Do taxes or information drive demand for bond insurance?

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Abstract

I perform the first-ever test of the tax arbitrage theory of bond insurance (Nanda and Singh, 2004) using a complete dataset of all 2015 municipal bond issues. For bonds that are insured in practice, the tax-arbitrage value created by insurance is negligible and, under a realistic calibration, negative. Consistent with this fact, and contrary to the theory’s predictions, taxable municipal bonds are insured as often as tax-exempt ones. Bond insurance is concentrated among small, unrated issues; for the smallest of these, the insurance premium is likely cheaper than rating agency fees. This evidence suggests that insurance creates value by producing information.

Keywords: Bond, insurance, tax, information
JEL: G18, G22, G28, G33, H26, H74, K34

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1 Introduction

At the onset of the 2007–2009 financial crisis, financial guaranty companies insured nearly one trillion dollars’ worth of municipal bonds, more than half of the entire market. The crisis abruptly reduced the role of insurance, as all the largest financial guaranty companies were wiped out by defaults on mortgage-related securities. In 2015, only about 18.3% of new municipal issues came with insurance (6.7%, by value). This adoption rate pales in comparison to the pre-crisis period when about two-thirds of new municipal issues came with insurance (half, by value). However, the 2015 adoption rate is almost twice that of 2013, suggesting that bond insurance is staging a comeback (Weitzman, 2016).

Whether this comeback is desirable from a policy perspective depends on what drives the demand for insurance in the first place. In the absence of frictions, bond insurance is a redundant security that does not add any value. The finance literature has proposed at least two justifications for insurance: an “information” theory and a “tax arbitrage” theory. The current low adoption rate presents a unique opportunity to discriminate between these competing theories: as scarce capital is allocated to the highest-value deals, the primary drivers of insurance adoption should be easier to identify.

The information theory maintains that insurance creates demand by potential investors that wouldn’t otherwise have the time and the capabilities to assess the quality of the bonds. Thus, insurance creates value by mitigating information frictions such as costly information acquisition and market segmentation. However, insurance also entails both positive and negative tax consequences.\(^1\) The tax arbitrage theory (Nanda and Singh, 2004, “NS”) maintains that under the right conditions the positive consequences prevail. Thus, insurance creates value for issuers, investors, and insurers at the expense of the U.S. Treasury even in the absence of need for actual insurance.

The two theories are not mutually exclusive. Existing empirical evidence supports the plausibility of the mechanism underlying the information theory. As for the tax arbitrage theory, the existence of the underlying mechanism is not in question. The question is rather one of relevance: what, in practice, drives the adoption of bond

\(^1\)These consequences are described in greater detail in Section 2. In short, bond insurance allows a taxable insurance company to pay tax-exempt interest in lieu of a bankrupt tax-exempt issuer, increasing the total expected amount of tax-exempt interest paid (positive arbitrage), but it eliminates the possibility of capital losses and the related tax deductions (negative arbitrage).
insurance? If tax arbitrage is the primary motive for bond insurance, then a comeback is undesirable. However, to my knowledge, no evidence exists for or against the relevance of the tax arbitrage theory, with the exception of the evidence provided by the authors in their original paper.

The tax arbitrage theory makes several straightforward testable predictions. First, tax-exempt bonds should be insured more often than taxable municipal bonds, for which insurance is at best value-neutral. Second, long-term bonds should be insured more often than short-term bonds. This is shown by NS, but a sharper untested prediction is that the relative advantage of long-term bonds is greater for riskier bonds (i.e., bonds whose underlying rating is lower).

I refute these predictions using information on all municipal bonds issued in 2015 and contained in the Merget database, enhanced with hand-collected data on the underlying rating at the time of issue. Taxable municipal bonds are insured as often as tax-exempt bonds, and the relative advantage of long-term bonds appears to be greater for safer bonds. Consistent with the value creation theory, the primary driver of insurance adoption appears to be issue size: 23% of bonds with issue size less than $1 million are insured, compared to 2% for the largest issues. For small issuers, insurance appears to be a substitute for a rating, as unrated bonds are 2–3 times as likely to be insured compared to rated bonds. In fact, for small-enough issues, the insurance premium is likely cheaper than rating agency fees.²

Although the demand for insurance is not motivated by tax arbitrage, the underlying mechanism remains true a priori. Thus, insurance could be beneficial to small issuers and entail a large revenue loss for the Treasury. To examine this possibility, I combine NS’s model, my complete dataset, and information on default and recovery by Moody’s to estimate the tax-arbitrage value added by insurance in practice. In 2015, out of a total issuance volume of $371 billion of tax-exempt bonds, $24 billion were insured. Under a realistic calibration, the total value added for these bonds was negative $7.3 million, that is, the average insured bond realized a small amount of negative tax arbitrage, thus destroying value for the issuer and benefitting the U.S. Treasury. Under the same calibration, if issuers had chosen to insure all and only those bonds that entail positive tax arbitrage, the total value added would have been about $4 million.

