Competitive Bids and Post-Issuance Price Performance in the Municipal Bond Market

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Abstract

In this paper we undertake the first joint investigation of bidding in the primary market and trading in the immediate post-issuance secondary market for municipal bonds. We introduce a 'distance-to-next-bid' measure – the distance by which the winning underwriter's bid exceeded the next highest (non-winning) bid in the primary market. We document a winners' curse effect: bonds where the distance-to-next-bid is lower see larger price increases (over the reoffering price) in the post-issuance secondary market. This winners' curse effect appears to vary significantly across time, being lower at the peak of the financial crisis. It also appears to vary by bond type, being higher in bonds sold with original issue discount.

Keywords: Municipal bonds.

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The $3.7 trillion municipal market is the channel through which state and local authorities finance construction of schools, roads, sewers, and other essential public facilities. The market is characterized by a highly dispersed set of issuers: the MSRB estimates that there are more than 55,000 different issuers. By way of comparison, the $12 trillion US Treasury market has only one issuer. The investor base is also relatively dispersed. As of the first quarter of 2013, the household sector directly owned $1.7 trillion, or 44 percent, of the municipal bond value outstanding. Only 10 percent of the US Treasury market is directly held by household investors.

The dispersion of investors and issuers makes the intermediation process for municipal bonds complicated. The process amounts to a massive matching process, where the bond issues must be broken up into retail-sized pieces and sold to the appropriate investors. Underwriting activity in the municipal bond market has been an active area of academic research for years. Richard Green (2007) focused on this intermediation process in his American Finance Association annual address, developing a model where municipal issuers, underwriters, and retail and institutional investors interact. In his model the underwriters compete to purchase a bond issue, with the winning underwriter turning around and selling the issue to retail and institutional investors. The model highlights the two stages of the issuance process, with a bond sale from issuer to underwriter followed by the sale of bonds to different types of investors.

In a related paper, Green et al (2007) characterize some empirical tendencies in the post-issuance market for municipal bonds. Among these is an apparent upward drift in transaction prices in the trades (particularly sales from dealers to non-dealer customers) in the post-issuance market. They describe this as a source of profits to dealers in this market. An alternative

interpretation of this upward drift is offered by Schultz (2012), whose work suggests that at least part of this upward drift reflects not economic rents, but the cost of breaking up bond issues into smaller pieces for retail investors. Schultz shows that this upward drift is larger for bonds that pass through longer chains of dealers before ending up with their final investors. Schultz' interpretation is that for these bonds, the cost of intermediation – matching the bond with an appropriate buyer – is higher, and the upward drift in prices (referred to as a markup) reflects the greater intermediation cost of placing these bonds, passed through to the eventual purchasers.

The empirical work on municipal bond trading in the post-issuance market has in the background, at least conceptually, a two stage model where bonds are first sold to an underwriter, who then channels bonds through (maybe through a chain of inter-dealer trades) to eventual investors. In spite of this conceptual background, there has been limited evidence on the first part of the intermediation process – the bidding by dealers on a new bond issue. In this paper we analyze jointly the full underwriting process, connecting data on the bids (both winning and non-winning) with data on the post-issuance secondary market trading activity of the bonds.

Focusing on bonds that are sold through the competitive sales process, we document a number of facts. First, the post-issuance upward drift in prices appears to be, on average, much less pronounced in the period after the financial crisis. Second, we develop a measure of the extent to which a winning 'bid' from a dealer syndicate beats the next-highest bid. We show that this measure, which we call 'Distance-to-Next-Bid' (sometimes abbreviating to **DTNB**), can be large, and appears to vary over time with market spreads.[1] Green et al (2007) use the term 'money left on the table,' to describe customer purchases in the post-issuance market at higher prices than the reoffering price. A similar term might be used here: the DTNB variable reflects

[1] The 'next bid' in the terminology of our paper is often referred to as the 'cover bid.'

money left on the table by the winning underwriting syndicate, in the form of a bid that was higher than would have been necessary to win the bond issue.

We then show that the DTNB measure has some predictive power for the observed markup on the post-issuance sales to customers. In our data, a higher Distance-to-Next-Bid is associated with a lower secondary market markup. This pattern suggests a risk (and resulting economic cost) in the underwriting process: in bidding on any issue, there is a chance of falling victim to a 'winners curse,' with the winning underwriting syndicate being awarded an issue for which they pay much more than the next most aggressive bid. We show that this winners curse appears to play out in practice, with bids that are more aggressive relative to competitors being associated with a lower secondary market markup. We view this result as offering a complement to Schultz' (2012) finding that the observed secondary market markup reflects a real economic cost rather than entirely reflecting a rent earned by dealers.

The remainder of the paper proceeds in four sections. The first section describes the competitive sales process for municipal bonds. The second section describes the data collected for this study. The third section describes our empirical results, and a brief final section concludes.

1. Background on the competitive sales process

Municipal bonds are, for the most part, sold to investors through two primary processes. In a negotiated sale, the issuer generally selects an underwriter at least a few months before the date that the issuer intends to issue the municipal bonds. The managing underwriter is selected through a process, generally involving a request for proposals. The managing underwriter then performs services related to the origination of the bonds as well as the actual act of underwriting,

or purchasing, the bonds on the date of issuance. The negotiated sale process is competitive, in the sense that issuers compete based on a request for proposals. But on the date of the bond sale, the identity of the underwriting bank is known in advance. The underwriter purchases the bonds from the issuer, and (ideally) sells the bonds to satisfy final investor demand.

In a competitive process, an issuer that has already designed a bond issue (generally with the advice of a municipal advisor), will invite potential underwriters (or underwriting syndicates) to bid on a bond issue. The date of the bond issue is set in advance, as is the process by which the winning bid will be selected. In general, a bond issue will consist of multiple bonds, and an underwriting syndicate will be bidding to purchase the entire issue. Most commonly bids are evaluated on the basis of a measure called 'True Interest Cost,' (often abbreviated as **TIC**) which can be thought of as a measure of the aggregate yield to maturity of the entire bond issue. The use of TIC represents an advance over the earlier practice of using a measure called 'Net Interest Cost,' (NIC), a measure that did not account for the time value of money.[2] If TIC is the criterion used, the winning bidder will purchase the bond issue at the price indicated in their bid. They then, ideally, turn around and sell the bonds to investors.

Our analysis in this paper focuses on the two stages of the intermediation process – first, the sale from the issuer to the underwriter, and second, the transactions that deliver the bonds into the hands of the investors who hold them at the end of the first month post-issuance. Our data cover only bonds sold through the competitive process and include details on the bids submitted – including both winning and non-winning bids.

[2] See *Bond Buyer* (2013) for a discussion of the limitations in the TIC measure. In particular, the TIC measure does not account for the value of embedded options in a bond issue.

Although our analysis extends the existing literature by jointly focusing on the two parts of the intermediation process, our starting point comes after the issuer has made a decision about the process through which to sell bonds. There is a great deal of empirical evidence that bonds sold through the different processes have different characteristics, and we document some of the differences in the tables that follow.

To start by characterizing the relative shares of the different sales processes, **Table 1** shows Securities Industry and Financial Markets Association (SIFMA) estimates of the size of the new-issue market for municipal bonds between 1996 and 2012, broken down by method of sale. Over that period, SIFMA estimates that approximately $1 trillion worth of municipal bonds have been sold through the competitive process. Over the same period $4.5 Trillion have been sold through the negotiated process.

Table 2 shows data that we use in our study, which investigates individual bond issues. The data source for Table 2 is the Mergent database, a key data source for municipal bond information. The period covered is 2005-2011, which is the same as the period of our study. Over that period, the Mergent database captures $2.4 trillion of municipal bond issuance, with 819,297 individual bonds sold. Forty-six percent of the bonds in the Mergent sample are identified as being sold through the competitive method, and these bonds amount to twenty-six percent of the value of the bonds sold. The Mergent data suggest that the bonds sold through the competitive channel are disproportionately smaller in size, carry higher credit ratings, and are more likely to have a general obligation pledge from the issuer than bonds sold through the negotiated process.

