}^{H}\left(\overline{E}_{c,t+h}-\overline{E}_{c,t}\right)=\alpha+\beta\overline{B}_c+\gamma\,Controls_c+e_c \tag{16}$$

The dependent variable is the change in employment, $\overline{E}_c$, in county c, scaled by the 2008 Census (estimated) population in the county. Employment data are end-of quarter, and are scaled by four, that is, they are annualized in order to facilitate the interpretation of the estimated coefficients (Chodorow-Reich (2017)). I consider overall employment first, and subsequently look at employment in the private and government sectors separately. The parameter α corresponds to a nation-wide shock;[20] $\overline{B}$ is the total (endogenous) per capita bank-financed *flow* of new debt issued in county c in 2009-2010, and e_c is a county-level mean zero shock.[21]

[19] Similarly to the literature, this is akin to obtaining the treatment on the treated.

[20] A monetary policy shock is a prominent example of a nation-wide shock, and it is averaged out in the cross-section.

[21] More precisely, $x=\sum_{h=0}^{H}\left(x_{t,t+h}\right)$, where $x=\{\alpha,\beta,\gamma,e_c\}$. Intuitively, β represents the cumulative impulse response.

The effect of the spending is cumulated across the horizon h: the base-period, t_0, is 2008Q4, and $H = \{2009Q1, ..., 2010Q4\}$. The path of the change in employment is averaged across the horizon h. This specification is akin to a summary measure of the multiplier path per dollar of bank-financed spending.

I zoom in on those municipalities that raised financing in 2009-2010, whose historical issuance before the 2009 regulatory change lies within the *constrained region*, the bandwidth of which is obtained from Section II.D (specifically, the lower limit, b_L). The historical debt issuance covers the years 2001 to 2008. As municipalities go on the market on average each 3.4 years, the set of local governments for which the bank-qualification constraint was likely binding in the past is formed by the issuers whose bank-qualified issuance falls within the constrained region at least once between 2001 and 2008.[22]

I aggregate the set of municipalities so defined at the county level. An extra dollar of spending likely has spillover effects in the neighboring areas, where the spending leakage is 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 is affected by expenditure switching as well as by migration forces. Forcing the impact of bank credit financing to be circumscribed to the single municipal geographical area is therefore likely to result in uninformative estimates. Detailed employment data are also available at the county-level. For these reasons, I choose the unit of analysis to be at the county-level.[23]

For every municipality in the defined constrained region, and for each given year both in the pre-treatment and in the 2009-2010 period, I calculate the amount of bank-qualified debt issued. The analysis is cross-sectional (eq. 16). The endogenous variable to be instrumented, $\overline{B}$, is calculated as the total (extended) bank-qualified debt issued by each municipality belonging to the constrained region, aggregated at the county level and across the two-year duration of the policy change (scaled per capita). I instrument this quantity using the municipalities' historical issuance, $\overline{Z}$. Specifically, I define the historical issuance as the average historical bank-qualified debt issued in the 2001-2008 pre-regulatory change period, scaled by the 2008 county population. This instrument is similar in spirit to Gruber and Saez (2002), and captures the

[22]Municipalities are defined as cities, townships, school districts, special districts, and county governments, and equivalent authorities such as parishes and boroughs.

[23]For the same reasons, I focus on regional markets with a population size of at least 25,000 residents, which reduces the potential bias from spending leakage and worker migration (see Dupor and McCrory (2017))

amount of bank debt that the municipality would have been able to raise had the policy limit not been changed. The instrument is also similar in nature (albeit in a different context and with a different set of assumptions) to the instruments used in the current literature on federal aid multipliers. In this light, the endogenous bank financed debt raised in 2009-2010, $\overline{B}$, can be thought as the sum of two components: a part that is independent of the current economic conditions[24], and a part that responds endogenously to the state of the economy. Given the ability of local governments to raise bank financing without size restrictions[25], following the change in the tax code, the instrument attempts to capture that part of the spending that is orthogonal to current economic conditions.[26] In the following section, I further discuss the validity of such instrument.

B.1. Conditional Independence and Exclusion Restriction

Besides a non-zero first stage, to be valid a good instrument needs to satisfy the independence assumption and the exclusion restriction, that is, it has to capture an as-good-as-random assignment that, by exclusively acting on the endogenous variable, instigates a chain of causal interpretation. Adding controls in the specification – both in the first and second stage – weakens these assumptions, by requiring that the instrument be valid, after accounting for such covariates. A good set of controls hence mirrors the parallel trend assumption commonly used in corporate finance. The sets of controls included in the estimation address the economic trajectory of the local area and the structure of the local economy.

Within the first subset of covariates, with employment being a persistent variable, I control for the one-year lagged change in employment, from 2007Q4 to 2008Q4. This is akin to conditioning on counties with similar pre-treatment employment trends. I also allow for the employment lags to enter the specification non-linearly (Gruber and Saez (2002)). I maintain the scaling throughout the analysis, dividing the employment change by the 2008 county population. To further help alleviate concerns of differential trends, I control for the change in the House Price Index (HPI) in each county for the periods going from 2005Q1 to 2007Q1, and

[24] An example could be a mandated fixed maintenance expenditure, or having to roll over an obligation that comes due.

[25] About 90% of local governments regularly issue less than $30M in the calendar year.

[26] I also consider different ways of calculating the historical issuance, given the same subset of issuers, such as (scaled) issuance in 2005-2006 as $\overline{Z}$, to account for funds deployability. This gives virtually unchanged results.

from 2007Q1 to 2008Q4. Municipal bonds are largely paid back though property taxes, which for the vast majority follow a lagged property value assessment, hence the ability of an issuer to raise debt is intimately linked to the value of the property in its geographic competence, both at shorter and longer horizons.

In order to control for potential heterogeneity in the structure of the local economies, I control for the (pre-2009) share of employment in the manufacturing sector, as well as for the share of employment in the tradable goods sector, following the classification in Mian and Sufi (2012). I also control for the (pre-2009) three-year moving-average personal income (per capita) and working age population in the county. I then include Census regions fixed effects, to look for within division variation.[27]

The instrument, $\overline{Z}$, is therefore valid if, given issuers in the same region with a similar pre-2009 economic trajectory and similar structures of their local economies, the residual variation in the cross-section is exogenous or as good as random. Finally, throughout the estimation, robust standard errors are clustered by State.

C. Results

Table II reports the results of the baseline specification for the employment outcomes across all sectors. Models 1-2 report results from the OLS specification, while columns 3-4 report 2SLS estimates. The OLS regressions with covariates indicate a positive impact on job creation; however, it is imprecisely estimated. The 2SLS estimation reports a large and significant impact of the instrumented bank-financed debt on employment. The annualized job creation across the spectrum of industries corresponds to 30 jobs per year per additional $1 million of bank-qualified debt. The estimate is robust to the inclusion of additional controls across different specifications. Compared to the OLS coefficients, the 2SLS estimates appear quantitatively larger, besides being precisely estimated. Given the validity of the instrument, this suggests that the endogenous component of spending that the instrument leaves out is plausibly corre-

[27]Demand for local government debt is potentially a function of the economic conditions of the area– in a positive (a bank looking for a safe asset) or in a negative way (an appetite for risk)–, which are captured by the economic health controls. Such demand is also potentially related to the health of the balance sheet of the institutional investor, but which in turn depends again on the risks the bank is exposed to. If we consider a local bank, its balance sheet will load on the same sources of risk embedded in the county-level controls. The region fixed effects instead will isolate those shocks that are shared across States.

lated with higher unemployment; such form of endogeneity would then bias the OLS estimates downward.

Table III and Table IV section employment creation across the private and public (local government, non-federal) sectors. The impact on employment appears to come exclusively from the private sector, while government employment estimates are both quantitatively minor and insignificant. Table V looks at employment in the services and goods sectors. The effect on employment in the non-tradable sector is quantitatively larger, in line with the literature. However, there is a significant response, albeit smaller, also in the goods (tradable) sector. This can be understood in light of the fact that municipal bonds are typically issued to finance capital spending, with proceeds being channeled toward building schools, and other public services such as sewage and pipelines. 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. Additionally, the funds are typically not intended to pay public-sector employees' wages. Hence, with regards to the null impact on government employment, this suggests that the proceeds are not fungible, but rather effectively deployed for their declared use.

I also vary the horizon, h, over which the employment effects are estimated, to allow for the possibility of spending to affect employment in the long-run; that is I estimate equation (16) for $H = \{2009Q1, ..., \overline{h}\}$, where $\overline{h}$ varies with quarterly increments from 2010Q4 to 2011Q4. Figure (10) reports the jobs per year estimates varying the horizon over which the employment effect is cumulated. As it is expected, while the estimates are still significant, standard errors grow with the horizon.[28]

In the baseline model, an additional million of bank-qualified debt appears to have generated (or saved) roughly 32 jobs per year in the private sector. This is equivalent to an annual cost per job – more precisely, the cost of generating a one-year job – of \$32,000 (=\$1M/32). It is possible to look at the average compensation in the economy to interpret the magnitude of the estimated cost per job. At the end of 2010, the total employee compensation (including wages and benefits, such as insurance) amounted to \$27.75 per hour;[29] with an average of 34-hours of work per week

[28]If the residual shock in the estimation is orthogonal with variance σ^2, then such residual variance is cumulated in the specification over horizon h, so that confidence intervals widen over longer horizons.

