



Review: BlackRock+Rhodium climate risk analysis¹

Earlier this month, BlackRock published a report² detailing a climate risk analysis they commissioned by the Rhodium Group, a New York-based research advisory firm. Through their collaboration with the Climate Impact Lab, Rhodium Group and its partners developed an econometric analysis³ of climate impacts to U.S. municipal debt at the metropolitan statistical area (MSA) level. Other industries covered in this analysis include commercial mortgage-backed securities (CMBS) and electric utilities. The underlying scientific methods were originally published in the journal of Science in June 2017.⁴

The BlackRock+Rhodium (BR+R) analysis breaks down the potential net economic impact — relative to where economic growth would have been absent the effects of climate change — for 383 MSAs under a “no climate action” (RCP 8.5) scenario. The U.S. municipal bond climate risk estimates are provided in the form of Average Annual Losses (AAL) to Gross Domestic Product (GDP).

Key Findings

- About 58% of metropolitan areas face climate-related GDP hits of 1% or more by 2060–2080 under a “no climate action” scenario.
- Changes in the climate since 1980 are already imposing an economic cost. BR+R estimates that the top ten most at risk MSAs are experiencing a 3%-15% AAL to GDP at the median, with a 1-in-20 chance of that AAL increasing to 7%-42%.
- *Muni Climate Risk Credit Premium?* BR+R compared a higher risk Jupiter, FL water revenue bond against a lower risk Neptune, NJ bond with fairly similar characteristics (taking coupon, maturity, callability, and the sector into account). The two bonds had almost identical yields after adjusting for the credit quality of the two bonds (AA vs A rating). If climate-related risks were being considered as a key factor, they would have expected the Neptune bond to carry a lower yield than the Jupiter bond. They found similar results for other spot checks of bonds in areas of high and low climate risk.

What we liked...

Firmly rooted in rigorous peer-reviewed climate science: Rhodium Group and its partners developed a coastal climate risk model combining (a) probabilistic local sea-level rise data developed by research partners at Rutgers University⁵, (b) synthetic hurricane tracks from Dr.

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² [BlackRock: Getting physical Scenario analysis for assessing climate-related risks](#)

³ [Rhodium Group: Clear, Present and Underpriced: The Physical Risks of Climate Change](#)

⁴ [Science: Estimating economic damage from climate change in the United States](#)

⁵ [Journal of Applied Meteorology and Climatology: Probability-Weighted Ensembles of U.S. County-Level Climate Projections for Climate Risk Analysis](#)

Emanuel's cyclogenesis model⁶, (c) spatial windfield model developed by the Climate Impact Lab⁷, (d) high-resolution surge model developed by Rhodium Group and its Climate Impact Lab partners⁸, and (e) building-level exposure data and historical hurricane damage estimates from both commercial and public sources.

Economic modeling: The economic impact categories employed in the BR+R analysis include direct expected losses from hurricane damage as well as effects on property and infrastructure, agricultural production, mortality rates, energy demand and costs, labor productivity, and crime rates (whereas previous municipal debt climate risk analyses have focused predominantly on population-weighted hazard scores, not directly tied to economic risk⁹).

Modeling outputs: This climate risk analysis provides risk metrics that effectively convey the economic impacts. Outputs are provided in average annual loss (AAL) as a percentage of GDP, as opposed to a climate risk score or expected loss aggregate at the national- or state-level.

Municipal market-centric future developments...

First order vs and second and third order impacts: While the conclusions of the BR+R analysis are indeed unfavorable, the likely impacts of climate change are far more complex and, in many respects, bleak. Increasingly intense and frequent catastrophic weather has begun to and will increasingly result in second- and third-order impacts (collapsing coastal property values, inter-state and county migration flows, corporate / retail relocation, exacerbation of inequality). These impacts are more dire than the direct effect on GDP and are complex to model.

Time horizon: Many data points in the BR+R analysis are provided with a view out to the end of the century: "*The New York City region faces annual losses equivalent to roughly 1% of GDP by late century.*" While the outlook of end-of-century implications should play a role in policy and planning decisions today, predictions on these time horizons are often associated with irreconcilable uncertainty and are outside of the scope of even the longest maturity municipal bonds.

Spatial scale: The analysis provides a view of climate risk on an MSA-level, though many of the most dire near-term impacts of climate change will be felt at the sub-MSA, obligor- and CUSIPs-level. The events following last year's California wildfires is a prime example -- as a result of Camp Fire burning down 80-90% of the Town of Paradise, the California Statewide Communities Development Authority taxable POBs 2007 A-2 capital appreciation bonds tied to

⁶ [American Meteorological Society: Hurricanes and Global Warming: Results from Downscaling IPCC AR4 Simulations](#)

⁷ [National Bureau Of Economic Research: The Causal Effect Of Environmental Catastrophe On Long-run Economic Growth: Evidence From 6,700 Cyclones](#)

⁸ [Ocean Modelling: Adaptive mesh refinement for storm surge](#)

⁹ [Four Twenty Seven: Assessing Exposure to Climate Change in U.S. Munis](#)

Paradise defaulted.¹⁰ These local scale impacts are difficult, if not impossible, to identify when modeling at the MSA-level.

Issuer features: In order to make climate risk analytics actionable, it's important to consider the underlying financial, economic and political features that are inherent to each municipal issuer. Examples of such municipal features that are difficult to incorporate into a national-scale, MSA-level econometric analysis include many of the factors that MMA incorporates in its determination of credit impairment: local economic and financial challenges, patterns of aggressive real estate speculation, a less-than-helpful state oversight context, and strong anti-tax sentiment. High relative climate risk could potentially exacerbate risk to already distressed credits.¹¹

Additional Hazards: Wildfire and inland flood analysis are not yet included. We have seen in just the past 6 months how catastrophic wildfire and inland flood can be in California and in the Midwest, respectively.¹²

Strong Foundation

The BR+R analysis is a testament to the importance of the financial sector addressing climate change risk as a material threat to municipal assets. The report is an excellent foundation for the treatment and analysis of physical climate change risk as an economic challenge and opportunity. Its framing of the municipal debt markets implications is apt and directionally correct, lending examples of analytics that could be extended and adapted to fit squarely within a municipal credit analyst's daily workflow. The climate change problem is one that requires a hyper-specific solution and approach to the municipal debt market. In order to produce actionable analytics for this industry, an imperative extension of the BR+R modeling effort includes mapping tax dollars-at-risk projections to CUSIP-level municipal debt ratings and valuations, and including expanded views on wildfire and inland flood risks.

About risQ

risQ's mission is to catalyze and inform systems-level adaptation to climate change. We model and translate the complex financial risks posed by climate change to actionable insights for municipal debt stakeholders. risQ is a spinout of Northeastern University's Sustainability and Data Sciences (SDS) Lab and is funded by the National Science Foundation.

¹⁰ [Bond Buyer: Near-certain default spurs downgrade of debt linked to fire-ravaged town](#)

¹¹ [risQ: Quantifying Wildfire Risk To Municipal Debt In California](#)

¹² [Axios: Midwest flooding is causing an exodus of U.S. workers](#)