2. Data sources and methods

The data used in this study are compiled from a variety of sources. The Mergent database provides characteristics of the bonds, including the security interest granted to the bondholders (whether the bond has a general obligation pledge or a revenue pledge), the maturity, whether the bond is insured, and other characteristics. These data are combined with data from Ipreo on the bids received in the competitive bidding process. The Ipreo data include the identities of the members of the underwriting syndicate making bids, and the TIC of the bids made. Credit rating data come from Standard and Poor's, and data on the trading activity come from the MSRB trades database.

Table 3 shows how these data sources come together to deliver the sample used in this study. From the 979,454 bond-level observations in the Mergent database, 546,903 are specifically identified as not having been sold through the competitive process and are therefore excluded from our study. An additional 122,959 bonds do not match to the Ipreo database. Most of these bonds are short-term issues that were not included in the dataset provided by Ipreo. A further 15,000 bonds match to the Ipreo database but do not have appear to have any observed trades in the MSRB database. For 282,076 bond observations we observe trades in the MSRB database on the days post-offering. In our notation, the day 0 is the date of the primary market sale. Most bonds, even where we observe trades on day zero, do not trade subsequently. Only 131,645 bonds have any trading activity observed on days 1-30, excluding the first day of trading.

One of the key variables we study in this work is the Distance-to-Next-Bid, or DTNB, described earlier. This variable captures the difference (in yield percent) between the winning

bid and the next-highest non-winning bid. The measure can be thought of as the extent to which the winning syndicate left money 'on the table,' by bidding higher than would have been necessary in order to win the competitive bond offering. **Table 4** shows the distribution of DTNB.[3] The data show an increase in the DTNB over the sample period (2005-2011). It appears that, by this measure, winning bidders are leaving more on the table in 2011 than they were in 2005. The increase in this measure is significant in economic magnitude. In 2005, the average winning bid beat the next highest bid by 4.7 basis points of TIC. In 2009 the average winning bid beat the next highest bid by 16 basis points of TIC. This increase occurs alongside an overall increase in the spread between AAA-rated and BBB-rated municipal bonds. The final two columns of table 4 show the BBB-AAA municipal bond spread in December of each year, and the ratio of the DTNB measure to the municipal bond spread for each year. **Figure 1** shows the same data, by month rather than year.

Table 5 shows changes over time in the count of bids. Because banks form syndicates, there is a distinction between the count of bids and the count of institutions that are involved in bids. Panel A shows the count of bids, and Panel B shows the count of bidders. Two patterns are striking. First, after a decrease in the average number of bids during the financial crisis, the average number of bids per issue has recovered in 2011. The average number of bids per issue has varied within a range between 4.46 and 5.51 over the 2005-2011 period. Panel B shows a pronounced increase, however, in the count of institutions that are involved as syndicate members in making bids. Average syndicate size has increased significantly over the period, so the average count of institutions involved in making bids, either as a lead or syndicate member,

[3] The observations in the paper are at the bond level – the level on which secondary market trading is observed, but the DTNB measure is calculated at the issue level, which is the level on which the primary market offering is sold to an underwriter. Where appropriate, standard errors reported in this paper are calculated using techniques that allow for 'clustering' at the issue level.

has increased from 11.68 to 17.16 over the period. The upper tail is striking – at the 75th percentile, 25 institutions are involved in bidding on a bond issue.

As a measure of the secondary market part of the intermediation process, we use a measure of the markup in the secondary market over the reoffering price. This measure is calculated based on the bond trades recorded in the MSRB trades database. Because we are focused on the intermediation process between underwriter and eventual purchaser, we include only sales from dealers to customers in calculating our price markup measure. The variable is constructed by taking each trade, and calculating a return for that trade over the reoffering price at which (at least some of) the bond was sold at the primary issuance. The price change is adjusted for the change in the Bloomberg AAA GO municipal bond index over the same period and normalized around 100; an increase of 1 percent would show up as a reading of 101 on this variable. For bonds that are sold at prices other than par (for example, a bond sold at a price of 90), the price change is normalized around the reoffering price – thus an increase from 90 to 90.9 would show up as a reading of 101. When an individual bond has multiple sales to customers over days 1 through 30, we calculate our markup measure by taking a weighted average (weighted by trade size) of the normalized price changes across the trades. We call the resulting measure Average Price Change – it follows closely similar measures used by Schultz (2012).

Table 6 shows the distribution of Average Price Change. The secondary market trading activity has changed over the 2005-2011 sample period. While in 2005, the average APC measure was 100.39, which was consistent with the tendency for secondary market prices to increase documented by Green et al (2007) and others. By 2011, the average APC measure for the year was 100.04. The upward tendency in trade prices in the secondary market was much more muted in 2011 than it had been in 2005.

Data at the monthly frequency are shown in **Figure 2**. The figure shows the median APC measure, as well as the upper and lower tails of the distribution. The behavior in the lower tail is also interesting. Between 2005 and 2008 the 25th percentile was just below 100, in the neighborhood of 99.9. By 2011 the 25th percentile was 99.54, indicating that 25 percent of the time customer purchases in the secondary market were happening at prices that – adjusted for the overall market movement – were lower than the bonds' reoffering price.

3. Evidence on the 'winners curse' and secondary market markups

This section investigates the relationship between the Distance-to-Next-Bid measure described earlier and price changes in the post-issuance secondary market. We start with regressions of DTNB on bond and issue characteristics. **Table 7** shows the results of this exercise. The dependent variable in all six specifications is the DTNB, which is the distance (in yield percent) between the Total Interest Cost of the winning bid and the TIC of the next-highest (non-winning) bid. The total size of the bond issue is strongly negatively correlated with DTNB. Our interpretation of this result is that increasing the size of the bond issue increases the interest on the part of bidders and tends to compress the distance between the winning and next-highest bids. The economic magnitude of the effect is large. In the specification with controls for bond purpose and month of issue, the coefficient estimate of -0.0116 implies that a doubling of the size of the bond issue is associated with a reduction in the DTNB of 1.16 basis points. The unit of observation in the regression is the bond, although the DTNB variable is measured at the issue level.[4] Running the regression at the bond level and including a measure of bond size delivers an interpretation of the negative coefficient on the bond size variable: holding constant the total size

[4] Reported standard errors have been corrected for issue-level clustering. The statistical significance of the reported results has thus been adjusted for the common variation in the variables by issue.

of the issue, the DTNB is smaller when the issue is made of a smaller number of bonds, each of which is of larger size.

Issues that are made up of bonds with longer maturities see larger DTNB measures. The coefficient estimate of 0.00356 in column (5) suggests that doubling the maturity of a particular bond in an issue is associated with an increase in 0.356 basis points in the difference between the winning bid and the next highest bid.

Municipal bonds can be issued at par; they can also be sold at a price higher than par (with Original Issue Premium, or OIP), or at a price lower than par (with Original Issue Discount, or OID). There is a strong tendency for bonds sold with OID to be directed towards the retail channel, while bonds sold with OIP are disproportionately sold to institutional investors. Thus the OID and OIP variables have some association with where the bonds will eventually end up. The coefficient estimates in column (5) suggest an association between our DTNB measure and OID. DTNB is significantly lower for bonds sold at a discount than it is for other bonds.

DTNB is much higher for taxable bonds in the sample than for other bonds. Controlling for all of the other variables, the coefficient on the taxable bond indicator is 0.187. The winning bidders in the taxable bond issues, many of which were Build America Bonds, tended to win by much more (and perhaps, by this measure, leave more 'on the table') than the winning bidders on other bond issues.

Credit characteristics of the bond are also associated with the DTNB measure. The regression specification includes three variables capturing the specific pledge for the bond. So-called double-barreled bonds have both a general obligation and a revenue pledge; the regression

also includes variables for Mergent's indicators for limited tax and unlimited tax general obligation pledges. The excluded variable is bonds with a revenue pledge: the coefficient estimates should be interpreted as a measure of the DTNB for bonds with that characteristic relative to the excluded category of revenue bonds. The DTNB measure is much lower for all of the bonds with some type of general obligation pledge. Bonds that are sold with bond insurance also have lower DTNB measures.