[29]Data from BLS, Employer Cost for Employee Compensation.

in the private industry and a 52-week work year,[30] the annual cost per employee to a private employer is $49,000. Taken together, the cost to a local government to generate (or save) one job per year was remarkably close to the typical compensation (including benefits) in the private sector. Following the literature (Chodorow-Reich (2012)), if total compensation captures the marginal product of labor, and if workers hired under the extended bank-qualification provision received the average compensation in the industry, the estimated cost per job would then roughly translate into an output multiplier of 1.55 ($\sim$ 49,000/32,000).[31] Section IV discusses the magnitude and interpretation of these findings in more detail.

D. *Alternative Identification Strategy*

In this section, I provide an alternative approach to identification. As previously explained, following the results in Section II.D, municipalities can be classified into four groups: (1) the municipalities whose historical issuance falls well below the $10M rule and for which hence the constraint did not bind in the first place; (2) the municipalities whose historical issuance size has been in the (left) interval of the $10M cap, specifically in the area where the bunching occurs; (3) the municipalities that are able to issue non-qualified bonds above the $10M limit and whose issuance needs lie below $30M; and (4) the municipalities that issue above $30M.

It is plausible to argue that municipalities in region (1) that never issued bonds of size in the range of the constraint, were considerably less affected by the change in regulation, being their optimal issuance always well below the cut-off. For these municipalities the $10M limit was never binding in the first place. These municipalities can then serve as a useful control to identify the extra slack that is coming from the bank-qualification shock, over and beyond current economic conditions. In this light, I estimate a 2SLS where the first stage follows:

$$\begin{aligned} B_{c,t} =& a_c + b_1 B_{c,t-1} + b_2 B_{c,t-1} * Constrain + b_3 B_{c,t-1} * Post + \\ & b_4 B_{c,t-1} * Constrain * Post + OtherControls_c + e_{c,t} \end{aligned} \tag{17}$$

In words, I compare counties where there are constrained issuers as defined in Section II.D – that is issuers close to the $10M limit, for which *Constrain* takes the value of 1 – to counties

[30] Numbers from the Current Employment Statistics.
[31] Capital is assumed to stay fixed.

where qualified-issuers are only of the region (1)-type, none of them ever having been close to the bunching area ($Constrain = 0$). I consider the five year window 2006-2010.[32] $Post$ takes value of 1 for 2009-2010.[33] I include county fixed effects, a_c, while $OtherControls$ represents house prices at the county level, and household units.[34] Standard errors are clustered at the county level. The coefficient b_2 captures the pre-treatment trends across the two groups to test their alignment. Given a valid counterfactual, the extra debt issued by the constrained municipalities can be interpreted as the extra slack coming from the regulatory shock, net of the current economic conditions which the unaffected issuers capture. The excluded instrument for the purpose of the second stage is therefore the triple interaction term $B_{c,t-1} * Constrain * Post$. This quantity serves as the instrument for the estimation of the fiscal multiplier on government spending, where the second stage dependent variable is the time-series of (log) employment. I look at aggregate employment, as well as private vs. government employment.

Table VI reports the results of the first stage regression. The coefficient on $B_{c,t-1} * Constrain$ is both small and insignificant, giving credit to the idea that in the pre-shock period the two groups were on similar trends. On the contrary, the coefficient on the instrument $B_{c,t-1} * Constrain * Post$ is large and significant, showing a substantial response of the constrained issuers following the bank-qualification shock, compared to the unconstrained issuers.

Table VII reports 2SLS estimates for aggregate employment.[35] Results are almost identical to the ones in Section III.B. The estimated coefficients are elasticities and are transformed into number of jobs using the standard elasticity formula. The results show that every extra \$1M of bank-financed debt generated 34 jobs. These jobs are concentrated in the private sector, confirming the results obtained in Section III.B. The estimated cost per job is \$29,000, which can be mapped into an output multiplier of 1.7.[36] In what follows, Section IV, I discuss how to interpret these estimates within the context of the larger literature on government spending, and in what respect they contribute to our understanding of fiscal multipliers.

[32] I restrict the analysis to the set of counties (both constrained, and unconstrained) in which at least one of the local governments has issued bonds in the five year period.

[33] Employment is observed as end of year. The policy change was voted into law in February, and first proposed in January 2009.

[34] To the extent that the measure was temporary, induced migration should not be a concern. Households units would be less responsive in any case, unless the entire unit is driven out of (or into) a county. However, I also estimate equation 17 without HPI and HH units.

[35] Baseline Controls: $B_{c,t-1}$, $B_{c,t-1} * Constrain$, $B_{c,t-1} * Post$. Other Controls are HPI and HH units. $\hat{B}$ is the instrumented bank-qualified expenditure.

[36] The calculation of the output multiplier follows Section III.C.

IV. Discussion: Deficit vs. Transfer and the Size of the Multiplier

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. Lacking the natural experiment, most of the estimates on fiscal multipliers in the literature have come from VAR studies and evidence from wars. Under the assumption that war spending is independent of the business cycle, the literature has estimated a near-zero (or even negative) impact of government purchases on the economy (Barro (1981), Hall (1986), Barro-Redlick (2011) among others). These estimates however do not take into account that in war-times, government spending is also associated with concomitant rationing and price controls, as well as forms of patriotism, biasing the coefficients in opposing directions and thus preventing an understanding of the results. Even worse, a large part of the Korean war and a portion of the WWs – where the identification comes from – were financed through taxes rather than deficit. The source of spending is important because it gives rise to vastly different implications for the size of the multiplier, as well as for the mechanism at play. Government spending that is financed through distortionary taxes implies negative multipliers, while deficit-financed spending may have a large positive impact on the economy, especially if persistent (Baxter and King (1993)). Estimates that average across the two are difficult to interpret.

Much of the recent literature, which emerged in the aftermath of the crisis, has tried to approach this long-standing question in a different way, specifically by borrowing the empiricist toolkit typical of the microeconomist researcher. In order to identify the fiscal multiplier, however, these papers have relied on forms of *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), relied on 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. All of these papers find large multipliers, usually in the range of 2, with a low cost per job, between $26,000 and $35,000.

Windfall spending however is an *external* source of public finance. And external sources of public finance can differ substantially from *internal*-based spending (e.g. taxes and deficit). The reason is that windfall, aid, or transfer money do not affect the future stream of taxes. Ramey (2011) provides a simple but illustrative example: 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) provide an insightful discussion on many of the open issues in this cross-sectional literature.

In this paper, however, 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. While obtained in a cross-sectional framework, the results in this paper can be informative of the *national* deficit-financed multiplier. As detailed in Chodorow-Reich (2017), geographical multipliers difference out national shocks such as monetary policy, and can therefore be interpreted as a lower-bound for national multipliers when monetary policy is passive or at the zero lower bound. They are a lower bound specifically because sub-national regions, e.g. counties, are not a closed economy, and therefore government spending is likely to give rise to expenditure switching and leakage effects, as demand "leaks" across local areas.

The estimate of the cost per job in this paper is in the range of $32,000, which can be mapped into an output multiplier of around 1.6. These results compare well with the emerging literature on state-dependent fiscal multipliers. Auerbach and Gorodnichenko (2011) in fact note that multipliers might be different depending on whether the economy is in recession or expansion. Using a regime switching model, they find that fiscal multipliers in booms are well below unity and even negative, whereas government purchases during recessions give rise to very large output multipliers, as high as 3.6. The results in this paper are obtained using variation during the crisis, and are thus in line with these recent theoretical contributions on

state-dependent asymmetric multipliers.

A final but important note regards budget fungibility. Many of the results in the cross-sectional multiplier literature rest on the assumption that different parts of local governments' budgets are uncorrelated with each other. One important reason behind this, is data limitations, as a census is run only every 5 years. However, municipal bonds represent a clear case of capital expenditure. This is important for two main reasons: first, given how municipal accounting works, the aggregate bond size is recorded in its entirety at issuance, regardless of when the spending takes place. Therefore, observing capital expenditure should plausibly prove similar to municipal issuance. Secondly, municipal bonds are typically accompanied by procurements and must finance capital expenditures; in other words, the money raised goes to build bridges, refurbish public buildings, fix sewage systems, and it is not used as a form of financing for operational expenses.

