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Abstract

This paper examines the growing importance of private insurance in urban resilience, drawing on research in three US cities that are bellwethers of climate adaptation: New Orleans, New York and Greater Miami. A number of scholars have suggested that insurance shifts the management of climate risks from governments to *private* actors and places the burden of risk on the shoulders of *individuals*. Drawing on and extending Michel Callon's work on the problematization of climate change, we suggest that such analyses overlook a significant dimension of the insurance industry's role in urban resilience. Namely, the tools and techniques of insurance are increasingly central to the constitution of climate change as a *public* problem that can be addressed by *collective* decision-making institutions.

Keywords: insurance; climate change; resilience; risk society; problematization.

In April 2018, at the annual Forum on Urban Resilience and Adaptation, United Nations Climate Change Executive Secretary Patricia Espinosa

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offered a stark appraisal of the current urban condition. Climate change impacts, Espinosa said, 'are an incredible risk to many cities throughout the world', affecting infrastructure, urban economies and 'the lives of people'. Cities, she intoned, 'are where the climate battle will be won or lost'. The time had thus come to 'build strong and resilient cities', first of all by developing 'the strategic partnerships cities need' to 'make investments toward climate change' (United Nations, 2018). According to a subsequent report on the forum, the relationship between cities and the insurance industry is one such 'strategic partnership'. Given their roles 'as risk managers, risk carriers, and investors', private insurers 'are in a unique position to leverage and incentivize local governments to undertake appropriate preventive measures' (ICLEI, 2018, p. 18). The centrality of insurance in urban resilience has also been emphasized in other major programmes and discussions of urban resilience, from international initiatives to national and local strategies (see, e.g. White House Office of Management and Budget, 2016; World Bank Group, 2016).

This paper examines the growing importance of private insurance in urban resilience efforts, drawing on extensive research in three cities that are bellwethers of climate adaptation in the United States: New Orleans, New York and Greater Miami.¹ A number of scholars (see below) have argued that insurance shifts the management of climate risks from the government to *private* actors and places the burden of such risk on the shoulders of *individuals*. We suggest that such analyses overlook a significant dimension of the insurance industry's role in urban resilience. Namely, insurance and insurantial mechanisms of assessment and risk spreading are increasingly central to the constitution of climate change as a *public* problem that can be addressed by *collective* decision-making institutions, such as city governments and other public agencies.

Our analysis begins from the observation that, notwithstanding confident declarations that cities are key players in the 'climate battle', city governments often lack the knowledge, incentives, resources, or authority to plan or institute resilience measures (Amundsen *et al.*, 2010). Public authorities generally do not have the capacity to model vulnerability to climate change impacts, or to assess the benefits and costs of measures to address vulnerability. Moreover, existing structures and instruments of municipal finance make it difficult to marshal resources for urban resilience measures, resulting in a persistent funding gap in addressing vulnerability to climate change impacts (see, e.g. Cleveland *et al.*, 2019). Finally, elected officials operate in time frames that are not aligned with long-term investments required for resilience and adaptation (Climate Adaptation Summit, 2021).

In this context, we argue, the knowledge practices and risk transfer mechanisms developed in the private insurance industry are playing increasingly important roles in addressing the significant challenges that city governments and other public authorities face in understanding and managing the effects of climate change. First, insurantial modelling and risk assessment tools are providing detailed knowledge about localized risks as the climate changes,

and about the benefits and costs of interventions to address these risks. Second, public authorities are beginning to purchase new risk transfer instruments, such as reinsurance and catastrophe bonds, not only to serve the classic insurantal purpose of indemnification (compensation for loss) but also to fund investments in resilience and provide ready access to funds for post-disaster relief and recovery. Third, the diffusion of financial instruments whose price reflects the risk of catastrophes, including both public and private insurance contracts, is providing city governments with incentives and resources to reduce these risks through a range of measures, from infrastructure investment to household flood-proofing programmes.

