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ABSTRACT

Tax-Subsidized Underpricing: Issuers and Underwriters in the Market for Build America Bonds*

Build America Bonds (BABs) were issued by states and municipalities for twenty months as an alternative to tax-exempt bonds. The program was part of the 2009 fiscal stimulus package. The bonds are taxable to the holder, but the federal Treasury rebates 35% of the coupon payment to the issuer. The stated purpose of the program was to provide municipal issuers with access to a more liquid market by making them attractive to foreign, tax-exempt, and tax-deferred investors. We evaluate one aspect of the liquidity of the bonds---the underpricing when the bonds are issued. We show that the structure of the rebate creates additional incentives to underprice the bonds when they are issued, and that the underpricing is larger for BABs than for traditional municipals, controlling for characteristics such as size of the issue or the trade. This suggests that the bonds are not more liquid, contrary to the stated purpose of the program, or that issuers and underwriters are strategically underpricing the bonds to increase the tax subsidy, or both. Several findings point to strategic underpricing. There is a negative correlation between the underwriter's spread and the underpricing. The underpricing for BABs is quite evident for institutional and interdealer trades, while that for tax-exempts is primarily for smaller sales to customers. Counterfactuals for our estimated structural model also suggest strategic underpricing.

JEL Classification: E44, E63, G23 and H74
Keywords: build america bonds, financial intermediation, incentive conflicts, municipal finance and underpricing

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1 Introduction

Build America Bonds (BABs) were created as part of the American Recovery and Reinvestment Act of February 2009, the fiscal stimulus package passed early in the Obama administration in response to the recession triggered by the financial crisis. The program was offered as an alternative to traditional municipal bonds, which pay interest that is exempt from the federal income tax. While the interest from BABs is taxed as ordinary income, the Treasury refunds 35% of the coupon on the BABs to the issuer. These bonds were very popular with issuers. From April 2009 to December 2010, when the program ended, there were 1,875 separate underwritings, involving 14,043 separate bond issues of $153 billion in face value. This comprised 30% of the par value of all municipal issues during the period. Since it ended several proposals have emerged to revive the program, although all of them involve rebate rates below 35%.

The stated purpose of the BAB program was to provide municipal issuers with access to greater liquidity for their borrowing needs. State and local governments can borrow to fund capital investments in infrastructure. Municipalities were seen as a source of "shovel-ready" projects by policy makers, but as constrained by the difficult credit conditions consequent to the financial crisis. The natural clientele for traditional municipal bonds, because they are tax-exempt and therefore have low yields, are taxable individuals, along with the mutual funds and trusts that hold the bonds on their behalf. Allowing municipalities to issue taxable bonds, while preserving the benefits of the tax exemption through the coupon rebate, would give municipalities access to a deeper pool of investors, including pension funds and endowments, along with sovereign funds and foreign investors who do not pay U.S. income taxes. This enhanced liquidity would lower the cost of capital to municipal issuers, and encourage investment, employment, and the rebuilding of publicly provided infrastructure.

Our paper asks whether the program achieved its stated objective of enhancing liquidity, and evaluates some of the program's unintended consequences.

A natural place to look for evidence of improved liquidity is in the patterns of trade when the bonds are first issued and in the underpricing of the new issues. "Underpricing" refers to the extent to which the price eventually paid by final investors exceeds the price at which the security is initially offered to the public. Underpricing of new issues is typically described by underwriters as a cost of liquidity or immediacy—the price concession needed to move a large quantity of securities simultaneously. It is also the subject of controversy in the academic finance literature and among practitioners. Underpricing transfers value from issuers to the intermediaries or customers who initially buy the underpriced security. Since underwriters control access to the initial offering, it can be a means of rewarding favored customers at the expense of the issuers.

There is an additional, and interesting, motive for underpricing in the case of the Build America Bonds. Since the tax subsidy is tied to the coupon payment on the bonds, by inflating the coupon level relative to competitive rates, the issuer and underwriter can raise the tax subsidy paid by the Treasury. While the higher coupon is a cost to the issuer, the present value of the higher coupon can be captured by the underwriters or favored customers who buy the bonds in the secondary market. The underwriter, in turn, can share the benefits of the underpricing with the issuer through lower fees. Thus, viewed as a coalition, the underwriter, the issuer, and investors have a shared interest in underpricing the bonds. We attempt to disentangle the liquidity costs and the strategic tax-induced underpricing by focusing on differences in the pricing of BABs and tax-exempt bonds issued over the same period. We also estimate a simple structural model, and perform counterfactual experiments to quantify the effects of differences in liquidity versus tax treatment.

The underpricing of newly issued securities has provided financial economics with a number of interesting and long-standing puzzles. For the most part, these questions revolve around why issuers tolerate underpricing, and how financial intermediaries benefit from it. Initial public offerings of equities are dramatically underpriced, and a long and rich literature speculates on the cross-sectional determinants of the underpricing, theoretical rationales such as adverse selection and signalling, and what indirect benefits issuing firms or investment banks might capture in exchange for surrendering underpriced securities to investors.[1]

Underpricing has also been studied in bond markets. There, because the newly issued securities are often absorbed into underwriter inventories, or purchased by hedge funds functioning as "flippers," the underpricing is largely captured by intermediaries. The questions in this setting involve

[1] See Jay Ritter's Web Page at `http://bear.warrington.ufl.edu/ritter/` for useful summaries of the empirical facts and of the research concerning them.

why issuers do not bargain more effectively with them, how the opacity of the market facilitates underpricing by the intermediaries, and the degree to which the underpricing is compensation for the costs of distributing the bonds to final investors (liquidity) rather than rents captured by financial intermediaries through market power.[2]

In the settings that have been extensively studied, IPOs and tax-exempt municipal bonds, underpricing comes at the expense of the issuer, and benefits investors and/or underwriters. For BABs, the rebate from the Treasury is tied to the coupon rate, reducing the costs of underpricing to the issuer. While the benefit of the underpricing is captured by the underwriters, or any favored intermediaries who act as "flippers" in the market, the underwriter's discount provides a straightforward means of transferring some of this surplus back to the issuer. Indeed, it appears the Treasury expressed concern about the possibility that the coupons were being set on the bonds at excessively high rates, triggering a vigorous lobbying effort on the part of the issuers, underwriters, and bond counsels in response. We discuss this debate in Section 3.

The secondary market pricing of BABs, and the contrasts to tax-exempt municipals, is of interest for other reasons besides the incentives issuers and underwriters have to collude at the expense of the Treasury. A goal of the program was to give issuers access to more liquid sources of capital by allowing them to issue bonds that would be attractive to pension funds, endowments, and foreign investors. On one hand, the bonds are issued by the same intermediaries through the same distribution channels and trade in the same over-the-counter markets as traditional municipals. On the other hand, the natural clientele for BABs are the types of investors the program explicitly targets: institutional investors such as pension funds and endowments. These investors are presumably more sophisticated "comparison shoppers" than are the individual investors that hold tax-exempts. Thus, the behavior of the bonds in aftermarket trading is informative about the relative importance of the institutions through which the bonds are issued and traded versus the natural investor clienteles for the bonds. Our results suggest the channels through which the bonds

[2]Green, Hollifield, and Schürhoff (2007b) show that average prices of municipal bonds rise from the reoffering price, but that this increase is associated with price dispersion and changes in the mix of buyers. Green (2007) argues that capacity constraints in retail distribution networks allow underwriter-dealers to avoid competitive outcomes in negotiating with issuers. Schultz (2011) argues that increased price transparency due to real-time reporting of transaction prices has reduced price dispersion, but has had little effect on average markups to final investors.

are distributed is very important for their pricing.

We study the evolution of prices in the secondary market once the bonds begin trading, and compare that behavior of BAB prices to those of traditional municipal bonds during the same period. Despite the goal of the BAB program to provide issuers access to a more liquid market, that the bonds to not appear to have achieved dramatically improved liquidity. Like traditional municipals, BABs exhibit a good deal of price dispersion, and the patterns of trade in the secondary market evolve through time in a similar manner. The large numbers of retail trades and evidence that the bonds are being flipped by large investors acting as intermediaries are also consistent with the aftermarket behavior of tax-exempt municipals.

Controlling for characteristics such as trade size, the size of the bond issue, and maturity the BABs exhibit more underpricing than do tax-exempt municipals. We also show that the underwriter discount is lower for issues that are more underpriced, for both BABs and tax-exempts, but this correlation is more pronounced for the Build America Bonds. Underpricing of BABs, unlike tax-exempts, is also quite evident in the prices at which dealers trade with each other. These behaviors are consistent with a recognition on the part of the issuers and underwriters of a shared tax benefit to the underpricing.

Of course, the underwriter fees, choosing to issue BABs, and the degree to which the bonds are underpriced at the reoffering price are all jointly endogenous variables that could be influenced by uncontrolled heterogeneity. In the later sections of the paper, we explore several means of accounting for this. First, we consider only those deals for which the same issuer simultaneously issues BABs and traditional tax-exempt municipals. Second, we regress the different components of the underpricing on deal characteristics allowing for the endogenous selection through the Heckman correction. Finally, we estimate a structural model, which allows us to perform counterfactuals that separate the contributions of liquidity and the tax rebate to the underpricing.

The paper is organized as follows. The next section provides a more detailed description of the BAB program. Section 3 illustrates how underpricing can collectively benefit the issuer and underwriter, and reviews the public debate about how the Treasury should determine the "interest rate" and the "issue price" on which the rebate is based. Section 4 describes the data. Section

5 considers the patters of trade for newly issued BAB and tax-exempt bonds, while in Section 6 we document the underpricing. In Section 7 we look at the relationship between the underwriter discount and amount of underpricing. Section 8 develops a structural specification and presents estimates and counterfactual experiments that separate the liquidity and strategic components of the underpricing. Section 9 concludes.

2 Build America Bonds

Tax-exempt bonds are priced, relative to taxable corporate or government bonds, at lower yields. The natural clientele for them is therefore individual investors who benefit from their tax-exempt status, along with mutual funds or other pass-through intermediaries holding bonds on their behalf. Traditional municipal bonds are unattractive to tax-exempt and tax-deferred entities such as pension funds and endowments, or to foreign investors.

The stated purpose of the BAB program was to provide states and cities with less expensive financing through access to broader clienteles and a more liquid market. According to the "Fact Sheet" on the Treasury's web site[3]:

> The Build America Bond program has broadened the market for municipal bonds to include investors that do not normally hold tax-exempt debt, such as pension funds and sovereign wealth funds. By attracting new investors to municipal bonds, BABs have helped to relieve the supply pressure in the municipal bond market and lower borrowing costs.

The final sentence, of course, seems to overlook the fact that subjecting the bonds to taxes excludes high-tax, individual investors as a clientele. Moreoever, in the taxable market BABs must compete for funds with corporates, Treasuries, agency, and foreign bonds. Indeed, given that the rebate rate, 35%, is chosen to reflect the tax rate of the marginal investor in municipal bonds, why would BABs offer cheaper financing to municipal issuers than traditional, tax-exempt bonds? Several possibilities suggest themselves.

[3]See U.S. Treasury web site, `http://www.treasury.gov/initiatives/recovery/Pages/babs.aspx`.

If the supply of funds channeled through these sources is broader, deeper, and more liquid than the funds available from taxable domestic investors, it is in principle possible that such investors will hold taxable bonds at lower yields on a tax-adjusted basis. Such an argument, however, presumes that funds from taxable investors are not operating as an equilibrating flow across the two markets. If investors in the 35% tax bracket are not "marginal" across the taxable and tax-exempt markets, however, then there is no particular justification for the choice of 35% as the rebate rate for the BABs.

