Climate, race, and the cost of capital in the municipal bond market

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Motivation

- The municipal bond market is on the "front lines" of the climate crisis
- It directly serves communities with unique economic realities and racialized histories
- Need better understanding on 1) how the market is responding to new climate data and climate risk understanding and 2) how the market might be propagating racial bias

THE BOND BUYER

ESG SPOTLIGHT 2022

Climate change, hurricanes, and their toll on municipal credit

By Robert Slavin July 01, 2022, 4:43 p.m. EDT 9 Min Read

Bloomberg

US Edition \sim

BlackRock, Goldman Join Racial-Justice Push in Muni-Bond Market

- Asking issuers about social policies ahead of bond offerings
- 'They are mammoth institutions that can impact pricing levels'

FINANCIAL TIMES Flooding could leave billions of US municipal debt under water

Default rate on muni bonds may rise as cash-strapped cities struggle with extreme weather events

The Washington Post Democracy Dies in Darkness

MADE BY HISTORY

The Fed could undo decades of damage to cities. Here's how.

The bond market has fueled vast inequities between cities and suburbs – especially in smaller locales.

Our focus is on how the market responds to physical climate risk and the percentage of community that is Black

- Studies on physical climate risk and bond prices have focused on either specific geographies of the U.S., or specific hazards, often using county-level climate assessments
 - We assess issuer-level climate risk for combined hurricane, flood, and wildfire for the entire continental U.S.
- Black Americans have been subject to racial and economic segregation and disenfranchisement, with multi-generational negative income and wealth impacts
 - We look at racial composition (% of issuer service area that is Black) directly

Conceptual approach

2 datasets, 2 response variables

Datasets:

- 1. The entire municipal bond market
- 2. Water/sewer revenue bonds only

>712,000 CUSIPs ~40,000 CUSIPs

Response variables:

- 1. Market spread, as of late April 2022
- 2. Spread at issue

Hypotheses

- Municipal bonds issued by communities with greater % of Black individuals pay higher yields on their municipal bonds (1)
- Municipal bonds issued by communities with greater physical climate risk do not pay higher yields, but water/sewer bonds issued by those same communities do pay higher yields (2)

Empirical methodology: hedonic analysis for market spread models



Empirical methodology: hedonic analysis for spread at issue models



*Data from year of issue

Datasets are both public and proprietary

Data Description	Example Variables	Data Provider	Projected?	Year of Data
Bond data	Price, yield, rating	Bloomberg	No	Current
Climate data	Event-based physical climate risk	Intercontinental Exchange/risQ	Yes	Current
Socioeconomic data	Income per capita, percent Black	Intercontinental Exchange/risQ	No	Most recent Census year/year of issue
Market condition data	Mutual fund flows, offerings	MMA	No	Current

Spread at issue results for the whole market show statistically sig. but not meaningful influence of climate risk, and significant and *more* meaningful race influence

	Model 4	Model 5	Model 6
maturity	2.673***	2.561***	2.564***
CPN	-2.640***	-3.564***	-3.609***
MUNI_ISSUE_SIZE	-0.842***	-0.004	-0.240***
MMAPriceIndex	0.856***	1.073***	1.043***
MutualFundFlows	-0.255***	-0.277***	-0.276***
SecondarySelling	0.193***	0.151***	0.098*
Offerings	-1.043***	-0.857***	-0.847***
gini_indexATISSUE		-17.936***	-25.073***
per_capita_incomeATISSUE		0.000***	0.000***
populationATISSUE		0.000***	0.000***
risq_score			0.610***
pct_blackATISSUE			0.187***
Num.Obs.	614831	437043	436585
R2	0.557	0.575	0.576
R2 Adj.	0.557	0.575	0.576
RMSE	25.87	25.47	25.39
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0	.001		

Robustness analysis corroborates that race coefficients are attributable to race and not "economic risk"



Our study shows racial bias in the municipal market that negatively impacts individual Black communities and Black Americans across the entire U.S.

- The "Black penalty" means that, all else equal, a hypothetical community that is 100% Black pays ~19 bps more on its bonds than one that is 0% Black
- This roughly sums to 900 million USD annually in additional cost of capital for Black Americans
 - 900 million less that cannot be invested in localities, making it harder for predominantly Black communities to manage their infrastructure and climate risk

Our study also shows that climate risk is not yet priced into the municipal market, despite known real cost and revenue impacts

- The coefficient on the risQ score of ~0.6-0.8 means that a change in risQ score of o to a risQ score of 5 equates to at most ~4 bps
- In other words, a change in climate risk exposure from Liberty County, Kansas to the Florida Keys only results in a 4 bp increase in borrowing costs
 - 4 bps for ~32x increase in insurance-equivalent financial risk is practically negligible

Thank you! Questions?

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Additional results: spread at issue results for water/sewer show sig. and slightly smaller race coefficient

	Model 4	Model 5	Model 6
maturity	2.327***	2.128***	2.129***
CPN	-10.553***	-13.210***	-13.270***
MUNI_ISSUE_SIZE	-1.392***	0.167	-0.030
MMAPriceIndex	2.206***	2.767***	2.793***
MutualFundFlows	-0.690***	-1.248***	-1.248***
SecondarySelling	1.916***	2.007***	2.007***
Offerings	-1.738***	-2.068***	-1.975***
gini_indexATISSUE		5.125	-3.982
per_capita_incomeATISSUE		0.000***	0.000***
populationATISSUE		0.000***	0.000***
risq_score			0.861***
pct_blackATISSUE			0.139***
Num.Obs.	32655	22393	22390
R2	0.508	0.514	0.515
R2 Adj.	0.507	0.512	0.514
RMSE	23.65	23.98	23.94
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.	001		

Additional results: market spread results for the whole market show statistically sig. but not meaningful influence of climate risk, and both significant and meaningful race influence

	Model 1	Model 2	Model 3
maturity_secondary	3.609***	3.803***	3.807***
CPN	-3.459***	-2.732***	-2.766***
MUNI_ISSUE_SIZE	-2.230***	-1.465***	-1.619***
Gini_Index		-28.022***	-32.269***
PerCapInc_DIrs		0.000***	0.000
Population		0.000	0.000
risq_score			0.841***
PctBlack			0.121***
Num.Obs.	720813	636821	636559
R2	0.498	0.569	0.570
R2 Adj.	0.498	0.569	0.570
RMSE	26.08	23.92	23.88
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001			

Additional results: market spread results for water/sewer show no significance for climate or race

	Model 1	Model 2	Model 3
maturity_secondary	3.789***	4.220***	4.219***
CPN	-6.114***	-5.614***	-5.619***
MUNI_ISSUE_SIZE	-3.304***	-2.188***	-2.213***
Gini_Index		23.942***	23.372***
PerCapInc_DIrs		0.000***	0.000***
Population		0.000***	0.000***
risq_score			-0.163
PctBlack			0.011
Num.Obs.	39738	33127	33127
R2	0.535	0.633	0.633
R2 Adj.	0.533	0.632	0.632
RMSE	23.01	20.33	20.33
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001			

Additional data information: demographic data are at the issuer level*



- Municipal Bond Issuers & Obligors
 - Comprehensive library of shapefiles and facility locations corresponding to issuers and obligors
 - Layering onto the 100m Economic grid enables in-depth characterization of the municipal bond universe

- broad range of <u>economic</u> inputs, combined through dasymetric modeling and folded into the 100m grid
- combination of public & proprietary data and models

Data from ICE Data Analytics, formerly risQ Additional data information: climate data are also at the issuer level, where the climate "risQ scores" include hurricane, flood, and wildfire risk

