The Price of Safety: The Evolution of Insurance Value in Municipal Markets

Kimberly Cornaggia[1] John Hund[2] Giang Nguyen[1]

[1]Penn State University

[2]University of Georgia

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The Big Picture

Question: Who benefits from municipal bond insurance?

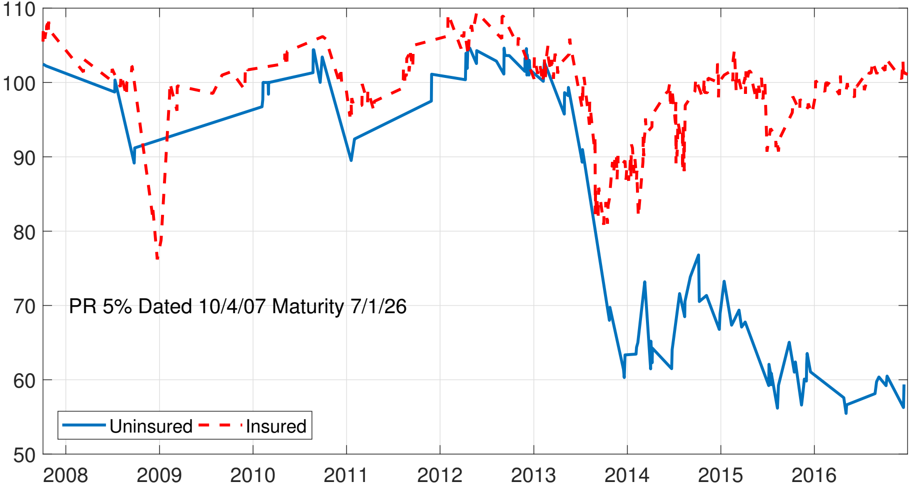
Method: Investigate liquidity & yield benefits in secondary markets and direct effects in primary markets, addressing endogenous choice to insure

Answer:

1. Insignificant liquidity benefits
2. Yield inversion during crisis explained by insurer downgrades
3. Small primary market value of Aaa-rated insurance prior to crisis
4. Since the crisis, gross value accrues only to low-rated issuers; no value for issuers rated A or better

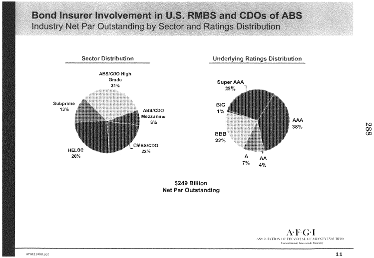
Puzzle: Why do issuers pay for insurance and seem to get no benefit?

After the fire, it's nice to have insurance



Contraction and Consolidation

- Bond insurance guarantees timely payment in default
  - AMBAC in 1971, quickly joined by MBIA, and then FGIC and FSA
  - Market expands to over 10 insurers in early 2000s
  - At the height of the market (2005), over 50% insured
  - Virtually zero-loss on US public finance insurance into 2008
  - Par insured to statutory capital ratios of 125x to 216x
- Most financial insurers go into receivership in 2008.



Assured Guaranty Mutual (AGM) has a monopoly from 2009-2013, then joined by Build America Mutual (BAM).

Municipal Bond Insurance Literature

- Insurance is valuable
  - Cole & Officer (1981 JRI), Thakor (1982 JF), Kidwell Sorensen & Wachowicz (1987 JFQA), Nanda & Singh (2004 JF), Gore, Sachs, Trzcinka (2004 JLE), Pirinsky & Wang (2011 FM), Wilkoff (2012 WP), Bergstresser, Cohen, & Shenai (2015 WP)
- Insurance may have limited value
  - Bergstresser, Cohen, & Shenai (2010 WP), Lai and Zhang (2013 FMII), Bronshtein (2015 WP), Chun, Namvar, Ye, & Yu (2018 MS), Ely (2012 PBF), Landoni (2018 JFE)
- Our contribution
  - Comprehensive data over 30 years and all GO issuers
  - Explanation of secondary market yield inversion during the crisis
  - Better measure of transactions costs and liquidity value of insurance
  - First evidence of yield inversion in primary municipal bond markets
  - Take seriously and control for selection and endogenous insurance
  - Consider the role of underwriters and advisors