Indeed, there is a history of evidence in the finance literature that long-term municipal rates are "too high" to be consistent with high-tax investors being marginal holders in both the taxable and tax-exempt markets. The tax-exempt yield curve is, typically, steeper than the taxable yield curve. The long-term taxable yields, times one minus the tax rate, understate the long-term municipal yields of the same maturity.[4] Some portion of the high yield on long municipals may be due to illiquidity, which has been the subject of considerable research since transactions price data became available in 2000. It is very expensive for retail investors to trade municipal bonds.[5]

Under any of the alternative explanations, long-term tax-exempt bonds are an expensive source of financing for municipal issuers, who would prefer to issue taxable bonds with a 35% coupon rebate. The limited amount of formal research on BABs to this point bears this out. Ang, Bhansali, and Xing (2010) estimate interest savings on newly issued BABs of 54 basis points on average relative to equivalent newly issued tax-exempt municipal bonds, with this benefit increasing in maturity.

Our interest here is with the behavior of the bonds when they are issued. If the interest savings to issuers are ultimately due to increased liquidity, then we should see the bonds exhibiting markedly different behaviors when issued. We show in subsequent sections that, broadly speaking, the BABs

[4]Green (1993) documents this behavior, and proposes a model to explain it based on tax-avoidance strategies. Chalmers (1998) shows the behavior is also evident in pre-refunded municipal bonds, which are backed by U.S. Treasury securities.

[5]See, for example, Hong and Warga (2004), Harris and Piwowar (2006), and Green, Hollifield and Schürhoff (2007a) who all document mean or median implicit spreads on retail-sized trades in excess of 2% using different methods. Green, Hollifield and Schürhoff (2007b) document a great deal of price dispersion for newly issued bonds, where there is considerable trade. On some bonds investors pay prices that vary by close to 5% of par value virtually simultaneously. Green, Li, and Schürhoff (2010) show that prices rise faster than the fall, as they often do in markets for consumer goods. Ang, Bhansali, and Xing (2011) decompose municipal yield spreads relative to Treasuries into several components, and identify the difference between pre-refunded yields and Treasury yields as due to liquidity.

show after-market behaviors that are very similar to traditional municipals. In one respect, however, the evolution of their prices is markedly different. The rebate from the Treasury is tied to the coupon level, creating a shared benefit to the issuer and the underwriter from underpricing the bonds. We will show that this underpricing is indeed more pronounced in the newly issued BABs.

3 Underpricing and the Tax Subsidy

In this section we illustrate how underpricing creates shared surplus for the issuers and underwriters at the expense of the Treasury. Assume an issuer and underwriter set the terms on a taxable bond (a BAB) of maturity T. The reoffering price of the bond must be set at a par value of \$1, and the issuer receives this price less the underwriter discount of D. If the bond has coupon C, then the value of the bond to investors is:

$$V_T = Ca_T + 1q_T,$$

where a_T is the value of a T-period (taxable) annuity, and q_T is the value of a pure-discount bond maturing at T. This present value can be viewed as what the bond would sell for in frictionless secondary market trading. In our empirical work, we use the inter-dealer price as a proxy for V_T.

The issuer receives a rebate of the coupon equal to τC each period, so the present value of the issuer's liability from the bond is $C(1-\tau)a_T + q_T$. Let C^* be the coupon rate on a bond that would trade at par value in the secondary market—the coupon rate solving $1 = C^* a_T + q_T$. Note that $V_T - 1 = (C - C^*)a_T$.

The underwriter pays the issuer the reoffering price of \$1, and receives the discount of D. He then sells the bonds to investors and receives $(1-\phi)1+\phi V_T$, where ϕ is a reduced-form representation of the extent to which the underwriter is able to recapture some of the benefits of the underpricing. This recapture could come in a number of forms. At the extreme, the underwriter might simply sell the bonds from inventory at full value, in which case $\phi = 1$. Alternatively, he may sell some of the bonds at the reoffering price, and others later at a higher value. Even if the entire issue is sold at the reoffering price, underpricing might reduce the underwriter's costs of marketing the bonds. Selling underpriced bonds to favored customers might also benefit the underwriter through purchases of other financial services by those customers.

In any case, the net liability to the issuer is

$$V_I = 1 - D - C(1-\tau)a_T - q_T,$$

and the net benefit to the underwriter is

$$V_U = (1-\phi)1 + \phi(Ca_T + q_T) - 1 + D.$$

Adding these together, the net surplus associated with issuing the bond is:

$$S = \tau Ca_T - (1-\phi)(V_T - 1).$$

Alternatively, the issuer and underwriter could issue a bond that sold in the secondary market at par, with coupon C^*, and create a surplus of

$$\begin{aligned} S^* &= 1 - (C^* a_T + q_T) + \tau C^* a_T \\ &= \tau C^* a_T. \end{aligned} \tag{1}$$

The difference between these two expressions gives the benefit (or cost) of underpricing the bond,

$$\begin{aligned} S - S^* &= \tau(C - C^*)a_T - (1-\phi)(V_T - 1) \\ &= \tau(V_T - 1) - (1-\phi)(V_T - 1) \\ &= [\tau - (1-\phi)](V_T - 1) \end{aligned} \tag{2}$$

Thus, if none of the benefit of underpricing is captured by the underwriter, ($\phi = 0$), then the issuer and underwriter have no incentive to underprice the bonds. The tax rebate reduces the cost to the issuer of an higher coupon, but not sufficiently to offset present value of the greater liability. Similarly, if the tax rate τ is set to zero, as is the case with traditional, tax-exempt municipals, then there is no incentive to underprice. Even if the underwriters fully capture the value, it is offset one-to-one by the greater liability to the issuer, so that underpricing is purely a transfer from issuer to underwriters or investors. Issuers and underwriters may have a shared interest in underpricing, however, when the tax rebate is positive and some of the present value of the underpriced bonds flows back to them. The purpose of the final section of the paper is to model this problem and by estimating the structural parameters gain a better understanding of the marginal costs and benefits summarized here in reduced-form by ϕ.

The Treasury appears to have expressed some concerns about the possibility that the bonds were being systematically underpriced, because in August of 2010 an open letter to the Treasury, widely reported in the financial press, was released jointly by the Government Finance Officers Association, the National Association of Bond Lawyers, the Regional Bond Dealers Association, and the Securities Industry and Financial Markets Association. This remarkable document complains about actions taken by IRS personnel that "continue to create uncertainty regarding the IRS's interpretation of the rules for establishing 'issue price.' " The letter urges the Treasury to continue the established practice of treating the reoffering price set through negotiation between issuers and underwriters, and made public in the final pricing wire as the issue price, and claims subsequent secondary market prices cannot be used for this purpose because they are uncertain at the time the bonds are issued.

> The final pricing wire, substantiated by evidence of the offering process, provides the basis for the parties' reasonable expectations regarding the proper issue price of the bonds, irrespective of the actual sales executed once the bonds become available to investors.

The letter goes on to provide evidence of initial underpricing in other settings and appeals to traditional practices in the tax-exempt setting: "The issue price for tax-exempt bond purposes has been based on the initial offering price to the public for over 25 years. We submit that there is no reason to depart from this approach." The underpricing in the tax-exempt market is coming at the expense of the issuer, and one might sensibly argue that issuers who fail to effectively bargain with their underwriters have only themselves to blame. Underpricing in the BAB market, however, is coming at the expense of a third party, the tax-paying public.

4 Data

Our data consist of the transaction-by-transaction trades reports for municipal bonds made available through the Municipal Securities Rule Making Board (MSRB). The MSRB dataset reports every trade carried out through registered broker-dealers in the U.S., which is virtually the entire municipal bond market. Trades are reported as sales to customers, purchases from customer, and inter-dealer trades. For each trade there is a price, the par value of the bonds exchanged, and the time at which the trade took place. When new bonds are issued, the MSRB data do not include the transfer of the bonds from the issuers to the underwriters. Thus, the first trades we see are sales from the underwriters to customers, or possibly to other dealers.

Along with the transactions data, we have information about specific bonds and issuers from two sources: SDC Platinum, and a database collected and made available to us by Primuni.com. The latter was hand collected from the official statements and information provided on the MSRB's Electronic Municipal Market Access (EMMA) website. We use both of these databases to check inconsistencies and resolve missing data where possible. The data include issuer characteristics (such as name, state, type), reoffering prices or yields for each bond issue, issue characteristics such as maturity, coupon, call schedule, taxable status, stated use of funds, and sinking fund provisions. These data also provide information on the underwriting syndicate, including underwriters' names and underwriting fees. The filters we apply to clean the data are similar to those in Green, Hollifield and Schürhoff (2007b). The appendix provides a detailed description of how records with missing or clearly incorrect data were treated, and an accounting of steps that lead to our final sample of 166,486 CUSIPs, or bonds, and 3,313,924 trades.

Municipal bonds are typically issued "in series," and this is often cited as a source of their low liquidity.[6] Multiple bonds with different maturities are underwritten simultaneously in one "deal." Each maturity has a separate CUSIP number, and trades as a separate security in the secondary market. The separate maturities in a deal are commonly referred to as "CUSIPs," bonds with the same terms and initial price. The first deal in our sample was on May 12, 2009, and the last was on December 29, 2010. Table 1 shows that there were fewer BAB deals over the sample period than

[6] See, for example, Ang and Green (2011).

traditional tax-exempts, but BAB deals were substantially larger. There were also fewer individual CUSIPs per deal. Liquidity requires coincident needs between large numbers of potential buyers and sellers, and this is, of course, facilitated by a greater supply of identical bonds. Thus, we would expect that the larger deals, with fewer CUSIPs per deal, would enhance liquidity, independently of the investor clientele. Often, multiple deals are combined in a single underwriting, managed by the same underwriter for the same issuer. For example, we have a number of instances where a municipality issues both BABs and tax-exempts at the same time through the same underwriting syndicate. We exploit these situations in some of our analysis.

Table 1
Deal Characteristics

Multiple CUSIPs, or bond issues, are underwritten simultaneously in a deal. The table reports descriptive statistics for deals in our sample for Build America Bonds (BABs) and traditional tax-exempt municipals.

	BAB	Muni
Number of Deals	1,875	13,554
Number of CUSIPs	14,043	140,350
Mean Number of CUSIPs per Deal	8.1	11.4
Mean Par Value per CUSIP (in million $)	10.3	2.81
Median Par Value per CUSIP (in million $)	1.14	0.52
Mean Deal Value (in million $)	80.9	27.7
Median Deal Value (in million $)	20.8	5.8

5 Patterns of Trade for New Issues

The results reported here compare patterns of trade for newly issued BABs and tax-exempt municipals issued over the period of time when the BAB program was in effect. We show that the bonds are distributed and trade in a manner similar to traditional municipals, but with more evidence of "flipping" and interdealer trading.

Table 2 provides statistics on the overall patterns of trade over the first 60 days of trading. Volume is dominated by sales to customers, and the median sale is actually smaller for BABs than for the tax-exempts. This is striking considering that one of the stated purposes of the program was to give municipal issuers access to institutional investors, such as endowments and pension funds, that trade in larger quantities.

Table 2
Patterns of Trade

The table reports aggregate summary statistics for the MSRB transactions data associated with the BABs and tax-exempt municipals issued from April 2009 through December 2010. Summary statistics are reported separately for transactions constituting a sale from a registered broker-dealer to a customer, a dealer purchase from a customer, and a transaction between dealers. In reporting the transaction size, we compute median transaction size per bond measured in thousands of dollars. Total volume is the cumulative dollar amount of all transactions of the given type during the first sixty days of trade.