V. Conclusion

I study the implications of banks' tax privileges for the municipal bond market. 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 10 times larger in the qualified segment where tax privileges are the highest. The discontinuous taxation creates shifts in the marginal investor in the market, which in turn affects the ability of local governments to raise financing. In fact, yields exhibit a sizable upward jump to the right of the bank taxation discontinuity and issuers appear to bunch at the bank qualification limit of $10M. I find that the average marginal bunching issuer reduces the size of its municipal bond issuance by 3.2 percentage points, and that roughly 17% of the issuers who would have issued a bond larger than $10M were induced to downsize to below the bank taxation cut-off.

By exploiting a regulatory change in the bank qualification limit, I then quantify the real impact of relaxing bank financing constraints for municipalities. The IV estimates are robust across specifications and show that every million dollars of additional bank-financed debt generates roughly 30 jobs per year. Job creation is concentrated in the private sector, while there

is no significant or sizable impact on government jobs, in line with the notion that municipal bonds are used to finance capital projects. The estimated cost per job is roughly $32,000; this compares well to the typical annual employee compensation in the private industry (including benefits and insurance), averaged across part-time and full-time jobs.

Taken together, the results in this paper indicate that discontinuous tax-privileges for banks generate market segmentation, which in turn restricts the ability of municipalities to raise funds. Relaxing municipalities' access to finance constraints translates into a sizable job creation. Importantly, as expenditures are financed through bank-qualified bonds, the estimates reflect a form of deficit-financed spending.

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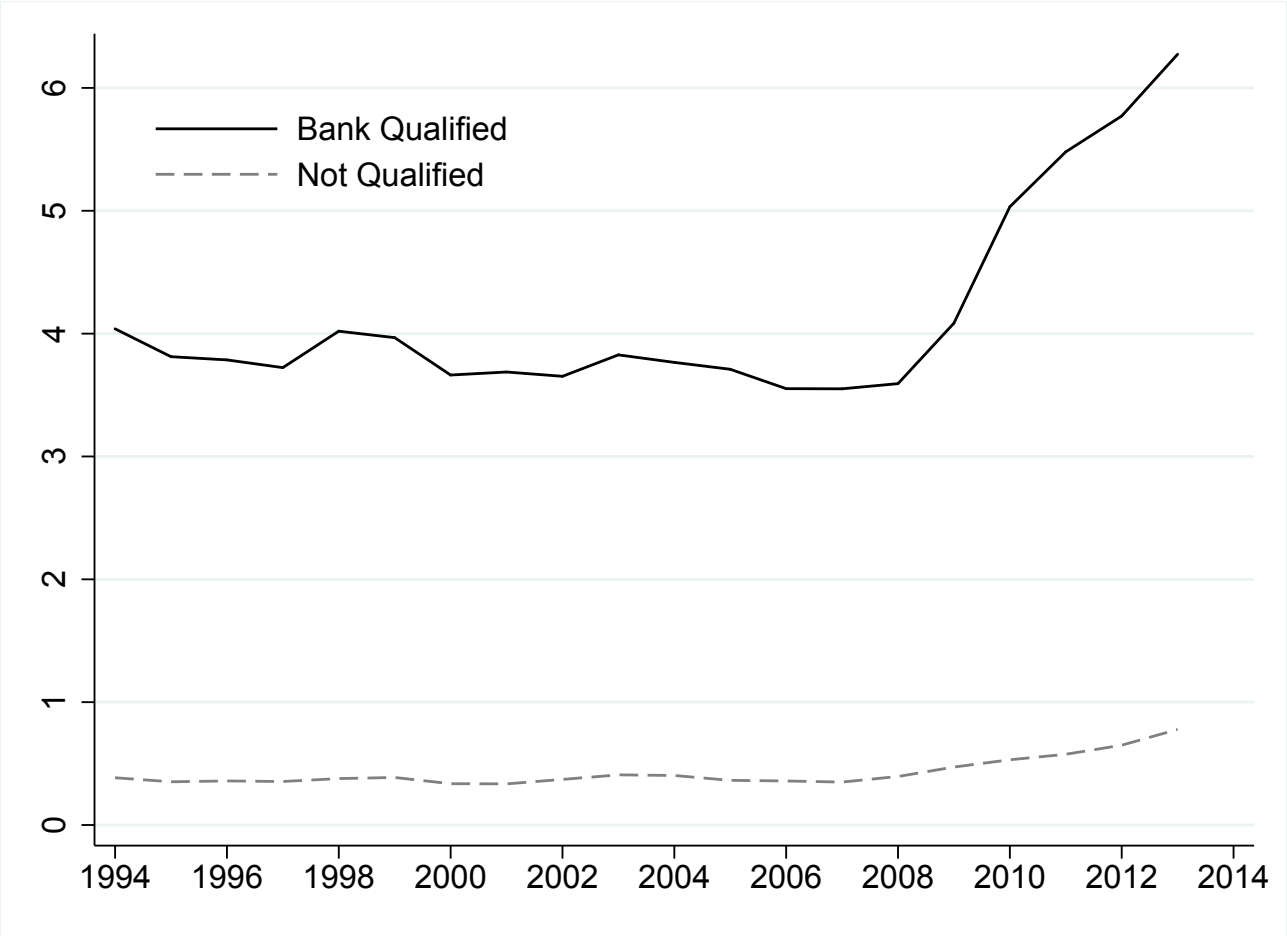

Figure 1. Banks' Holdings of Municipal Securities. This figure plots average banks' holdings of bank-qualified (solid line) and non-qualified (dashed line) municipal securities, as of December of the calendar year. Holdings are expressed as percentage of total assets. Data comes from Call Reports. Please refer to Section A.III for details on variable construction.

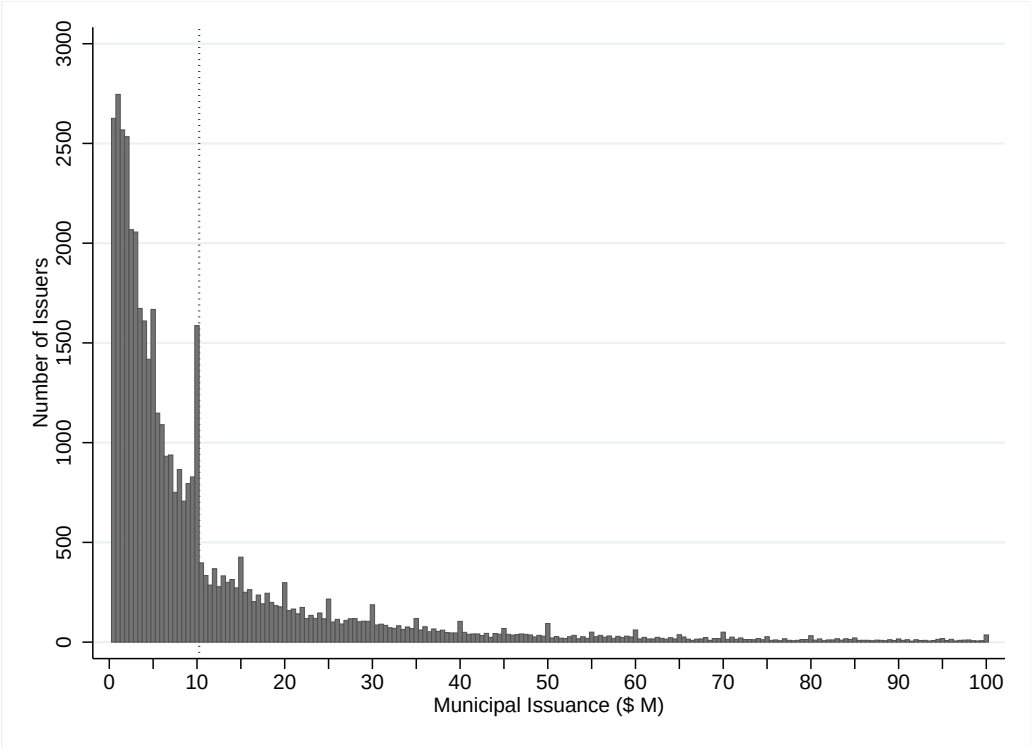

Figure 2. Bunching. This figure plots the distribution of issuers for the years 2000-2008. The x-axis reports the size of municipal issuance in bins of $500,000. Every bar corresponds to the number of issuers within the size bin. Data is pooled across years. Municipal bonds are issued in round-numbers, 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.