Data

1. Mergent Municipal Bond Securities database:
   - 3,555,964 bonds issued by 53,045 municipal issuers
   - Final sample: 760,084 G.O. bonds issued between 1985 - June 2016
2. Mergent insurer's data: have only the most recent insurer (original insurer overwritten)
   - Hand collect insurer portfolio novation data from insurance companies, track down transfered CUSIPs, and re-instate original insurer data
3. Mergent rating data: overwritten each update, and no distinction between insured and underlying credit rating
   - Comprehensive ratings histories directly from Moodys and S&P websites (provided by Ryan Israelsen MSU)
   - Since July 2013, from Moodys & S&P due to Rule 17g-7(b) (cleaned and provided by Marc Joffe)
4. MSRB Municipal Bond Trade database:
   - Remove primary market trades, trades a year before maturity, trades less than $1,000: 7,284,088 trades in 281,882 bonds spanning dates 2005-2016/06

Is there yield inversion in the secondary market?

Begin with the cross-sectional regressions of trade yields using the specification proposed in Bergstresser et al. (2010):

$$y_{i,j} = I_{buy,i,j}(\beta_1 + \beta_2 \text{LnTradeSize}_{i,j}) + I_{sell,i,j}(\beta_3 + \beta_4 \text{LnTradeSize}_{i,j}) + \beta_5 \text{Mat}_i + \beta_6 \text{Mat}_i^2 + \beta_7 \text{LnIssueSize}_i + \beta_8 \text{LnBondSize}_i + \beta_9 I_{insured,i} + \epsilon_{i,j}$$

Panel A: Pre-crisis Period (2005–2007)

Underlying Rating	Estimate	t-stat	Nobs
Aa	-0.102	-23.03	18,383
A	-0.184	-32.10	16,032
Baa	-0.174	-26.94	2,689
Unrated	-0.197	-26.45	7,050
Number of monthly regressions: 36			

Panel B: Crisis and Post-Crisis Period (2008–2018)

Underlying Rating	Estimate	t-stat	Nobs
Aa	0.603	15.46	22,872
A	0.325	13.56	9,104
Baa	-0.660	-8.68	2,119
Unrated	0.347	13.77	9,871
Number of monthly regressions: 132			

Insurers are rated too...

Now break the insurance dummy into contemporaneous insurance rating dummies

Insurance is only valuable if insurer is more highly rated than underlying credit...if not, yield inversion.

	Insurance Rating											
	Aaa			Aa			A			Baa		
Underlying Rating	Estimate	t-stat	Nregs	Estimate	t-stat	Nregs	Estimate	t-stat	Nregs	Estimate	t-stat	Nregs
Aa	-0.091	-8.74	11	**0.177**	9.15	127	**0.798**	17.34	82	**0.261**	9.34	132
A	-0.140	-4.53	16	-0.106	-5.88	131	**0.157**	6.64	84	**0.299**	7.71	132
Baa	-0.213	-8.95	11	-0.607	-13.28	132	-0.828	-6.88	86	-0.234	-3.92	132
Unrated	-0.200	-13.30	11	-0.100	-6.09	132	0.456	14.41	86	0.176	7.14	132

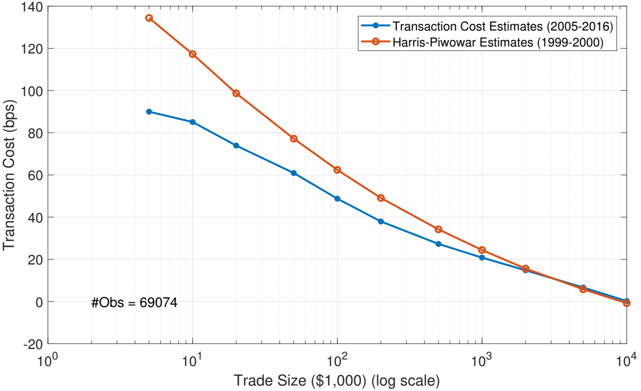
Does insurance convey liquidity advantages?