	All transactions	Sales to customers	Purchases from customers	Interdealer transactions
Panel A: BAB				
Number of Trades (in thousands)	620	478	16	125
Median Trade Size (in thousand $)	20	15	499	51
Total Volume (in billion $)	253	163	23	67
Panel B: Muni				
Number of Trades (in thousands)	2,422	1,629	63	730
Median Trade Size (in thousand $)	45	30	166	54
Total Volume (in billion $)	709	437	46	226

Table 3 shows that the picture is a more complicated when we consider the cross section of issues rather than the cross section of trades. As is evident from the dramatic differences between medians and means, trading activity for both BABs and tax exempts is highly skewed, with most of the trades occurring in a small number of issues. Where Table 2 reports the median transaction size for all transactions in the sample, in Table 3 we first compute the median or mean transaction size for each CUSIP, and then report the median or mean across bond. The median CUSIP of BABs has very few transactions, as with the tax-exempts, and the median transaction size on the median issue is larger than for the tax-exempts. This suggests that many of the issues are, indeed, being placed with institutional investors, as intended. The small number of trades for the median issue shows that, for both BABs and tax-exempts, relatively little trading is involved in distributing many of the bonds to their final holders. The typical bond is quickly sold off in large blocks to large institutions. Most of the trading activity is associated with a subset of bonds that are widely distributed to smaller investors. These tend to be associated with larger, more visible issuers in bigger deals.

Table 3

Transactions and Volume per Issue

The table reports summary statistics for the cross-section of new bond issues. The first row in each panel reports the fraction of issues with transactions during the first sixty business days after issuance. The issuance date is defined as the earliest date on which transactions are reported in the MSRB database and as the settlement date if no trades are recorded before then. The statistics of the cross-sectional distribution reported in the remaining rows in each panel are conditional on the occurrence of transactions of the given type for the given bond issue. In reporting the transaction size, we compute median transaction size across all trades measured in thousands of dollars. Total volume is the cumulative dollar amount of all transactions of the given type during the first sixty days.

	Median	Mean	S.D.
Panel A: BAB			
Sales to customers:			
Issues with Transactions		100%	
Number of Transactions	3	34	151
Transaction Size (in thousand $)	160	772	2,898
Total Volume (in thousand $)	1,175	11,659	66,692
Purchases from customers:			
Issues with Transactions		25%	
Number of Transactions	2	5	9
Transaction Size (in thousand $)	335	762	1,985
Total Volume (in thousand $)	756	6,583	24,151
Interdealer transactions:			
Issues with Transactions		63%	
Number of Transactions	4	14	43
Transaction Size (in thousand $)	205	556	1,995
Total Volume (in thousand $)	1,229	7,506	26,320
Panel B: Muni			
Sales to customers:			
Issues with Transactions		100%	
Number of Transactions	3	12	80
Transaction Size (in thousand $)	104	507	2,216
Total Volume (in thousand $)	530	3,124	34,212
Purchases from customers:			
Issues with Transactions		14%	
Number of Transactions	1	3	7
Transaction Size (in thousand $)	151	578	1,796
Total Volume (in thousand $)	280	2,260	11,280
Interdealer transactions:			
Issues with Transactions		58%	
Number of Transactions	3	9	35
Transaction Size (in thousand $)	105	293	817
Total Volume (in thousand $)	562	2,778	57,132

The financial press and the regulatory authorities have frequently expressed concern over "flipping" of new municipal bonds by large intermediaries such as hedge funds. Customers who flip municipal bonds are effectively performing the underwriters' function of distributing the bonds to final customers. They buy large blocks of bonds from a dealer, and then sell them to other dealers who have retail distribution capability, who in turn sell them to taxable, retail investors who are likely to buy and hold the bonds. Since the stated purpose of the BAB program was to provide issuers with access to a more liquid market, we might expect less need for flipping of the bonds, since they can be purchased and held directly by large institutional investors. On the other hand, since the final customers for BABs are not the traditional clientele for municipal issuers and underwriters, we might expect more intermediation by third parties as the bonds make their way through new distribution channels to the final investors.

A simple means of detecting flipping of newly issued bonds is to ask if the par value of total sales to customers over the first 60 days of trading exceeds the par value of the issue. If that is the case for a given CUSIP, then evidently some customers are buying the bonds, selling them back to dealers, who are in turn selling them to other customers. A less conservative measure of the bonds being recycled through dealers is the ratio of sales to customers over total "underwriter sales," defined as the difference between the par value of an issue and the par value of bonds still in dealer inventory at the end of 60 days. Suppose, for example, a dealer initially places 85% of the bonds in a specific new issue with one hedge fund, and the dealer is unable to sell the remaining bonds, which remain in inventory. If the hedge fund sells its bonds to regional broker-dealers, who in turn sell them to retail investors, then sales will be two-times underwriter sales, which means all the bonds the dealer has sold have been flipped. None of them end up with the investors who first purchased them.[7]

Table 4 shows a similar picture emerges for either measure of flipping. For each CUSIP in

[7] We exclude from the sample in these calculations CUSIPs with final inventory greater than the CUSIP Principal. Missing sales to customer will increase the ratio total sales/underwriter sales. We do not include those CUSIPs with ratios that are obviously too large (greater than 10). When underwriter sales are greater than the CUSIP principal (negative final inventory) we set them to be equal to the CUSIP principal. This might underestimate the ratio total sales/underwriters sells. Obviously, these procedures would only bias our comparison of the BABs and tax-exempts if omissions or other data errors are more prevalent in one case than another, which seems unlikely given that the same issuers, regulators, and underwriters are involved.

the sample, we compute the ratios of total sales to par value and total sales to underwriter sales, and report the means across CUSIPs. For both tax-exempts and BABs the averages exceed one, and they are slightly higher for BABs. We define bonds that have been flipped as those where total sales over underwriter sales exceed one, and the table shows that 22% of the BABs have this characteristic, while only 16% of tax-exempts issued during the same period of time show evidence of flipping. The greater prevalence of flipping by customers for BABs may be due to the larger deals and fewer CUSIPs per deal. The size of the issues may require dealers to enlist (and compensate) non-broker-dealers in the distribution process. If higher liquidity is the reason the BABs are turning over more in the first 60 days of trade, then we would expect less underpricing for those bonds. On the other hand, if the reason the bonds are turning over is because of limited access to the final customers, which one would associated with lower liquidity, then we would expect higher markups over the reoffering price, or greater underpricing, to be associated with BABs. Accordingly, we turn to the underpricing in the next section.

Table 4
Flipping of New Issues

The table reports ratios of sales-to-customers to par value of the issue or to total sales of the bond by underwriters. Underwriter sales are defined as the par value of the issue less bonds that remain in dealer inventories after the first 60 days of trade. We define bonds that have been "flipped" are bonds where the ratio of total sales to underwriter sales exceeds one.

	BAB	Muni
Total Sales / Par Value of New Issues (average of CUSIP means)	1.05	1.03
Total Sales / Underwriter Sales (average of CUSIP means)	1.10	1.06
CUSIPs with flipping by customers (in %)	26.4	15.6

6 Underpricing of Build America Bonds

We now consider the differences between the behavior of the BAB prices and those of the tax-exempts.

6.1 Amount of Underpricing

Figure 1 shows median markups over the offering price by day from the start of trading. The BAB bonds are the two left-hand panels, and the tax-exempt bonds are on the right. In each case, the top panel shows the median markups in the pooled cross section of all transactions, and the bottom shows the median across issues of the median markup computed first for each CUSIP. We see that for traditional municipals the average price at which sales to customers occurs rises after the first day, while the interdealer trades and purchases from customers are much more stable through time and close to the reoffering price. In contrast, all the prices continue to rise for the BABs after the first day, and the initial underpricing is much larger.

This is also evident in Figure 2, which illustrates how the mix of sales to customers is changing through time by plotting the distribution of markups by day. For both traditional municipals and BABs, there is a large spike at zero markup (sales to customers at the reoffering price) on the first day, but it is much larger for the tax-exempts. As time moves forward, trades at the reoffering price continue to dominate the distribution of sale to customers for tax-exempts, but for the BABs the zero-markup sales are quickly surpassed by sales at higher markups. By this metric, once again, the BABs seem to be more underpriced. Overall, 46% of the BAB CUSIPs have at least one sale to customer at a positive markup over the reoffering price, compared to 43% for tax-exempts. The bonds that are sold at a markup, however, dominate trade to a greater extent for the BABs. Trades at a positive markup represent 75% of all sales to customers for the BABs, but only 56% of sales for tax-exempts.

Both traditional municipal bonds and BABs tend to be either placed entirely in large blocks with institutions or targeted, at least to some extent, to retail investors. Roughly half of the CUSIPs issued during our sample period appear to be sold to institutions in large blocks exhibiting no markups. Table 5 provides descriptive information about the characteristics and trading patters of CUSIPs where none of the trades show a positive markup, where some of the trades show a positive markup, and where none of the trades are marked up. The biggest deals and the biggest CUSIPs show a mix of retail and institutional trading. Not surprisingly, there are more trades in these bonds, and they are more likely to exhibit behavior suggesting flipping by institutions. Average trade size, however, is much larger for CUSIPs that show no markup at all. The final rows of the table report average and median markups for bonds in each category, in basis points. Conditional on the bonds being targeted at least in part towards retail investors, the average markup over the reoffering price exceeds two percent for BABs, which is considerably higher than for traditional municipals. The lower medians of the median markup for each CUSIP reflects the skewness of the distribution.

Table 5
Characteristics of Marked-Up Bonds

The table reports the fraction of CUSIPs that sell with no positive markups, with some trades at a markup, and with all trades at a markup, along with descriptive statistics for each category. The row labeled "mean flipping" gives the average ratio of par value of bonds sold to dealer sales over the first sixty days. Trade, CUSIP, and deal sizes are par values.

	BAB			Muni		
	No Markup	Markup	All	No Markup	Markup	All
Fraction of CUSIPs (in %)	51	43	7	57	31	12
Mean CUSIP Size (in million $)	2.56	20.8	1.51	1.79	5.42	0.69
Median CUSIP Size (in million $)	0.59	2.8	0.63	0.39	1.00	0.34
Mean Deal Size (in million $)	36.8	103.0	20.9	25.8	61.6	13.4
Med. Deal Size (in million $)	11.7	32.3	11.8	5.9	15.5	5.7
Mean Trade Size (in thousand $)	645.94	329.63	71.76	541.15	217.89	93.29
Mean Number of Sales	4.0	72.0	18.5	3.30	27.8	7.3
Mean Flipping	1.01	1.14	1.01	1.01	1.21	1.02
Median Markup (in basis points)	0.0	94.0	125.0	0.0	16.8	100.6
Mean Markup (in basis points)	-14.9	216.9	249.8	-26.3	129.7	199.6

The differences in the averages and medians reflected in Figure 1 are also evident in the maxima. That is, the biggest markups within a CUSIP for BABs tend to be larger than the biggest markups for the tax-exempts. The mean maximum markup across all CUSIPs is 1.41% for BABs and 0.74% for tax exempts. This difference is more dramatic when we limit the sample to issues where at lest one transaction occurred above the reoffering price (2.8% for BABs versus 1.74% for tax exempts). The worst underpricing, then, is worse for the BABs than for the tax-exempts.

6.2 Trade Size, Maturity, and Issuer Effects

The evidence that the BABs are as underpriced, or more underpriced, than tax-exempt municipals is subject to the caveat that the issuers and underwriters are choosing to issue BABs in light of anticipated liquidity, credit risk, and other sources of heterogeneity through time and across issuers. Here we offer some descriptive evidence on these concerns.

We first consider the effects of holding trade size fixed. The top two panels in Figure 3 stratifies the average markup over the reoffering price by trade size, for the BABs (left panel) and the tax-exempts (right panel). For every trade-size category, the initial underpricing is higher for the BABs, and the increases in price appear to continue for a longer time.