The credit rating of the bond is also correlated with DTNB in our sample. For these variables the excluded category is bonds without an S&P credit rating. Our regression results suggest that the higher the credit rating, the closer (in yield) the winning bid is to the next highest bid.

We also include variables measuring the use of a financial advisor and the type of financial advisor and underwriter used. We construct a categorical variable for large and small financial advisors, with a cutoff at a market share of 1 percent (in the neighborhood of the sample mean); we construct a similar variable for underwriters, with a cutoff of 3 percent (also the sample mean for that variable).

Column (6) includes some additional variables measuring bid density. These variables are potentially correlated with, and capture some of the same information as, the DTNB variable. The bid count captures the number of independent bidding groups making bids for a bond issue. The coefficient on this variable is not surprising: the more groups making bids for a given bond issue, the smaller the distance between the winning bid and the next highest bid. The main reason for including this variable is to investigate the impact that including it has on the other coefficients. The interesting thing to us is that the impact of including this variable on the other

coefficients is more muted than we expected. This suggests that the relationship between DTNB and many of these bond and issue characteristics is orthogonal to the impact of bidder count. For example, the coefficient on OID suggests that – even controlling for the number of bidders, the top two bids are more closely bunched for bonds sold with OID.

Table 8 investigates the relationship between DTNB and the price change of the bond in the immediate (day 1-30) secondary market for the bond. The key contribution of this work is to investigate the extent to which 'being out on an island' in the winning bid is associated with a reduced markup in the secondary market. Across all of the specifications, DTNB is a statistically significant determinant of the secondary market price change. The standard deviation of the DTNB variable across the entire sample is 0.173. The coefficient estimate of -0.115 in column (5) suggest that a 2-standard deviation change in the DTNB variable is associated with a -0.04 percent change, on average, in the average secondary market price change of the bond. In the next section we will show that this effect varies significantly by time period, and is larger in 2005-2008 and 2011, and statistically indistinguishable from zero in 2009 and 2010.

The other coefficients are of interest as well. Bonds that are part of larger offers see larger increases in prices in the 30 days post issuance. The coefficient on the bond size must be interpreted carefully, given that the issue size is already included in the regression. Conditional on the total issue size, an issue with fewer bonds appears to be cheaper to intermediate. This is not surprising, given the real economic costs of breaking up an issue into small pieces.

Another interesting relationship is the relationship between OID, OIP, and the price change in the secondary market. Bonds sold with OID have significantly higher observed price

markups in the post-issuance secondary market. As mentioned earlier, these bonds are also disproportionately sold into the retail channel. Thus the higher markup on those bonds is consistent with either Schultz (2012), and a higher cost of breaking up the bond into retail-sized pieces, or with Green et al (2007), and the presence of some rents accruing to underwriters owing to their informational advantage vis-à-vis relatively uninformed retail investors.

The price change in the secondary market is larger for bond issues where the issuer used a large advisor. Given that the advisor-issuer matching process is not randomized, one cannot ascribe a causal interpretation to this correlation – it is possible, indeed conceivable, that issuers of bonds that are more expensive to intermediate are using larger advisors, and the coefficient on this variable reflects joint causation by some underlying issue characteristic.

Table 9 investigates the coefficient magnitude within different subsamples. First, we investigate the coefficient magnitude by time period. The winners' curse effect is at its largest economic magnitude in 2005-2008 and in 2011. During these periods, the coefficient estimate is roughly four to five times as large is in the pooled sample. In the crisis period of 2009 to 2010, the coefficient estimate is not statistically distinguishable from zero. The time variation in the coefficient estimate is something of a puzzle, and reflects a lower measured winners curse effect at the height of the financial crisis. The winners curse effect is present across credit ratings, although when the sample is split at the A- and above and BBB+ and below level, the winners curse effect is stronger in the higher-rated bonds. The winners curse effect is strongest with bonds destined for the retail channel, and the effect is stronger with long maturity bonds.

4. Conclusion

In this paper we undertake the first joint investigation of bidding in the primary market and trading in the immediate post-issuance secondary market for municipal bonds. We introduce a 'distance-to-next-bid' measure – the distance by which the winning underwriter's bid exceeded the next highest (non-winning) bid in the primary market. We document a winners' curse effect: bonds where the distance-to-next-bid is lower see larger price increases (over the reoffering price) in the post-issuance secondary market. This winners' curse effect appears to vary across time, and by bond type.

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2. Data sources and methods

The data used in this study are compiled from a variety of sources. The Mergent database provides characteristics of the bonds, including the security interest granted to the bondholders (whether the bond has a general obligation pledge or a revenue pledge), the maturity, whether the bond is insured, and other characteristics. These data are combined with data from Ipreo on the bids received in the competitive bidding process. The Ipreo data include the identities of the members of the underwriting syndicate making bids, and the TIC of the bids made. Credit rating data come from Standard and Poor's, and data on the trading activity come from the MSRB trades database.

Table 3 shows how these data sources come together to deliver the sample used in this study. From the 979,454 bond-level observations in the Mergent database, 546,903 are specifically identified as not having been sold through the competitive process and are therefore excluded from our study. An additional 122,959 bonds do not match to the Ipreo database. Most of these bonds are short-term issues that were not included in the dataset provided by Ipreo. A further 15,000 bonds match to the Ipreo database but do not have appear to have any observed trades in the MSRB database. For 282,076 bond observations we observe trades in the MSRB database on the days post-offering. In our notation, the day 0 is the date of the primary market sale. Most bonds, even where we observe trades on day zero, do not trade subsequently. Only 131,645 bonds have any trading activity observed on days 1-30, excluding the first day of trading.

One of the key variables we study in this work is the Distance-to-Next-Bid, or DTNB, described earlier. This variable captures the difference (in yield percent) between the winning

bid and the next-highest non-winning bid. The measure can be thought of as the extent to which the winning syndicate left money 'on the table,' by bidding higher than would have been necessary in order to win the competitive bond offering. **Table 4** shows the distribution of DTNB.[3] The data show an increase in the DTNB over the sample period (2005-2011). It appears that, by this measure, winning bidders are leaving more on the table in 2011 than they were in 2005. The increase in this measure is significant in economic magnitude. In 2005, the average winning bid beat the next highest bid by 4.7 basis points of TIC. In 2009 the average winning bid beat the next highest bid by 16 basis points of TIC. This increase occurs alongside an overall increase in the spread between AAA-rated and BBB-rated municipal bonds. The final two columns of table 4 show the BBB-AAA municipal bond spread in December of each year, and the ratio of the DTNB measure to the municipal bond spread for each year. **Figure 1** shows the same data, by month rather than year.

Table 5 shows changes over time in the count of bids. Because banks form syndicates, there is a distinction between the count of bids and the count of institutions that are involved in bids. Panel A shows the count of bids, and Panel B shows the count of bidders. Two patterns are striking. First, after a decrease in the average number of bids during the financial crisis, the average number of bids per issue has recovered in 2011. The average number of bids per issue has varied within a range between 4.46 and 5.51 over the 2005-2011 period. Panel B shows a pronounced increase, however, in the count of institutions that are involved as syndicate members in making bids. Average syndicate size has increased significantly over the period, so the average count of institutions involved in making bids, either as a lead or syndicate member,

[3] The observations in the paper are at the bond level – the level on which secondary market trading is observed, but the DTNB measure is calculated at the issue level, which is the level on which the primary market offering is sold to an underwriter. Where appropriate, standard errors reported in this paper are calculated using techniques that allow for 'clustering' at the issue level.

has increased from 11.68 to 17.16 over the period. The upper tail is striking – at the 75th percentile, 25 institutions are involved in bidding on a bond issue.