Our argument draws from and builds on Michel Callon's (2009) analysis of the 'problematization' of climate change. For Callon, problematization refers to the work that experts, officials, activists and other situated actors do to formulate the inchoate and unqualifiable 'issue' of climate change as a series of 'well-identified problems' that can be 'addressed by planning specific actions' (Callon, 2009, pp. 542–543). Callon focused on carbon markets, a mechanism for climate mitigation (or emissions reduction) that works by 'internalizing' the negative externalities of emissions in the calculations of economic actors. He was thus concerned with the constitution of *market* agencies, specifically, the private actors who buy and sell emission credits. Our analysis, by contrast, focuses on how insurance and insurantal mechanisms are being used to specify resilience to the risks associated with climate change as problems that government officials can address through specific planning and policy measures. Insurance, in this context, is a device for the constitution of *public* agencies.

The first section of this paper situates our analysis in a scholarly literature that has examined how insurantal mechanisms of risk assessment and risk spreading shape basic features of governing in modern societies. Our analysis of urban resilience takes up a specific issue that has been addressed in this broader literature: whether insurantal techniques can be extended to catastrophe risks, including those associated with climate change. A key point of reference in this discussion is Ulrich Beck's (1992a [1986]) claim that catastrophe risk marks a limit of *private* insurance and can only be managed through government intervention. In response to Beck, a number of scholars showed that private insurers have extended coverage to catastrophe risks. Our analysis points to a contemporary dynamic that complicates Beck's account in a different way. Namely, insurantal techniques for assessing and managing catastrophe risk are being used to address the limits of *public* security mechanisms. Building on, but revising, Callon's (2009) work on the problematization of climate change, we trace how, through insurantal techniques, the 'inchoate' issue of urban resilience is being transformed into a set of well-specified (or at least better-specified) public problems.

An important dimension of Callon's work for our purposes is its account of problematization as a contingent and situated process: existing practices and devices are drawn together – based in part on the perceived successes and failures or past programmes and policies – to specify novel issues as problems that

can be addressed through planned interventions. Sections II and III, which present the main empirical analysis of the paper, examine the existing programmes, practices and devices through which catastrophe risk is being assessed and managed through insurantal mechanisms, and show how these elements are being reassembled in initiatives to address urban resilience. Section II focuses on the two largest catastrophe insurance programmes in the United States: the public National Flood Insurance Program and private but publicly regulated wind-damage insurance. Though neither programme focuses specifically on cities, over the last several decades they have generated a toolkit of knowledge forms and governmental devices from which contemporary urban resilience measures draw. These programmes have also generated 'lessons learned' about the unintended consequences and breakdowns of public programmes to manage disaster risks. Even as experts and policymakers work to expand the role of public authorities in managing urban vulnerabilities to climate change, they are preoccupied with the limitations of public risk management, and are seeking to address these limitations by carving out an expanded role for actors in the insurance industry. Section III analyses ongoing urban resilience initiatives in New Orleans, Greater Miami and New York, drawing on scores of interviews with officials, policymakers, experts, activists and community organizers. It describes the three ways, listed above, that insurance and insurantal mechanisms are contributing to the problematization of urban resilience: generating knowledge about future climate risks, providing various forms of risk transfer and creating incentives to reduce catastrophic risks associated with climate change.

Section IV describes the implications of our analysis for broader critical discussions of resilience. A number of scholars have argued that resilience measures transfer the management of catastrophe risks to private markets and shift the burden of security away from governments to individuals. Our analysis points to a more ambiguous story. While the recent involvement of private insurance in urban resilience measures may 'individualize' responsibility for managing risk in some cases, insurantal knowledge forms and risk transfer mechanisms also make it possible for government officials to plan and implement collective actions to address urban resilience and adaptation. In this context, we suggest, the knowledge practices and tools of risk transfer developed in the private insurance industry are not *alternatives* to public intervention but *means* of public intervention. As such, insurance – along with other mechanisms of financial risk assessment and management – is emerging as a key site around which moral and political questions of urban climate adaptation are being worked out.

I. The 'problematization' of climate change: Insurance, risk and security

The analysis that follows contributes to a longstanding scholarly investigation of insurance as a key technique through which modern societies are governed.