As we discussed in Section 2, the term structure is steeper for tax-exempt bonds than it is for taxables. BABs, therefore, are more likely to be issued for longer maturities. Indeed, in some instances during the program tax-exempt bonds and BABs were issued simultaneously in series, with traditional municipals at the shorter maturities and BABs and the longer maturities. If underpricing is associated with illiquidity, then longer maturities are likely to be more underpriced.

The two middle panels of Figure 3 shows the evolution of markups over the reoffering price for bonds with a fixed maturity of 20 years.[8] The panel on the left is for BABs and the one on the right is for tax-exempts. Note that the basic behaviors evident in Figure 2 are also present here. Fixing the maturity, BABs appear to be as underpriced or more underpriced than the tax-exempt bonds. In particular, the BABs show more evidence of larger markups for interdealer trades and purchases from customers.

Unobserved heterogeneity across issuers potentially contaminates some of the comparisons described above. Given that there are thousands of issuers, it is difficult to obtain data on their characteristics that would provide adequate controls for differences in credit risk, familiarity to investors, and transparency in reporting that might bear upon a given bond's liquidity. The data provides something of a natural check on the robustness of the results on this dimension because many BABs were issued simultaneously with tax-exempt bonds in a single underwriting. In bottom row of panels in Figure 3, we reproduce Figure 1, but limit the sample to BABs and tax-exempts

[8] Plots for 10-year maturities and 30-year maturities look very similar, and are omitted in the interest of space. The plot shows averages across CUSIPs of daily average markups per CUSIP, as in the bottom panels of Figure 1.

issued at the same time through the same underwriter by the same municipality. Again, the central behaviors evident for the overall sample are present here.[9] The BABs show more price appreciation through time, especially when considering the interdealer prices.

6.3 Determinants of Markups

The characteristics of a bond deal, its pricing, and whether to use tax-exempts or BABs are determined simultaneously and endogenously. A first attempt to deal with the resulting possible selection bias is made in Tables 6, 7, and 8. The first of these provides estimates of probit and logit specifications that use characteristics of the bond to predict whether the municipality chooses to to issue BABs or tax-exempt bonds. The results are very similar across specifications. BABs are likely to be longer maturity, more likely to be rated, and are issued in larger deals. We then examine the determinants of the percentage markup on interdealer trades (Table 7) and sales to customers conditional on the sale not occurring at the reoffering price (Table 8). In each case, the deal is the unit of observation, and the characteristics of the component CUSIPs within a deal are par-value weighted. The first three columns report results of OLS regressions, controlling for progressively larger sets of characteristics. The probit model from the second column of Table 6 is then used to control for selectivity (the "Heckman correction") in the final column.

The coefficient on the BAB dummy variable in these regressions measures the underpricing controlling for characteristics and selectivity. The markup over the reoffering price of sales to customers is 8-12 basis points higher for BABs once one controls for characteristics. When one compares the markup on interdealer trades, however, the BABs are underpriced by 29-33 basis points more. These differences are not surprising given the different reasons for underpricing. The price dealers charge each other provides a natural measure of the intrinsic value of the bond. If the bonds are being underpriced strategically, due to tax incentives, this should be evident in the prices dealers pay each other, as we see in the BABs. If underpricing is compensation to dealers and other intermediaries for the costs of distributing the bonds to final investors, or a liquidity premium, then we should see underpricing evident in prices those investors pay when they buy the bonds, but not

[9] The plots are averages across CUSIPs of the average markup for each CUSIP, as in the bottom panels of Figure 1.

in the prices dealers pay each other. This is what we see in traditional tax exempts. Because the tax-exempts are being issued in smaller deals, and presumably more frequently to individual, retail investors, the component of the underpricing due to liquidity may be greater for them than for the BABs. Hence the difference between the markups to investors for BABs and tax-exempts is substantially less than the difference in markups on interdealer trades. Counterfactuals using the structural model we estimate below allows us to further disentangle the contributions of liquidity and tax incentives.

7 The Underwriter Discount

Underwriters are compensated through fees, as well as any profits they can earn on newly issued bonds they absorb into inventories. The fees, known as the underwriter "discount" or "gross spread," are specified in the official statement for the bonds (the analogue of a prospectus). The underwriter discount applies to all the CUSIPs in a given financing or "deal." (Recall that municipals are issued "in series," and each maturity a separate CUSIP.).

The previous section showed that, despite being issued in larger deals with fewer CUSIPs per deal, the BAB are as underpriced, and by most measures more underpriced, than municipal bonds issued in the same period. To what extent is this a strategic response to the tax subsidy, which increases with underpricing, versus simply underestimation of the value of the bond or compensation to the intermediaries for the costs of distributing the bonds? The analysis of the tax incentives in Section 3 suggests that underpricing increases the shared surplus to the issues and underwriter, but the means through which the issuers would capture part of this surplus would be through lower fees, which are a transfer payment from the issuer to the underwriter. Accordingly, in the section we ask whether the gross spread is negatively correlated with the amount of underpricing.

Bonds that are simply distributed to institutional investors at or very near the reoffering price in large blocks should be relatively inexpensive to distribute, and in a competitive environment with no strategic incentive to underprice, we would expect underwrites to earn low fees on such deals. Placing bonds with retail investors is more costly, and underwriters can be compensated for those costs through fees or markup on the bonds. Market participants report that as fees are more

Table 6
Determinants of BAB Issuance

The table reports the determinants of BAB issuance. Each bond deal is an observation, and characteristics of CUSIPs within a deal are value-weighted. Specifications (A)-(B) are estimated using a probit model. Specifications (C)-(D) are estimated using a logit model. All specifications include state fixed effects and month of issuance fixed effects. Standard errors are clustered by month of issuance.

	(A)	(B)	(C)	(D)
Maturity	0.04***	0.06***	0.07***	0.11***
	(0.00)	(0.00)	(0.01)	(0.01)
Rating	-0.13***	-0.10***	-0.25***	-0.18***
	(0.02)	(0.02)	(0.03)	(0.03)
Unrated	-0.94***	-0.71***	-1.81***	-1.33***
	(0.07)	(0.08)	(0.14)	(0.15)
Insured	-0.21**	-0.22*	-0.40**	-0.45**
	(0.08)	(0.09)	(0.14)	(0.17)
Callable	0.55***	0.57***	1.08***	1.11***
	(0.06)	(0.05)	(0.12)	(0.10)
Sinkable	0.36***	0.33***	0.68***	0.61***
	(0.06)	(0.07)	(0.11)	(0.13)
Fixed Coupon	0.05	-0.01	0.05	-0.05
	(0.04)	(0.04)	(0.08)	(0.09)
Extraordinary Redemption	0.86***	1.11***	1.54***	2.11***
	(0.07)	(0.08)	(0.14)	(0.14)
ln(Deal Size)	0.18***	0.29***	0.32***	0.54***
	(0.01)	(0.02)	(0.02)	(0.03)
Number of CUSIPs in Deal	-0.06***	-0.07***	-0.11***	-0.13***
	(0.00)	(0.00)	(0.01)	(0.01)
Competitive Offering	0.24*	0.06	0.46*	0.10
	(0.10)	(0.10)	(0.19)	(0.19)
Refunding Bond	-3.06***	-3.13***	-6.80***	-7.09***
	(0.43)	(0.55)	(1.00)	(1.08)
Advanced Refunding	0.66	0.42	2.06	1.84
	(0.55)	(0.65)	(1.41)	(1.34)
Constant	-0.07	-2.39***	0.14	-4.44***
	(0.34)	(0.49)	(0.62)	(0.88)
State F.E.	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes
Issuer Type F.E.		Yes		Yes
Use of Proceeds F.E.		Yes		Yes
N	15,252	15,179	15,252	15,179

Table 7
Determinants of Interdealer Markups

The table reports the determinants of the markups on interdealer trades. Markups on interdealer trades are constructed as the mean markup over the reoffering price on all interdealer transactions weighted by the trade par. The dependent variable is scaled by the reoffering price and expressed in basis points. Markups and characteristics are value weighted by bond deal. Specifications (A)-(C) are estimated using OLS. Specification (D) is estimated using a treatment effect model. All specifications include state fixed effects and month of issuance fixed effects. Standard errors are clustered by month of issuance.

	(A)	(B)	(C)	(D)
BAB	47.69***	32.96***	28.89***	32.44***
	(5.08)	(4.20)	(4.09)	(4.23)
Maturity		0.76*	0.90*	0.85***
		(0.36)	(0.37)	(0.15)
Rating		-0.10	-0.01	0.05
		(0.49)	(0.49)	(0.45)
Unrated		-3.14	-2.29	-2.01
		(2.66)	(2.52)	(2.20)
Insured		17.59***	17.73***	17.87***
		(3.26)	(3.41)	(2.35)
Callable		-0.75	-0.75	-0.92
		(1.83)	(1.78)	(2.00)
Sinkable		2.51	3.68*	3.52*
		(1.48)	(1.60)	(1.73)
Fixed Coupon		-7.32***	-7.38***	-7.42***
		(1.60)	(1.69)	(1.87)
Extraordinary Redemption		-1.70	1.02	0.13
		(2.68)	(2.45)	(2.61)
ln(Deal Size)		1.54	2.70	2.53***
		(1.68)	(1.56)	(0.64)
Number of CUSIPs in Deal		-0.95***	-0.95***	-0.91***
		(0.09)	(0.09)	(0.12)
Competitive Offering		-51.46***	-53.27***	-53.19***
		(2.21)	(2.14)	(1.72)
Refunding Bond		4.38	3.76	4.15*
		(2.62)	(2.58)	(1.78)
Advanced Refunding		-8.29*	-9.41*	-9.24**
		(3.93)	(3.89)	(3.32)
Constant	-59.44**	-53.96**	-69.30**	-69.88***
	(16.15)	(16.18)	(22.65)	(19.14)
State F.E.	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes
Issuer Type F.E.			Yes	Yes
Use of Proceeds F.E.			Yes	Yes
R^2	0.160	0.248	0.255	–
N	12,058	11,963	11,963	11,963

Table 8
Determinants of Investor Markups

The table reports the determinants of markups on investor trades. Markups on investor trades are constructed as the mean markup over the reoffer price on all transactions not at the reoffer price, weighted by the trade par. The dependent variable is scaled by the reoffer price and expressed in basis points. Underpricing and characteristics are value weighted by bond deal. Specifications (A)-(C) are estimated using OLS. Specification (D) is estimated using a treatment effect model. All specifications include state fixed effects and month of issuance fixed effects. Standard errors are clustered by month of issuance.

