Inscriptions of resilience: Bond ratings and the government of climate risk in Greater Miami, Florida

Savannah Cox (iD)

Department of City and Regional Planning, University of California, Berkeley, CA, USA.

Abstract

In recent years, credit rating agencies have begun to incorporate a municipality's resilience and vulnerability to climate change into their US municipal bond rating methods. Drawing on the case of Greater Miami resilience planning and Science and Technology Studies-inspired work on inscriptive devices, I investigate how this incorporation practically happens, and how it shapes the ways that Greater Miami governments attempt to govern climate risk through resilience investments. What "counts" as resilience there, I suggest, is increasingly an effect of the observational practices of rating agencies. However, the still-emergent status of resilience as an object of knowledge among rating agencies and Greater Miami governments means that resilience retains a degree of plasticity, allowing government officials and residents alike to mobilize the term for different purposes and toward different ends. In tracing the emergent relations between rating agency practice on climate risk and local government resilience investments, the paper makes two contributions to scholarship in economic and urban geography. First, it illuminates the ways that extra-local practices of expert valuation shape the local construction of environmental fixes. Second, it offers insights into how one of the key actors of the 2007–2008 financial crisis is beginning to lay the epistemic groundwork for future economic crises and inequalities in and between cities, this time as they relate to climate change impacts and a city's supposed resilience and vulnerability to them.

On the afternoon of 29 June 2019, lifelong Miami Beach resident Bob Kunst walked toward the edge of his street and stared out into the waterways of Biscayne Bay. He did not like what he saw. The 78-year-old career activist pointed out one newly constructed "abomination," a Ritz

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Corresponding author:
Savannah Cox, Department of City and Regional Planning, University of California, Berkeley, CA, USA.
E-mail: savannah.cox@berkeley.edu

Carlton Hotel, which stretched along the coast to his right. Across the waters, he lamented the sight of several boxy mansions that he said had overtaken his historically middle-class neighborhood like kudzu. But he especially disliked what he could not see: two massive pipes that the City of Miami Beach had recently installed to channel stormwater into the regional waterway. Both pipes were buried a few feet below Kunst. Both pipes, the City claimed, were meant to develop resilience to the effects of climate change, even though subsequent studies suggested the pipes may have degraded local ecosystems, a key defense against climate change.[1] "This whole resilience thing is such a sham," Kunst muttered. For Kunst and other residents interviewed, the City was installing this "worthless" infrastructure with one item in mind: credit ratings (B Kunst, 29 June 2019, personal communication).

Greater Miami government officials, too, have tied recent resilience investments to credit ratings. In an April 2019 missive between the Mayor of Miami Beach and the City Manager, for instance, the Mayor indicated that the City must continue to invest in resilient infrastructure to maintain its strong credit ratings.[2] Nearly two years later, at the 2021 United Nations Climate Adaptation Summit in which Miami elected officials led a session on resilient cities, the Mayor pointed once again to credit ratings as a key driver of his City's resilience plans. In this speech, he noted that rating agency decisions to improve the City's municipal bond rating following a series of resilient infrastructure investments signaled that Miami Beach is "on the right track" in preparing for climate change. Even better, the Mayor suggested, the City could see future "financial returns" if it made more investments along these lines (Climate Adaptation Summit, 2021).

But given the significant uncertainties regarding how best to prepare for climate change and evaluate climate risk, let alone the contested meanings of resilience (Meerow et al., 2016), how do rating agency analysts and local government officials arrive at a shared understanding of what "counts" as resilience? What might these shared understandings spell for the government of climate risk in US cities and the work that resilience does in relation to urban political economies? This paper investigates these questions through a case study of resilience planning efforts in the highly financialized[3] and highly climate-vulnerable region of Greater Miami, Florida,[4] as they articulate with the changing practices of rating agencies. I argue that the practical meanings and infrastructural forms of resilience in Greater Miami are increasingly an effect of the observational practices of rating agencies. Even still, rating-driven resilience investments in the region are wide-ranging. This is at least partially because the rating agency and city government understandings of resilience are just emerging, which in turn creates a new set of practical dilemmas and political opportunities for Greater Miami officials and residents as they prepare for climate change impacts. On the one hand, lack of clarity on what "counts" as resilience makes it difficult for officials in Greater Miami, a well-resourced but fiscally conservative metropolitan region, to know in advance what specific investments rating agencies will reward. On the other hand, the ambiguity is politically useful. Social and environmental justice activists have strategically mobilized particular meanings of resilience to successfully demand affordable housing (Grove et al., 2020), which rating agencies have described as examples of resilient behavior, just as some Greater Miami officials have seized the term's ambiguities to, in the words of one risk management expert, "see what they can get away with" in rating agency analyses (D Stander, 14 June 2019, personal communication). Thus, even as the observational practices of rating agency analysts increasingly inform the significance of resilience among Greater Miami officials—in terms of its meaning, investment-worthy physical forms, and general importance—its status as a still-emergent object of knowledge means that resilience retains a degree of plasticity and can be mobilized for different purposes and toward different ends.