²Joffe (2015a, p. 14) shows an example of an issuer paying $9,500 (or 0.44% of issue proceeds on a $2.2 million issue) in rating agency fees, a cost comparable to the cost of insurance.
Although careful, the calibration exercise is subject to a great deal of uncertainty. To show that the gist of the argument is qualitatively robust to the choice of calibrated parameters, I perform an alternative calibration, using an unrealistically high probability of default (which maximizes the positive arbitrage) and an unrealistically high recovery rate of 100% (which eliminates the possibility of negative arbitrage). Even under this exceedingly conservative calibration, the tax-arbitrage value added by insurance is $24 million (or 0.1% of the insured amount).

Taken together, these results indicate that policy makers should not be concerned about the tax-arbitrage potential of bond insurance for tax-exempt bonds, as its magnitude is small in absolute value; municipal issuers, especially small ones, appear to buy insurance because it creates value by producing information in a fragmented market.

2 Competing theories of bond insurance

Bond insurance provides for the payment of principal and interest by an insurance company in lieu of a defaulted issuer. In an efficient market, bond insurance would be a redundant security that does not add value. The classical finance theory justification for bond insurance is based on some form of information frictions. Thakor (1982) first proposes debt insurance as a form of costly and informative signaling of the issuer’s quality. A distinct but related theory is Bergstresser et al.’s (2015) characterization of bond insurers as rating agencies with “skin in the game.”

The municipal market features tens of thousands of issuers, many of which small and obscure. In addition to this physical fragmentation, state-level taxes further segment the market by creating an incentive for residents to buy in-state bonds (Schultz, 2012). Within such an opaque market, information-based explanations are an obvious candidate to explain bond insurance. Indeed, in support of an information-based explanation, Gore et al. (2004) show that government-mandated disclosure reduces the need for insurance. Liu (2012) shows directly that insurance premia predict default even conditional on rating, implying that insurers produce information above and beyond that produced by credit rating agencies.

An alternative theory of bond insurance is based on tax arbitrage (Nanda and Singh, 2004). The potential for tax arbitrage stems from the fact that a financial guaranty company (a taxable corporation) is allowed to make tax-exempt interest payments in
lieu of a bankrupt tax-exempt issuer, becoming itself an issuer of tax-exempt securities. Because this transformation happens precisely in those states of the world in which the original tax-exempt issuer does not exist any longer, insurance has the ex-ante effect of increasing the total expected amount of tax-exempt interest paid.

In addition to this positive tax arbitrage effect, insurance creates negative tax arbitrage because it eliminates capital losses for the holders of tax-exempt bonds. Although the interest income from the bonds is tax-exempt, capital losses due to principal write-offs give rise to tax loss deductions just like losses on common taxable assets. Thus, compared to an insured bond, an uninsured bond would have a higher tax-exempt yield to compensate the investor for expected taxable losses. Whether positive or negative tax arbitrage prevails depends on several parameters such as the bond’s maturity, the probability of default, and the fraction of principal amount recovered upon default.

The existence of a potential for tax arbitrage appears to be the result of conscious tax policy, rather than oversight. In Revenue Ruling 94-42 (the most recent important ruling on the topic of tax-exempt bond insurance), the Internal Revenue Service (IRS) states clearly that good-faith insurance contracts are “not inconsistent” with the original rationale for the existence of tax-exempt bonds:

The exclusion from gross income of interest on obligations of states and political subdivisions thereof is not all-embracing and applies only where consistent with the purposes of § 103. [...] An overriding purpose of § 103 is to enable state and local governments to borrow at subsidized interest rates to carry out governmental purposes. [...] [I]nsurance, whether purchased by the issuer or separately by the bondholders, enhances the marketability of the bonds, without artificially overburdening the market with tax-exempt bonds. Accordingly, [...] treating payments of defaulted interest by the insurance company as excludable from gross income is generally not inconsistent with the purposes of § 103 [...] if, at the time [the insurance contract] is purchased, the amount paid is reasonable, customary, and consistent with the reasonable expectation that the issuer of the bonds, rather than the insurer, will pay debt service on the bonds.