- **Challenge**: Very infrequent trading, and different costs for institutional and retail investors
- **Best Option**: Harris and Piwowar (2006) uses all available trade data to estimate a transaction cost function for each bond.
  - Estimate trading costs for various trade sizes for each bond.
  - Transaction cost function is interpreted as a half-spread, i.e. the increase in price if a customer wants to buy
  - Another option is dealer markups (matching trades within varying windows) as in Green et. al. (2007)
- Use iterated WLS using individual time series estimates for each bond, and pooled regressions for bond variances and derive coefficient estimates for each bond's cost function:

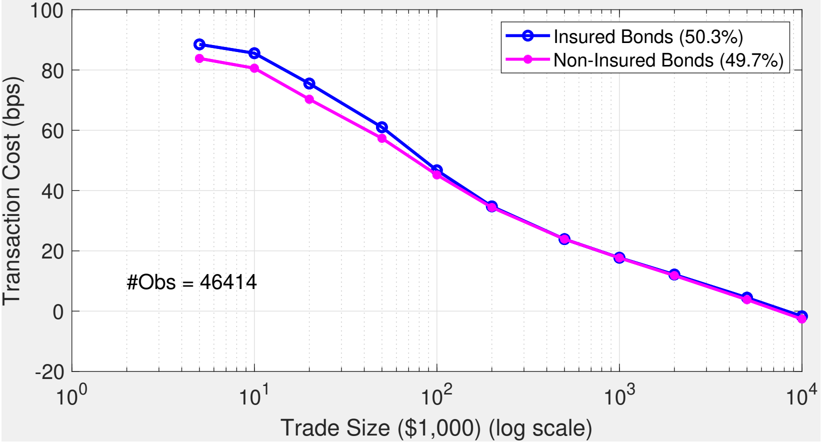
$$\hat{c}(S) = c_0 + c_1 \frac{1}{S} + c_2 \log S.$$

We briefly interrupt this talk for some good news!

- Disclosure works...transactions costs have fallen significantly for retail investors
- Complements the results on the short event window in Chalmers, Liu, and Wang (2017)



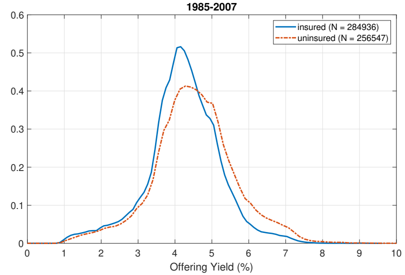
But No Clear Liquidity Benefit of Insurance

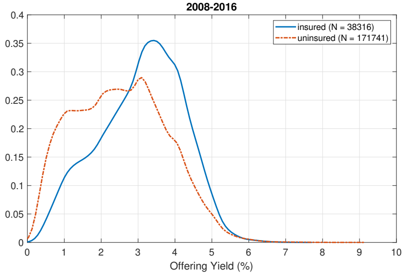


Primary market analysis

- Does bond insurance provide ex ante value to issuers paying the premium?
- Directly estimate the direct benefits (reduction in offer yield)
  - First look at unconditional values
  - OLS regressions (**by year**) controlling for observable issuer characteristics & macroeconomic variables
  - Selection-adjusted models to control for decision to insure the bonds.
    - Average treatment effects from propensity score matching model
    - Doubly-robust inverse-probability weighted regression adjustment (IPWRA) method of Cattaneo (2010) (less sensitive to insurance selection model)
  - Subsample analysis: 1985-1999, 2000-2007, and 2008-2016

Distribution of Offering Yields





Unconditional differences

Post-crisis inversion, persistent credit differences

Pre 2000 Period: 1985-1999

	N(Ins.)	Insured	N(Unins.)	UnInsured	Diff.	Std. Error
Offering Yield	47,171	5.01	63,262	5.21	**-0.21*** **	0.0060
Coupon	47,171	5.37	63,262	5.59	-0.22***	0.0068
Maturity	47,171	10.40	63,262	10.47	-0.07*	0.0362
Bond Rating	47,171	15.64	63,262	17.79	-2.15***	0.0124
LN(Issue Amount)	47,153	15.90	63,046	16.06	-0.16***	0.0089
LN(Bond Amount)	47,171	12.88	63,262	13.04	-0.16***	0.0091
Num. of Agents	47,032	4.78	62,872	5.01	-0.23***	0.0145