The first section of the paper situates these arguments within a wider set of scholarly literatures that examine the power that credit rating agencies and their ratings are said to possess regarding the operations and behavior of governments. Because the issue of climate change is a novel object of

concern among rating agencies, and because the meanings of resilience remain contested in scholarly and policy literatures alike, this section introduces science and technology studies (STS)-inspired scholarship on inscriptive devices as useful analytics in (1) analyzing how resilience comes to have specific, shared meanings among rating agency analysts and Greater Miami governments and (2) assessing how rating work on resilience may drive further inequalities in and between cities as the climate changes (Latour, 1987; Mitchell, 2005; Rose, 1999). I then investigate how analysts at Moody's Investors Services are acquiring knowledge about a municipality's resilience and vulnerability to climate change and are inscribing that knowledge into existing municipal bond rating practices. Next, I discuss some of the initial effects of rating agency action on resilience, detailing the series of investments that Greater Miami government officials have undertaken to demonstrate their resilience to market actors such as rating agencies, as well as local responses to these investments. Finally, I conclude with a broader discussion of the implications and limits of the case and identifies avenues for future research.

In developing these arguments with a focus on the inscription, this paper makes two key interventions in ongoing debates in economic and urban geography. First, it contributes to recent work in economic geography which treats the practices and perspectives of market actors, such as rating agencies, as fundamental in critical analyses of climate governance and in doing so also advances calls for inductive modes of research on the politics of resilience (Anderson, 2015; Christophers, 2019; Grove et al., 2020; Langley and Morris, 2020). Second, this article responds to a significant body of economic and urban geography scholarship which has stressed the need for analyses of how "green" or "sustainability" fixes are materially and discursively constructed in cities (see, e.g. Holgersen and Malm, 2015; Long, 2016; Temenos and McCann, 2012). Moreover, by tracing rating agency action on resilience, the paper offers a window into how key players in the 2008 financial crisis are beginning to create key epistemic conditions that may help (1) exacerbate economic inequalities in and among cities as the climate crisis intensifies and (2) reinforce the view among city governments that urban resilience efforts and infrastructures must predominantly work to shore up existing regimes of capital accumulation, not transform them (Webber et al., 2020).

The analysis is based on 28 interviews with officials and analysts at Moody's Investor Services, Greater Miami municipal officials and residents[5], 30 hours of participant observation at municipal finance, Greater Miami government, and financial industry meetings, as well as documentary analysis of relevant rating agency, government, and media publications. Moody's Investor Services is a suitable site from which to generalize about rating agency thought on climate risk because it is the first of the three rating agencies that corner the ratings market to announce climate-linked changes in its bond rating methods. Scholars have shown that these firms tend to exert isomorphic behavior: that is, mirroring one another's practices with minor differences in procedures (Sinclair, 2005). This tendency suggests that many elements of Moody's' actions will likely be borrowed or mimicked by the rest. I selected Greater Miami because the region is an exemplary and early "edge" case of how highly financialized cities are responding to changing, climate-linked market conditions through investments in urban resilience (Taylor, 2020; Wakefield, 2019). Thus, elements of what transpires in Greater Miami as it responds to changing rating practices may be seen in other, highly financialized cities as climates change, inviting comparative projects in this rapidly growing arena.

"Little machines:" Putting credit ratings to work on urban resilience

A considerable amount of literature from the fields of economic sociology and economic geography has examined how credit ratings function as what Rose and Miller (1992) call *technologies of government*: that is, the "humble and mundane" mechanisms by which authorities seek to instantiate

self-regulating government. While ratings are now consequential at multiple scales of government, they have not always held the power that scholars commonly attribute to them now. Many identify the mid-to-late 20th century as a pivotal moment in which the authority of credit rating agencies, and the treatment of the states whose creditworthiness they evaluate, began to assume the taken-for-granted form we see today (Hackworth, 2007; Sinclair, 2005). As Lemoine (2017) argues, it was in the post-Bretton Woods era that states increasingly depended on capital markets for investment and, as a consequence, that states were no longer considered to be sovereign "authorities" over their economies. Instead, they became economic "things" whose claims to sovereignty are measured against the evaluations and concerns of external financial actors such as rating agencies (Lemoine, 2017: 315).

This analysis holds at the municipal level in the United States. In the past few decades, twin processes of market liberalization and federal government rollbacks on regular investments in municipalities have decreased the centrality of the bank in municipal lending practices,[6] increased the range and type of actors who purchase, issue, and evaluate municipal debt; and have cultivated an economic climate whereby "entrepreneurial" cities are increasingly reliant on capital market investment to reproduce themselves (see, e.g. Ponder, 2017; Ponder and Omstedt, 2019). Municipal bond markets, a key capital pool into which municipalities have tapped over the same period of time, have seen a significant amount of growth. From 1980 to 2020 for instance, the market has ballooned 875%, growing from a $400 billion market to a $3.9 trillion market (Municipal Securities Rulemaking Board, 2020).

Rating agencies play a critical role in the structure of this market, making up what Sinclair (2005: 52) calls the "cognitive life" of capital markets. This moniker comes from the daily practices of CRAs: soliciting and absorbing an array of information about a debt issuer, comparing this information to a set of weighted "rules of thumb" about creditworthiness—such as tax base size, median family income, and debt-to-revenue ratios—and eventually rendering their judgment on the issuer's creditworthiness in the form of a grade rating. These practices stand in contrast to the individual credit score, which is typically of algorithmic origin, easy to model, and draws from a larger set of specific quantitative behaviors over a given time (Poon, 2009). In fact, government credit rating methods are remarkably qualitative—so much so that rating agencies routinely refer to themselves as mere "market observers" and to their government credit ratings as "opinions" (Fourcade, 2017: 105).