As the IRS’s statement about “marketability” suggests, prior to the crisis, insured bonds traded at yields below those of comparable bonds (Quigley and Rubinfeld, 1991). The
2007 financial crisis brought seismic changes in the market for municipal bond insurance. In the years leading up to 2007, all the largest financial guaranty companies expanded their business from mostly municipal bonds to include mortgage-related securities. While in principle an efficient way to harness economies of scale and scope, this move caused their rapid downfall when the crisis hit and the mortgage-related securities suffered heavy losses. The resulting lapse in insurance coverage caused many municipal bonds to experience a credit downgrade or to become effectively unrated, with negative pricing consequences. Indeed, because of a selection effect, insured bonds came to be traded at higher yields than comparable uninsured bonds (Bergstresser et al., 2011; Wilkoff, 2012). Recent working papers appear to show that the benefit of insurance has shrunk (Lai and Zhang, 2013; Bronshtein, 2015) because of the lower perceived credit quality of remaining insurers.

Other justifications for bond insurance exist, testing which is outside the scope of this paper. Notably, Joffe (2015b) argues that the pre-crisis credit ratings of insurance companies were more lenient than muni ratings, pointing out that out of seven Aaa-rated insurers that existed prior to the crisis, five failed. Thus, insurance existed as a way for issuers to “buy into” such leniency.

3 Data

All original data analysis in this study is based on the Mergent Municipal sample ("Mergent") augmented with hand-collected data. Mergent is the broadest available collection of static information on municipal bond issues. This information includes, among other items, issue date, maturity date, coupon and insurer name (if any). Mergent also includes some dynamic information, such as the latest credit rating by three leading agencies (Moody’s, Standard & Poor, and Fitch), if these ratings exist, and a default flag that is equal to “Y” if the issue has defaulted.

Although Mergent reports the latest rating, I use an early 2016 snapshot of the Mergent database to recover the original Moody’s rating (henceforth, simply “rating”) assigned at the time of issue for all bonds issued in 2015. For roughly 99% of rated bonds, I verify that the reported rating is still the original rating because the rating date is earlier than the bond’s offering date. For the remaining 1% of the bonds, I hand-collect the relevant information from the official statements published on the Municipal
Securities’ Rulemaking Board’s (MSRB) disclosure website (“EMMA”).

For insured bonds, I am also able to verify that the reported rating is the underlying rating, i.e., the rating that Moody’s assigned regardless of the bond’s insurance status. Only 111 issues out of 25,091 insured issues have a reported rating equal or greater than that of their chosen financial guaranty company, implying that the rating is the underlying rating. For these 111 issues I hand-collect the relevant information from EMMA and verify that the rating is nonetheless the underlying rating. Although a handful of issues acquired insurance for no apparent reason, the majority of this small set of issues had either a negative outlook at the time of issuance, or a lower rating from another issuer.

The total number of 2015 issues was 136,952 (including taxable and tax-exempt). Of these, 25,091 (18.3%, or 6.7% by value) were insured and 69,568 (50.8%, or 76.3% by value) had a rating.

4 Empirical analysis

4.1 Evidence against the tax arbitrage theory

Bond insurance has been historically very common in the municipal bond market and uncommon in the corporate bond market. Nanda and Singh (2004, “NS”) propose a tax arbitrage theory to explain this phenomenon: bond insurance is value-neutral for taxable bonds, but it creates positive tax arbitrage for tax-exempt bonds. Therefore, municipal bonds are likely to be insured because most municipal bonds are tax-exempt. However, Table 1 shows that taxable bonds appear to be just as likely to be insured as tax-exempt bonds (less likely, on an equal-weighted basis, and more likely, on a value-weighted basis, but altogether the difference is not substantial).

NS point to a basic stylized fact of the municipal market to support their hypothesis: the likelihood of insurance adoption is a hump-shaped function of bond quality. Fig. 1 shows this pattern clearly. Bonds rated Aaa to Aa2 are extremely unlikely to be insured, because the issuer has a better rating than insurance companies. The proportion of insured bonds is highest for bonds rated A2, and it declines thereafter. NS argue that

\footnote{Essentially all financial guaranty companies active in 2015 had a rating of AA. The exception is National Public Finance Guarantee Corporation with a rating of AA-, which guaranteed 268 issues. The method described here can be applied to any financial guaranty company regardless of rating.}
the drop in insurance likelihood for lower-rated bonds can be explained by the increasing importance of negative tax arbitrage: as the bonds’ quality drops, the expected value of tax loss harvesting increases. Insurance eliminates the possibility of loss, thus destroying value. However, Table 1 shows that a similar declining pattern can also be observed for taxable municipal bonds. Among taxable bonds, 34.4% of bonds rated A are insured, compared to only 25% of unrated bonds.