Pre-Crisis Period: 2000-2007

	N(Ins.)	Insured	N(Unins.)	UnInsured	Diff.	Std. Error
Offering Yield	129,697	3.86	72,169	3.96	**-0.10*** **	0.0041
Coupon	129,697	4.26	72,169	4.35	-0.09***	0.0039
Maturity	129,697	10.54	72,169	9.93	0.60***	0.0279
Bond Rating	129,697	16.43	72,169	18.65	-2.22***	0.0092
LN(Issue Amount)	129,697	16.17	72,169	16.31	-0.14***	0.0063
LN(Bond Amount)	129,697	13.09	72,169	13.32	-0.23***	0.0065
Num. of Agents	129,680	5.65	72,150	6.13	-0.47***	0.0108

Post-Crisis Period: 2008-2016

	N(Ins.)	Insured	N(Unins.)	UnInsured	Diff.	Std. Error
Offering Yield	35,211	3.06	133,200	2.43	**0.63*** **	0.0071
Coupon	35,211	3.68	133,200	3.36	0.32***	0.0066
Maturity	35,211	10.71	133,200	9.92	0.80***	0.0371
Bond Rating	35,211	15.87	133,200	18.64	-2.76***	0.0104
LN(Issue Amount)	35,211	15.77	133,200	16.31	-0.55***	0.0081
LN(Bond Amount)	35,211	12.72	133,200	13.40	-0.68***	0.0083
Num. of Agents	35,211	5.84	133,179	6.16	-0.32***	0.0150

OLS regressions: methods and notation

- First estimate an OLS model (by year) on uninsured bonds.
- Then create fitted yields for insured bonds, and take the difference between the actual yield and the fitted yield.
  - Negative values: Insurance lowers yields (fitted $>$ actual)
  - Positive values: Insurance raises yields (actual $>$ fitted)
- Two models: Baseline and Expanded

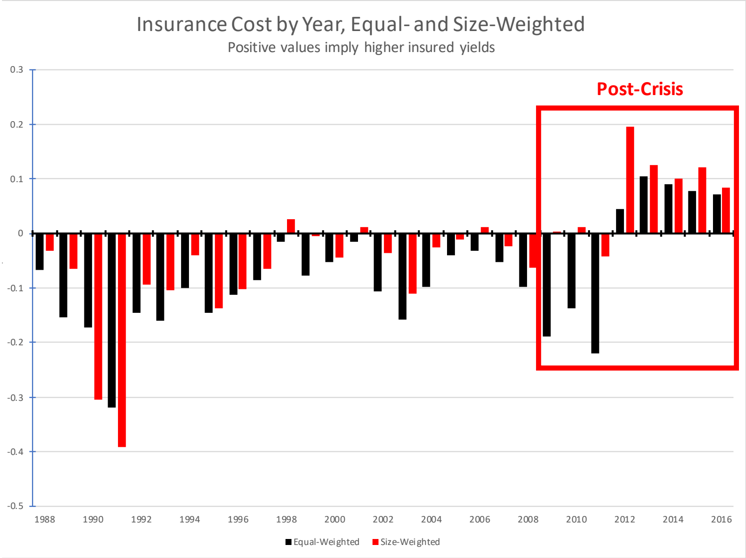
$$\begin{aligned}\mathsf{OffYield}_{it} = \alpha &+ \beta_1 \mathsf{Insured}_i + \beta_2 \mathsf{CallDummy}_i + \beta_3 \mathsf{LnBondSize}_i + \beta_4 \mathsf{LnIssueSize}_i \\ &+ \beta_5 \mathsf{LnMaturity}_i + \beta_6 \mathsf{I.Rating}_i + \beta_7 \mathsf{BankQlf}_i \\ &+ \gamma_1 \mathsf{MacroVar}_t + \gamma_2 \mathsf{BigState}_i + \epsilon_{it}\end{aligned}$$