As a measure of the secondary market part of the intermediation process, we use a measure of the markup in the secondary market over the reoffering price. This measure is calculated based on the bond trades recorded in the MSRB trades database. Because we are focused on the intermediation process between underwriter and eventual purchaser, we include only sales from dealers to customers in calculating our price markup measure. The variable is constructed by taking each trade, and calculating a return for that trade over the reoffering price at which (at least some of) the bond was sold at the primary issuance. The price change is adjusted for the change in the Bloomberg AAA GO municipal bond index over the same period and normalized around 100; an increase of 1 percent would show up as a reading of 101 on this variable. For bonds that are sold at prices other than par (for example, a bond sold at a price of 90), the price change is normalized around the reoffering price – thus an increase from 90 to 90.9 would show up as a reading of 101. When an individual bond has multiple sales to customers over days 1 through 30, we calculate our markup measure by taking a weighted average (weighted by trade size) of the normalized price changes across the trades. We call the resulting measure Average Price Change – it follows closely similar measures used by Schultz (2012).

Table 6 shows the distribution of Average Price Change. The secondary market trading activity has changed over the 2005-2011 sample period. While in 2005, the average APC measure was 100.39, which was consistent with the tendency for secondary market prices to increase documented by Green et al (2007) and others. By 2011, the average APC measure for the year was 100.04. The upward tendency in trade prices in the secondary market was much more muted in 2011 than it had been in 2005.

Data at the monthly frequency are shown in **Figure 2**. The figure shows the median APC measure, as well as the upper and lower tails of the distribution. The behavior in the lower tail is also interesting. Between 2005 and 2008 the 25th percentile was just below 100, in the neighborhood of 99.9. By 2011 the 25th percentile was 99.54, indicating that 25 percent of the time customer purchases in the secondary market were happening at prices that – adjusted for the overall market movement – were lower than the bonds' reoffering price.

3. Evidence on the 'winners curse' and secondary market markups

This section investigates the relationship between the Distance-to-Next-Bid measure described earlier and price changes in the post-issuance secondary market. We start with regressions of DTNB on bond and issue characteristics. **Table 7** shows the results of this exercise. The dependent variable in all six specifications is the DTNB, which is the distance (in yield percent) between the Total Interest Cost of the winning bid and the TIC of the next-highest (non-winning) bid. The total size of the bond issue is strongly negatively correlated with DTNB. Our interpretation of this result is that increasing the size of the bond issue increases the interest on the part of bidders and tends to compress the distance between the winning and next-highest bids. The economic magnitude of the effect is large. In the specification with controls for bond purpose and month of issue, the coefficient estimate of -0.0116 implies that a doubling of the size of the bond issue is associated with a reduction in the DTNB of 1.16 basis points. The unit of observation in the regression is the bond, although the DTNB variable is measured at the issue level.[4] Running the regression at the bond level and including a measure of bond size delivers an interpretation of the negative coefficient on the bond size variable: holding constant the total size

[4] Reported standard errors have been corrected for issue-level clustering. The statistical significance of the reported results has thus been adjusted for the common variation in the variables by issue.

of the issue, the DTNB is smaller when the issue is made of a smaller number of bonds, each of which is of larger size.

Issues that are made up of bonds with longer maturities see larger DTNB measures. The coefficient estimate of 0.00356 in column (5) suggests that doubling the maturity of a particular bond in an issue is associated with an increase in 0.356 basis points in the difference between the winning bid and the next highest bid.

Municipal bonds can be issued at par; they can also be sold at a price higher than par (with Original Issue Premium, or OIP), or at a price lower than par (with Original Issue Discount, or OID). There is a strong tendency for bonds sold with OID to be directed towards the retail channel, while bonds sold with OIP are disproportionately sold to institutional investors. Thus the OID and OIP variables have some association with where the bonds will eventually end up. The coefficient estimates in column (5) suggest an association between our DTNB measure and OID. DTNB is significantly lower for bonds sold at a discount than it is for other bonds.

DTNB is much higher for taxable bonds in the sample than for other bonds. Controlling for all of the other variables, the coefficient on the taxable bond indicator is 0.187. The winning bidders in the taxable bond issues, many of which were Build America Bonds, tended to win by much more (and perhaps, by this measure, leave more 'on the table') than the winning bidders on other bond issues.

Credit characteristics of the bond are also associated with the DTNB measure. The regression specification includes three variables capturing the specific pledge for the bond. So-called double-barreled bonds have both a general obligation and a revenue pledge; the regression

also includes variables for Mergent's indicators for limited tax and unlimited tax general obligation pledges. The excluded variable is bonds with a revenue pledge: the coefficient estimates should be interpreted as a measure of the DTNB for bonds with that characteristic relative to the excluded category of revenue bonds. The DTNB measure is much lower for all of the bonds with some type of general obligation pledge. Bonds that are sold with bond insurance also have lower DTNB measures.

The credit rating of the bond is also correlated with DTNB in our sample. For these variables the excluded category is bonds without an S&P credit rating. Our regression results suggest that the higher the credit rating, the closer (in yield) the winning bid is to the next highest bid.

We also include variables measuring the use of a financial advisor and the type of financial advisor and underwriter used. We construct a categorical variable for large and small financial advisors, with a cutoff at a market share of 1 percent (in the neighborhood of the sample mean); we construct a similar variable for underwriters, with a cutoff of 3 percent (also the sample mean for that variable).

Column (6) includes some additional variables measuring bid density. These variables are potentially correlated with, and capture some of the same information as, the DTNB variable. The bid count captures the number of independent bidding groups making bids for a bond issue. The coefficient on this variable is not surprising: the more groups making bids for a given bond issue, the smaller the distance between the winning bid and the next highest bid. The main reason for including this variable is to investigate the impact that including it has on the other coefficients. The interesting thing to us is that the impact of including this variable on the other

coefficients is more muted than we expected. This suggests that the relationship between DTNB and many of these bond and issue characteristics is orthogonal to the impact of bidder count. For example, the coefficient on OID suggests that – even controlling for the number of bidders, the top two bids are more closely bunched for bonds sold with OID.

Table 8 investigates the relationship between DTNB and the price change of the bond in the immediate (day 1-30) secondary market for the bond. The key contribution of this work is to investigate the extent to which 'being out on an island' in the winning bid is associated with a reduced markup in the secondary market. Across all of the specifications, DTNB is a statistically significant determinant of the secondary market price change. The standard deviation of the DTNB variable across the entire sample is 0.173. The coefficient estimate of -0.115 in column (5) suggest that a 2-standard deviation change in the DTNB variable is associated with a -0.04 percent change, on average, in the average secondary market price change of the bond. In the next section we will show that this effect varies significantly by time period, and is larger in 2005-2008 and 2011, and statistically indistinguishable from zero in 2009 and 2010.

The other coefficients are of interest as well. Bonds that are part of larger offers see larger increases in prices in the 30 days post issuance. The coefficient on the bond size must be interpreted carefully, given that the issue size is already included in the regression. Conditional on the total issue size, an issue with fewer bonds appears to be cheaper to intermediate. This is not surprising, given the real economic costs of breaking up an issue into small pieces.

Another interesting relationship is the relationship between OID, OIP, and the price change in the secondary market. Bonds sold with OID have significantly higher observed price

markups in the post-issuance secondary market. As mentioned earlier, these bonds are also disproportionately sold into the retail channel. Thus the higher markup on those bonds is consistent with either Schultz (2012), and a higher cost of breaking up the bond into retail-sized pieces, or with Green et al (2007), and the presence of some rents accruing to underwriters owing to their informational advantage vis-à-vis relatively uninformed retail investors.

The price change in the secondary market is larger for bond issues where the issuer used a large advisor. Given that the advisor-issuer matching process is not randomized, one cannot ascribe a causal interpretation to this correlation – it is possible, indeed conceivable, that issuers of bonds that are more expensive to intermediate are using larger advisors, and the coefficient on this variable reflects joint causation by some underlying issue characteristic.