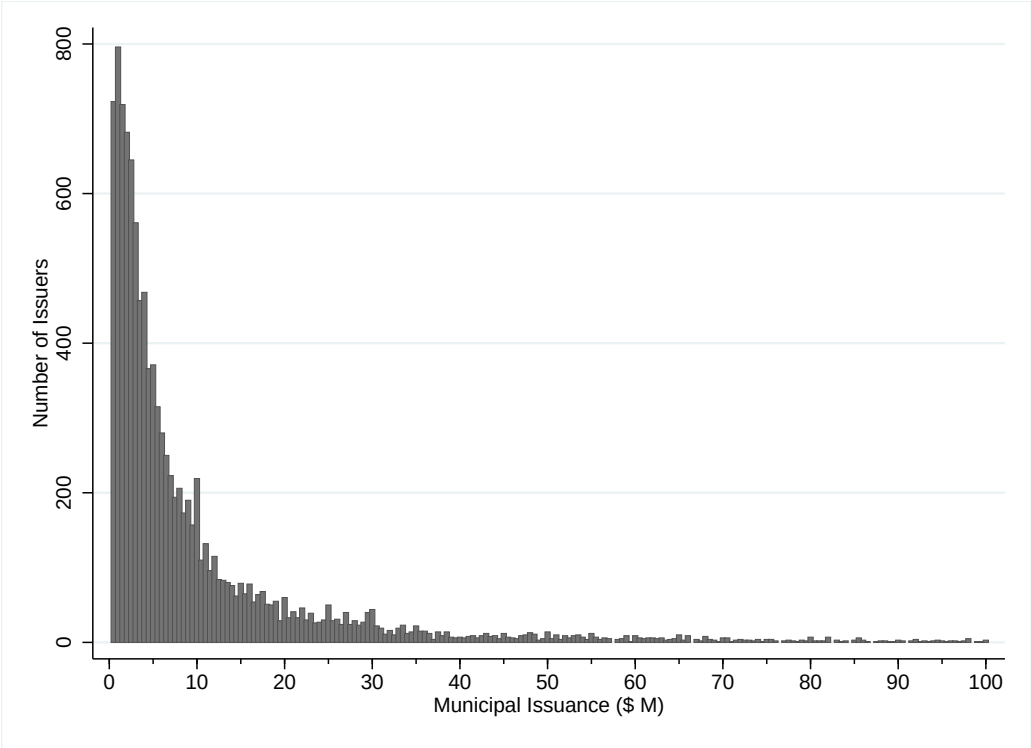

Figure 3. Post-Regulatory Change Distribution. This figure plots the distribution of issuers for the years 2009-2010. The x-axis reports the size of municipal issuance in bins of $500,000. Every bar corresponds to the number of issuers within the size bin. Data is pooled across years. In this period, the bank-qualification limit was moved from $10M to $30M. The distribution appears significantly smoother than in the pre-2009 period.

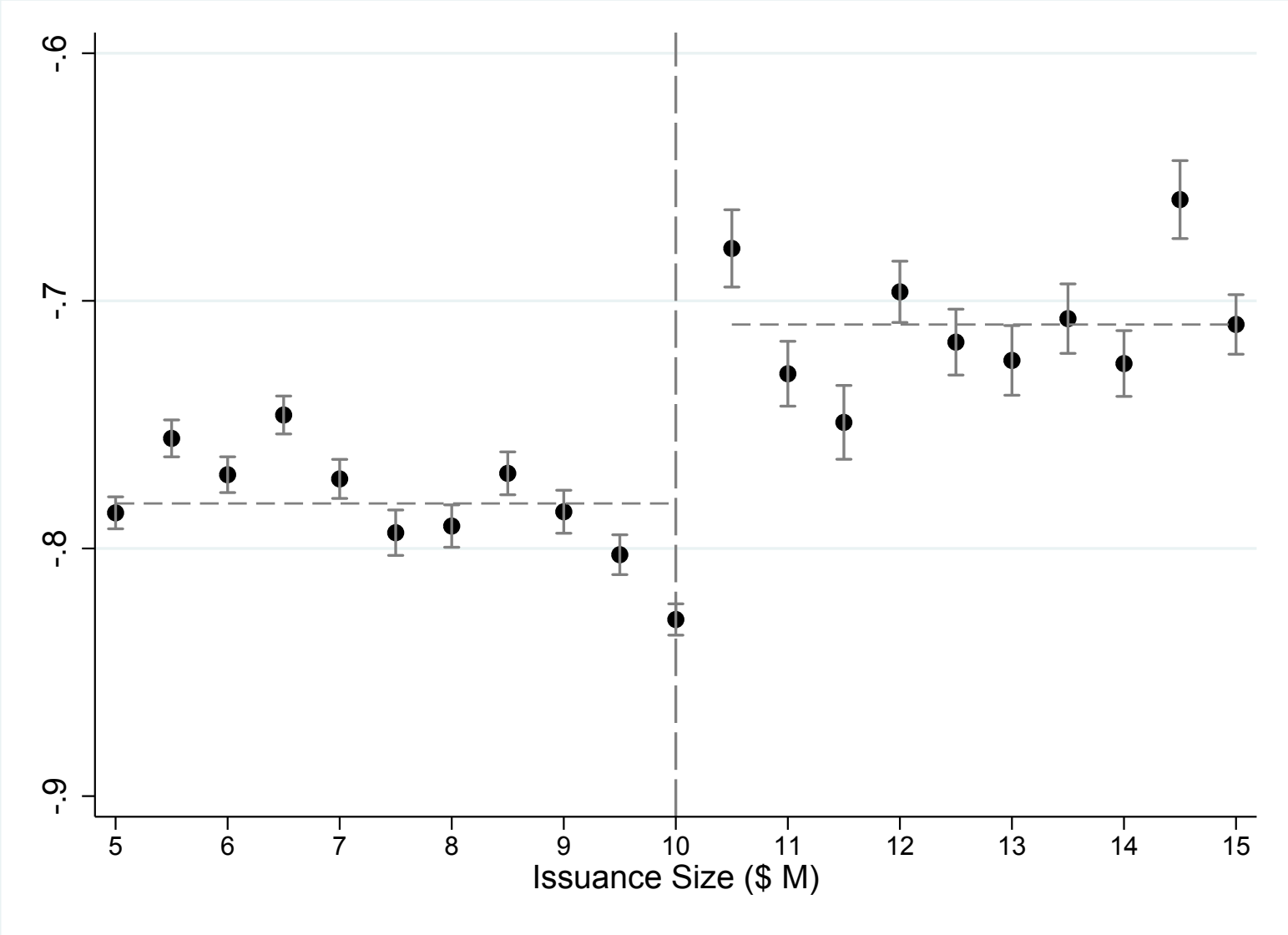

Figure 4. Spread Notch. This figure plots the spread over a maturity- and coupon-matched synthetic treasury, for municipal issuances around the policy threshold ($10M). The horizontal dashed lines are averages for the binned data for the region below and above the policy cut-off. Vertical lines indicate 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.

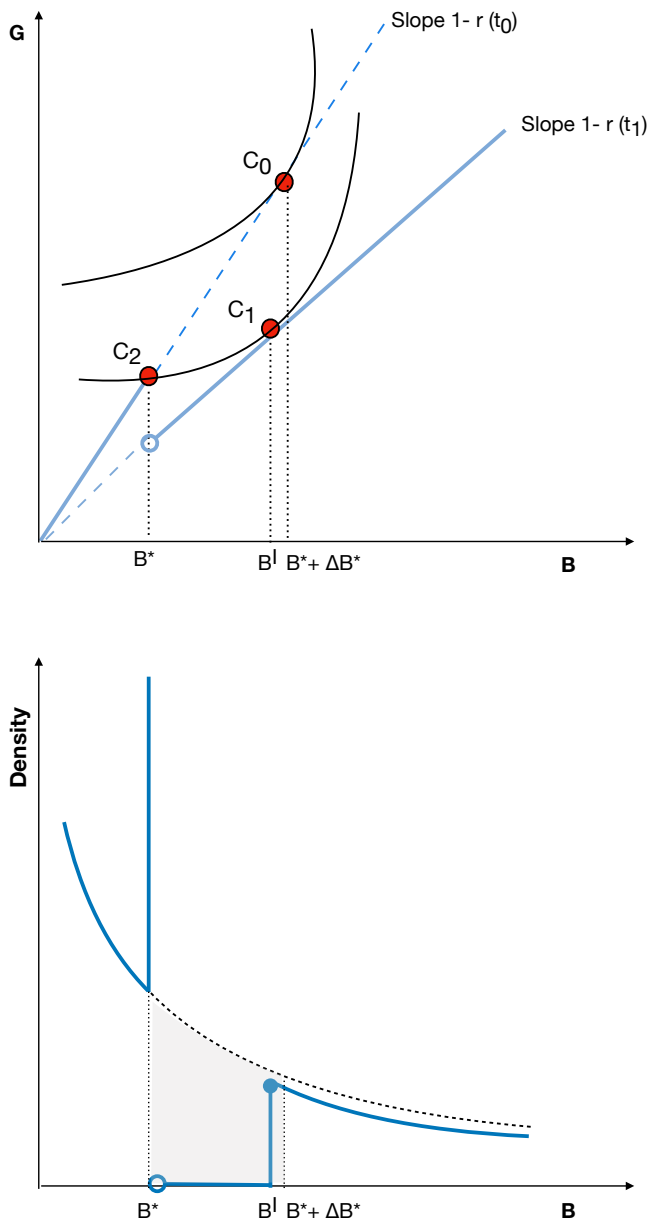

Figure 5. Notch Theory. This figure shows the impact of a notch on a municipality's budget set. The notch represents a discrete jump in the average tax rate from t_0 to $t_1 = t_0 + \Delta t$ in the bank's taxation schedule. When faced with the notch, a municipality that would have otherwise issued $B^* + \Delta B^*$, 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).