	(A)	(B)	(C)	(D)
BAB	75.39***	26.15***	24.65***	23.14***
	(7.81)	(5.79)	(5.70)	(3.55)
Maturity		4.96***	5.08***	5.10***
		(0.26)	(0.27)	(0.14)
Rating		2.31***	2.03***	2.01***
		(0.50)	(0.45)	(0.41)
Unrated		5.03*	4.65*	4.53*
		(2.22)	(1.98)	(2.02)
Insured		17.02***	16.43***	16.38***
		(3.08)	(2.98)	(2.13)
Callable		14.47***	14.23***	14.30***
		(2.05)	(2.01)	(1.87)
Sinkable		7.30***	6.36***	6.43***
		(1.51)	(1.55)	(1.58)
Fixed Coupon		-3.94	-3.94	-3.92*
		(1.98)	(2.07)	(1.71)
Extraordinary Redemption		3.20	4.15	4.53
		(2.29)	(2.59)	(2.37)
ln(Deal Size)		1.56	1.25	1.33*
		(1.31)	(1.34)	(0.59)
Number of CUSIPs in Deal		0.20	0.21*	0.20
		(0.10)	(0.10)	(0.11)
Competitive Offering		-38.53***	-38.81***	-38.84***
		(1.65)	(1.70)	(1.59)
Refunding Bond		1.91	1.47	1.29
		(1.81)	(1.92)	(1.64)
Advanced Refunding		0.00	-0.08	-0.15
		(2.93)	(3.10)	(3.08)
Constant	82.45***	7.18	0.44	0.65
	(9.05)	(10.74)	(12.75)	(17.58)
State F.E.	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes
Issuer Type F.E.			Yes	Yes
Use of Proceeds F.E.			Yes	Yes
R^2	0.177	0.428	0.434	–
N	11,367	11,272	11,272	11,272

transparent to the press, the public, and regulators, underpricing tends to reflect heterogeneity in costs more than fees. In any case, it should not surprise us to see some evidence of substitution between these forms of compensation and thus negative correlation between spreads and markups. We show below the negative correlation is much larger for the BABs. Moreover, this negative association tends to increase over the life of the BAB program.

The average spread is lower for BABs than for tax exempts (81.5 versus 92.8 basis points), and the deals are on average larger ($81 million par value versus $28 million). We would expect lower spreads for bigger deals if there are fixed costs to underwriting, as emphasized by Chen and Ritter (2000) in the context of IPOs. Table 9 reports coefficients from regressing average markups for bonds in each deal in our sample against controls along with the gross spread, a BAB dummy, and interaction terms for three different specifications. The first row shows BABs have higher markups for all three specifications, as we have seen. The first specification, in column (A), shows that across all deals, both BABs and tax exempts, the gross spread has a positive, though insignificant, correlation with the underpricing. The next column shows that when the spread is interacted with a BAB indicator, the markup is positively related to spread for tax exempts, negatively for BABs. The final term shows that the interaction term becomes larger through time. This suggests dealers and issuers may have taken some time to fully adjust to the incentives to underprice under the BAB program.

8 A Model of the Issuance Process

In this section we present a relatively simple structural model of the bargaining between issuer and underwriter. Estimates of the structural parameters then allow us to decompose the underpricing we observe for tax-exempts and BABs into components due to liquidity and due to exploitation of the tax rebate by inflating the coupon.

We take as given the issuer's decision to issue a bond of one type or the other, BAB or traditional tax-exempt, and of a given maturity T. Let V be the present value of the liability to the issuer,

$$V = Ca_T + q_T$$

Table 9
Gross Spread and Underpricing

The dependent variable is the average percentage markup over the reoffering price on all trades in a deal. The sample pools all deals on tax-exempt municipals and BABs. Deal size is measured in hundreds of millions. The sample period from 05/2009 to 12/2010 is divided into five equal subperiods of four months each. Standard errors are clustered by month of issuance.

	(A)	(B)	(C)
BAB	98.59***	141.94**	139.52**
	(12.47)	(23.47)	(23.59)
Gross Spread	0.11	0.50**	0.49**
	(0.15)	(0.11)	(0.11)
BAB × Gross Spread		-5.19*	-1.45
		(1.73)	(2.22)
BAB × Gross Spread × (09/2009–12/2009)			-3.34***
			(0.22)
BAB × Gross Spread × (01/2010–04/2010)			-1.92***
			(0.11)
BAB × Gross Spread × (05/2010–08/2010)			-3.37***
			(0.38)
BAB × Gross Spread × (09/2010–12/2010)			-6.34***
			(0.13)
Deal Size	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)
Number of CUSIPs in Deal	1.16	1.22*	1.23*
	(0.46)	(0.46)	(0.46)
Constant	34.41*	30.03*	14.46
	(10.21)	(9.97)	(12.24)
State F.E.	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes
Issuer Type F.E.	Yes	Yes	Yes
Use of Proceeds F.E.	Yes	Yes	Yes
R^2	0.295	0.301	0.306
N	6,151	6,151	6,151

where a_T is the value of a \$1 annuity, and q_T the discount factor, each for T periods. We can view V as the intrinsic value of the bond trading in an environment free of liquidity frictions. Our empirical proxy for this value will be the average interdealer price after the bond is issued.

The underwriter can sell the bonds to informed investors at the reoffering price R. Alternatively, the underwriter can seek out retail investors willing to pay higher prices because of search costs, inattention, lagged information, a preference for local bonds, or other factors particular to retail investors. A continuum of such retail investors have private valuations v, with distribution function $F(x) = Pr\{v - V \leq x\}$. Thus, if the underwriter sets a retail price of P, he will sell $1 - F(P - V) = \Lambda$ of the issue to retail investors and the residual, $F(P - V) = 1 - \Lambda$ to institutions, or other informed traders, at the reoffering price. Our empirical proxy for P is the par-weighted average price at which dealers sell to customers, conditional on the sale not being at the reoffering price, and our proxy for Λ is the fraction of the issue sold above the reoffering price.

If the bond is a BAB, then the value of the tax rebate the issuer receives on the bond is:

$$\tau C a_T = \tau(V - q_T) = \tau(V - R) + \tau Q,$$

where $Q = R - q_T$ is the discount on a maturity-matched zero coupon bond.

Issuers face expected enforcement and monitoring costs, $h(\Lambda, P)$, if the bonds are excessively underpriced. These would include potential loss of the coupon tax rebate. Underwriters face costs in placing the bonds, $c(\Lambda, V)$, which depend on how much of the issue is sold to retail investors and which decline in the intrinsic value. The issuer's benefit from the bond issue is then:

$$V_I = R - D - V + \tau(V - q_T)\mathbf{1}_{BAB} - h(\Lambda, P), \tag{3}$$

where $\mathbf{1}_{BAB}$ is an indicator variable that takes the value one if the bond is a BAB, and zero otherwise.

We assume R is set close to par, as per IRS rules, and the issuer and underwriter choose P and V to maximize their joint surplus.[10] This implies a choice of $\Lambda = 1 - F(P - V)$. They then bargain

[10]In the empirical implementation we normalize all variables by the reoffering price R.

over the underwriter discount, D, which determines the division of the surplus between them. The value to the underwriter is

$$V_U = (1 - \Lambda)R + \lambda P - R + D - c(\Lambda, V). \tag{4}$$

Combining expressions (3) and (4), the joint surplus is

$$S = \overline{S} - h(\Lambda, P) - c(\Lambda, V), \tag{5}$$

with maximal surplus

$$\overline{S} = \Lambda(P - R) - (1 - \tau \mathbf{1}_{BAB})(V - R) + \tau Q \mathbf{1}_{BAB}. \tag{6}$$

We parameterize the cost functions as follows:

$$c(\Lambda, V) = (1 - \Lambda)\delta_i + \Lambda\delta_r - \phi(V - R),$$

where δ_i (δ_r) measures the cost per bond when selling to institutional (retail) investors. Institutions are buying bonds at reoffer R and so any discount $V - R$ lowers issuance costs at the margin by ϕ. The expected enforcement costs to the issuer are quadratic in the underpricing $U = \Lambda(P - R)$ created by the issuance and equal to

$$h(\Lambda, P) = \frac{\psi}{2} U^2.$$

The first-order condition with respect to P, after some simplification, gives[11]:

$$F'(P - V)[(1 - \psi U)(P - R) - (\delta_r - \delta_i)] = \Lambda(1 - \psi U). \tag{7}$$

[11] To deriving these expressions, note that $\frac{\partial \Lambda}{\partial V} = -\frac{\partial \Lambda}{\partial P} = F'(P - V)$

The first-order condition for V gives:

$$F'(P-V)[(1-\psi U)(P-R)-(\delta_r-\delta_i)] = 1-\tau \mathbf{1}_{BAB}-\phi. \tag{8}$$

Combining these expressions with the second-order conditions yields that Λ is the largest root of the following quadratic expression:

$$\Lambda - \psi(P-R)\Lambda^2 - (1-\phi-\tau \mathbf{1}_{BAB}) = 0 \tag{9}$$

After some manipulations, we obtain,

$$\Lambda = \frac{1}{2\psi(P-R)} + \sqrt{\left(\frac{1}{2\psi(P-R)}\right)^2 - \frac{1-\phi-\tau \mathbf{1}_{BAB}}{\psi(P-R)}}. \tag{10}$$

Suppose the distribution function F is exponential over the range $x \geq 0$ with parameter γ. We then have $F'(x)/(1-F(x)) = 1/\gamma$ for all x, and the expected probability of trade above the reoffering price is $\Lambda = 1-F(P-V) = e^{-\frac{1}{\gamma}(P-V)}$. Taking logs,

$$V = P + \gamma \ln \Lambda. \tag{11}$$

The retail price then satisfies

$$\begin{aligned} P &= R + \gamma + \frac{1}{1-\psi U}(\delta_r - \delta_i) \\ &= R + \gamma + \frac{\delta_r - \delta_i}{1-\phi-\tau \mathbf{1}_{BAB}}\Lambda. \end{aligned} \tag{12}$$

The underwriter discount, D, can be determined by maximizing the usual Nash product:

$$\max_D \; (1-\theta)\ln(V_I) + \theta \ln(V_U).$$

This yields

$$\begin{aligned} D &= \theta(V_I + D) - (1-\theta)(V_U - D) \\ &= \theta\tau Q\mathbf{1}_{BAB} - (1-\theta)U - \theta(1-\tau\mathbf{1}_{BAB})(V-R) - \theta h(\Lambda, P) + (1-\theta)c(\Lambda, V). \end{aligned} \tag{13}$$

We assume the endogenous variables are chosen using all information available at the time the bonds are issued, $\mathcal{F}$. Thus, we obtain the following moment conditions, assuming that any deviations from the above are attributable to expectational errors:

$$\begin{aligned} &E[(P-R-\gamma)(1-\psi U) - (\delta_r - \delta_i)|\mathcal{F}] = 0, \\ &E[\Lambda(\delta_r - \delta_i) - (P-R-\gamma)(1-\phi-\tau\mathbf{1}_{BAB})|\mathcal{F}] = 0, \\ &E[P - V + \gamma \ln \Lambda|\mathcal{F}] = 0, \\ &E[D + U - c(\Lambda, V) - \theta\{\tau Q\mathbf{1}_{BAB} + U - (1-\tau\mathbf{1}_{BAB})(V-R) - h(\Lambda, P) - c(\Lambda, V)\}|\mathcal{F}] = 0, \end{aligned} \tag{14}$$

Note that we do not need the annuity factors to estimate the model, only a maturity-matched zero rate for each bond which one can obtain from the Treasury term structure.

We estimate the model using GMM separately for BABs and tax-exempt munis, and report results that treat the deal as the unit of observation. The data are, for each bond deal, P, V, D, Λ, and explanatory variables. All variables are par value-weighted averages across the CUSIPs in each deal. Standard errors are clustered by month of issuance.

The following variables are known at the time of issuance and likely informative about the terms of the bond deals, and so we use them as conditioning variables: the maturity-matched zero rate Q, short rate (1yr Treasury rate), term premium (20yr–1yr Treasury rate), credit spread (BAA–AAA corporate rate), 20yr Muni–Treasury rate spread, and overnight LIBOR–Fed funds rate spread.[12]

To capture heterogeneity across bond deals, we allow the model parameters Φ=(γ, ψ, δ_r, δ_i, ϕ,

[12]We have, alternatively, also included the HY option-adjusted spread (FRED code *bamlh0a0hym2*), St. Louis Financial Stress Index (FRED code *stlfsi*), S&P500 index level, and the total municipal bond issuance during the sale week net of the deal under consideration. The results are very similar.