Much of this work builds on François Ewald's (1992, 2019) analysis of insurance as an 'abstract technology' that has been actualized in apparatuses that operate both through and outside the formal institutions of government.² Originally invented to address the risks of long-distance trade, Ewald argues, insurance became a paradigmatic technology of liberal government in the late nineteenth century. Private insurance for events such as premature death, debilitating injury, or property loss constituted these events as risks that could be distributed over larger collectivities while simultaneously 'responsibilizing' individuals. A scholarly literature building on Ewald's work has traced how insurantal technologies operate in various governmental apparatuses, analysing the role of risk assessment, rate-making, pooling and marketing in shaping fundamental features of modern government, such as the interplay between the public and private, between the individual and the collective, and between risk and responsibility (Lehtonen & Liukko, 2011).

Our analysis of urban resilience engages with a part of this literature that has examined insurance cover of risks such as floods, fires and terror attacks as a window on the distinctive problems that catastrophes pose to the security mechanisms that have underpinned modern societies. The central point of reference in these discussions is Ulrich Beck's (1992a [1986]) analysis of second modernity or 'risk society'. Beck argued that in contrast to the risks of 'first' modernity, which were relatively predictable and limited in their scope, the threats of second modernity escape established mechanisms of rational assessment and mitigation. Beck repeatedly turned to insurance – and specifically to private insurance – as indicative of the shift from first to second modernity. Insurantal practices for assessing and distributing risk, he argued, could not be applied to catastrophes, due to their uncertainty and potentially unbounded effects. The line between the controllable risks of first modernity and the uncertain threats of second modernity is crossed when the risk becomes 'too large or too unpredictable', and 'the logic of private insurance disengages' (Beck, 1992b, p. 103; see also Ewald, 2002).

A number of scholars have pointed out that Beck's (1992a [1986], 1992b) prediction has not held up. In the last 30 years, private insurance has been extended to catastrophes (Ericson & Doyle, 2004), in part through the development of new techniques of assessment such as catastrophe modelling (Collier, 2008) and alternative risk transfer mechanisms such as catastrophe bonds (Bougen, 2003). Indeed, policymakers and experts have increasingly understood private insurance as a key technique for governing catastrophe risk, as it incentivizes disaster risk reduction and provides compensation for loss (Collier, 2014; Collier *et al.*, 2021). In response, Beck (2009, p. 138) more recently refined his account. While private insurance cover may be extended to catastrophe risk, he argued, it is both 'selective' and 'fragile', characterized by 'simultaneous collapse and expansion'. Insurance companies seek out new profit opportunities by offering coverage for catastrophes, but then experience episodic bouts of insolvency, after which they are bailed out, backed up, or replaced by government programmes.

As we will see, Beck's account of the 'simultaneous collapse and expansion' of private insurance describes an important dynamic in the government of catastrophe risk through insurance in the United States. Natural disasters and other catastrophes have often been followed by waves of insolvency among private insurers, leading to the withdrawal of private coverage in some cases. One result is that private catastrophe insurance is heavily regulated or back-stopped by public authorities, and important lines of catastrophe insurance are directly provided by state or national governments. But the management of catastrophe risk through insurance today has also been shaped by another dynamic not captured in Beck's account, which is particularly important for our investigation of urban resilience in the United States. In the face of mounting losses from catastrophes, policymakers and other advocates of urban resilience are increasingly preoccupied with the limitations and failures of *public* mechanisms – both insurantal and non-insurantal – for managing catastrophe risks. Among these are moral hazards generated by government disaster relief and compensation programmes, bureaucratic delays in the release of post-disaster relief and recovery funds, political difficulties in mobilizing resources for investments in risk reduction, and limited government capacity to assess risk and weigh the benefits of resilience interventions.³ In sum, the dynamic that Beck identified – of episodic crises in private insurance that are met by government backstop and regulation – is today mirrored by growing concern with the limits and unintended consequences of government measures to manage catastrophe risk.

Our argument is not that Beck's story about market failure and a turn to government should be replaced by a story about government failure and a turn to private markets.⁴ Rather, the point is that insurantal knowledge practices and risk transfer mechanisms are being employed in urban resilience initiatives as *means* of public intervention. We analyse this still-nascent process by drawing on Michel Callon's (2009) work on the 'problematization' of climate change. Callon did not use 'problematization' in the common language sense of 'rendering problematic'. Instead, problematization refers to the processes through which an inchoate issue is turned into a series of well-defined problems.⁵ In its 'current state', Callon (2009, p. 542) wrote, climate change is 'an issue that is unqualifiable not in theory but in practice'; it is 'protean, constantly changing as it spreads', and 'no framing is able to embrace it in its entirety'. Through the process of problematization, climate change is 'divided' into more clearly defined problems that can be addressed by 'planning specific actions'.