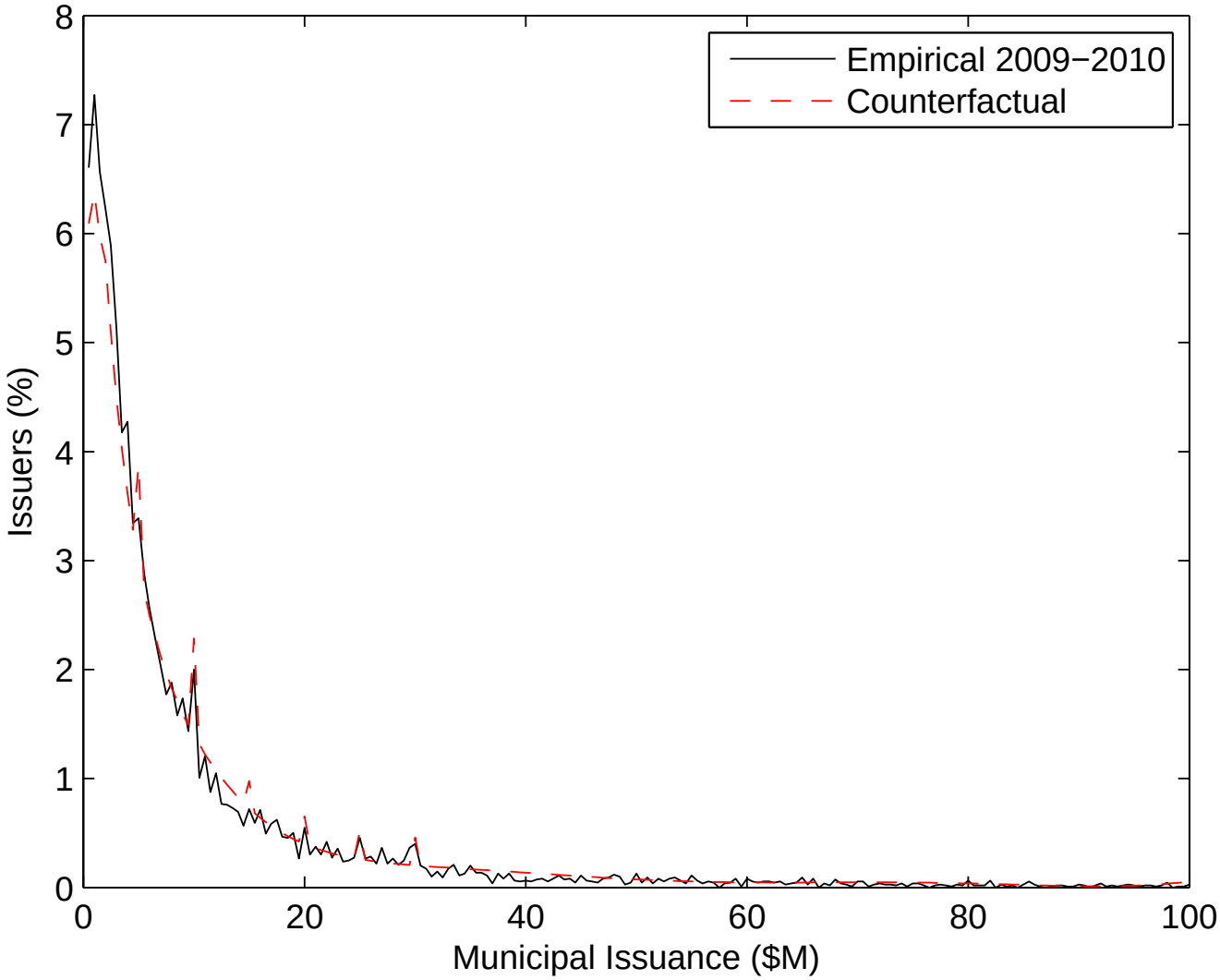

Figure 6. Counterfactual Validation. This Figure compares the estimated counterfactual distribution for the years 2000-2008 against the observed distribution in the post-regulatory change years (2009-2010). The two distributions appear remarkably similar, providing support in favour of the ability of the estimation to capture the distribution of municipal issuance had the $10M policy not been in place.

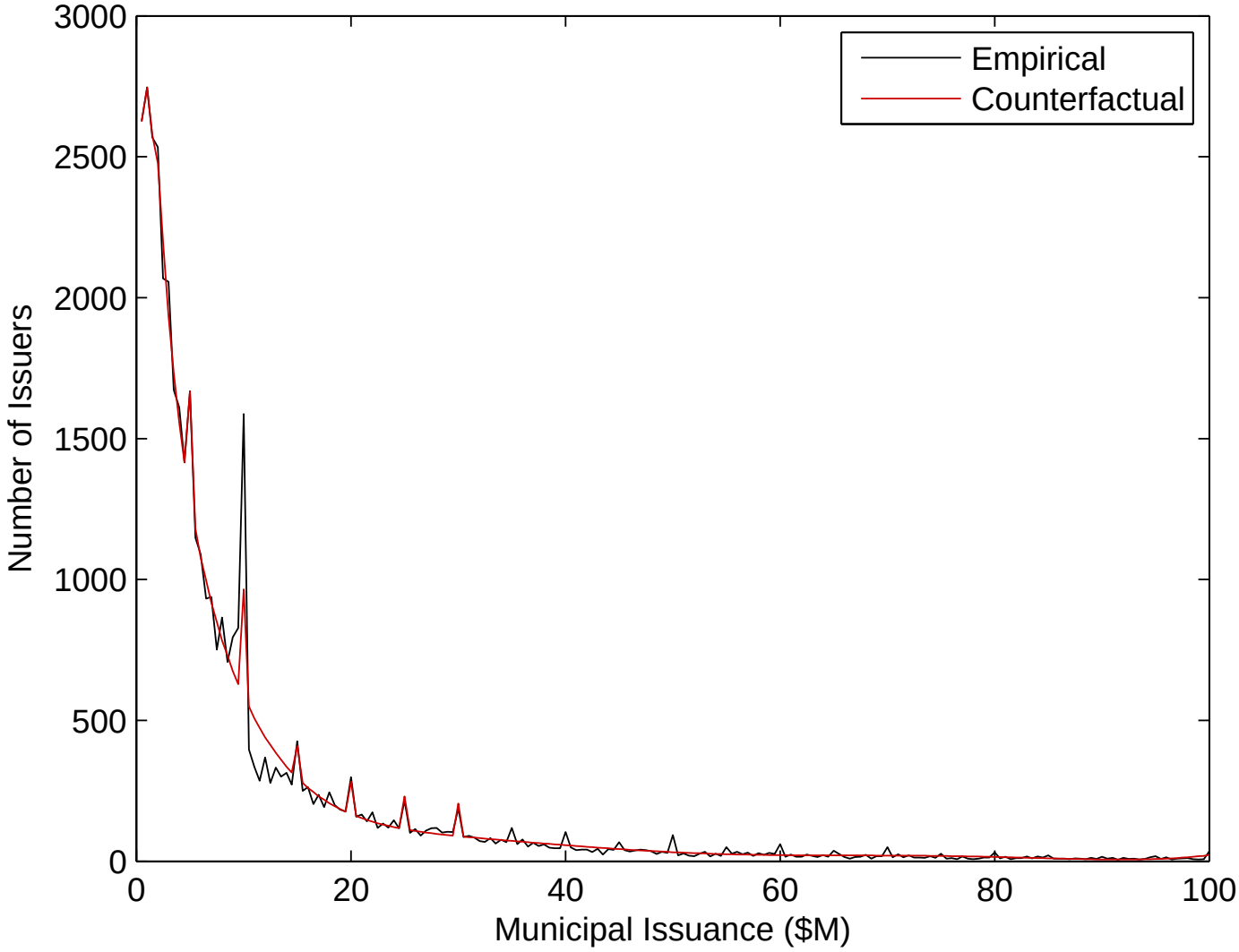

Figure 7. Estimation. This figure plots the observed distribution of issuers (black) alongside the estimated counterfactual (red) for the years 2000-2008.