$$\begin{aligned}\mathsf{OffYield}_{it} = \alpha &+ \beta_1 \mathsf{Insured}_i + \beta_2 \mathsf{LnBondSize}_i + \beta_3 \mathsf{LnIssueSize}_i + \beta_4 \mathsf{Maturity}_i \\ &+ \beta_5 \mathsf{Maturity}_i^2 + \beta_6 \mathsf{CallDummy}_i + \beta_7 \mathsf{I.Rating}_i + \beta_8 \mathsf{I.UnderwriterDec}_i \\ &+ \beta_9 \mathsf{NumOfAgents}_i + \beta_1 0 \mathsf{BankQlf}_i + \beta_{11} \mathsf{Comp}_i + \beta_{12} \mathsf{Neg}_i + \gamma_1 \mathsf{MacroVar}_t \\ &+ \gamma_2 \mathsf{BiggerState}_i + \gamma_3 \mathsf{UseOfProceeds}_i + \gamma_4 \mathsf{PrevInsurance}_i + \epsilon_{it}.\end{aligned}$$

Economic impact of offer yield differences

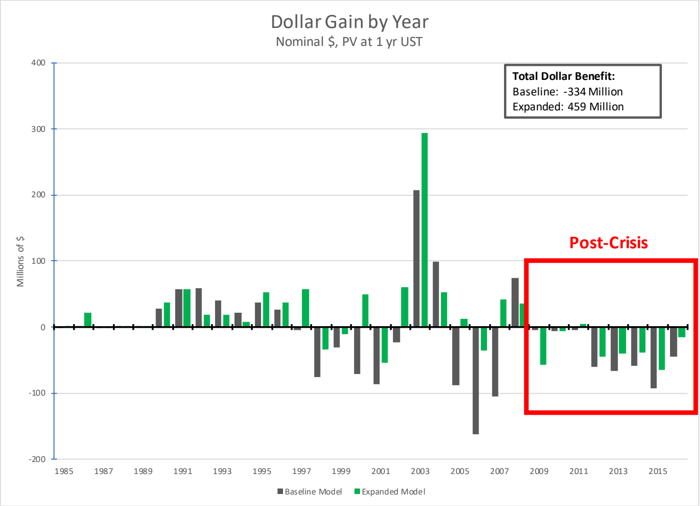
- Mean difference in offering yields does not translate into an economic effect easily
- Multiplying the mean effect by the total issuance amount gives biased estimates of economic impact due to heterogeneity (insured bonds tend to be longer maturity, smaller size)
- To estimate a dollar cost:
  - Multiply the difference in offer yield by issued amount for each bond
  - Treat this amount as an annuity paid until maturity of the bond
  - Discount at the 1-year UST rate at issuance (consistent with insurer premium accounting)

Equal- and Size-Weighted Yield Differences



Gross Dollar Benefit to Insurance by Year

Note: premiums further erode gains



Insurance Cost by Rating

High-rated issuers subsidize low-rated issuers

Rating	N	Diff. Yield (%, S.A.)	Diff. Yield (%, W.A.)	Insured ($ million)	Dollar Loss ($ million)	% Loss
Aaa	578	0.093	0.194	1,724	44.2	2.562
Aa1	3,250	0.006	0.048	7,964	50.3	0.631
Aa2	13,394	-0.000	0.043	32,850	224.9	0.685
Aa3	24,834	-0.004	0.042	55,746	354.9	0.637
A1	51,789	-0.025	-0.003	57,124	124.8	0.219
A2	54,099	-0.069	-0.044	43,623	-138.0	-0.316
A3	27,909	-0.032	-0.004	21,648	19.9	0.092
Baa1	17,995	-0.191	-0.139	18,946	-219.6	-1.159
Baa2	12,348	-0.152	-0.107	8,155	-50.8	-0.623
Baa3	5,281	-0.280	-0.245	2,431	-65.2	-2.680
Ba1	114	-0.334	-0.198	651	-11.4	-1.755
Total	211,591	-0.060	-0.008	250,861	334.0	0.133