Callon's (2009) central example – carbon markets – illustrates how the concept of problematization connects to his longstanding interest in the constitution of market agencies or *agencements* (e.g. Callon, 1998). Through caps on overall emissions and the distribution of tradable emissions permits, government regulators force private actors to take the negative externalities of emitting activities into account when making decisions. Such mechanisms structure a choice between different states of the world: engaging in activities that result

in emissions (which require the purchase of credits on carbon markets) or avoiding emissions (which require investment in 'clean' technology, etc.). At the same time, the case of carbon markets also indicates how the analysis of the problematization of climate change suggests a new direction in Callon's work. As Barry (2021) points out, Callon used the concept of 'problematization' in his earlier work on science, but not in relation to government or politics.⁶ By contrast, as is suggested by Callon's reference to the 'civilizing' function of carbon markets, his work on the problematization of climate change marks a new interest in action by political authorities to constitute market agencies in the pursuit of the public purposes of government (Frankel *et al.*, 2019, p. 154), and in marketization, therefore, as a 'political technology' (Gray, 2017).⁷

In important respects, the urban resilience initiatives we analyse differ from the carbon markets that are at the centre of Callon's account. Where carbon markets address climate mitigation – the reduction of emissions – urban resilience initiatives address vulnerability to the effects of climate change. And whereas in the case of carbon markets, experts have worked to problematize climate change by constituting *market* agencies, our analysis of urban resilience initiatives focuses on the constitution of *public* agencies. But Callon's analysis of problematization still offers a valuable guide to our material. For the reasons we have discussed, urban resilience is an inchoate issue in the sense that Callon (2009) has defined this term. The question is how this issue is being transformed into a series of problems on which public officials can act. This is happening in part, we suggest, through insurantal tools and techniques that public officials draw on to model future climate risks; determine how to address these risks through vulnerability reduction measures; weigh the costs and benefits of alternate courses of action; and, finally, take specific actions to implement such measures.

Callon's (2009) analysis of problematization allows us to link the constitution of agencies or *agencements* through insurance to the broader questions that have been raised by literature on insurance as a governmental technology in modern societies. An insurance contract defines a choice situation for an actor. A price for insurance cover is established that is meant to signal a particular level of risk (the likelihood of monetary loss over time) and a particular level of compensation for loss, should it occur. Insurance may be particularly significant in constituting agencies in relation to catastrophes that are rare, uncertain and cognitively distant. Catastrophe insurance structures agents' choices to the extent that its price is tied to decisions a given agent makes (to locate in a flood-prone area, to invest in flood-proofing, etc.). It is crucial that nothing in the description of insurance up to this point suggests that the agencies it constitutes are political or economic, public or private, collective or individual. Rather, as Callon (2009) puts it, the distribution of the political and the economic (and the collective and the individual, etc.) is an *outcome* of the processes of problematization, through which situated actors respond to breakdowns or limits in existing ways of governing and arrange existing elements to address novel issues. Thus, policymakers may respond to 'market failure' in privately

provided catastrophe insurance by creating a public insurance programme, as the US Congress did when it created the National Flood Insurance Program. This programme aimed to constitute *market* agencies by putting a price on the decision to purchase a home in a risky location. Conversely, a diagnosis of the failure of public intervention may spur a turn to financial markets for risk transfer mechanisms to ensure the continuity of government operations following future disasters. Here, knowledge practices and risk-transfer mechanisms developed by the private insurance industry are enlisted in constituting *public* agencies. In sum, Callon's framework offers a way to study the emergence of new forms of governing risk and security by focusing on how novel issues are constituted as problems that are 'manipulable and manageable', with a particular emphasis on the capacity (of government officials, urban residents, etc.) to act on these issues (Callon, 2009, p. 544).⁸

The remaining sections of this paper draw on Callon's framework to analyse the problematization of urban resilience in the United States. Section II describes the existing programmes, practices and devices through which catastrophe risk is being assessed and managed through insurantal mechanisms. Section III shows how, today, a variety of actors are reassembling these elements in urban resilience initiatives in New Orleans, New York and Greater Miami.