$\theta)'$ to be linear functions of the characteristics X:

$$\Phi = \Phi_0 + X'\Phi_X.$$

As explanatory variables X we consider the bonds' average maturity (in years), rating (AAA=1, AA+=2, AA=3, ...), indicator variables for whether the bond is insured, callable, sinkable, the log of deal size, and an indicator for a competitive offering.

Table 10 reports the parameter estimates. The left (right) column reports the parameter estimates Φ_{BAB} (Φ_{Muni}) for the BAB (tax-exempt municipal) sample.

After estimation, we check the model predictions in Table 11. The model predictions for the BAB sample are based on the parameter estimates Φ_{BAB} and computed by solving the moment conditions (14) for the optimal choices of V, P, Λ, and D and evaluating the resulting expressions at the estimated parameters. The model fit is captured by the data variation across bond deals that is explained by the model predictions (R^2) and the mean squared prediction error ($\sqrt{MSE}$). Relative to the averages in the data, the model predicts the total markups, $\frac{P-R}{R}$, quite accurately. It predicts more substitution between the coupon inflation, $\frac{V-R}{R}$, and the underwriter fees, $\frac{D}{R}$, than is evident in the averages.

Table 11 reports two counterfactual experiments. The first counterfactual allows us to assess the impact of the Federal tax rebate. The counterfactuals are computed by solving in each BAB deal for the optimal choices (V, P, Λ, D) based on the parameter estimates Φ_{BAB} from the BAB sample, assuming the rate on the Federal tax rebate is $\tau = 0\%$. This is intended to tell us what terms would have prevailed if otherwise identical tax-exempts rather than BABs had been issued. The model predicts underwriter discount would be substantially higher without the tax rebate, and associated coupon inflation.

The second counterfactual allows us to assess the impact of differential liquidity between BABs and tax-exempt municipal bonds. The counterfactuals are computed by again solving in each BAB deal for the optimal choices (V, P, Λ, D) but now based on the parameter estimates from the muni sample, Φ_{BAB}. These numbers suggest the improvement in liquidity has very modest quantitative consequences. The underwriter discount and retail markup, for example, change very little. Keep in mind, of course, that these comparisons control for the size of the issue, and it is difficult to assess whether the BAB program made larger issues possible, or whether the larger issuers, who are probably also more sophisticated, were the ones to quickly make use of the BAB program.

Figure 4 compares the actual to the counterfactual underpricing and, respectively, underwriter discount. The left graph plots the empirical distribution of the underpricing U in the BAB sample (bars) and the counterfactual distribution under no Federal tax rebate (line). The dashed vertical line indicates the sample mean. The plot shows that only in rare cases underpricing would be more than 1% for BABs if the Federal tax rebate was zero. The right graph plots the empirical distribution of the underwriter discount D in the BAB sample (bars) and the counterfactual distribution under no Federal tax rebate (line). The plot shows that the underwriter discount would exceed 1% in most cases if the Federal tax rebate was zero.

9 Conclusion

The Build America Bonds were an attempt to give municipal issuers access to a deeper pool of investors, thus improving liquidity. We have examined the effect this had on initial underpricing of the bonds when issued, a natural setting to examine the price of liquidity. The BABs are as underpriced, or more underpriced than traditional tax-exempt municipal bonds issued in the same period. The prices between dealers clearly show more underpricing. One reason for this might be that the tax rebate to the issuer on the bonds is tied to the coupon level, reducing the costs of underpricing to issuers, underwriters, and investors as a coalition. Our structural model allows us to evaluate the quantitative importance of these perverse incentives.

Table 10
Model Estimates

The table reports the parameter estimates. The parameter estimates are obtained from GMM estimation of the moment conditions (14). The instruments include the maturity-matched zero rate Q, short rate (1yr Treasury rate), term premium (20yr–1yr Treasury rate), credit spread (BAA–AAA corporate rate), 20yr Muni–Treasury rate spread, and overnight LIBOR–Fed funds rate spread. The parameters Φ=(γ, ψ, δ_r, δ_i, ϕ, θ)$'$ are assumed to be linear functions of the characteristics X=(Maturity, Rating, Insured, Callable, Sinkable, ln(Deal Size), Competitive Offering):

$$\Phi = \Phi_0 + X'\Phi_X.$$

The explanatory variables X are the bonds' average maturity (in years), rating (AAA=1, AA+=2, AA=3, ...), indicator variables for whether the bond is insured, callable, sinkable, the log of deal size, and an indicator for a competitive offering. The unit of observation is a bond deal. All characteristics are par value-weighted averages across CUSIPs in each deal. Standard errors are clustered by month of issuance.

	BAB	Muni
γ:		
Constant	0.00913***	0.00403***
Maturity	0.00020***	0.00034***
Rating	0.00020	0.00006
Insured	0.00369*	0.00314***
Callable	0.00164*	0.00267***
Sinkable	0.00168***	0.00114***
ln(Deal Size)	-0.00172***	-0.00076***
Competitive Offering	-0.00246***	0.00040*
ψ:		
Constant	46.12044*	157.13198***
Maturity	-1.53789*	-3.12090**
Rating	-0.82664	0.54610
Insured	-48.67340***	18.45058
Callable	15.99841	-43.86518
Sinkable	-0.43956	9.82922
ln(Deal Size)	13.78532***	6.82236
Competitive Offering	-4.30772	67.54290**
δ_r:		
Constant	0.01152***	0.00447***
Maturity	0.00043***	0.00003
Rating	0.00058	0.00005
Insured	0.00191	-0.00040
Callable	0.00221	0.00102*
Sinkable	0.00271	0.00036
ln(Deal Size)	-0.00163***	-0.00035*
Competitive Offering	-0.00459***	-0.00159*

Continued

Table 10
Model Estimates—Continued

	BAB	Muni
δ_i:		
Constant	0.01139***	0.00437***
Maturity	0.00036***	0.00004**
Rating	0.00065*	0.00000
Insured	-0.00098	0.00130*
Callable	0.00289	0.00155***
Sinkable	0.00336**	0.00092**
ln(Deal Size)	-0.00261***	-0.00096***
Competitive Offering	-0.00404***	0.00028
ϕ:		
Constant	0.61540***	0.76107***
Maturity	0.00007	0.00332
Rating	0.00207	0.00433
Insured	-0.19613***	0.01326
Callable	-0.04181	-0.02692
Sinkable	-0.01031	-0.00651
ln(Deal Size)	-0.01318	0.00816
Competitive Offering	-0.28328***	0.00274
θ:		
Constant	0.02797	-0.50076
Maturity	-0.00064	-0.27684***
Rating	0.00114	0.00527
Insured	0.05761	0.75291
Callable	-0.02213	1.58124*
Sinkable	-0.02948**	0.32729
ln(Deal Size)	0.00373	-1.58535***
Competitive Offering	-0.00476	2.14180**
N	1,875	13,554

Table 11
Model Predictions and Counterfactuals

The table reports the model predictions and counterfactuals. The panel 'Data' reports the mean and standard deviation of the corresponding values in the BAB sample. The model predictions are based on the parameter estimates Φ_{BAB} (left column in Table 10). The model predictions are computed by solving the moment conditions (14) for the optimal choices of V, P, Λ, and D and evaluating the resulting expressions at the estimated parameters. The model fit is captured by the explained variation across bond deals and the mean squared prediction error. The counterfactuals with tax rate $\tau = 0\%$ allow to assess the impact of the Federal tax rebate. The counterfactuals are computed by solving in each BAB deal for the optimal choices (V, P, Λ, D) based on the parameter estimates Φ_{BAB} from the BAB sample, assuming the rate on the Federal tax rebate is $\tau = 0\%$. The counterfactuals with alternate liquidity allow to assess the impact of differential liquidity between BABs and tax-exempt municipal bonds. The counterfactuals are computed by solving for (V, P, Λ, D) in the BAB sample based on the parameter estimates Φ_{Muni} from the muni sample (right column in Table 10). The first row reports the mean values, expressed in basis points, and the second row the standard deviation in parentheses.

	Coupon Inflation $\frac{V-R}{R}$	Retail Markup $\frac{P-V}{R}$	Total Markup $\frac{P-R}{R}$	Retail Share Λ	Under-pricing $\frac{U}{R}$	Underwriter Discount $\frac{D}{R}$
Data	0.23	1.62	1.90	0.27	0.55	0.82
	(1.02)	(0.90)	(1.15)	(0.25)	(0.64)	(0.38)
Model Prediction	0.90	0.93	1.86	0.42	0.80	0.42
	(0.82)	(0.36)	(0.71)	(0.17)	(0.55)	(0.47)
Model Fit:						
R^2	0.09	0.71	0.77	0.51	0.41	0.44
$\sqrt{MSE}$	0.99	1.00	1.06	0.26	0.65	0.67
Counterfactuals:						
Federal Tax Rebate $\tau = 0\%$	0.00	1.20	1.20	0.32	0.37	1.25
	(0.00)	(0.31)	(0.31)	(0.11)	(0.11)	(0.43)
Muni Liquidity $\Phi = \Phi_{Muni}$	0.32	0.97	1.30	0.43	0.55	0.56
	(0.42)	(0.21)	(0.49)	(0.12)	(0.28)	(0.48)

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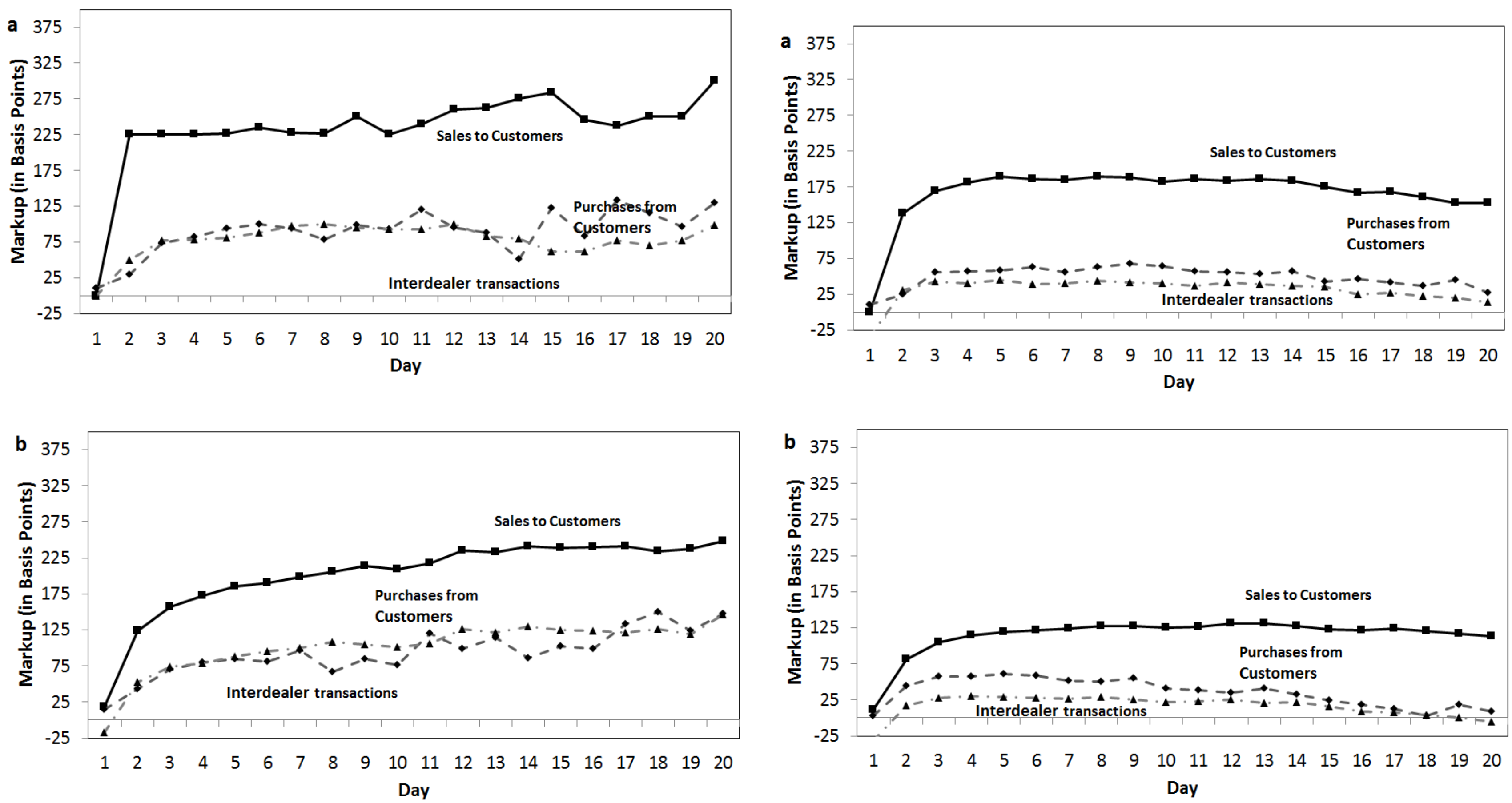