To be insured or not to be insured

- Insurance is a choice related to issuer characteristics
  - Credit rating, and potentially state tax rates
  - Could also be driven by choice of municipal advisor or underwriter
  - Maturity and issue size are also related
- As far as we can tell, no comprehensive analysis of the determinants of insurance purchase

- **Approach 1:** 3-nearest neighbor matching on propensity scores
  - Sensitive to the selection model specification
  - Non-parametric with respect to the determinants of offering yield
- **Approach 2:** Inverse-Probability-Weighted Regression Adj.
  - Generate weights from selection model equation (probit)
  - Use the inverse of these weights to adjust the regression of the outcome model
  - Doubly-robust property...unbiased if either equation is unbiased

Propensity to Buy Insurance

"Kitchen Sink" approach!

$$\begin{aligned}\text{Insured}_{it} &= \alpha + \beta_1 \text{LnBondSize}_i + \beta_2 \text{LnIssueSize}_i + \beta_3 \text{Maturity}_i + \beta_4 \text{Maturity}_i^2 + \beta_5 \text{CallDummy}_i \\ &+ \beta_6 \text{I.Rating}_i + \beta_7 \text{I.UnderwriterDec}_i + \beta_8 \text{NumOfAgents}_i + \beta_9 \text{BankQlf}_i + \beta_{10} \text{Comp}_i \\ &+ \beta_{11} \text{Neg}_i + \gamma_1 \text{MacroVar}_t + \gamma_2 \text{BiggerState}_i + \gamma_3 \text{UseOfProceeds}_i + \gamma_4 \text{PrevInsurance}_i + \epsilon_{it}.\end{aligned}$$

Variable	Full Period	1985–1999	2000–2007	2008–2016
Maturity	0.007***	0.011***	0.012***	0.003***
Maturity sq.	-0.000***	-0.000***	-0.000***	-0.000***
LN(Issue Amount)	0.015***	0.035***	0.017***	-0.009**
Under. Decile	-0.007***	-0.007***	-0.013***	-0.000
Num. of Agents	-0.003*	-0.011***	-0.010***	-0.005**
Comp. Offering	0.006	-0.036*	0.026**	0.102
Neg. Offering	-0.010	-0.071	0.022	0.113
Bank Qualified	-0.051***	-0.055***	-0.025**	0.004
Call Dummy	0.018***	-0.019*	-0.001	-0.002
Ratings (surpressed)				
Proceeds				
General	0.002	0.025	-0.012	-0.003
OtherEd	0.046**	0.009	0.024	0.039
PrimaryEd	-0.006	0.044*	0.008	-0.006
Water	0.117***	0.014	0.089***	0.111***
LowPre2000			-0.105***	
MedPre2000			0.012	
HighPre2000			0.096***	
PriorIssuance				
LowPreCrisis				-0.091***
MedPreCrisis				-0.021*
HighPreCrisis				0.025**
Observations	469,910	104,361	197,212	168,330
Pseudo R^2	33.33	38.30	40.16	49.38
% Insured Correct	78.78	81.13	92.03	69.90
% UnInsured Correct	77.21	78.09	65.14	93.67

IPWRA: selection and outcome

- Leverage knowledge of offering yield determinants (90% R^2 in Expanded Model)

Selection Model:

$$\begin{aligned}\text{Insured}_i = {} & \alpha + \beta_1 \text{LnIssueSize}_i + \beta_2 \text{Maturity}_i + \beta_3 \text{Maturity}_i^2 + \beta_4 \text{I.Rating}_i \\ & + \beta_5 \text{I.UnderwriterDec}_i + \beta_6 \text{NumOfAgents}_i + \beta_7 \text{BankQlf}_i + \beta_8 \text{Comp}_i \\ & + \beta_9 \text{Neg}_i + \beta_{10} \text{CallDummy}_i + \gamma_1 \text{BiggerState}_i + \gamma_2 \text{UseOfProceeds}_i \\ & + \gamma_3 \text{PrevInsurance}_i + \epsilon_i\end{aligned}$$