Table 9 investigates the coefficient magnitude within different subsamples. First, we investigate the coefficient magnitude by time period. The winners' curse effect is at its largest economic magnitude in 2005-2008 and in 2011. During these periods, the coefficient estimate is roughly four to five times as large is in the pooled sample. In the crisis period of 2009 to 2010, the coefficient estimate is not statistically distinguishable from zero. The time variation in the coefficient estimate is something of a puzzle, and reflects a lower measured winners curse effect at the height of the financial crisis. The winners curse effect is present across credit ratings, although when the sample is split at the A- and above and BBB+ and below level, the winners curse effect is stronger in the higher-rated bonds. The winners curse effect is strongest with bonds destined for the retail channel, and the effect is stronger with long maturity bonds.

4. Conclusion

In this paper we undertake the first joint investigation of bidding in the primary market and trading in the immediate post-issuance secondary market for municipal bonds. We introduce a 'distance-to-next-bid' measure – the distance by which the winning underwriter's bid exceeded the next highest (non-winning) bid in the primary market. We document a winners' curse effect: bonds where the distance-to-next-bid is lower see larger price increases (over the reoffering price) in the post-issuance secondary market. This winners' curse effect appears to vary across time, and by bond type.

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Table 1. Municipal Bond Issuance, by Bid Type, 1996-2012 (Billions of dollars), SIFMA

	Competitive Bid			Negotiated Bid				
Year	General Obligation	Revenue	Total	General Obligation	Revenue	Total	Private Placement, Total	Grand Total
1996	31.3	15.7	47.0	33.1	101.4	134.5	3.7	185.2
1997	35.4	12.4	47.8	36.8	129.5	166.3	6.6	220.7
1998	43.9	21.4	65.3	49.6	165.8	215.4	6.1	286.8
1999	38.4	14.4	52.8	32.4	134.2	166.6	8.1	227.5
2000	35.3	13.3	48.6	31.0	115.0	146.0	6.2	200.8
2001	45.8	17.3	63.1	55.6	165.9	221.5	3.1	287.7
2002	52.3	19.5	71.8	73.1	209.9	283.0	2.7	357.5
2003	54.0	21.8	75.8	86.6	216.4	303.0	3.9	382.7
2004	51.5	17.3	68.8	77.6	210.5	288.1	2.9	359.8
2005	55.5	20.6	76.1	88.5	241.8	330.3	1.8	408.2
2006	48.7	20.9	69.6	65.9	246.6	312.5	4.4	386.5
2007	51.1	21.7	72.8	79.0	272.6	351.6	4.9	429.3
2008	37.9	15.5	53.4	72.3	260.7	333.1	4.2	390.6
2009	46.2	11.8	58.0	108.7	240.2	348.9	2.7	409.6
2010	49.0	24.1	73.1	97.9	259.3	357.2	2.8	433.1
2011	40.9	18.7	59.6	64.1	161.6	225.7	9.5	294.7
2012	47.7	26.4	74.1	87.6	207.8	295.4	9.3	378.9
Total	764.9	312.8	1077.7	1139.8	3339.2	4479.0	82.9	5639.6
Note: Share (percent)	13.6%	5.5%	19.1%	20.2%	59.2%	79.4%	1.5%	100.0%

Source: SIFMA, based on data from Thompson Reuters

Table 2. Municipal Bond Issuance, by Bid Type, 2005-2011, Mergent

			Competitive Bid		Negotiated Bid		Private Placement	
	Bond Count	Value (Billions of dollars)	Share of Bonds	Share of Value	Share of Bonds	Share of Value	Share of Bonds	Share of Value
2005	147,259	357.5	38.6%	24.1%	61.2%	75.4%	0.1%	0.5%
2006	128,002	361.8	38.2%	18.2%	61.2%	81.1%	0.6%	0.7%
2007	121,373	417.2	38.0%	16.7%	61.3%	82.5%	0.7%	0.7%
2008	96,607	372.3	41.5%	14.4%	57.6%	84.2%	0.9%	1.5%
2009	106,897	331.5	42.6%	21.9%	57.2%	75.7%	0.3%	2.4%
2010	114,388	296.9	63.9%	46.8%	35.8%	52.0%	0.4%	1.2%
2011	104,771	273.1	63.6%	48.3%	36.1%	51.2%	0.2%	0.5%
Insured	309,837	675.7	40.3%	21.5%	59.7%	78.3%	0.1%	0.2%
BBB rating and below	27,067	84.6	44.6%	16.0%	55.2%	83.9%	0.2%	0.1%
General Obligation	384,954	625.5	56.8%	44.5%	43.0%	55.4%	0.3%	0.1%
Refunding issue	376,378	1137.6	39.3%	24.3%	60.5%	75.3%	0.2%	0.5%
Total	819,297	2410.3	46.0%	25.7%	53.5%	73.3%	0.4%	1.1%

Source: Mergent database. Sample includes all bond issuance from the Mergent municipal database between 2005 and 2011 that is identified as being sold through competitive did, negotiated bid, or private placement processes.

Table 3. Link Between Mergent, Ipreo, and MSRB databases.

					Bonds identified by Mergent as Comp. Bid			
					Can calculate distance to next bid			
	Bonds in Mergent Database	Bonds identified by Mergent as Not Comp. Bid	No Match to Ipreo database	Match to Ipreo database	Subtotal	Observe at least one trade, days 0-30	Observe at least one trade, days 1-30	Observe at least one trade, days 1-30, Value, Billions of Dollars
2005	174,404	113,526	10,798	50,080	47,393	43,668	22,374	32.4
2006	149,881	95,821	5,535	48,525	46,562	43,719	21,627	35.5
2007	144,955	94,485	4,729	45,741	44,284	42,435	19,569	34.9
2008	115,799	71,540	4,542	39,717	37,389	36,059	16,686	29.4
2009	130,140	75,730	14,064	40,346	37,481	36,596	16,579	31.6
2010	146,390	53,440	45,814	47,136	44,676	44,048	19,886	42.7
2011	117,885	42,361	37,477	38,047	36,645	35,551	14,924	34.9
Total	979,454	546,903	122,959	309,592	294,430	282,076	131,645	241.4

Source: Ipreo, Mergent, and MSRB databases.

Table 4. Difference-To-Next-Bid (DTNB), 2005-2011.

Year	Bonds in sample	Average	Standard Deviation	Percentiles 10th	25th	50th	75th	90th	Note: BBB-AAA muni spread	Ratio of average DTNB to spread
2005	47,325	0.047	0.098	0.002	0.008	0.023	0.051	0.101	0.550	0.085
2006	46,562	0.039	0.072	0.002	0.007	0.019	0.044	0.094	0.490	0.080
2007	44,274	0.040	0.074	0.002	0.007	0.019	0.043	0.092	0.750	0.053
2008	37,389	0.092	0.153	0.006	0.015	0.041	0.104	0.220	1.970	0.047
2009	37,481	0.160	0.320	0.009	0.027	0.066	0.156	0.322	1.540	0.104
2010	44,676	0.112	0.208	0.007	0.023	0.057	0.126	0.238	1.400	0.080
2011	36,645	0.099	0.142	0.008	0.022	0.055	0.120	0.226	1.640	0.060
ALL	294,352	0.081	0.173	0.004	0.012	0.034	0.084	0.183		

Table 5. Bid and Bidder Count, 2005-2011.