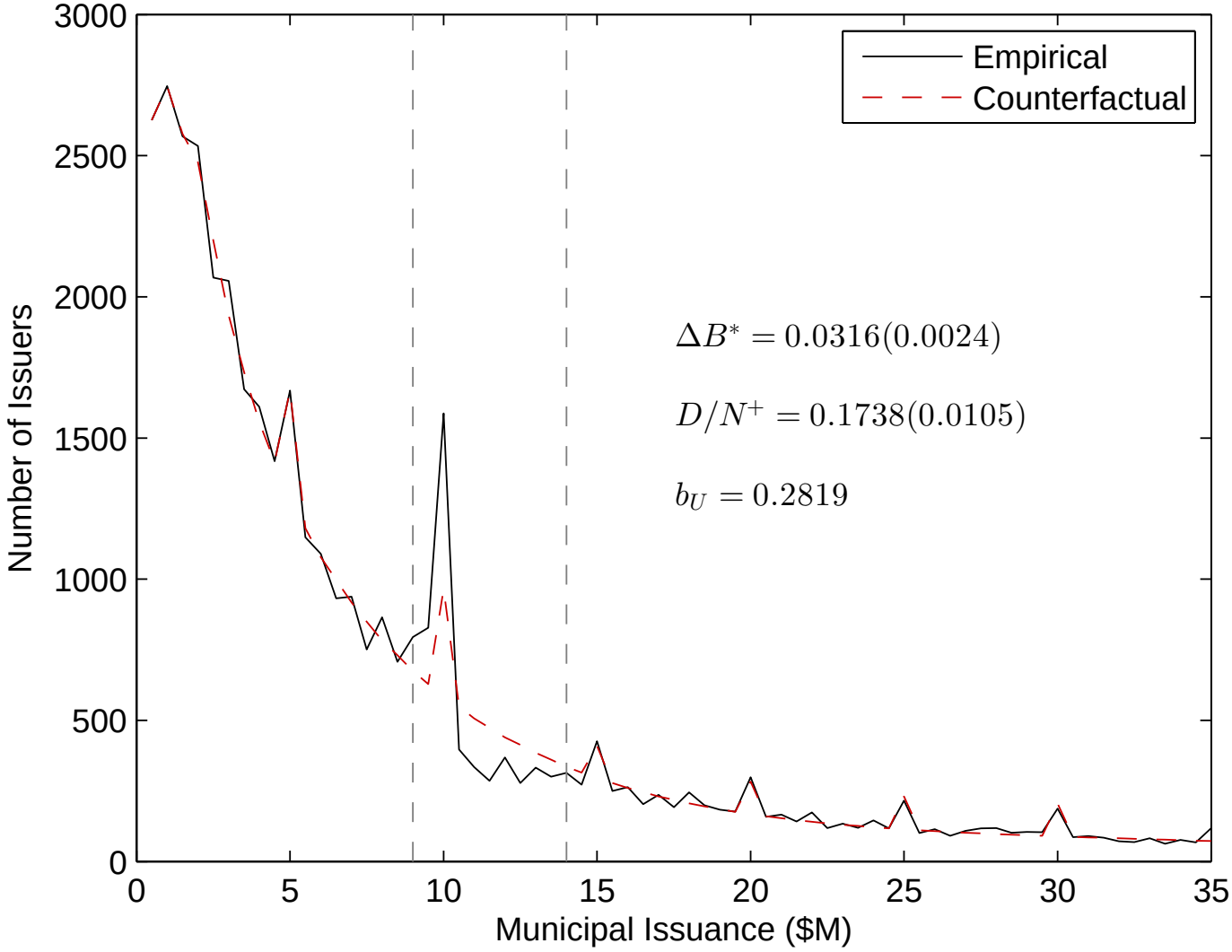

Figure 8. Estimation. This figure plots the observed distribution of issuers (solid black line) alongside the estimated counterfactual (dashed red line) for the years 2000-2008, and zooms in around the policy cut-off. Each point represents the count of issuers in each given 5% issuance size bin. The 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.

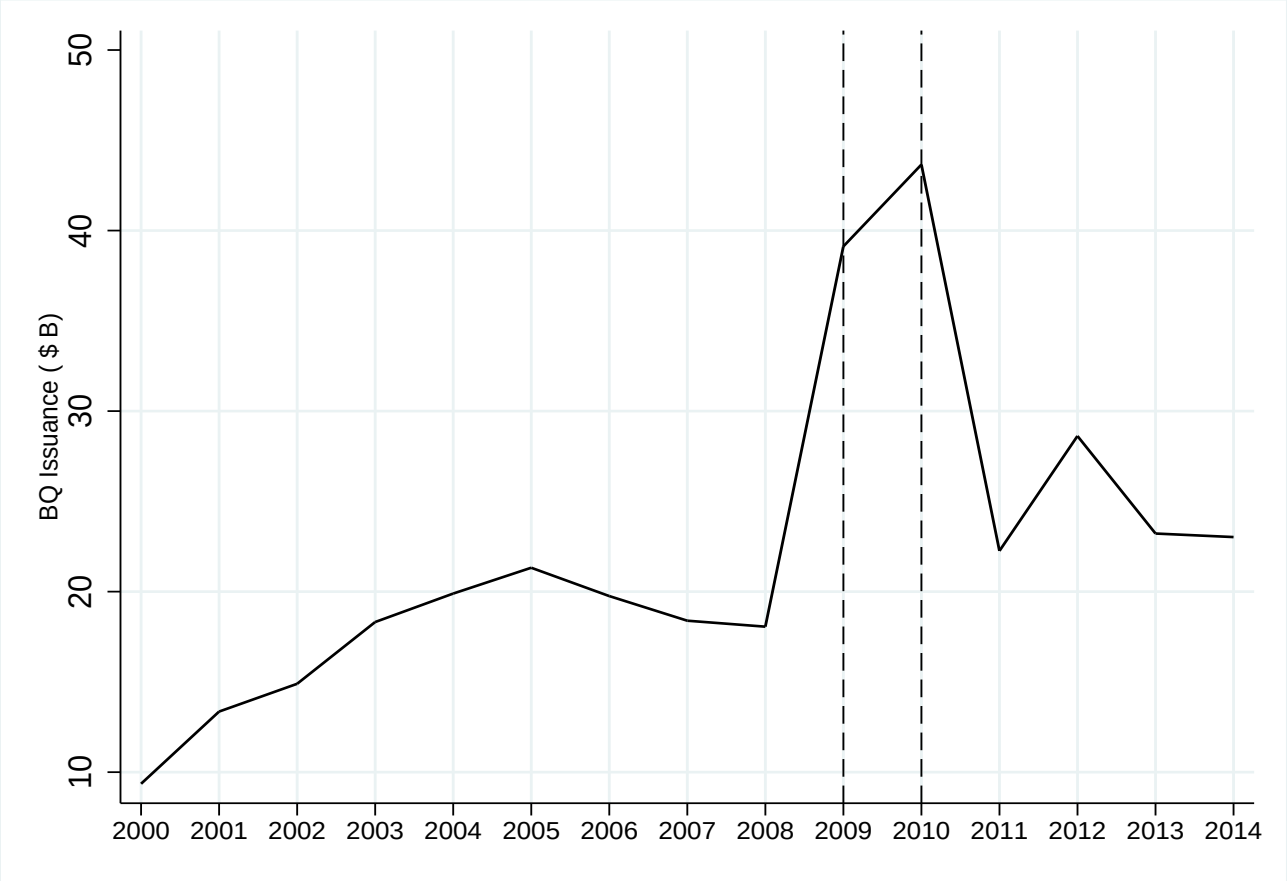

Figure 9. Bank-Qualified Debt Issuance. This figure shows the time series of aggregate bank-qualified debt issuance, expressed in billions.