Even so, the development of these "opinions" is practically challenging and politically charged (Besedovsky, 2018). In their efforts to make qualitatively distinct municipalities comparable, for instance, rating agencies introduce value-laden categories that promote norms such as budget flexibility, which effectively create deficits in municipalities whose budgets are more limited than others' (Omstedt, 2020). For these reasons, rating agencies are not so much "neutral" observers as they are productive of new forms of fiscal control, surveillance, and policing (Hackworth, 2007). As Fourcade (2017: 106) argues, ratings—always made against an ideal type of government behavior—compel governments to adjust their behavior to "move up the ladder." Indeed, ratings themselves may be treated as inscriptive devices: items such as maps, statistics, and charts that work to reduce the complexities of a given space, such as a city, into stable, durable, and comparable forms such that these spaces can be governed from a distance (Latour, 1987; Mitchell, 2005). As Rose (1999: 37) puts it, inasmuch as these inscriptions should be regarded as technical accomplishments—reducing a physically distant world to paper is, after all, hard work—they must also be viewed as "little machines" that, in Fourcade's terms, produce movement among the objects, subjects, and spaces they claim to merely depict. In the case of sovereign credit ratings, Fourcade shows how nations seeking to "upgrade" their rating may implement austerity programs that create conditions for further economic and political crisis—and thus shape how nations become culturally regarded as broken or failed. Moreover, governments feeling the pressure to be classified as

"fiscally responsible" are likely to sidestep debate on what makes for a responsible government in the first place, favoring instead the pre-packaged, investor-oriented views of the rating agencies (Jones et al., 2020). As democracies are reduced to the terms of investors and rating agencies, governments too are reduced to "easily duped…customers" (Ross, 2017: 27).

This literature is enormously helpful in directing scholarly attention to "micro-level" financial practices and technologies as they relate to the disciplining of (local) states and macro-level changes in political economy (Berndt and Boeckler, 2009; Braun, 2016). But baked into many of these arguments is an assumption that the rating's disciplinary power on a given issue has already been formed and is awaiting "transmission" to a government that can always be disciplined in a predictable way on the issue at hand. This assumption is often warranted. After all, indicators of a municipality's "fiscal responsibility" have been established for decades. Climate change, however, presents a novel set of practical problems for rating analysts. Through what means, for instance, are they to assess a municipality's specific vulnerabilities to climate change? Are some vulnerabilities or climate risks more harmful than others? If so, over what time period? Once assessed, how should these vulnerabilities be incorporated into existing rating practices? While dramatic increases in sea-level rise may be decades away, what are analysts to make of what is happening today: namely, the implementation of resilience projects in cities around the world? Indeed, analysts are left with one question that has vexed countless scholars for at least the past decade: just what kind of thing *is* resilience (Anderson, 2015)?[7]

In answering these questions, I analyze published bond ratings and methods on resilience as inscriptive devices. Doing so helps illuminate the strategic reductions and framings that allow some features and forms of resilience to be made salient and others to be made invisible, and that are instrumental in enabling "objective" comparison of climate-vulnerable cities and the transmission of these ideal features and forms to city governments through the rating process. Beyond helping resolve basic empirical questions mentioned above, a focus on inscriptions of resilience makes two important contributions to critical scholarship on resilience and "green" urban economies more broadly. First, it advances scholarly calls for inductive modes of inquiry on the politics of resilience, specifically as they relate to the role(s) that risk rating mechanisms play in constituting urban resilience as a public problem (Collier and Cox, 2021; Grove et al., 2020). Second, in attending to the extra-local expert practices that help shape local development-oriented policy agendas and investments that selectively attempt to accommodate environmental concerns—coined the sustainability fix by While et al. (2004) and further developed by others—inscription work contributes to urban and economic geographic scholarship that has suggested that these fixes be treated as material and discursive constructions, but has only recently engaged with expert practices of valuation (see Knuth, 2020; Taylor, 2020). By tracing these practices, we see how resilience efforts often support existing regimes of capital accumulation (Webber et al., 2020), and how key actors in the 2007–2008 financial crisis may be helping to lay the epistemic groundwork for future economic crises and inequalities in and among cities, this time as they relate to climate change impacts and a city's supposed resilience and vulnerability to them.

"We want to make sure nothing crazy's going on": the work of making resilience

This section details how Moody's analysts are attempting to make sense of, and inscribe, climate vulnerability and resilience into their rating practices. Analysts are not starting from a blank slate: the firm is accumulating novel inscriptions (e.g. climate projections and historical weather indices) and combining them with existing ones (e.g. categories of assessment, such as property tax base).[8] For analysts interviewed, the addition of novel climate inscriptions is changing their interpretations of existing inscriptions: past bond ratings act as a strong indicator of an issuer's resilience and

vulnerability to climate change. As discussed in the conclusion, this shifting significance may help produce uneven economic outcomes in US cities as climates change.