Figure 1

Markups over reoffering price by transaction type and day since issuance. The figure plots gross markups for different days since issuance and by transaction types. The two figures on the left are BABs, and the two figures on the right are tax-exempt municipals. In each case, the upper figure (a) plots median markups in the pooled cross-section by day since issuance. The bottom figure (b) plots cross-sectional averages per day of mean markups per bond issue and day

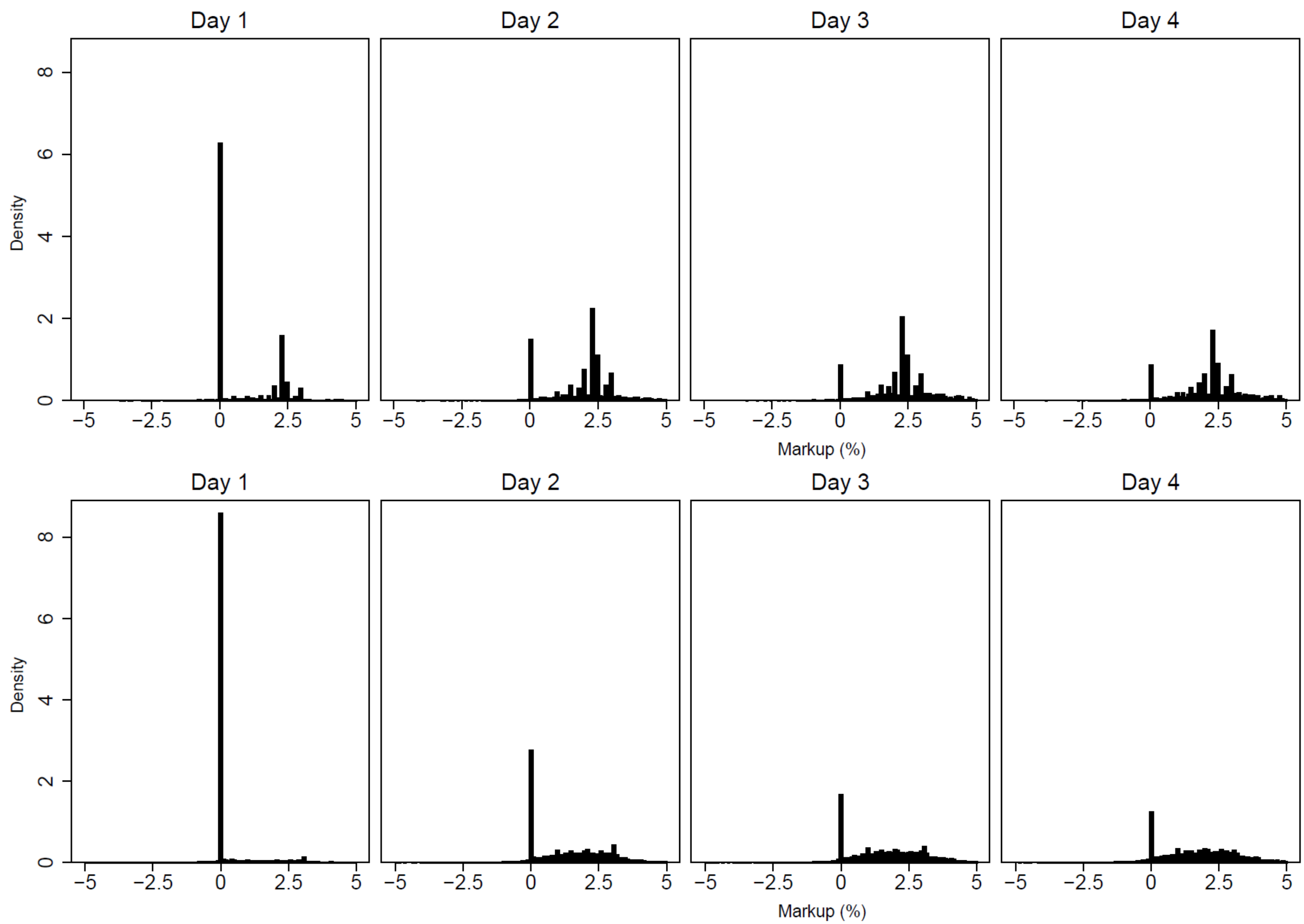

Figure 2
Distribution of markups over reoffering price on sales to customers by day since issuance. The figure plots the cross-sectional distribution of gross markups on sales from dealers to customers. The gross markup is defined as the transaction price on the sales transaction minus the reoffering price and then divided by the reoffering price. The data is winsorized at the 0.5% and 99.5% levels. The first panel reports the distribution of markups for BABs. The second panel reproduces the plot of this distribution for tax-exempts issued over the same period.

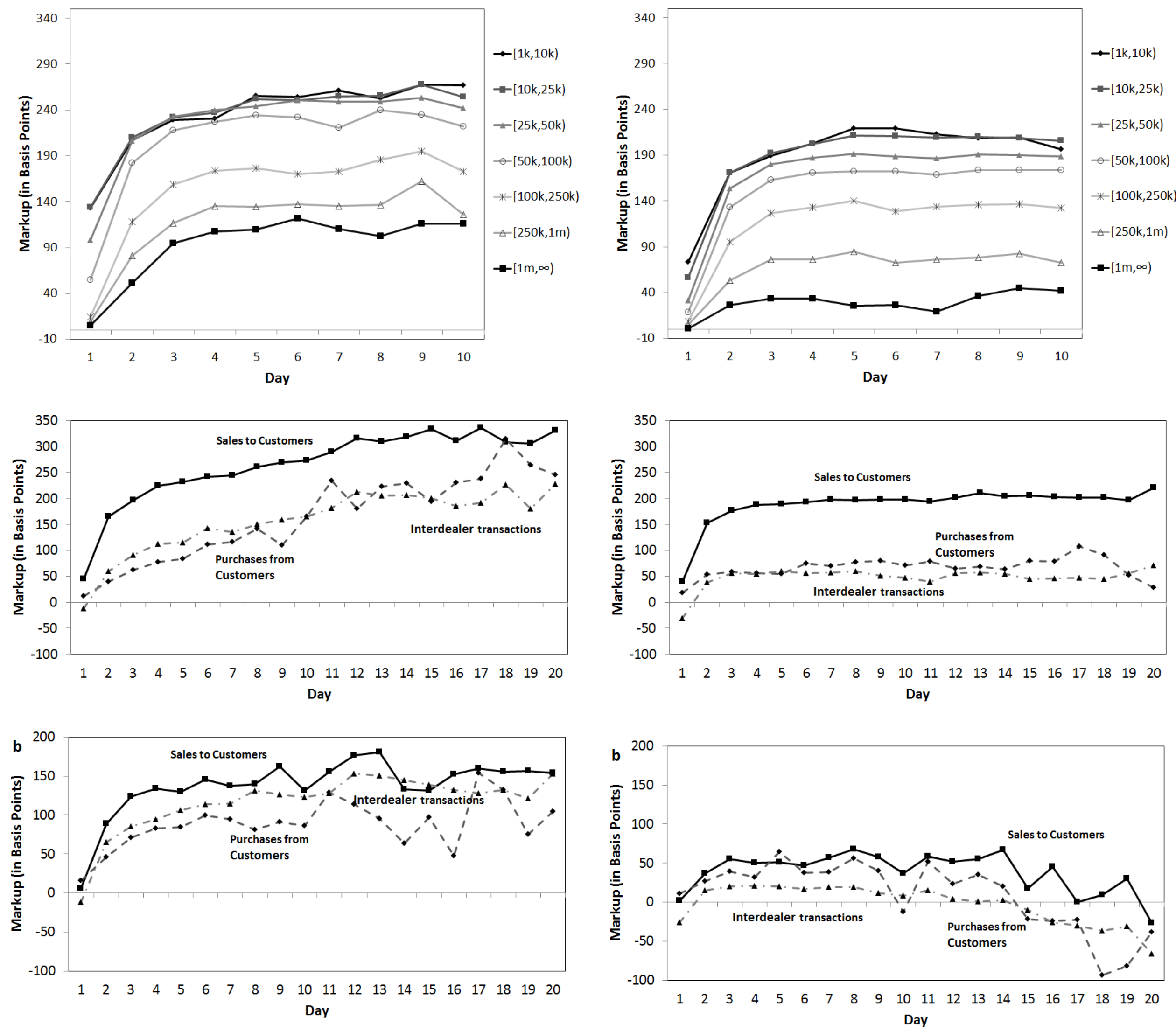

Figure 3

Evolution of markup over reoffering price by day from initial trading stratified by transaction size (top row), for fixed maturities 20 years (middle row), and for deals where BABs and tax exempts were issued simultaneously.

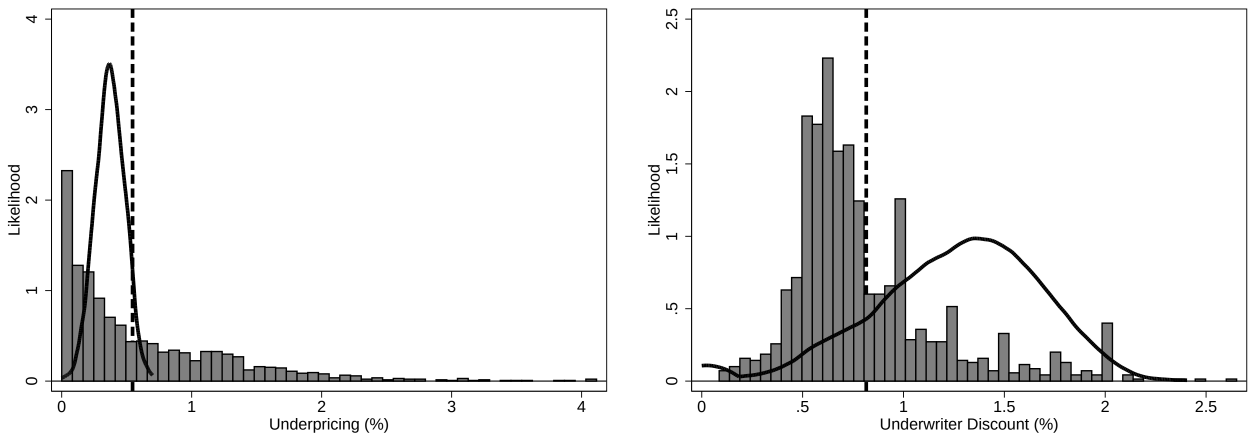

Figure 4
The figure compares actual to counterfactual underpricing and, respectively, underwriter discount. The left graph plots the empirical distribution of the underpricing U in the BAB sample (bars) and the counterfactual distribution under no Federal tax rebate (line). The right graph plots the empirical distribution of the underwriter discount D in the BAB sample (bars) and the counterfactual distribution under no Federal tax rebate (line). The dashed lines indicate the sample mean.