II. Governing disaster risk: Catastrophe insurance

This section examines the two largest and most important catastrophe insurance programmes in the United States: the public National Flood Insurance Program and private but publicly regulated insurance for wind damage in the US state of Florida. Neither programme was designed to address climate change, and neither focuses primarily on cities. But both forms of insurance have become central to the constitution of urban resilience as a public problem. First, through ongoing reform of these programmes, officials, policy-makers, experts and private insurance companies have produced a toolkit for framing choice situations in relation to uncertain future catastrophes. This toolkit includes both knowledge practices, such as detailed risk mapping and catastrophe modelling, and technical devices, such as risk-rated insurance contracts and catastrophe bonds. Second, these programmes have generated 'lessons learned' that are shaping how experts and officials design urban resilience initiatives. In both programmes, we see dynamics that were initially similar to those that Beck (1992a, 2009) anticipated in his work on risk society: private insurance markets 'failed' and the public sector intervened. But these public responses have been subsequently criticized for their costs and for the perverse incentives that they create. Today, officials and experts are working to reform public mechanisms, in part by transferring risk to private insurance and reinsurance firms. Due to their growing capacity to assess and transfer catastrophe risk, private insurers and reinsurers have been

taking on such risks, and capital markets increasingly trust the assessment and modelling procedures that the insurance industry employs.

The National Flood Insurance Program

The National Flood Insurance Program (NFIP), created by federal statute in 1968, was the first large-scale catastrophe insurance programme in the United States. Today over five million households are insured by NFIP, with over \$13 trillion in total policies in force (FEMA, 2020). The NFIP generates and disseminates knowledge about risk through a mapping programme that assesses flood heights and frequencies on an address-by-address level, based on climate, flood-plain topology and other factors. The Federal Emergency Management Agency (FEMA), which administers the NFIP, oversees ongoing programmes to make maps more accurate and widely accessible through digitization, data sharing and participatory mapping (FEMA, n.d.). The programme's designers intended to employ such risk maps to shape homeowners' locational decisions through a novel governmental device: insurance contracts whose premiums are calibrated to the specific location (and, thus, the specific risk profile) of structures in a floodplain. The aim, in short, was to frame calculative agencies in relation to flood risk.

The history of the NFIP exemplifies the dynamic that Beck anticipated in his work on insurance and catastrophe risk. Prior to the creation of this programme, private insurers viewed catastrophic flood risk as uninsurable, due to the difficulty of accurately assessing the likelihood and likely impacts of catastrophic floods, and the covariation of risk.⁹ Sporadic private forays into flood insurance markets generally ended in bankruptcy. The public programme – created by an act of Congress in 1968 – was thus designed to address market failure (Collier, 2014). But today, 50 years later, most experts and policymakers are preoccupied not with market failure but with the problems of this public programme. Over the NFIP's history, the rates charged to homeowners in the most flood-prone areas have not reflected technical assessments of risk, in part because the US Congress has been unwilling to impose actuarial premiums on residents. As a result, critics argue, the programme has created a moral hazard: homeowners in flood-prone areas are able to impose the costs of living in a risky location on other policyholders or on taxpayers in general. Contrary to its designers' intent, the NFIP effectively subsidizes floodplain occupancy (Michel-Kerjan, 2010). One consequence of below-actuarial rates has been that indemnification payments from the programme increasingly exceed revenue from premiums. In 2017 alone, the NFIP amassed over \$30 billion in debt following large losses from the hurricane season (Insurance Information Institute, n.d.).

Policymakers have tried to address these issues. Reforms have been repeatedly advanced to make premiums reflect updated risk assessments, most recently through FEMA's 'Risk Rating 2.0' initiative, introduced in March

2019 (FEMA, 2020). Amid continued resistance to such reforms and mounting debts, NFIP officials have worked to ensure the functioning of the programme by shifting some NFIP risk to private markets. For example, Congress recently authorized FEMA to enter into reinsurance contracts so that funds are readily available following future disasters, thereby eliminating the need to await Congressional authorization of bailouts. In January 2017, FEMA announced that it had transferred approximately \$1 billion of NFIP risk to 25 reinsurers, and has purchased similar volumes of reinsurance in subsequent years (FEMA, 2018; Simpson, 2020). This recent turn to private insurance is partly a product of what many observers see as the limitations and unintended consequences of public insurance. But it is also a product of the changing landscape of private insurance. If in 1968, when the NFIP was created, private insurers were unwilling to extend coverage to most natural disasters, today they are increasingly eager to do so, using new tools of risk assessment and risk transfer, particularly those developed in the largest *private* catastrophe insurance pool in the United States: for hurricane-caused wind damage in the American southeast.