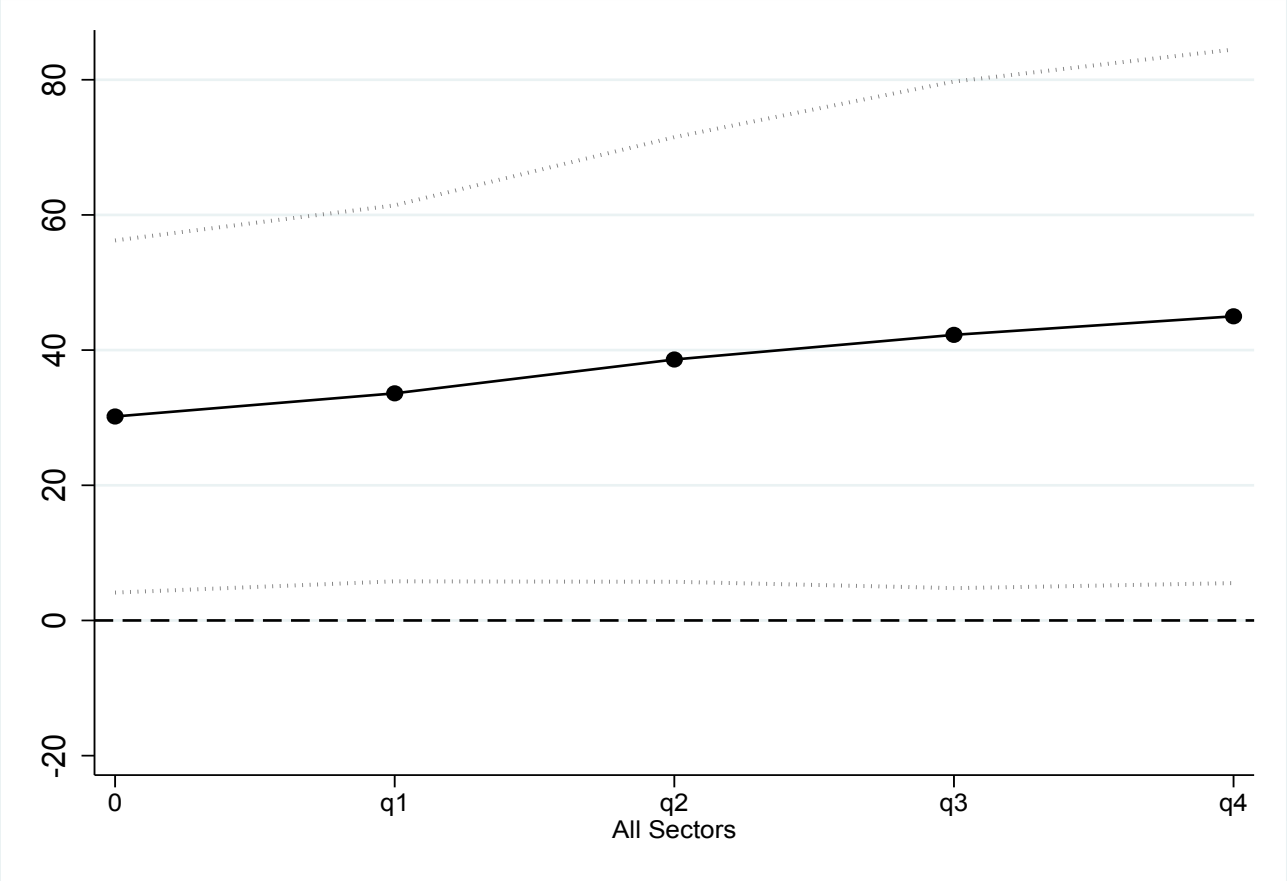

Figure 10. Jobs-Year. These figure show the annualized value of job creation per additional \$1M of bank-qualified debt issued between 2009 and 2010, as the horizon of the estimation varies. The origin at zero corresponds to the baseline estimation with h=2010q4. The horizon varies in increments of one quarter. Dotted lines represent 90% confidence interval.

Table I: This table reports the results of the bunching estimation: the behavioral response (ΔB^*), the intensive margin effect (D/N^+), the extensive margin effect ($(\hat{M}-\hat{D})/\hat{N}^+$) and the upper limit in deviation from the cut-off (logs), b_U. Bootstrapped standard errors in parenthesis. The first column represents the preferred specification under nil extensive margin responses. Column (2) and (3) explore robustness to the presence of extensive margin adjustments and polynomial specification.

	Baseline	Alternative	Specifications
		$b_U = 0.51$	$p = 6$
	(1)	(2)	(3)
Behavioral Response (ΔB^*)	0.0316	0.0279	0.0339
	(0.0024)	(0.0024)	(0.0022)
Intensive Margin Effect ($\hat{D}/\hat{N}^+$)	0.1738	0.1016	0.1433
	(0.0105)	(0.0068)	(0.0075)
Extensive Margin Effect ($(\hat{M}-\hat{D})/\hat{N}^+$)		0.1017	
		(0.0068)	
Upper Limit (b_U)	0.2819	0.5187	0.4238

Table II: This Table reports OLS and IV estimates of the impact on employment in the economy of bank-qualified debt. The unit of analysis is the county. Robust standard errors clustered by State are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent. Coefficients and S.E. for † are rescaled by 100 to facilitate interpretation.

Unit: County
Jobs per Year

	OLS			2SLS	
	(1)	(2)		(3)	(4)
Bank financed debt (per capita, mils)	-0.81	3.22		25.37*	31.72**
	(7.58)	(7.40)		(14.75)	(15.79)
Δ HPI 2005Q1-2007Q1†	1.41	2.77		0.71	2.08
	(1.93)	(1.77)		(1.92)	(1.79)
Δ HPI 2007Q1-2008Q4 †	4.22	4.73		3.18	3.86
	(2.64)	(2.97)		(2.83)	(2.98)
Personal Income		-9.89**			-10.85***
05-08 (per capita, mils)		(3.77)			(3.62)
Manufacturing share†		-11.74***			-13.56***
		(2.41)			(2.73)
Tradable goods share†		7.59***			7.81***
		(2.35)			(2.56)
Working Age Population		-0.20**			-0.21**
		(0.09)			(0.09)
Lags of Employment change	X	X		X	X
Region Fixed Effects	X	X		X	X
State Clusters	X	X		X	X
F stat first stage				89.48	85.62
R^2 first stage				0.28	0.30
Observations	644	644	644	644	644

Table III: This Table reports OLS and IV estimates of the impact on employment in the private sector of bank-qualified debt. The unit of analysis is the county. Robust standard errors clustered by State are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent. Coefficients and S.E. for † are rescaled by 100 to facilitate interpretation.

Unit: County Jobs per Year- Private				
		OLS		2SLS
	(1)	(2)	(3)	(4)
Bank financed debt (per capita, mils)	0.07	4.10	28.32**	32.91**
	(7.27)	(7.05)	(14.26)	(15.42)
Δ HPI 2005Q1-2007Q1†	1.49	3.07*	0.73	2.37
	(1.84)	(1.75)	(1.85)	(1.78)
Δ HPI 2007Q1-2008Q4†	3.60	3.78	2.49	2.90
	(2.62)	(2.98)	(2.80)	(3.00)
Personal Income		-10.55***		-11.52***
05-08 (per capita, mils)		(3.79)		(3.66)
Manufacturing share†		-11.88***		-13.72***
		(2.47)		(2.80)
Tradable goods share†		8.13***		8.35***
		(2.53)		(2.73)
Working Age Population		-0.19*		-0.20**
		(0.909)		(0.09)
Lags of Employment change	X	X	X	X
Region Fixed Effects	X	X	X	X
State Clusters	X	X	X	X
F stat first stage			89.48	85.62
R^2 first stage			0.28	0.30
Observations	644	644	644	644

Table IV: This Table reports OLS and IV estimates of the impact on employment in the government sector of bank-qualified debt. The unit of analysis is the county. Robust standard errors clustered by State are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent. Coefficients and S.E. for † are rescaled by 100 to facilitate interpretation.

Unit: County Jobs per Year- Local Government (non Federal)				
	OLS		2SLS	
	(1)	(2)	(3)	(4)
Bank financed debt (per capita, mils)	-0.47	-0.64	-2.99	-1.97
	(1.08)	(1.12)	(1.97)	(1.88)
Δ HPI 2005Q1-2007Q1†	-0.20	-0.40	-0.12	-0.37
	(0.41)	(0.42)	(0.40)	(0.40)
Δ HPI 2007Q1-2008Q4†	0.54	0.79**	0.64**	0.83**
	(0.32)	(0.33)	(0.31)	(0.33)
Personal Income		0.92***		0.96***
05-08 (per capita, mils)		(0.33)		(0.34)
Manufacturing share †		0.18		0.26
		(0.43)		(0.42)
Tradable goods share†		-0.19		-0.20
		(0.51)		(0.51)
Working Age Population		-0.009		-0..1
		(0.009)		(0.09)
Lags of Employment change	X	X	X	X
Region Fixed Effects	X	X	X	X
State Clusters	X	X	X	X
F stat first stage			89.48	85.62
R^2 first stage			0.28	0.30
Observations	644	644	644	644

Table V: This Table reports IV estimates of the impact on employment in the service and goods sectors of bank-qualified debt. The unit of analysis is the county. Robust standard errors clustered by State are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent. Coefficients and S.E. for † are rescaled by 100 to facilitate interpretation.