Identifying climate risks

The November 2017 report announcing Moody's' incorporation of climate resilience and vulnerability into its municipal bond rating methods begins by disaggregating the term "climate risk" across physical, temporal, and geographical lines. After listing physical events that are projected to occur as climates change—such as severe heat, drought, and rising sea levels—the report authors slot the events into two temporal categories: climate trends (events that take place over longer periods of time, such as sea-level rise) and climate shocks (events, such as flooding, that take place over the short-term). The main purpose of these classifications is to demarcate the temporal limits of the firm's climate risk accounting: the firm suggests it will almost exclusively consider climate shocks in its analyses, in part because its analysts can immediately observe the impacts of climate shocks on an issuer's infrastructure, economy, revenue base, and environment—all of which they already evaluate when issuing a rating.[9]

That does not necessarily mean that cities can simply ignore the longer-term threat of climate trends, however. As one Gulf Coast lead analyst told me, "Some of the bonds we evaluate go well into the future, like 20–30 years. I can't tell you what will happen in 30 years, but based on the science we know that the challenges are coming. So even if the rating doesn't change today, absence of any initiatives or infrastructural improvement makes you more vulnerable to what the science is telling us. And if we believe we see a mismatch between what an entity does and the risks they face related to climate change over time, their rating will likely change" (3 February 2021, personal communication).

For now, these "beliefs" are made or negated via regular surveys issued to, and interviews with, city government officials.[10] From there, the firm draws on climate projections from the National Oceanic and Atmospheric Association (NOAA) and the National Climate Assessment to attribute particular climate trends and shocks to various geographic regions of the United States. Doing so allows Moody's to further geographically disaggregate "climate risk" and create regional and county-level climate risk profiles that the firm then distributes to its state and regional analysts for their own rating purposes. Concurrently, Moody's representatives issue climate-specific surveys to rated local governments to gather what one Moody's representative describes as "qualitative intel" on geographically specific climate risks. "Our analysts are speaking to the 14,000-plus issuers we rate on a one-one basis all the time," this representative said. "So [our analysts] can actually ask management questions about their planning processes, what their exposure is and how they interpret that. That's the qualitative intel we get beyond the raw numbers about the size of the economy, the income statements, the balance sheet, and that [intel] is important for informing our view about climate risks at a very local level" (1 February 2019, personal communication).

The firm also gathers "intel" from the press. "Sometimes when you talk to an issuer they're not really sure what the climate on the ground is," one Moody's state lead analyst told me. "Reading local newspapers is…the first thing I do in the morning to make sure nothing crazy is happening…I can see what the problems are, if there are any climate issues people are pushing local governments on and how government is responding to it. This helps fill out my analysis" (15 February 2019, personal communication). A last, but increasingly important, analytical "filler" comes from recently contracted work with climate data firms. At a county-by-county level, these analysts provide Moody's analysts with weather index-based "pictures" of a given issuer, which are meant to provide more detailed information on the hazards to which an issuer has historically been exposed, and how these past exposures may translate to physical climate change risks in the future (25 September 2019, personal communication).

"Forming" resilience and vulnerability

As Moody's analysts develop climate risk profiles, they also begin to link specific physical, fiscal, and institutional infrastructural forms to climate resilience and vulnerability. Importantly, many of these infrastructures (such as tax base and capital plans) are already considered in Moody's' rating scheme. We can view this step as an act of commensuration: making disparate elements available for comparison (Espeland and Stevens, 1998). Once identified—often through surveys issued to city management, interviews with capital planners, and basic desk research—these infrastructural forms function as shorthand indicators of climate resilience and vulnerability.

With respect to physical infrastructures, Moody's works with city governments to learn what types of physical assets are most vulnerable to climate risks, and the physical infrastructures the city plans to install (or has installed) to develop resilience against these vulnerabilities. Moody's curates its survey questions according to the climate risk profiles it has created. If Moody's analysts have identified flooding and sea-level rise as their primary climate risks, for instance, analysts ask questions such as "how are sea level rise and flooding risks incorporated into capital planning" and "have there been any zoning/long-term planning adjustments downtown and along the waterfront to mitigate future flooding" (City of Miami Beach, 2019).

Survey responses find their way into credit rating outlooks and reports for the rated government in question—and into the types of physical infrastructures that Moody's analysts associate with resilience and vulnerability. For instance, a 2019 report on New York City lists wastewater treatment facilities, power plants, and hospitals as particularly climate-vulnerable, because the City identified them as such in its survey responses. The report then describes the City's post-Hurricane Sandy completion of coastal defenses—such as drainage pipes and hardened boardwalks—as "resilient" infrastructure that will decrease the vulnerability of these physical assets (Samuels et al., 2019). A May 2019 credit opinion on Houston, TX, similarly praises the City for drafting a plan that calls for the development of an extensive system of floodwalls, seawall improvements, and pump stations to manage flooding, which Houston identified in surveys as its primary climate risk. In the next sentence, the firm writes that resilience to climate change will hinge on continued investments in these types of public infrastructures (Kushimo et al., 2019). In both cases, we see a certain reflexivity: urban infrastructures are resilient or vulnerable insofar as cities identify them as such, which in turn helps inform rating analyst evaluations and characterizations of resilient and vulnerable physical infrastructures.