Catastrophe modelling and reinsurance: Florida hurricanes

In contrast to flood damage, hurricane wind damage in the United States has been covered by private insurers. But in the early 1990s, a series of hurricanes produced massive losses that bankrupted several insurance companies operating in the key Florida market, and led the remaining companies in that market to drop over 80,000 policyholders. In response, Florida state officials imposed a three-year moratorium on policy cancellations and non-renewals (Insurance Information Institute, 2012). They also created a state-backed insurer of last resort to accommodate high-risk properties that private insurers had dropped following the hurricane. This pool held nearly one million policies at its September 1996 zenith, a massive transfer of risk from private to public insurance.

As with the NFIP, the case of wind damage insurance in Florida seems at first glance to follow Beck's story about the failure of private insurance. But the picture has since changed. First, partly in response to the massive losses and bankruptcies in the early 1990s, private insurers and reinsurers began to base their insurance premiums on risk assessments of proprietary catastrophe modelling services, largely provided by three firms: AIR, RMS and EQECAT. Although such models remain controversial, they are increasingly used for rate-making and portfolio risk assessments (Collier, 2008; Gray, 2021). Second, as such assessment tools have become more pervasive and authoritative – and as massive pools of surplus capital have accumulated globally (Johnson, 2015; Taylor, 2020) – financial market actors have been ever more willing to provide capital through risk transfer mechanisms, such as reinsurance and catastrophe bonds. Brendan Plessis, the Vice President of

Emerging Markets at XL Catlin, refers to this development as a ‘paradigm shift in the insurance sector’, as a result of which capital markets ‘will likely have increased opportunity, and are well-suited to finance risk arising from climate change’ (personal communication, 2 February 2017).

Public officials have responded to this ‘paradigm shift’ by beginning to transfer risk from public pools to private markets. In 2002, Florida lawmakers merged two large public pools to create Citizens Property Insurance (Citizens). This new entity was mandated to maintain actuarially sound premiums in an effort to push policyholders to private insurance policies (Citizens, 2002). Like the NFIP, Citizens has sought to transfer its own risk to capital markets. In 2014, Citizens issued a \$1.5 billion catastrophe bond – at that time the largest ever – as well as \$1.3 billion in traditional reinsurance (Adams, 2014).

To summarize, ongoing reforms of the NFIP and Florida’s wind insurance have produced a toolkit of knowledge techniques and governmental devices for governing catastrophe risk. Among these are risk mapping, catastrophe models, catastrophe risk-rated insurance policies, reinsurance and catastrophe bonds. Moreover, due to the experience of these programmes, policymakers, experts and officials are wary of the limits and unintended consequences of public programmes and are working directly with actors from the private insurance industry to understand climate risks, assess the costs and benefits of interventions, and mobilize resources to address these risks. This does not mean that private actors and interests are displacing public interventions. Rather, as described in the next section, we observe a recalibration of the public and private in light of mounting catastrophic losses, greater confidence in private risk assessment, and new tools for risk transfer.

III. Constituting urban resilience as a public problem

This section turns to urban resilience initiatives in three cities that are bellwethers of urban climate adaptation in the United States: Greater Miami, New York City and New Orleans. These cities are acutely vulnerable to sea-level rise and have recently invested significant resources in formulating and implementing resilience plans. Although city governments have often led these efforts, regional task forces, school systems, utilities and other public authorities, and local social and climate justice organizations have also been involved. Drawing on interviews with city officials, policymakers and insurance industry experts, we outline three ways in which knowledge practices and risk-transfer mechanisms developed in the private insurance industry are being mobilized to constitute urban resilience as a problem on which public authorities can act: generating knowledge about future climate risks; providing new forms of risk transfer; and creating incentives to reduce catastrophic risks associated with climate change by linking premiums for insurance to mitigation measures.