APPENDIX

Appendix A. Data Sources and Filters

This appendix describes our data sources and the filters and procedures we used to clean the data and arrive at our final sample.

Our final sample was constructed using four databases:

1. SDC Platinum database: Provides information about specific deals and CUSIPs.
2. MSRB-Primuni database: CUSIP-specific information hand collected by Primuni.com from several sources including the MSRB's EMMA web site.
3. MSRB EMMA web-page: CUSIP-specific information.
4. MSRB trades: Trade-by-trade date provided by the MSRB.

Note that the sources of the first three above are the Official Statements filed as part of the issuance process. We began with the CUSIPs identified by the SDC database, and checked or supplemented these with information from the other sources.

The total number of CUSIPs for BABs or municipals listed in SDC Platinum for the time period of the BAB program was 273,155. From this we deleted:

- CUSIPs repeated in the same deal: 1,212
- CUSIPs with clearly wrong gross spreads: 8
- CUSIPs with missing CUSIP number: 4,368
- CUSIPs repeated in different deals: 2,675

This leaves 264,892 CUSIPs.

We then checked the resulting sample of CUSIPs with information in the Primuni.com dataset. This led us to delete:

- CUSIPs issued before first issued BAB: 39,070
- CUSIPs that are not taxed or tax-exempt: 1,033
- CUSIPs with different principal values in the SDC database and the MSRB-primuni database: 7,328
- CUSIPs with no information provided on their principal amount: 22
- CUSIPs with different maturity date in the SDC database and the MSRB-primuni database: 1,472
- CUSIPs with no maturity date and no price data: 14

The data sources sometimes provide a reoffering yield, and we require a reoffering price. To be able to calculate one from the other requires the maturity date, dated date, and coupon rate. At this stage we do not delete CUSIPs with missing maturity date, dated date, coupon rate or yield rate if we have price data from the Primuni.com database, because the goal at this stage is to have a reoffering price (calculated from the reoffering yeild or reported). This led us to delete:

- CUSIPs with different coupon rate data in the SDC database and the MSRB-primuni database: 1,014
- CUSIPs without coupon rate data and no price data: 873
- CUSIPs with different dated date data in the SDC database and the MSRB-primuni database: 3,154
- CUSIPs with no dated date data and no price data: 30
- CUSIPs with no yield data and no price data: 4,208.

This left us with 206,674 CUSIPs, for which we could calculate or have a reported reoffering price. We wanted to be sure that any reported reoffering prices were correct, and therefore deleted those CUSIPs for which we could not check on the reported price in this way (17,505 CUSIPs), where there was no reoffering price available (3,001 CUSIPs), or where the check revealed differences between the reported price and the price we calculated (7,443 CUSIPs). Possible explanations for this problem are reporting of the wrong coupon, the wrong yield, using yield to maturity instead of yield to worst, the wrong call date, the wrong call price, or typos and errors in the original statement. The database may have an errors in one or more of these items because the original official statements are incorrect. For instance, we have examples of official statements that claim to report the yield to worst when in fact they are reporting the yield to maturity. We then went on to delete 721 CUSIPs with clearly wrong yields ($> 30\%$). Some of these were issued before the first BAB in the sample (2,436). After deleting those, we have 175,568 CUSIPs, of which 74,066 are missing gross spread data. These were not deleted, as many of our tests do not require gross underwriter spreads

Next, we combine the data on individual CUSIPs with information on trades in the MSRB database. Some CUSIPs never show any trades (8,917), and these were deleted from our sample. There are 4,195,724 trades in the remaining CUSIPs. We have 988 trades with par value ”more than $1,000,000” but without the exact value. When customers make a sale to a Dealer above 1,000,000, the MSRB only publishes the real trade par after a one-week delay. Sometimes the trade never does appear in the dataset, because they neglect to report it. Instead of deleting those trades we change treated them as trades of 1,000,000. Of the remaining trades we deleted:

- Trades with trade price¡10 of non-zero coupon bonds (38).
- Trades where the absolute difference between the reoffering price and the trade price was greater than 20 or between the trade yield and reoffering yield was greater than 0.1 (5). In such cases either the trade price or the reported trade yield are obviously wrong.
- Trades that for other reasons had nonsensical trade prices (1) or trade yields (1).
- CUSIPs with just one trade that was a trade from Customer to Dealer (38).

- Trades that took place more than 1950 days before the sale date of the CUSIP (2).

The Sale Date is the expected sale date of the bonds to the underwriter. In practice the actual sale date may differ from the stipulated date in the statement. Green, Hollifield, Schurhoff (2007) considers the issue date as the first day of trade. We do here also, but with some minor changes. We checked the trades that happened before the sale date and deleted those that were obviously wrong. Candidates were chosen according to the following criteria. We checked the first trade of a CUSIP and if the trade happened before sale date. For the resulting 70 candidate CUSIPs, we deleted the trades if there was no trade on the same or the next day, there was no more than 1 trade for the CUSIP, and there were none for CUSIPs belonging to the same deal. There were 9 trades deleted. Sometimes the first trades of a CUSIP are missing . If the first registered trade happens for example, 9 month after the real issue date, it will probably be at a different price than the reoferring price. That would affect our results. We therefore applied the following 2 filters:

- If the first registered trade is from a Customer to a Dealer and the trade date happens after the maximum between the sale date and the dated date, we set the issue date to the maximum date between the dated date and the sale date. This does not change the trade date, just the issue date for that CUSIP). This led to 2,729 such changes.

- If the first registered trade is from a Dealer to a Customer and the trade date is after the maximum of the sale date and the dated date plus 60 days, we set the issue date to the maximum date between the dated date and the sale date plus 60. Again, this does not change the trade date, just the issue date for that CUSIP). There were 2,428 such changes.

- For a variety of reasons the true issue date may be different from the sale date registered in the statement. I consider that it would be improbable that the real issue date was 60 days after the dated date. In general the dated date is 15-30 days after the sale date.

To construct the variable "trade days since issuance" we do not count weekends and holidays.

Customer to Dealers trades before Dealer to Customer trades may occur for 2 reasons: The sale of the bonds from the issuer to the underwriter is registered as a trade, or there are missing Dealer to Customer trades. Deletion of these trades could result in a under-estimation of the amount of flipping by Customers. We therefore divided these trades into 11 categories.

1. Category 1: Customer to Dealer trades on the first date of trade, that take place at least one day before the first Dealer to Customer trade, with a trade par equal to the CUSIP's principal at a price strictly lower then the reoffering price. Total: 325

2. Category 2: Customer to Dealer trades on the first date of trade, that take place at the same day that the first Dealer to Customer trade *but before in time*, with a trade par equal to the CUSIP's principal, at a price strictly lower then the reoffering price and *at the same trade time that the first trade of the CUSIP*. Total: 554

3. Category 3: Customer to Dealer trades on the first date of trade, that take place at the same day *and time* that the first Dealer to Customer trade, with a trade par equal to the CUSIP's principal, at a price strictly lower then the reoffering price, at the same trade time that the first trade of the CUSIP and *that the first trade of a Dealer to a Customer takes place at a strictly higher price than this trade price* . Total: 66

4. Category 4: Customer to Dealer trades that take place at least one day before the first Dealer to Customer trade, with a trade par equal to the CUSIP's principal and that are not category 1,2 or 3. Total: 161

5. Category 5: Customer to Dealer trades that take place at the same day that the first Dealer to Customer trade but before in time, with a trade par equal to the CUSIP's principal, at a price lower or equal than the first Dealer to Customer trade price and that are not category 1,2 or 3. Total: 229

6. Category 6: Customer to Dealer trades that take place at the same day and time that the first Dealer to Customer trade, with a trade par equal to the CUSIP's principal, at a price strictly lower than the first Dealer to Customer trade price and that are not category 1,2 or 3. Total: 0

7. Category 7: Customer to Dealer trades that take place at the same day that the first Dealer to Customer trade but *later in time*, with a trade par equal to the CUSIP's principal, at a price strictly lower than the first Dealer to Customer trade price and that are not category 1,2 or 3. Total: 36
   Categories 4-7 are candidates of Customers flipping the entire issue with missing Dealer to Customer trade leg.

8. Category 8: Customer to Dealer trades that take place at least one day before the first Dealer to Customer trade and that are not category 1-7. Total: 189

9. Category 9: Customer to Dealer trades that take place at the same day that the first Dealer to Customer trade but before in time, at a price lower or equal than the first Dealer to Customer trade price and that are not category 1-7. Total: 237

10. Category 10: Customer to Dealer trades that take place at least one day before that the first Dealer to Customer trade that has larger trade par than the first Customer to Dealer trade and that are not category 1-9. Total: 721

11. Category 11: Customer to Dealer trades that take place at the same day but before in time that the first Dealer to Customer trade that has larger trade par than the first Customer to Dealer trade, and that are not category 1-9. Total: 960

Categories 1,2 and 3 are candidates of Issuer to underwriters trades. Categories 8-11 are candidates of Customers flipping with missing Dealer to Customer trade leg.

We also applied some specific filters to calculate the underwriter's inventory after 60 trading days. We deleted:

- Trades that occur after 60 trading days (880,087).

- Trades of CUSIPs that have an inventory above the CUSIP principal at the *end of any day* during the first 60 days of trade, and that are categories 1-3 above (552).

- Trades that have same trade date, same trade time, same trade price, same trade par and for which (minimum day inventory + trade par)=0 (772). These are trades that are probably registered twice.

- Trades that have same trade date, same trade time, same trade par and that (minimum day inventory + trade par)=0 (81). These are trades that are probably entered twice to correct the price.

- Trades that have same trade date, same trade par and that (minimum day inventory + trade par)=0 (808). These are trades that a probably entered twice to correct the time.

After applying these filters, the total number of CUSIPs with excess inventory at any day during the first 60 days of trade was 721. The total number of trades from CUSIPs with excess inventory at any day during the first 60 days of trade was 49,351. The total number of CUSIPs with excess inventory at any day during the first 60 days of trade with at least one trade in category 4-11 was 555. The total number of trades from CUSIPs with excess inventory at any day during the first 60 days of trade with at least one trade in category 4-11 was 31,398. The total number of CUSIPs with negative inventory at any day during the first 60 days of trade was 4,873, and the total number of trades from CUSIPs with negative inventory at any day during the first 60 days of trade was 508,450.

Not all municipal bonds that are taxable to the holder are BABs, and our data sources do not always treat the tax status of the bonds in a consistent manner. We therefore:

- Deleted CUSIPs that are tax-exempt in the SDC database but are in the Primuni BAB CUSIP's list (2).

- Deleted trades from bonds that are tax-exempt in the SDC database but are in the Primuni BAB CUSIP's list (1,045).

- Deleted CUSIPs that are taxable in the SDC database but are not in the Primuni BAB CUSIP's list (12,149).

- Deleted trades from bonds that are tax-exempt in the SDC database but they are not in the Primuni BAB CUSIP's list (272,468).

The final sample, then, consists of the following:

- 154,393 CUSIPs.

- 3,041,130 trades.

- 149,228 CUSIPs without excess or negative inventory.

- 2,535,459 trades in CUSIPs without excess or negative inventory.