Existing fiscal infrastructures—such as a city's tax base and budget—are increasingly tied to climate resilience and vulnerability as well. In its surveys to cities, Moody's always asks—no matter the stated climate risk—how much money has been spent to mitigate the city's primary climate risk(s), if the government anticipates federal funding for mitigation projects, and how much the primary climate risk(s) have impacted city budgets and budget projections. Of course, they ask this because municipal budget analysis makes up a key part of their existing rating scheme: if budgets expand significantly to incorporate investments in resilient infrastructure, and if these investments are financed primarily by the city without any plans for additional revenue generation, this may make the city in question more economically "vulnerable" to climate change. That is why Moody's representatives routinely equate the promise of federal government aid with resilience in general.[11] As one analyst told me:

> One of the big equalizers between a small southern town and a big city is that regardless of their own local financial wherewithal, there's an expectation that if a natural disaster occurs, and honestly even before the disaster occurs, the federal government will marshal the necessary resources to help that place recover in the short-term and for the longer-term rebuild (13 February 2019, personal communication).

At a local level, analysts associate climate risk management-minded debt issuance with strong institutional leadership—another indicator of resilient fiscal infrastructure. Speaking about a $400 million bond the City of Miami issued to install stormwater pumps and that contributed to her decision to raise the city's credit rating, one analyst noted that "Miami is a big, fast-growing city. I'm sure they have a ton of ideas of things they could spend $400 million in capital dollars on…so the fact that they prioritized [flooding] shows a commitment to keeping Miami attractive to residents, developers, and tourists. It shows that they're serious about resilience" (personal interview: 15 February 2019).

Lastly, Moody's analysts link various institutional infrastructures—here meaning participation in reputable knowledge-sharing networks and in-house experience with disaster management—with resilience. In credit outlooks issued on local governments throughout the country, Moody's regularly cites government involvement in initiatives such as 100 Resilient Cities and the 2017 Paris Climate Agreement as "credit-positive" behavior, the logic being that sustained participation in global climate knowledge networks facilitates the constitution of more "comprehensive" resilience strategies that address the climate shocks for which Moody's says it accounts in its ratings methods (Gomez and Lee-Allen, 2019; Kushimo et al., 2019). Analysts interviewed have also indicated that a local government's history with disaster management helps with evaluating a city's institutional resilience and vulnerability to climate change. "It's a huge credit strength when we know that the [issuer] is not sort of building an emergency response apparatus from nothing, or from, like, 'oh, we had a snowstorm here ten years ago,'" one lead analyst said. "When we know that cities really know what they're doing, they know the FEMA process, the state process, they know who their contacts are, which departments are in charge of what, this prior experience is really an advantage" in the rating process (17 February 2019, personal communication).

Inscribing climate resilience and vulnerability into existing credit risk categories and rating methods

After identifying, classifying, and giving specific "forms" to climate resilience, Moody's inscribes climate risk and resilience into existing (and distinct) municipal credit risk categories and rating methods. In its November 2017 report, Moody's illustrates how these climate risks can become credit risks, such as economic disruption, physical damage, health and public safety, and population displacement. In the category of economic disruption, for example, the firm writes that climate shocks can drive "economic disorder," with apparent symptoms being property loss, supply chain disruption, and declining agricultural production (Okuji et al., 2017). The prognosis is grim: sudden events such as these will "weaken [the issuer's] revenue base while simultaneously confronting them with current or long-term costs for recovery," such as higher insurance premiums and rebuilding costs.

The firm then offers an example of how it accounts for climate risk in its Local Government General Bond Obligation methodology, which is separated into four weighted factors: economy/tax base (30%); finances (30%); management (20%), and debt/pensions (20%). In doing so, Moody's does not just offer a sample *translation* of climate risks into credit rating methods, it provides early *characterizations* of what it considers to be a resilient or vulnerable city in an epoch of climate change—which, to reiterate, are largely formed on the basis of existing rating methods and what issuers tell them. In the economy/tax base factor, for example, Moody's writes that "small economies" and "issuers with economies concentrated in sectors exposed to climate risks" are at "high vulnerability" to climate change. In contrast, it claims that issuers with "large, diverse economies" are more resilient to the effects of climate change and will suffer lower credit impacts from

climate risks—even if these large cities have a similar physical risk exposure to their smaller peers. As one analyst told me of how she evaluates wildfire risk in the Pacific Northwest, "We're looking at, you know, we're more concerned about smaller places, like Paradise [California]…but if it's a larger, like a decent-sized city with maybe one edge on the WUI [wildland-urban-interface], we are not going to be as concerned as if it's these small little subdivisions essentially" (12 May 2020, personal communication). Debtor cities—those with "already high debt obligations"—are particularly vulnerable to climate change, and largely because these cities will struggle to "accommodate new burdens into their existing debt portfolios." Cities with less debt are comparatively more resilient, mainly because they "[have] capacity to incorporate obligations to finance capital improvements" (Okuji et al., 2017).