Unit: County Jobs per Year- Services and Goods		
	Services	Goods
Bank financed debt (per capita, mils)	22.93**	9.9*
	(11.85)	(5.65)
Δ HPI 2005Q1-2007Q1	1.91*	0.45
	(1.13)	(0.84)
Δ HPI 2007Q1-2008Q4	1.33	1.58
	(1.52)	(1.76)
Personal Income	-5.19**	-6.32***
05-08 (per capita, mils)	(2.30)	(1.90)
Manufacturing share	-0.44	-13.26***
	(1.76)	(1.90)
Tradable goods share	2.63	5.70***
	(1.77)	(1.42)
Working Age Population	-0.09**	-0.10
	(0.03)	(0.06)
Lags of Employment change	X	X
Region Fixed Effects	X	X
State Clusters	X	X
F stat first stage	85.62	85.62
R^2 first stage	0.30	0.30
Observations	644	644

Table VI: This Table reports first stage results following specification in Section III.D. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

First Stage		
	(1)	(2)
B_{t-1} x Post x Constr	0.44***	0.46***
	(0.11)	(0.11)
B_{t-1}	-0.21**	-0.20**
	(0.09)	(0.09)
B_{t-1} x Constr	0.02	0.02
	(0.11)	(0.11)
B_{t-1} x Post	0.12	0.09
	(0.09)	(0.10)
Other controls		X
R^2	0.39	0.39
Number of Obs.	2,144	2,144
Number of Counties	536	536

Table VII: This Table reports job creation estimates following specification in Section III.D. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

Employment		
	(1)	(2)
$\hat{B}_t$	0.54***	0.36***
	(0.18)	(0.11)
Baseline controls	X	X
Other controls		X
F-stat 1st stage	14.36	17.71
Number of Obs.	2,144	2,144
Number of Counties	536	536
Jobs (per $1M)		34.7
Implied Cost-per-Job		29,000

Table VIII: This Table reports job creation estimates in the private sector following specification in Section III.D. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

Employment- private		
	(1)	(2)
$\hat{B}_t$	0.65***	0.45***
	(0.21)	(0.14)
Baseline controls	X	X
Other controls		X
F-stat 1st stage	14.36	17.71
Number of Obs.	2,144	2,144
Number of Counties	536	536

Table IX: This Table reports job creation estimates for public servants following specification in Section III.D. Robust standard errors clustered by county are reported in parenthesis. Significance follows: * 10 percent; ** 5 percent; *** 1 percent.

Employment- government		
	(1)	(2)
$\hat{B}_t$	0.07	-0.006
	(0.09)	(0.06)
Baseline controls	X	X
Other controls		X
F-stat 1st stage	14.36	17.71
Number of Obs.	2,144	2,144
Number of Counties	536	536

Appendix

I. Qualified Small Issuer Requirements

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. Not all obligations can count towards determining the status of qualified issuer, even when well within the cutoff value. Private activity bonds, that is bonds that do not pass the public purpose test, are excluded from being designated as qualified. Exceptions are provided for 501(c)(3) types under the Internal Revenue Code Section 145, under which charitable organization can be beneficiaries of state and local government funds derived from the sale of bonds, whereby the municipality acted as a conduit borrower.

Conduit bonds under 501(c)(3) count towards the qualification limit of the borrower that issued them. In other words, an issuer and the entities that issue on its behalf count as one issuer. The Recovery Act changed this provision, by allowing the extended $30M limit to be counted separately for the borrower and its ultimate beneficiary. For example, a Municipality would act as a conduit borrower for a private purpose Organization, and raise $3M. The municipality would also raise $5M of public purpose tax-exempt debt. The total qualified issuance counting towards the qualification limit would be $8M, up until 2009. In 2009-2010, the 501(c)(3) 3mils issuance would be considered a stand-alone bond, and would not count towards the municipality limit; both the conduit and the ultimate beneficiary would be treated as separated qualified issuer, each entitled to its own $30M limit.

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 prorata 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 prorata 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. Not all bonds can be Bank-Qualified. To be defined as such, a municipal issuer must be recognized as a *qualified small issuer* and it must actively designate the bond issue as bank qualified. Broadly speaking, an issuer is "small qualified" when it can reasonably expect to issue no more than $10 million worth of tax-exempt bonds within the calendar year.

The $10M threshold hence creates a discontinuity in banks' tax treatment of municipal bonds. Since the Tax Reform Act came into force, banks' holdings of bank-qualified obligations have been on average over 10 times the value of their non-qualified holdings.

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 sheet 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 Balance Sheets.

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 back out the bank's exposure to non qualified municipal securities, and then in turn from aggregate municipal securities holdings, the exposure to qualified obligations.

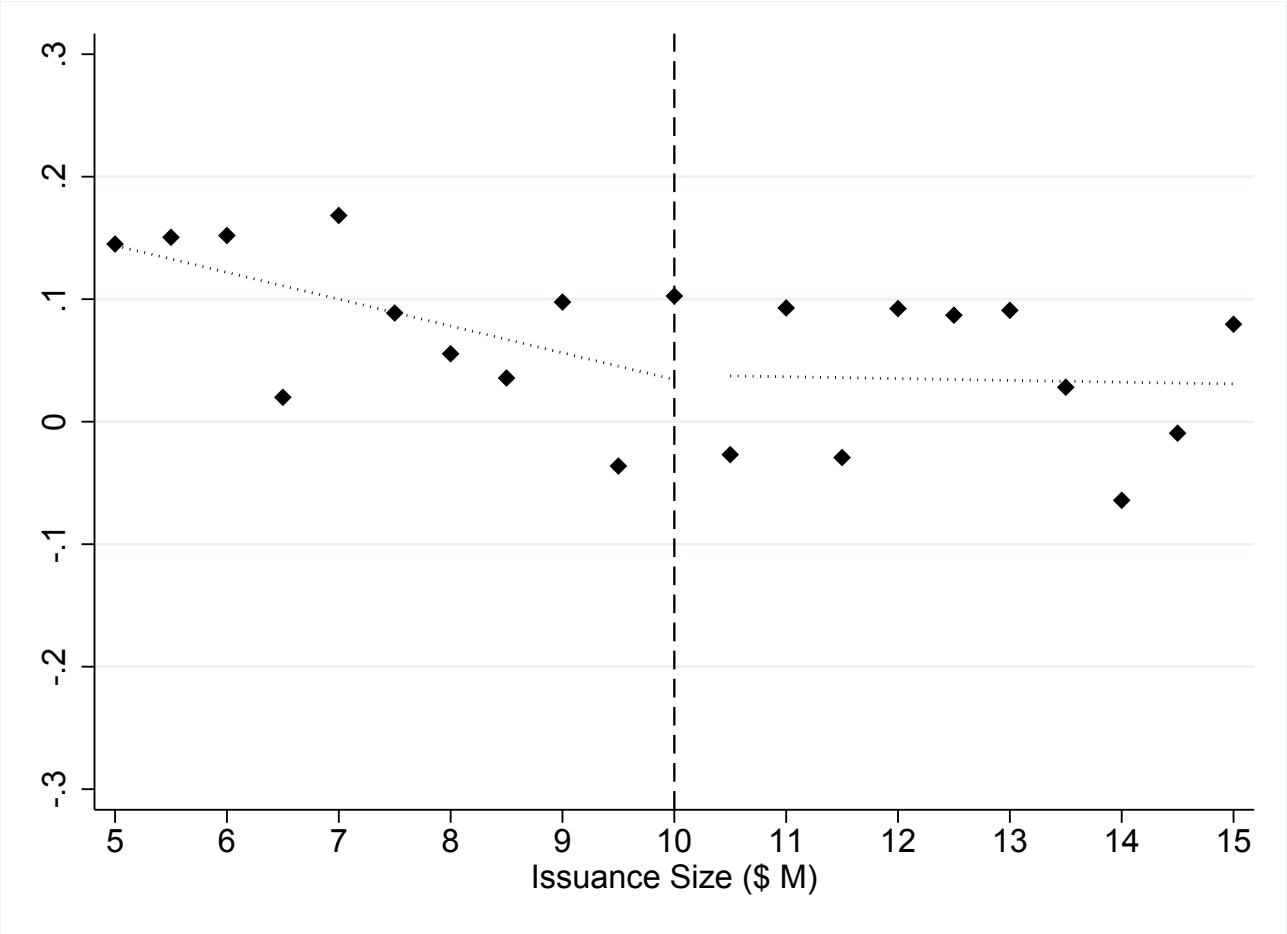

Figure A1. Spread Notch Counterfactual. The figure plots the spread over a maturity- and coupon-matched synthetic treasury, for municipal issuances around the old policy cut-off ($10M). All bonds are tax-exempt general obligations issued in 2010, when the bank-qualification threshold was moved to $30M.The 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.

Table A1: This table explores robustness to the choice of the limits of the excluded region for the estimation of bunching. Reported in the table are: the behavioral response (ΔB^*), the intensive margin effect (D/N^+), the extensive margin effect ($(\hat{M}-\hat{D})/\hat{N}^+$), and the lower and upper limits in issuance size terms. The behavioral response remains similar and significant across specifications. Bootstrapped standard errors in parenthesis.

	(1)	(2)	(3)	(4)
Behavioral Response (ΔB^*)	0.0312***	0.0304***	0.0294***	0.0257***
	(0.0025)	(0.0025)	(0.0025)	(0.0021)
Intensive Margin Effect ($\hat{D}/\hat{N}^+$)	0.1596	0.1355	0.1139	0.1366
	(0.0097)	(0.0085)	(0.0075)	(0.0085)
Extensive Margin Effect ($(\hat{M}-\hat{D})/\hat{N}^+$)	0.0144	0.0320	0.0556	0.0022
	(0.0097)	(0.0085)	(0.0075)	(0.0085)
Exclusion Limits ($M)	(9,14)	(9,15)	(9,16.5)	(8.5,16.5)