Another prediction of the tax arbitrage model is that the value of insurance is higher for longer-term bonds, because in case of default the insurer is allowed to pay tax-exempt interest for a longer time. NS report anecdotally that within a series (a set of bonds of different maturities issued by a given issuer on the same day as part of one issuance event), longer-maturity bonds are more likely to be insured. A sharper, untested prediction is that the positive relation between maturity and value of insurance is stronger for riskier bonds. (This pattern is evident, for instance, from the calibration results of Section 5). To test this prediction, I compare rated and unrated bonds. The rated bond sample is restricted to bonds rated A1, A2 or A3 for a simple reason: bonds rated Aaa and Aa are almost never insured, and bonds rated Baa and lower are too few to ensure accurate estimation. The comparison is therefore between A-rated bonds (safer) vs. unrated bonds (less safe).

Formally, I estimate a linear probability model:

\[
Insured_{s,N} = \alpha + \alpha_s + \beta_2 Maturity_{s,N} + \beta_3 Unrated_{s,N} \times Maturity_{s,N} + \varepsilon_{s,N} \quad (1)
\]
Figure 1: Percent of insured bonds by original issue rating. Ratings lower than Baa3 are omitted because of low number of observations

where Insured is an indicator variable that is 0 if the bond is uninsured and 100 if insured (100, rather than 1, so that coefficients can be interpreted as percentage points). Unrated is an indicator variable that is 1 if the bond is unrated and 0 if rated, and Maturity is the bond’s maturity in years. The subscript N indicates the bond’s maturity and s indicates the series. Therefore, the $\alpha_s$’s are series fixed-effects in addition to the constant term $\alpha$. (The $\alpha_s$’s are restricted to sum to zero so that an unconditional constant term can also be estimated). Unrated is collinear to the fixed effects and therefore excluded.

Table 2 reports the estimation results. The coefficient on Maturity is positive and significant, confirming the stylized fact reported by NS. If the association between maturity and likelihood of insurance is driven by tax considerations, however, we would also expect the interaction between Unrated $\times$ Maturity to have a positive coefficient, i.e., the slope of the relation between maturity and likelihood of insurance should be steeper for unrated bonds, which are riskier than rated bonds. However, the coefficient is negative and significant, indicating that the likelihood of insurance rises faster for safer bonds. Taken together, these facts suggest that municipal bonds are likely to be insured because they are municipal, not because they are tax-exempt.
Table 2: Linear probability model with series fixed effects. The dependent variable is an indicator variable that is zero if the bond is uninsured and 100 if insured. Maturity is the bond’s maturity in years. Unrated is an indicator variable that is 1 if unrated and 0 if rated. A negative coefficient on the interaction term Maturity × Unrated indicates that, within a series, the probability of being insured rises faster with maturity for rated bonds than it does for unrated bonds.

4.2 Evidence in favor of the information theory

There is substantial evidence that insurance reduces bond yields and plays a role in reducing information frictions akin to that played by rating agencies. In this section I argue that insurance is more likely to be adopted for those bonds that suffer from the greatest information frictions. The argument is based on two stylized facts suggesting that insurance can be a substitute for a rating.

First, unrated bonds are disproportionately likely to be insured, as shown in Table 3. On an equal-weighted basis, they are twice as likely to have insurance (24% vs. 13%). On a value-weighted basis, they are more than three times as likely (14% vs. 4%). Thus, issuers of unrated bonds appear to have a stronger incentive to seek insurance.

Second, smaller issues are disproportionately likely to be insured. Table 4 shows that 23% of issues with size less than $1 million are insured, compared to 13% of issues between 1 and 10 million, and 2-3% of larger issues (“% Insured” column). Moreover, smaller issuers are less likely to be rated (“% Rated” column), even though, conditional on being rated, small issuers are not unfavorably rated compared to large issuers. This phenomenon could be the result of an endogenous decision: small issuers choose not to get a rating because they expect to receive an unfavorable one. However, this phenomenon could also have a much simpler explanation: getting a rating can be more expensive than getting insurance, and unlike insurance (which comes with an AA rat-
<table>
<thead>
<tr>
<th>Number of Insurance Status</th>
<th>Insured</th>
<th>Uninsured</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated</td>
<td>9,022</td>
<td>60,546</td>
<td>69,568</td>
</tr>
<tr>
<td>Unrated</td>
<td>16,069</td>
<td>51,315</td>
<td>77,384</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value ($b) Insurance Status</th>
<th>Insured</th>
<th>Uninsured</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated</td>
<td>13</td>
<td>290</td>
<td>303</td>
</tr>
<tr>
<td>Unrated</td>
<td>14</td>
<td>80</td>
<td>94</td>
</tr>
</tbody>
</table>

Table 3: Distribution of bonds (number and value) by rating status and insurance status. For both tables, a χ-squared test rejects the null hypothesis that the distribution of insurance status is independent of the distribution of rating status at the 0.01% level or more.