Here, and perhaps surprisingly, an issuer's past matters much in Moody's present evaluation of its resilience or vulnerability to climate change. For instance, while a Moody's report discloses that Virginia Beach has significant flood risks, because of its "*history* of strong financial management, adherence to policies to maintain satisfactory reserves, liquidity and debt levels," the firm *believes* that the City is a leader in climate resilience. In contrast, Moody's analysts and reports consistently describe relatively poor US territories and cities such as Puerto Rico and New Orleans, whose ratings the firm downgraded in the wake of two recent hurricane events, as vulnerable to climate change. In justifying these classifications, Moody's analysts often point to the lowered ratings themselves. Because Moody's downgraded the City of New Orleans from Baa1 (investment grade) to Ba1 (speculative grade) due to its "observation" of how the City responded to Hurricane Katrina, for example, many reports and analyst remarks framed New Orleans as a worst-case example of vulnerability to climate change (Okuji et al., 2017; personal interviews 2 and 12, 14 February 2019).

Indeed, *past judgments* of a city's creditworthiness, as expressed through the inscriptive device of prior municipal bond ratings, play a critical role in Moody's *present construction* of a city's resilience or vulnerability to climate change. This, as I discuss in the conclusion, has significant implications for the amplification of urban inequalities as climates change. For now, however, it is necessary to examine the extent to which these combined and consolidated inscriptions of resilience are "sent back" to the physically distant municipalities whose resilience the firm increasingly evaluates, and their effects (Latour, 1987: 259). For that, I turn to the case of Greater Miami.

Spaces of negotiation

For many of the Greater Miami officials I interviewed, Moody's' announced changes have compelled them to act on resilience—if not simply to better communicate their existing work on the matter. Describing the announcement as something that "weighs heavy" in her mind, one official said that these changes are "incredibly important and should help direct our policies and how we build" in the future (31 January 2018, personal communication). For this reason, officials working within Greater Miami resilience offices—whose funding has been consistently precarious and may be even more so due to COVID-19 revenue shortfalls—conveyed that the agency's announcement was helpful in garnering the necessary political will to act on climate change. "Moody's' announcement really reinforced the need for our community to make proper planning investments," one resilience officer said. "It was really very useful…Some people are just more responsive to the economics conversation, so the rating announcement elevates our work to that broader community that ultimately has to be part of the planning and investment strategy, and that might not otherwise be interested in resilience planning, or being taxed for it" (31 January 2019, personal communication).

Nevertheless, the content of what "counts" to CRAs as resilience—and thus what city officials should do to "act" on resilience themselves—remains frustratingly unclear. As one resilience officer told me,

> They're [Moody's] still kind of figuring it out, which is, not to be critical, but I think some of the things we hope get clarified over time is, how more specifically the rating agency is going to monitor and measure resilience [...]. For the credit rating agencies, they want to understand your reserves, your debt, your property values, your growth. And these are very easy things for them to measure. Vulnerability to climate change? Strategies to reduce those vulnerabilities? They're really not very clear. So we feel that we're constantly learning and doing so much all the time, strategically and in operations. So we want to make sure that we really are able to get that effort reflected and understood (23 April 2019, personal communication).

Another risk management officer put it in plainer terms. "Rating agencies like Moody's really hold the key to our future as climates change…The problem is that we really just don't know how they're thinking about resilience, and it would be really helpful for Moody's to share that with us so we get a better sense of what's worth doing and what's not" (13 April 2019, personal communication). In other words, many of these officials would like credit ratings to govern more: that is, to specify concretely what actions Greater Miami governments can take to be "rewarded" for their work, and thereby indicate what they can do to avoid punishment in the form of a downgrade. In the absence of such clarity, Greater Miami governments have undertaken an array of resilience interventions that they believe should be rewarded by rating agencies—and that they think they can help make "count" as resilience in the eyes of agency analysts. As one county official told me, "Look, we know we are going to get regulated [on climate risk] eventually. What I keep saying, and keep trying to do in my work [on resilience], is say 'hey, why don't we help set the terms?'" (22 April 2021, personal communication). For this official, "[setting] the terms" entails in-depth discussions with analysts in which officials discuss their climate risks and attempt to educate analysts on the concrete ways that they are planning to address them, along with the quantitative value of these risk-mitigating interventions.

In addition to more substantive term-setting, other Greater Miami officials have indicated that such a resilience "fix" can be achieved through linguistic performance. As discussed in the previous section, because Moody's analysts presently use inscriptions such as surveys, newspapers, and interviews to gain specific knowledge on a city's resilience initiatives, cities *are resilient* insofar as city officials successfully *demonstrate resilience* through survey and interview responses, as well as popular media coverage of their resilience activities.[12] As one capital planner told me, "part of my job is overseeing projects and building resilience through them." The other part, he grinned, "is storytelling." These stories, which he says he assembles through resilience plans and projects as well as the public-facing narratives he crafts around them, are first and foremost meant to persuade global financial actors such as rating agencies that his city will remain "an investee of choice" well into the 21st century (S Williamson, 16 June 2019, personal communication). A financial officer characterized his performance of resilience in Moody's' interviews and surveys as follows:

> We decided to beef up [our statements], just anticipating "OK, it looks like there's a lot of questions about these topics [on climate change] these days, so let's just go ahead and include language there." Now if we were, let's say, trying to hide a little bit of—that we haven't done much, we wouldn't have done that ["beefed up" their answers to survey questions]. But because we feel like we've done a lot, we wrote a lot, so they would see it and value it. (27 June 2019, personal communication).