'Knowledge leadership': Maps and modelling

One role of insurantial practices in urban resilience is in the production of knowledge about climate change risks and about the potential benefits and costs of resilience interventions. Such knowledge plays a key role in constituting public agencies by bringing uncertain and cognitively distant future catastrophes into current decisions of city governments and other governmental authorities (Lehtonen, 2016, p. 2). Joyce Coffee, the president of a climate resilience consultancy, refers to this role of insurance as 'knowledge leadership'. For Coffee, such knowledge leadership – rather than risk transfer through insurance contracts – will likely be the most significant contribution of insurance to urban resilience over the next decade (personal communication, 21 March 2017). As one industry analyst described this role of 'knowledge leadership':

The ultimate objective is to give the city the tools it needs to prioritize their own strategies – so what physical adaptation measures should they be spending their time on, where should they be putting their capital dollars, amongst all possible adaptation measures, and then we can see how much it actually reduces risk. (A. Kaplan, personal communication, 29 March 2018)

Our interviews point to many cases in which models and risk assessments provided by insurers and reinsurers played a significant role in making the risks of climate change – and the benefits and costs of resilience measures – intelligible for city officials. For instance, Swiss Re contributed to New York City's resilience plan following Superstorm Sandy in 2012. According to our interviews, the risk assessments that the firm conducted for this report made it possible for city officials to contemplate massive, capital-intensive resilience interventions, such as a flood protection system that will wrap around the lower part of Manhattan. As Mark Way, former Vice President of Global Partnerships of Swiss Re, framed it, 'putting a price tag on the exposure was a catalyst for these truly big ideas. ... Without the numbers we provided, a quantification of that risk, they would have laughed those ideas off' (personal communication, 30 September 2015).

Swiss Re also played a significant role in assessing climate change risks and resilience interventions through its work with the Miami-Dade County Sea Level Rise Task Force. Swiss Re presented catastrophe models that projected a sharp rise in the County's disaster losses in the coming decades. The company also assessed the benefits of a comprehensive programme of adaptation policies, which included grey infrastructure, flood protection, desalination plants and risk transfer. It concluded that by the year 2050, such a programme could avert up to \$30 billion in annual expected losses for the County and its residents, would lower insurance costs in the County (see below), and in some areas would 'avoid or postpone wholesale abandonment due to non-insurability or the high cost of premiums' (Miami-Dade County

Sea Level Rise Task Force, 2014, p. 10). While some resilience officials in Miami note that these models 'serve the purposes of the industry', they characterize their relationship with reinsurers as symbiotic because '[reinsurers] have certain information and we have other information and we both benefit from knowing how they interact' (K. Hagemann, personal communication, 26 June 2018).

Officials in New Orleans also indicated that insurers provide access to detailed data about risks as well as analytical tools required to assess the 'return' on resilience measures. The city's work with Swiss Re, one official told us, helped 'illuminate at a systemic level what some of the issues are, and the order of magnitude' (J. Genova, personal communication, 20 November 2017). Our interviews suggest that advocates of urban resilience initiatives also seek out such assessments to justify projects to both local and federal officials, and to demonstrate to rating agencies that the city is taking meaningful steps to deal with climate risk. As one New Orleans official explained, without authoritative assessments, the city would not be given 'credit' for its resilience actions: 'Do the credit raters and do the insurance markets really understand all of this? ... Do they have ... the understanding of what cities are actually doing to mitigate that risk?' (R. Mast, personal communication, 6 September 2019). In sum, advocates of resilience measures in city governments are using the risk assessments and cost–benefit analyses provided by private insurance industry actors to make the case for public investment in urban resilience.

Financial resilience and post-disaster recovery

A second way that insurantal techniques are shaping urban resilience measures is through new risk transfer instruments that indemnify losses or provide funds to maintain services and finance post-disaster recovery efforts. Our interviews suggest that at present catastrophe bonds are the most widely adopted of these mechanisms.¹⁰ Upon an event of a pre-specified magnitude (defined by wind speed, flood height, etc.), these bonds provide a payout to public entities such as city governments, utilities and school districts and allow for continued financing of vital infrastructures, social services and reconstruction. Some city agencies and actors have purchased these instruments as an alternative to private insurance lines, whose prices are often volatile. Others, meanwhile, are considering using these instruments to address the instability and fragility of *public* relief and reconstruction financing.