Outcome Model:

$$\begin{aligned}\text{OffYield}_{it} = {} & \alpha + \beta_1 \text{LnIssueSize}_i + \beta_2 \text{Maturity}_i + \beta_3 \text{Maturity}_i^2 + \beta_4 \text{I.Rating}_i \\ & + \beta_5 \text{CallDummy}_i + \beta_6 \text{BankQlf}_i + \beta_7 \text{Comp}_i + \beta_8 \text{Neg}_i \\ & + \gamma_1 \text{MacroVar}_t + \gamma_2 \text{BiggerState}_i + \gamma_3 \text{UseOfProceeds}_i + \epsilon_{it},\end{aligned}$$

Selected Results

Propensity score and IPWRA models both generate the same results

After controlling for insurance selection, post-crisis yield inversion
Unconditional difference of 63 bps becomes selection-adjusted 4 bps

Panel A: Propensity-Score Matching Models

	1985–2016	1985–1999	2000–2007	2008–2016
Uninsured	3.873	5.214	3.942	2.648
Insured	3.847	5.059	3.868	2.889
Avg. Treatment Effect	-0.027***	-0.155***	-0.075***	0.240***
	(0.003)	(0.014)	(0.006)	(0.014)
Observations	417,451	95,372	175,138	146,931

Panel B: IPWRA Models

	1985–2016	1985–1999	2000–2007	2008–2016
Uninsured	3.779	5.195	3.960	2.623
Insured	3.725	5.103	3.874	2.662
Avg. Treatment Effect	-0.054***	-0.092***	-0.086***	0.039*
	(0.002)	(0.003)	(0.004)	(0.017)
Observations	417,451	95,372	175,138	146,934

Wait. We HAVE to be wrong.

- Characteristics of what must be omitted:
  - Unimportant in the decades prior to 2008
  - Suddenly significant in the post-crisis period
  - Known and observable to the (primarily retail) investors
  - Known and observable to the municipal officials issuing, advising, and insuring the bonds
  - Unknown and/or unobservable to the credit rating agencies
  - Uncorrelated with most macroeconomic variables we have data on
- What has changed? Organizational structure of the market
  - But no one MUST buy insurance.
- *Why do highly rated municipal issuers purchase insurance from relatively low-rated companies?*
  - Moody's recalibration
- *Why do primary market bond investors penalize them?*

Conflict of Interest?

1. Potential COI among underwriters
   - Cannot observe counterfactuals
   - Holding inventory

2. Potential COI among advisors
   - Qualifications
     - MSRB G-2 & 3 impose first professional standards
   - Fiduciary duty
     - MSRB G-42 first duties of care and loyalty
     - MSRB G-20 & 37 impose first pay-to-play restrictions and restrictions on gifts-gratuities
     - Non-compliance; SEC (2017) and Bergstresser and Luby (2018)

3. Potential public corruption
   - Municipality corruption linked to yield; Butler et. al. (2009)
   - Advisors solicit business for third parties; conflicts may spillover to public servants

Money Left on the Table

1. Transactional Records Access Clearinghouse (TRAC):
   - Prosecution & conviction rates for Official corruption by year & district
2. Hypothesis: agent size = power and influence
   - Anecdotal evidence for largest advisors over derivative usage
3. Losses correlate with:
   - Influential underwriters $\uparrow$ losses
   - Influential advisors $\uparrow$ losses
   - High corruption level (conviction) $\uparrow$ losses
   - Aggressive prosecution (deterrent) $\downarrow$ losses
   - High corruption and low deterrent, highest losses

Conclusions

1. Insurance provides gross value to investors in and issuers of lowest quality municipal bonds, but provides no clear economic benefit to issuers of higher quality bonds.
2. An apparent wealth transfer from high-grade to low-grade municipalities.
3. Losses correlate with potential conflict of interest among agents.
4. Transaction cost evidence commends regulatory efforts toward improved transparency.
5. Our results indicate need for similar regulatory efforts to better inform issuers and enforce new advisor standards.