Panel A. Bid count

				Percentiles						
Year	Bonds in sample	Average	Standard Deviation	5th	10th	25th	50th	75th	90th	95th
2005	50012	5.11	2.637	1	2	3	5	7	9	10
2006	48525	5.51	2.725	2	2	3	5	7	9	10
2007	45731	5.427	2.676	2	2	3	5	7	9	10
2008	39717	4.463	2.406	1	2	3	4	6	8	9
2009	40346	4.482	2.394	1	2	3	4	6	8	9
2010	47136	4.827	2.513	1	2	3	4	6	8	10
2011	38047	5.399	2.788	2	2	3	5	7	9	11
Total	309514	5.047	2.63	2	2	3	5	7	9	10

Panel B. Bidder count

				Percentiles						
Year	Bonds in sample	Average	Standard Deviation	5th	10th	25th	50th	75th	90th	95th
2005	50012	11.676	6.922	2	3	6	11	17	22	24
2006	48525	11.595	7.621	2	3	5	10	17	23	26
2007	45731	11.118	7.195	2	3	5	10	16	22	25
2008	39717	9.044	6.694	2	2	4	7	13	20	22
2009	40346	11.445	7.014	2	3	5	11	17	21	24
2010	47136	14.229	8.313	2	3	7	15	21	25	28
2011	38047	17.158	9.829	2	3	8	18	25	30	33
Total	309514	12.276	8.021	2	3	5	11	18	24	27

Source: Ipreo, Bloomberg

Table 6. Price change in secondary market

Year	Total Count	Count with trades, days 0-30	Average normalized price increase, days 0-30	Count with trades, days 1-30	Normalized price increase, days 1-30					
						Percentiles				
					Average	10th	25th	50th	75th	90th
2005	50,080	45,918	100.16	23,311	100.39	99.47	99.92	100.25	100.87	101.60
2006	48,525	45,410	100.13	22,091	100.33	99.50	99.89	100.17	100.76	101.47
2007	45,741	43,771	100.12	19,989	100.39	99.59	99.94	100.21	100.83	101.58
2008	39,717	38,289	100.11	17,592	100.34	99.35	99.84	100.17	100.83	101.65
2009	40,346	39,351	100.04	17,652	100.10	98.96	99.66	100.02	100.60	101.41
2010	47,136	46,485	100.02	20,687	100.18	99.12	99.74	100.05	100.66	101.46
2011	38,047	36,928	99.99	15,316	100.04	98.73	99.54	99.99	100.59	101.52
Total	309,592	296,152	100.09	136,638	100.27	99.27	99.82	100.13	100.76	101.53

Source. MSRB, Bloomberg, Mergent

Table 7. Regressions of Distance-To-Next-Bid on Issue and Bond Characteristics

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
Total amount in issue (log)	-0.0148***	-0.0150***	-0.0122***	-0.0116***	-0.0116***	-0.00665***
	(0.00137)	(0.00137)	(0.00136)	(0.00136)	(0.00136)	(0.00138)
Total size of bond (log)	-0.00134	-0.000813	-0.00278**	-0.00292**	-0.00292**	0.000517
	(0.00129)	(0.00129)	(0.00128)	(0.00127)	(0.00127)	(0.00123)
Maturity of bond (log)	0.00474***	0.00443***	0.00360***	0.00356***	0.00356***	0.00150
	(0.00126)	(0.00126)	(0.00122)	(0.00122)	(0.00122)	(0.00118)
Bond sold with OID[1]	-0.0176***	-0.0170***	-0.0130***	-0.0121***	-0.0121***	-0.0100***
	(0.00347)	(0.00345)	(0.00340)	(0.00336)	(0.00336)	(0.00334)
Bond sold with OIP[1]	-0.00360	-0.00328	-0.00494	-0.00500	-0.00500	-0.00424
	(0.00365)	(0.00365)	(0.00357)	(0.00356)	(0.00356)	(0.00354)
Taxable	0.198***	0.204***	0.190***	0.187***	0.187***	0.180***
	(0.0199)	(0.0207)	(0.0204)	(0.0200)	(0.0200)	(0.0199)
Refunding bond	0.00246	0.00220	-0.00513***	-0.00541***	-0.00541***	-0.00615***
	(0.00190)	(0.00188)	(0.00186)	(0.00189)	(0.00189)	(0.00185)
Bond security variables:						
Double-Barreled[2]	-0.0267***	-0.0278***	-0.0324***	-0.0314***	-0.0314***	-0.0248***
	(0.00627)	(0.00636)	(0.00638)	(0.00640)	(0.00640)	(0.00632)
Limited Tax GO[2]	-0.0260***	-0.0236***	-0.0292***	-0.0295***	-0.0295***	-0.0221***
	(0.00349)	(0.00386)	(0.00384)	(0.00385)	(0.00385)	(0.00388)
Unlimited Tax GO[2]	-0.0154***	-0.0129***	-0.0159***	-0.0162***	-0.0162***	-0.0114***
	(0.00310)	(0.00348)	(0.00342)	(0.00345)	(0.00345)	(0.00344)
Bond insured	-0.0312***	-0.0313***	-0.00578***	-0.00508**	-0.00508**	-0.00898***
	(0.00193)	(0.00193)	(0.00215)	(0.00214)	(0.00214)	(0.00212)
Bond credit rating variables:						
S&P Rating = AAA[3]	-0.0232***	-0.0230***	-0.0258***	-0.0254***	-0.0254***	-0.0155***
	(0.00348)	(0.00346)	(0.00344)	(0.00345)	(0.00345)	(0.00347)
S&P Rating = AA+[3]	-0.00490	-0.00381	-0.0142***	-0.0140***	-0.0140***	-0.00683
	(0.00477)	(0.00478)	(0.00473)	(0.00474)	(0.00474)	(0.00470)
S&P Rating = AA[3]	-0.00899***	-0.00997***	-0.0180***	-0.0178***	-0.0178***	-0.0104***
	(0.00312)	(0.00319)	(0.00322)	(0.00330)	(0.00330)	(0.00324)
S&P Rating = AA-[3]	0.00327	0.00413	-0.00484	-0.00616	-0.00616	-0.00230
	(0.00411)	(0.00412)	(0.00410)	(0.00409)	(0.00409)	(0.00405)
S&P Rating = A+[3]	0.0113***	0.0114***	-0.00143	-0.00250	-0.00250	0.0000615
	(0.00381)	(0.00383)	(0.00364)	(0.00370)	(0.00370)	(0.00360)
S&P Rating = A[3]	0.0140**	0.0142**	0.00877	0.00859	0.00859	0.0108*
	(0.00626)	(0.00633)	(0.00610)	(0.00609)	(0.00609)	(0.00602)
S&P Rating = A-[3]	0.0154*	0.0150*	0.0160*	0.0160*	0.0160*	0.0116
	(0.00866)	(0.00894)	(0.00834)	(0.00829)	(0.00829)	(0.00787)
S&P Rating = BBB+[3]	0.0453***	0.0421***	0.0334**	0.0330**	0.0330**	0.0265**
	(0.0132)	(0.0137)	(0.0131)	(0.0129)	(0.0129)	(0.0126)

Table 7. Regressions of Distance-To-Next-Bid on Issue and Bond Characteristics

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
S&P Rating = BBB[3]	0.0196**	0.0127	0.000333	0.0000183	0.0000183	-0.00671
	(0.00833)	(0.00885)	(0.00844)	(0.00847)	(0.00847)	(0.00838)
S&P Rating = BBB-[3]	0.0384***	0.0342**	0.0216*	0.0184	0.0184	0.0109
	(0.0133)	(0.0135)	(0.0131)	(0.0127)	(0.0127)	(0.0125)
S&P Rating = BB+ and below[3]	0.0484***	0.0493***	0.0548***	0.0348***	0.0348***	0.00278
	(0.00333)	(0.00355)	(0.00357)	(0.00952)	(0.00952)	(0.00960)
Callable	0.00319	0.00277	0.00121	0.000645	0.000645	-0.00174
	(0.00229)	(0.00228)	(0.00223)	(0.00221)	(0.00221)	(0.00219)
Advisor/Underwriter variables						
Issuer did not use advisor[4]	-0.000184	0.00133	-0.000489	-0.00141	-0.00141	-0.00410
	(0.00319)	(0.00321)	(0.00311)	(0.00317)	(0.00317)	(0.00309)
Issuer used large advisor[4]	0.0000491	0.000449	-0.00128	-0.00195	-0.00195	-0.000247
	(0.00233)	(0.00237)	(0.00232)	(0.00232)	(0.00232)	(0.00230)
Issuer used a large underwriter[5]	-0.00224	-0.00156	-0.000750	-0.000594	-0.000594	-0.000698
	(0.00234)	(0.00233)	(0.00229)	(0.00231)	(0.00231)	(0.00228)
Other measures of bid density						
Bid Count						-0.00950***
						(0.000579)
Institutions making bids[5]						-0.000256
						(0.000191)
Constant	0.341***	0.348***	0.328***	0.322***	0.322***	0.249***
	(0.0153)	(0.0153)	(0.0151)	(0.0149)	(0.0149)	(0.0153)
Dummies for (60) use of proceeds		X	X	X	X	X
Time control	None	None	Year	Year/month	Year/month	Year/month
N	129431	129431	129431	129431	129431	129431
R-sq	0.114	0.121	0.160	0.170	0.170	0.190

[1] OID is original issue discount, OIP is original issue premium. Coefficients measure effect relative to bonds sold at par.