There is no certainty in advance that a rating will reduce the cost of borrowing. Joffe (2015a, p. 14) shows an example of a recent issue whose issuance costs included $9,500 in “rating agency fees.” On a principal amount of roughly $2.2 million, rating agency fees are 0.44% of issue proceeds, an amount similar to the cost of insurance. The last column of Table 4 (“% Rated or Insured”) shows that insurance plays an important role in closing the information gap between large issuers and small issuers.

Taken together, these facts suggest that the prevalence of insurance in the municipal bond market may be a consequence of the existence of many small issues and issuers, rather than a form of tax arbitrage.

5 Calibration

5.1 Realistic calibration

Even though the evidence examined so far suggests that tax arbitrage does not drive the adoption of bond insurance, both the positive and negative tax arbitrage components of bond insurance highlighted by Nanda and Singh (2004, “NS”) exist. In this section I calibrate the parameters of NS’s model to estimate the value added (or destroyed) by insurance for all tax-exempt bonds actually issued in 2015.
<table>
<thead>
<tr>
<th>Issue size</th>
<th>N. Bonds</th>
<th>% Insured</th>
<th>% Rated</th>
<th>% Rated or Insured</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;$1m</td>
<td>81,833</td>
<td>23%</td>
<td>39%</td>
<td>55%</td>
</tr>
<tr>
<td>$1m to 10m</td>
<td>46,768</td>
<td>13%</td>
<td>65%</td>
<td>72%</td>
</tr>
<tr>
<td>$1m to 100m</td>
<td>7,935</td>
<td>3%</td>
<td>83%</td>
<td>84%</td>
</tr>
<tr>
<td>&gt;$100m</td>
<td>203</td>
<td>2%</td>
<td>86%</td>
<td>86%</td>
</tr>
</tbody>
</table>

Table 4: Percentage of bonds that are rated, insured, and either rated or insured, by issue size.

5.1.1 Tax rate ($\tau$)

The tax rate is assumed to be 39.6%, corresponding to the top tax bracket for individual investors in 2015.

5.1.2 Bond maturity ($N$)

Bond maturity is calculated at the individual bond level as the difference (in years) between maturity date and offering date. For callable bonds, the time to maturity is considered to be the time of first call.

5.1.3 Interest rate ($r$)

The model assumes risk-neutral agents and a flat, nonstochastic yield curve, so that all cash flows are discounted using a pre-tax discount rate $r$. To reduce the error from this simplification, I calculate a maturity-specific interest rate $r_N$ for each maturity $N$. An initial estimate $\tilde{r}_N$ is obtained as the average original issue yield of bonds with maturity $N$ that are rated Aaa (to approximate the risk-free rate). For tax-exempt bonds, the yield is “grossed up”, i.e. divided by $1 - \tau$ (to approximate the pre-tax discount rate). This estimate is then smoothed by projecting $\tilde{r}_N$ on the vector $[N \ N^2 \ N^3 \ \ln(N)]$. The resulting taxable discount rate curve is shown in Fig. 2.

5.1.4 Probability of default ($q$) and recovery rate ($\alpha$)

The one-year default probability ($q$) and the recovery rate ($\alpha$) are calibrated based on each bond’s coarse rating (Aaa, Aa, A, Baa, Ba or less, NR). For rated bonds, the values of $q$ and $\alpha$ are inferred from the information contained in a comprehensive Moody’s
study of rated bonds from 1970 to 2014 (Tudela et al., 2015). The default rate is taken from Exhibit 13, which reports cumulative default rates by coarse rating from 1 to 10 years after the rating. The cumulative default rates are turned into one-year default probabilities assuming a constant probability of default. The resulting \( q \) depends on the time horizon chosen, but it is roughly similar for all time horizons. I choose a time horizon of 5 years, resulting in the default probabilities shown in Table 5. For unrated bonds, I use the information in the Mergent sample. I restrict my analysis to bonds issued between 1986 and 2005, most of which have either matured or defaulted by early 2016 (the date of the Mergent snapshot used). The total sample contains 1,989,689 bonds of which 1,848 defaulted. For each issuance vintage, I calculate the ultimate default rate as the number of bonds defaulted divided by the number of bonds issued. I estimate \( q \) as the equal-weighted average of all 20 vintages (1986–2005). The resulting estimate of \( q \) is 0.14% per year.