Much of this "a lot" refers to the significant resilient infrastructure investments Greater Miami governments have undertaken. As discussed in the opening vignette, government officials are increasingly tying the value of these infrastructures to sustained creditworthiness. In the City of Miami, both critics and proponents of the Miami Forever Bond, a $400 million bond meant to finance a suite of resilient infrastructure in the City, have cited credit ratings, alongside insurance premiums, as key drivers of the Bond's issuance (23 June 2018 and 28 June 2019, personal communication). And indeed, Moody's analysts have praised the City of Miami for the November 2017 passage of this Bond, tying its decision to finance resilience projects—which include stormwater pumps and pipe installations, road raising, and affordable housing construction—as one key reason they upgraded the City's municipal bond rating in later months (15 February 2019, personal communication).

What are we to make of all of these developments as they relate to the role of credit ratings in Greater Miami resilience planning? For one, it suggests that rating agency power is extending to the protection of physical infrastructure systems as climates change. Moreover, ratings also legitimate, and indeed motivate, significant government spending on resilience efforts. But not all resilience efforts are of equal value, and emerging rating agencies thought on what counts as resilience also works to make that so. Because Moody's analysts presently privilege existing indicators of economic strength and physical infrastructures in the development of their understandings of resilience, arguments that debt-financed resilience initiatives must first (if not exclusively) focus on the security of vital systems are strengthened to the point that they become, in the eyes of Greater Miami officials detailed in the opening vignette, apolitical imperatives. Indeed, that the City of Miami has—after years of public battles over the future of an independent Office of Resilience —collapsed the Office into its Public Works Department may provide some clues regarding the durable forms that resilience will take, at least somewhat due to the growing role that rating agency practices are playing in Greater Miami resilience planning.

But the rating does more than that. Because rating agency action renders resilience a legitimate category of government spending, resilience efforts become equivalent to other government spending and debt on collective items, such as pensions. This practical equivalence, paired with the still somewhat ambiguous meaning of resilience, helps create and sustain a field of struggle regarding what "resilient" Greater Miami should look like, and to whom resilience to climate change is substantively owed. Municipal debt issuance stands at the heart of these struggles, and Greater Miami residents have already taken many of them on. As one climate justice activist told me of his work, "We are in a constant battle with the City…as to whether investments will go to shore up infrastructure or protect our really vulnerable populations from displacement" (D MacDougal, 6 June 2019, personal communication). In the City of Miami, residents long excluded on the basis of race from municipal decision-making processes have mobilized Miami's "Forever" resilience bond—and the multiple possible meanings of resilience—to demand never-before-seen levels of participation in urban planning and to reconfigure the audiences to which bond-financed resilience efforts are meant to speak (Grove et al., 2020). In the City of Miami Beach, "anti-resilience" coalitions led by Kunst, introduced in the opening vignette, have formed around the belief that bond- and fee-financed resilience projects are meant to maintain financial market investments as climates change, not to protect vulnerable residents and ecosystems. As research has linked these investments to recent ecosystem degradation, these coalitions have delayed or thwarted significant portions of fee- and bond-funded resilience projects (Wakefield, 2019). These struggles are ongoing and work to counter increasingly dominant conceptions of resilience that rating agency action on resilience has helped stabilize. At the same time, and perhaps paradoxically, the sustainability of these struggles stems at least partially from the fact that rating agencies have helped constitute resilience as a legitimate and increasingly vital, object of government and infrastructure investment.

Discipline and dupe? New terrains of inequality on the bond market

This paper has investigated the role of credit ratings in urban resilience, specifically through a case study of Greater Miami resilience planning. Mobilizing STS-inspired literature on inscriptive devices to contribute to ongoing urban and economic geography scholarship on the politics of urban climate governance and environmental fixes, I have argued that what "counts" as resilience in Greater Miami is increasingly an effect of the observational practices of rating agencies. For this reason, arguments that resilience efforts must shore up the already-existing Greater Miami regional economy are strengthened, putting more radical understandings of resilience (e.g. transforming the regional economy in the face of climate change) at a disadvantage. That is not to say that these understandings of resilience are immediately discounted. As I have shown, the still emergent status of resilience as an object of knowledge among rating agency analysts and government officials means that resilience retains a degree of plasticity and can be mobilized for different purposes and toward different ends.

But the ability to negotiate one's resilience and vulnerability with rating agency analysts is not distributed evenly across US municipalities, owing in large part to already-existing rating practices and decisions. As I have attempted to show, and corresponding with much critical scholarship on credit ratings, rating agency observations are not neutral, even and especially as they take climate into account. As analysts begin to cast their eyes toward the issue of climate change, already existing inscriptive devices—prior bond ratings—take on a new, and important, meaning: they function as strong indicators of a municipality's likely resilience and vulnerability to climate change. This may have the effect of unduly penalizing poor US municipalities and territories for their pasts, while rewarding wealthier municipalities whose futures, thanks to climate change, will look less and less like their creditworthy presents. In the words of one risk management expert, historically creditworthy "cities can sound and look like they're doing a lot and get away with it, when in fact they're doing quite little." In short, this expert suggested, resilience efforts in historically creditworthy cities may be little more than a "credit gimmick" (D Stander, 13 June 2019, personal communication). Indeed, and contra Ross (2017: 27), it is not only (local) states that are "easily duped" in highly financialized political economies. Rating agency analysts may be fooled, too. In the case of resilience, at least for now, we might examine the uneven power relations between rating agencies and municipalities a bit differently: it is not simply about who dupes whom, but also about which (local) states have the capacity to dupe rating agency analysts in the first place.