[2] Coefficients measure effect relative to omitted category (revenue bonds).

[3] Omitted category is bonds without an S&P rating.

[4] Large advisors are advisors with greater than 1 percent market share. Omitted category is issues where the issuer used a small advisor.

[5] Large underwriters are underwriters with > 3 percent market share.

[5] This is the total number of institutions involved in bidding. For example, if there were two bidding groups with

Source: Ipreo, Mergent, S&P, MSRB.

Table 8. Regressions of Secondary Market Price Change on Issue and Bond Characteristics

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
Difference-to-Next-Bid	-0.168***	-0.169***	-0.0903**	-0.115***	-0.115***	-0.137***
	(0.0413)	(0.0415)	(0.0415)	(0.0403)	(0.0403)	(0.0406)
Total amount in issue (log)	0.0609***	0.0600***	0.0541***	0.0549***	0.0549***	0.0507***
	(0.00757)	(0.00763)	(0.00761)	(0.00749)	(0.00749)	(0.00806)
Total size of bond (log)	-0.0361***	-0.0361***	-0.0312***	-0.0341***	-0.0341***	-0.0278***
	(0.00679)	(0.00682)	(0.00681)	(0.00673)	(0.00673)	(0.00684)
Maturity of bond (log)	0.0721***	0.0728***	0.0748***	0.0761***	0.0761***	0.0722***
	(0.00631)	(0.00629)	(0.00626)	(0.00620)	(0.00620)	(0.00624)
Bond sold with OID[1]	0.591***	0.591***	0.585***	0.589***	0.589***	0.580***
	(0.0147)	(0.0146)	(0.0146)	(0.0144)	(0.0144)	(0.0145)
Bond sold with OIP[1]	-0.183***	-0.182***	-0.176***	-0.173***	-0.173***	-0.182***
	(0.0147)	(0.0147)	(0.0147)	(0.0144)	(0.0144)	(0.0146)
Taxable	0.186***	0.184***	0.201***	0.178***	0.178***	0.173***
	(0.0347)	(0.0357)	(0.0360)	(0.0345)	(0.0345)	(0.0346)
Refunding bond	-0.0757***	-0.0764***	-0.0513***	-0.0566***	-0.0566***	-0.0569***
	(0.0119)	(0.0119)	(0.0121)	(0.0117)	(0.0117)	(0.0117)
Bond security variables:						
Double-Barreled[2]	0.0397	0.0344	0.0403	0.0398	0.0398	0.0374
	(0.0297)	(0.0299)	(0.0300)	(0.0292)	(0.0292)	(0.0293)
Limited Tax GO[2]	-0.0644***	-0.0639***	-0.0494**	-0.0602***	-0.0602***	-0.0626***
	(0.0195)	(0.0204)	(0.0203)	(0.0198)	(0.0198)	(0.0199)
Unlimited Tax GO[2]	-0.0406***	-0.0337**	-0.0305**	-0.0313**	-0.0313**	-0.0325**
	(0.0140)	(0.0154)	(0.0153)	(0.0149)	(0.0149)	(0.0150)
Bond insured	0.153***	0.158***	0.0881***	0.0835***	0.0835***	0.0744***
	(0.0122)	(0.0122)	(0.0129)	(0.0127)	(0.0127)	(0.0127)
Bond credit rating variables:						
S&P Rating = AAA[3]	0.0474**	0.0432**	0.0437**	0.0462**	0.0462**	0.0519***
	(0.0200)	(0.0203)	(0.0200)	(0.0196)	(0.0196)	(0.0196)
S&P Rating = AA+[3]	-0.0511**	-0.0593**	-0.0419*	-0.0318	-0.0318	-0.0296
	(0.0232)	(0.0232)	(0.0234)	(0.0227)	(0.0227)	(0.0227)
S&P Rating = AA[3]	-0.00580	-0.0144	0.00338	0.00625	0.00625	0.00967
	(0.0184)	(0.0185)	(0.0184)	(0.0178)	(0.0178)	(0.0178)
S&P Rating = AA-[3]	0.0426**	0.0331	0.0530***	0.0597***	0.0597***	0.0613***
	(0.0202)	(0.0202)	(0.0201)	(0.0196)	(0.0196)	(0.0196)
S&P Rating = A+[3]	0.0387*	0.0379*	0.0701***	0.0646***	0.0646***	0.0696***
	(0.0226)	(0.0226)	(0.0225)	(0.0216)	(0.0216)	(0.0216)
S&P Rating = A[3]	0.0432*	0.0393	0.0542**	0.0538**	0.0538**	0.0627***
	(0.0248)	(0.0248)	(0.0249)	(0.0241)	(0.0241)	(0.0240)
S&P Rating = A-[3]	-0.0200	-0.0335	-0.0332	-0.0294	-0.0294	-0.0229
	(0.0378)	(0.0384)	(0.0369)	(0.0360)	(0.0360)	(0.0357)
S&P Rating = BBB+[3]	0.00794	0.00810	0.0329	0.00189	0.00189	0.0140

Table 8. Regressions of Secondary Market Price Change on Issue and Bond Characteristics

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
	(0.0598)	(0.0599)	(0.0583)	(0.0565)	(0.0565)	(0.0557)
S&P Rating = BBB[3]	-0.134**	-0.132**	-0.104*	-0.118*	-0.118*	-0.101
	(0.0622)	(0.0614)	(0.0601)	(0.0620)	(0.0620)	(0.0618)
S&P Rating = BBB-[3]	0.0578	0.0706	0.0967	0.115*	0.115*	0.128**
	(0.0625)	(0.0635)	(0.0623)	(0.0589)	(0.0589)	(0.0589)
S&P Rating = BB+ and below[3]	1.854***	1.823***	1.787***	1.826***	1.826***	1.847***
	(0.0190)	(0.0203)	(0.0226)	(0.0429)	(0.0429)	(0.0448)
Callable	-0.101***	-0.100***	-0.0931***	-0.0926***	-0.0926***	-0.0947***
	(0.0123)	(0.0123)	(0.0123)	(0.0121)	(0.0121)	(0.0121)
Advisor/Underwriter variables						
Issuer did not use advisor[4]	0.00934	0.00852	0.0151	0.0160	0.0160	0.0183
	(0.0196)	(0.0196)	(0.0196)	(0.0188)	(0.0188)	(0.0187)
Issuer used large advisor[4]	0.0259**	0.0232**	0.0306***	0.0282**	0.0282**	0.0305***
	(0.0118)	(0.0118)	(0.0117)	(0.0113)	(0.0113)	(0.0113)
Issuer used a large underwriter[5]	0.00417	0.00411	0.00635	0.00925	0.00925	0.00754
	(0.0115)	(0.0115)	(0.0114)	(0.0110)	(0.0110)	(0.0109)
Other measures of bid density						
Bid Count						-0.0183***
						(0.00281)
Institutions making bids[6]						0.00563***
						(0.00103)
Constant	99.58***	99.59***	99.62***	99.64***	99.64***	99.66***
	(0.0911)	(0.0914)	(0.0909)	(0.0891)	(0.0891)	(0.0965)
Dummies for (60) use of proceeds		X	X	X	X	X
Time control	None	None	Year	Year/month	Year/month	Year/month
N	129431	129431	129431	129431	129431	129431
R-sq	0.109	0.111	0.117	0.133	0.133	0.134

[1] OID is original issue discount, OIP is original issue premium. Coefficients measure effect relative to bonds sold at par.