Recovery rates for rated bonds are also inferred from the Moody’s study. Exhibit 16 includes detailed information on all 95 bankruptcies recorded. The table includes the coarse rating at default, one year prior to default, and five years prior to default. I categorize defaults based on the highest rating of the three, and calculate the average recovery rate for each category. The results are also shown in Table 5. For unrated bonds, I use the same recovery rate as Baa bonds, because their default rate is closest to the Baa default rate.
Table 5: Tax arbitrage value of bond insurance under a realistic calibration for all tax-exempt bonds actually issued in 2015. In Nanda and Singh (2004)’s model, $q$ is the one-year default probability, $\alpha$ is the recovery rate conditional on default, and $N$ is the bond maturity. The middle panel shows the tax arbitrage gains as a percent of issue size. Negative numbers (in bold) indicate negative arbitrage, and missing numbers indicate that no bonds were issued for that maturity and rating. The right panel shows the total value added in millions of dollars for those bonds that were actually insured (“Actual”) and the theoretical maximum value added by insuring all and only those bonds that entail positive arbitrage (“Max”).

<table>
<thead>
<tr>
<th>Rating</th>
<th>Inputs</th>
<th>Tax arbitrage gains (%)</th>
<th>Value added ($m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$q$</td>
<td>$\alpha$</td>
<td>$N = 5$</td>
</tr>
<tr>
<td>Aaa</td>
<td>0.00%</td>
<td>1.000</td>
<td>0</td>
</tr>
<tr>
<td>Aa</td>
<td>0.00%</td>
<td>.940</td>
<td>0</td>
</tr>
<tr>
<td>A</td>
<td>0.01%</td>
<td>.865</td>
<td>-0.001%</td>
</tr>
<tr>
<td>Baa</td>
<td>0.03%</td>
<td>.570</td>
<td>-0.019%</td>
</tr>
<tr>
<td>Ba or less</td>
<td>0.48%</td>
<td>.470</td>
<td>-0.348%</td>
</tr>
<tr>
<td>NR</td>
<td>0.14%</td>
<td>.570</td>
<td>-0.067%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.1.5 Result

Table 5 shows the results of the calibration. The tax arbitrage value of the insured bonds is mostly negative, except for long-term A-rated and unrated bonds.

5.2 Conservative calibration (an upper bound)

The greatest uncertainty in the above calibration comes from the credit quality parameters—the probability of default (“$q$”) and the fraction of principal amount recovered upon default (“$\alpha$”). These parameters are extremely difficult to calibrate because of the rarity of municipal bond defaults.

Given the rarity of defaults, it is also not surprising that the calibrated value of tax arbitrage is small. The question, of course, remains whether the ex-post positive historical experience is representative of the insurers’ expectations at the time of underwriting: tax-arbitrage considerations may have still driven insurance adoption if expected default rates (and the associated expected value of tax arbitrage) were much higher than the realized experience.
It is also possible (and plausible) that insurers know that the recovery rate ($\alpha$) needs to be very high in order to realize positive tax arbitrage, and therefore pick the very best bonds within each category. This is consistent with the available empirical evidence, showing that in general insured bonds perform better than comparable uninsured ones (Bergstresser et al., 2015; Liu, 2012).

To address these concerns, I perform a second, conservative calibration under which I assume $\alpha = 1$ within every single rating category, thus eliminating the possibility of negative arbitrage. The problem with this view is that if insurers pick the very best bonds, the arbitrage value of insurance can be positive, but it’s also very small because the best bonds have a very low probability of default ($q$). Counterfactually, I pick a large $q$ — 0.1% per year for bonds rated Baa or better, and 0.4% per year for unrated bonds and bonds rated Ba or less — so as to maximize positive tax arbitrage. The other parameters are unvaried. The result of this calibration should be considered an upper bound to the value of tax arbitrage. The results are shown in Table 6. Unlike in Table 5, the maximum theoretical value under this calibration is not reported, because it cannot be simultaneously assumed that (i) insurers pick the bonds with the highest $\alpha$ and $q$, but also (ii) all bonds are insured.

6 Conclusion

In this paper, I examine the tax arbitrage theory of bond insurance (Nanda and Singh, 2004). According to this theory, bond insurance on tax-exempt bonds entails a positive tax arbitrage component (as taxable insurance companies are allowed to pay tax-exempt interest) and a negative arbitrage component (as the yield on tax-exempt bonds is reduced, and tax benefits from capital losses are eliminated).