With that said, there are important limitations to this analysis that should be addressed through further scholarly inquiry. For one, this analysis draws largely from the words of rating agency analysts and the public-facing documents that they produce on the subject. Rating agencies are notoriously secretive regarding their practices—so much so that one climate data analyst interviewed said that even she does not know precisely how rating agency analysts are using the data she provides (26 September 2019, personal communication). While I have attempted to make up for lack of access with supplemental materials (e.g. interviews with Moody's analysts, non-public facing documents such as surveys sent to municipalities, and interviews with aligned experts and city officials who have taken part in rating processes), the practices described in this paper should be supplemented with further interviews and observation to develop a thicker description of rating agency work on resilience. Second, comparative work in less financialized cities, or highly financialized cities outside of the US, is needed to deepen the analysis presented here. Furthermore, that agency analysts and executives have routinely pointed to New Orleans and Puerto Rico as highly climate-vulnerable speaks to the need for further research on the role of race and colonialism in the establishment of relations of domination among bond market actors and how they may be reproduced and/or extended as climates change (see, e.g. Ponder, 2021).

Third, the developments described in this paper may change rapidly given the infancy of the field. While what Besedovsky (2018) describes as the *traditional rating paradigm* persists with respect to rating agency analysis of climate resilience and vulnerability thus far, it may be replaced or complemented with elements of what she calls the *structured finance paradigm*. This paradigm, which can be found in mortgage-backed securities markets, is marked by its use of inscriptive devices such as algorithms and simulations and is increasingly "colonizing" traditional paradigms and practices, such as the more descriptive and "qualitative" work presently deployed by municipal bond rating agencies (Besedovsky, 2018: 20). Highly place-specific climate models and projections lend themselves to this paradigm, and Moody's' recent, and growing, work with climate data firms may be indicative of how the techniques, mechanisms, and rationalities of structured finance are seeping deeper into traditional rating paradigms. Thus, further study is needed to examine if, how, and why structured finance practices and their respective inscriptive devices come to occupy rating agency thought and action on US municipal climate risk, and the disputes and effects that this occupation may bring about. It may be through this recombinant inscription work that historically creditworthy cities such as Greater Miami are finally—and fatally—made vulnerable to climate change by their projected futures, not made resilient by their performed presents and observed pasts.

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ORCID iD

Savannah Cox https://orcid.org/0000-0001-7686-0865

Notes

1. A 2016 NOAA study found that the City's "resilient" storm water infrastructure was directing significant amounts of human and animal fecal matter into Biscayne Bay, a 428-square mile lagoon in South Florida (Wendel, 2016).
2. As per the document: "…[W]e have been able to maintain our strong credit ratings through our proactive efforts to … invest in our aging infrastructure and adapt to climate change by using the best available science and knowledge. We must continue to act along these lines as climate resilience will continue to be a consideration for future ratings" (City of Miami Beach, 2019).

3. By highly financialized, I mean that Greater Miami largely relies on international trade, banking and real estate investments, and debt issuance to reproduce itself.

4. Greater Miami refers to cities in Miami-Dade County, which include the City of Miami and Miami Beach.

5. Some informant names have been anonymized.

6. It is important to note that though the general presence of commercial banks in municipal markets decreased over this time period, their private equity branches continued to invest in these markets.

7. Resilience has multiple and competing definitions (Meerow et al., 2016). In the field of urban security, for example, resilience refers to infrastructure hardening to prevent significant disruptions from disaster events such as terrorist attacks (Coaffee and Rogers, 2008). In urban ecology, resilience refers to infrastructural and institutional changes designed to allow a city—taken as a coherent socio-ecological system—to absorb, withstand, and adapt to unpreventable disruptions (Brand and Jax, 2007). The latter understanding has become the basis for mainstream urban resilience efforts, particularly those promoted by the Rockefeller Foundation and the United Nations.

8. See Christophers (2019) for an illustrative example of how existing organizational structures shape what investors take into account regarding climate risk disclosure.

9. Subsequent rating downgrades corroborate this claim: the majority followed hurricane and wildfire damage.

10. For one risk expert, this intelligence derives from remarkably basic questions (personal communication, June 15, 2019). In a survey issued to the City of Virginia Beach Office of Resilience, for instance, Moody's simply asks the City to "discuss sea level rise and other climate risks," leaving the depth of discussion up to the municipal issuer in question (City of Virginia Beach, 2016).

11. One analyst suggested that this is why top-down, federal interventions such as a Green New Deal would help cities maintain their creditworthiness. "State or federal governments have a lot more resources than local governments," this analyst said. "So if vulnerable areas get additional funding for infrastructure to reduce their exposure, that's certainly credit positive for local governments" (personal communication, February 3, 2021).

12. See, e.g., the 2018 *New York Times* op-ed that the Mayor of Miami wrote with former UN Secretary General Ban-Ki Moon about the resilient future that the City of Miami will realize with its "Miami Forever" resilience bond.

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