[2] Coefficients measure effect relative to omitted category (revenue bonds).

[3] Omitted category is bonds without an S&P rating.

[4] Large advisors are advisors with greater than 1 percent market share. Omitted category is issues where the issuer used a small advisor.

[5] Large underwriters are underwriters with > 3 percent market share.

[6] This is the total number of institutions involved in bidding. For example, if there were two bidding groups with two institutions each, the value of this variable would be four.

Source: Ipreo, Mergent, S&P, MSRB.

Table 9. Regressions of Secondary Market Price Change on Issue and Bond Characteristics

Table shows coefficients on the Distance-to-Next-Bid variable in the regression of bond secondary market price change on bond characteristics. Regression run separately by group; columns 1-3 show the coefficient estimate based on that group and 4-6 show the coefficient estimate from the specification estimated on the complementary group.

	Regression results within group			Regression results in alternative group		
Group	DTNB Coefficient (1)	Standard error (2)	N (3)	DTNB Coefficient (4)	Standard error (5)	N (6)
Year of issue = 2005	-0.3441	(0.1461)	21394	-0.1108	(0.0413)	108037
Year of issue = 2006	-0.6519	(0.2547)	21048	-0.1146	(0.0408)	108383
Year of issue = 2007	-0.5673	(0.2105)	19127	-0.1125	(0.0408)	110304
Year of issue = 2008	-0.2789	(0.1786)	16532	-0.1054	(0.04)	112899
Year of issue = 2009	-0.0606	(0.0574)	16494	-0.1819	(0.0623)	112937
Year of issue = 2010	-0.0677	(0.0855)	19796	-0.0979	(0.0487)	109635
Year of issue = 2011	-0.3462	(0.1517)	14848	-0.0996	(0.0412)	114583
S&P credit rating >=AA-	-0.1072	(0.0659)	54749	-0.1112	(0.049)	74682
S&P credit rating >=A-	-0.1492	(0.0559)	74271	-0.0645	(0.055)	55160
Issue size >= 10M	-0.121	(0.0572)	67423	-0.1064	(0.0554)	62008
Bond size >= 1M	-0.0888	(0.0654)	43578	-0.1016	(0.0485)	85853
Bond size >= 0.5M	-0.0703	(0.0529)	73879	-0.1253	(0.0531)	55552
Large lead underwriter	-0.0522	(0.0569)	64431	-0.1212	(0.0568)	65000
Large financial advisor	-0.0682	(0.0501)	57383	-0.1651	(0.0669)	72048
Maturity >= 10 years	-0.1565	(0.0572)	59548	-0.0729	(0.0408)	69883
Unlimited tax GO bond	-0.097	(0.0569)	74942	-0.1319	(0.0575)	54489
Bond sold with OID	-0.2394	(0.0989)	34208	-0.0882	(0.0416)	95223
Bond sold with OIP	-0.1315	(0.0564)	77732	-0.1038	(0.051)	51699

[1] Large advisors are advisors with greater than 1 percent market share. Omitted category is issues where the issuer used a small advisor.

[2] Large underwriters are underwriters with > 3 percent market share.

[3] OID is original issue discount, OIP is original issue premium. Coefficients measure effect relative to bonds sold at par.

Source: Ipreo, Mergent, S&P, MSRB.

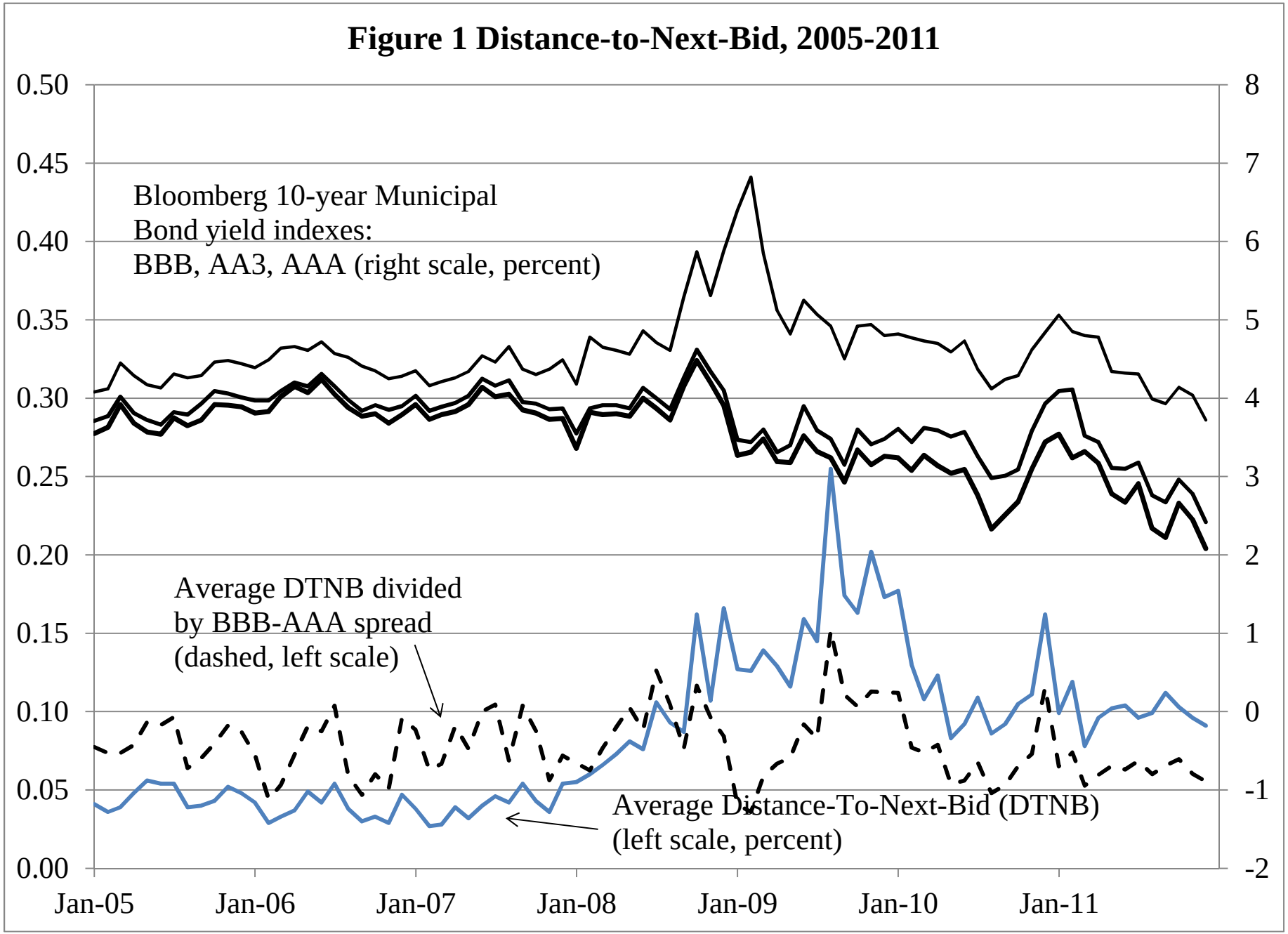
Figure 1 Distance-to-Next-Bid, 2005-2011
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
8
7
6
5
4
3
2
1
0
-1
-2
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Bloomberg 10-year Municipal
Bond yield indexes:
BBB, AA3, AAA (right scale, percent)
Average DTNB divided
by BBB-AAA spread
(dashed, left scale)
Average Distance-To-Next-Bid (DTNB)
(left scale, percent)

Figure 2. Secondary market price change, 2005-2011