If the positive component prevails, tax arbitrage could in principle explain why bond insurance is more common in the municipal bond market compared to the corporate bond market. However, I show that in practice the negative arbitrage component is likely to prevail; moreover, even if the positive component prevails, the net effect is economically too small to drive the widespread adoption of insurance. Consistent with this realization, I show that taxable municipal bonds (for which bond insurance does not entail any positive or negative tax arbitrage) are insured as often as tax-exempt bonds. Other predictions of the theory also fail to hold true in the data, suggesting
<table>
<thead>
<tr>
<th>Rating</th>
<th>Inputs</th>
<th>Tax arbitrage gains (%)</th>
<th>Value added ($m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$q$</td>
<td>$\alpha$</td>
<td>$N = 5$</td>
</tr>
<tr>
<td>Aaa</td>
<td>0.1%</td>
<td>1.000</td>
<td>0.009%</td>
</tr>
<tr>
<td>Aa</td>
<td>0.1%</td>
<td>1.000</td>
<td>0.011%</td>
</tr>
<tr>
<td>A</td>
<td>0.1%</td>
<td>1.000</td>
<td>0.010%</td>
</tr>
<tr>
<td>Baa</td>
<td>0.1%</td>
<td>1.000</td>
<td>0.010%</td>
</tr>
<tr>
<td>Ba or less</td>
<td>0.4%</td>
<td>1.000</td>
<td>0.042%</td>
</tr>
<tr>
<td>NR</td>
<td>0.4%</td>
<td>1.000</td>
<td>0.045%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Tax arbitrage value of bond insurance under a conservative calibration for all tax-exempt bonds actually issued in 2015. In Nanda and Singh (2004)’s model, $q$ is the one-year default probability, $\alpha$ is the recovery rate conditional on default, and $N$ is the bond maturity. The middle panel shows the tax arbitrage gains as a percent of issue size. Unlike in Table 5, because $\alpha = 1$ for all bonds, there is no possibility of negative arbitrage. Missing numbers indicate that no bonds were issued for that maturity and rating. The right panel shows the total value added in millions of dollars for those bonds that were actually insured (“Actual”). Unlike in Table 5, the maximum theoretical value under this calibration is not reported, because it cannot be simultaneously assumed that (i) insurers pick the bonds with the highest $\alpha$ and $q$, but also (ii) all bonds are insured.
that tax arbitrage does not drive the adoption of insurance for municipal bonds.

In contrast, I find that bond insurance is most prevalent among small, unrated issues. For these issues, the insurance premium is likely cheaper than rating agency fees. For instance, a rating fee of $9,500 is 0.44% of issue proceeds on a $2.2 million issue, an amount comparable to the cost of insurance. This evidence supports the standard theory that bond insurance creates value by mitigating information frictions and reducing investors’ cost of information acquisition.
References


A  The tax-arbitrage value of bond insurance

In this appendix, I review Nanda and Singh’s (2004) multiperiod model. Although the model is described in full detail in the original, several important mathematical expressions in the published version contain typos. This appendix may be helpful for a reader interested in reproducing the present results (or NS’s results) without having to derive the model from scratch.

A.1  The relative prices of insured and uninsured bonds

For simplicity, assume all agents are risk-neutral and the yield curve is flat and non-stochastic. A prospective issuer is deciding between two alternative $N$-period par bonds:

- An insured bond priced at $P_I$
- An uninsured bond priced at $P_U$

Because the bonds are issued at par, the final maturity payment (the face value) is equal to the issue price. In order to maintain the assumption that the issuer’s probability of default $q$ is exogenous, we would like to make all the cash flows identical across the two bonds. For this reason, we assume that regardless of bond the issuer promises to pay a pretax coupon of 1 per period. For the same reason, we would also like to make the final payment the same. However, the insured bond is worth more than the uninsured bond because it never defaults, so its face value is higher ($P_I - P_U > 0$). To make the final payment the same, we assume that the issuer of an insured bond places an amount $P_Z$ of the issue proceeds in an escrow account. This amount is used to buy a zero-coupon bond that will pay an amount $P_I - P_U$ at maturity. Thus, in both cases, the issuer commits to pay 1 each period and $P_U$ at maturity. The net issue proceeds are therefore $P_U$ for the uninsured bond, and $P_I - P_Z - \pi$ for the insured bond, where $\pi$ is the insurance premium.

A.2  Bond prices

Bond interest income is taxed at a rate $\tau_C$. If the bond is taxable, $\tau_C = \tau$; if the bond is tax-exempt, $\tau_C = 0$. Thus, the insured bond pays after-tax income of $1 - \tau_C$
every period for \( N \) periods with no possibility of default. The yield to maturity on a
default-free bond is \( R \equiv r (1 - \tau) \). Thus, the price of the insured bond is:

\[
P_I = \frac{1 - \tau_C}{R} = \frac{1 - \tau_C}{r (1 - \tau)}.
\]

The price of the uninsured bond can be derived as the present value of expected
after-tax cash flows. Conditional on survival (i.e. on not having defaulted) until time
\( n \in \{1 \ldots N\} \), the uninsured bond pays an after-tax cash flow of

\[
CF = \begin{cases} 
1 - \tau_C & \text{with probability } 1 - q \text{ (no default case)} \\
\alpha P_U + \tau (1 - \alpha) P_U & \text{with probability } q \text{ (default case)}
\end{cases}
\]

where \( \alpha \) is the recovery rate in case of default, and \( \tau (1 - \alpha) P_U \) is the tax benefit from
the capital loss. Note that the coupon could be taxable \((\tau_C = \tau)\) or not \((\tau_C = 0)\), but
the loss is always taxable. Thus, the expected cash flow at time \( n \) conditional on bond
survival is

\[
\mathbb{E} [CF] = (1 - q) (1 - \tau_C) + q P_U (\alpha + \tau (1 - \alpha)) .
\]

Absent any default, the bond pays its face value \( P_U \) upon maturity. The value of the
bond is therefore

\[
P_U = \sum_{n=1}^{N} \frac{(1 - q)^{n-1} \mathbb{E} [CF]}{(1 + R)^n} + \frac{(1 - q)^N}{(1 + R)^N} P_U .
\]

which, solving for \( P_U \), simplifies to

\[
P_U = \frac{1 - q}{R + q (1 - \alpha)} \cdot \frac{1 - \tau_C}{1 - \tau} .
\]

The default-free zero-coupon bond of face value 1 would be worth

\[
Z = \left( 1 + \frac{1 - \tau}{1 - \tau_C} r \right)^{-N} ;
\]

thus, the amount of money needed to fund the escrow is

\[
P_Z = (P_I - P_U) Z = (P_I - P_U) \left( 1 + \frac{1 - \tau}{1 - \tau_C} r \right)^{-N} .
\]
A.3 Insurance premium

The derivation of the insurance premium is complex, and it is clearly explained in detail in the appendix to NS. The actuarially fair insurance premium is

$$\pi = q \frac{(1 + r(1 - \alpha P_U))}{r (q + r)} \cdot \left(1 - \left(\frac{1 - q}{1 + r}\right)^N\right) \cdot \frac{1 - (1 - q)^N}{(1 + r)^N} \cdot \left(\frac{1}{r} - P_U\right).$$

A.4 Value of insurance

The tax advantage of insurance per dollar of promised coupon ($\psi$) is the difference between (i) the issue proceeds of the insured bond, net of the escrow amount and of the insurance premium, and (ii) the issue proceeds of the uninsured bonds:

$$\psi = (P_I - P_Z - \pi) - P_U = (P_I - P_U) (1 - Z) - \pi. \quad (2)$$

To show that $\psi$ is the correct value, Fig. A.1 replicates Fig. 2 in Nanda and Singh (2004). Following the authors, in order to reduce the parameter space the recovery rate is assumed to be negatively related to the default rate:

$$\alpha = \frac{1}{1 + \Delta q}.$$

Fig. A.2 plots $\psi/P_I$, i.e., the expected present value of future tax arbitrage embedded in the insured bond. “Gross” issue proceeds are defined as the market value of the bond at the time of issuance ($P_I$), as opposed to “net” issue proceeds, defined as the market value of the bond minus the insurance premium ($P_I - \pi$), i.e., what the issuer receives. In Section 5, the value $\psi/P_I$ is calibrated for each bond and multiplied by the issue amount to obtain the total value of tax arbitrage.
Figure A.1: Replication of Nanda and Singh (2004), Fig. 2. Note that the axes of the top-left panel have different labels compared to the original. The original labels must be incorrect, because the solid line (using the baseline values $\tau = .38$, $r = .06$, $N = 8$ and $\Delta = 25$) is the same line throughout all panels.
Figure A.2: This figure is equivalent to Nanda and Singh (2004), Fig. 2 but it is expressed in percent of gross issue proceeds. For instance, a value of “.4” indicates that the expected present value of future tax arbitrage embedded in the insured bond is equal 0.4% of gross issue proceeds.