Industry experts point to the 2013 issuance of New York City's Metropolitan Transit Authority's (MTA) first catastrophe bond as a pioneering use of this risk transfer mechanism. The MTA's (2013) flood insurance premiums increased dramatically following Hurricane Sandy in 2012. The catastrophe bond, which was designed to supplement existing insurance lines, was

structured to pay out at a certain height of storm surge recorded at monitoring points around New York. RMS, a catastrophe modelling firm, produced models to price the bond. According to our interviews, the bond issuance succeeded because investors 'trusted' the results of catastrophe modelling, reflecting the extent to which this technique has come to be accepted as authoritative (B. Plessis, personal communication, 2 February 2017). Since the cost to the MTA for issuing a bond with a particular payout is tied to expected loss, these bonds also incentivize the agency to institute resilience measures. If the MTA takes steps to protect its infrastructure from future floods, future catastrophe bonds will be less expensive.¹¹ Other public agencies, such as the Miami-Dade County Public School system, are also experimenting with alternative risk transfer mechanisms to address the rising costs of traditional insurance. In response to the increasing price volatility of its existing insurance lines, the agency purchased a parametric policy from Swiss Re to help ensure the continuity of its operations following a future storm (Office of Superintendent of Schools, 2017).

Officials in New Orleans are pursuing alternative risk transfer mechanisms for a different reason: to address the unpredictability of *public* funding for post-disaster reconstruction. As one city official told us in 2017, over a decade after Hurricane Katrina struck, the city still had billions of dollars of federal reconstruction money 'that need[ed] to be released in order for us to be able to execute our projects which are 10 years or even longer old'. In this official's view, the more the City could do to 'create independence from that, the better'. (J. Genova, personal communication, 20 November 2017). As the city's risk manager put it, 'FEMA, they're great, but FEMA doesn't pay quickly. I mean, it could take years and again, that's why insurance is there because we can't wait years to rebuild buildings' (E. Morris, personal communication, 4 September 2019). City officials recognize that work with large private insurers might provoke criticism. But following years of frustration with public reconstruction funds – and given the city's limited ability to pay for post-disaster reconstruction out of its own budget – these officials argued that such mechanisms have to be kept on the table (J. Genova, personal communication, 20 November 2017).

Resilience as a collective interest

A third role that insurantal techniques are playing in urban resilience is in creating a collective interest in directing investments to resilience measures. For example, risk-based rates on broadly held household NFIP policies are designed to push homeowners to undertake *individual* risk-reduction measures such as flood-proofing. But if many homeowners in a city hold such policies, the city government may see benefits to *collective* risk reduction. In the NFIP, a Community Rating System – which allows communities to reduce premiums through actions that mitigate flood risk beyond NFIP's minimum

requirements – incentivizes collective action by local governments (Congressional Research Service, 2021).

We first turn to New Orleans, where insurance rates (for households and the city) and credit risk premiums (for municipal debt) have been central considerations in formulating and implementing resilience plans. In the aftermath of Hurricane Katrina countless uninsured residents abandoned their homes. Population flight and deterioration of the city's fiscal situation prompted a series of rating downgrades that resulted in the City losing access to municipal bond markets (D. Barnes, personal communication, 5 September 2019). City officials hope that by reducing insurance premiums (for the city and residents) and lowering the city's cost of borrowing, investment in resilience is 'going to pay for itself' (R. Mast, personal communication, 6 September 2019). The key initiative that New Orleans officials are undertaking to address rising insurance rates is the Gentilly Resilience District (GRD), funded by the Federal Government's National Disaster Resilience Competition. Most of the \$141 million the city received will be spent on green infrastructure measures to 'reduce flood risk, slow land subsidence, and encourage neighbor revitalisation' by turning portions of canals into public waterfronts and transforming public lands into water absorbing parks (City of New Orleans, 2018). City officials told us that the federal government's methodology for determining the city's community rating guided their investment planning, and that they are eager to ensure that federal officials account for their efforts. As one city official explained to us, in putting together their portfolio of green infrastructure projects, the city

hired a person who basically wrote the [Community Rating System] manual, and said, "hey, can you come in here and review all of our projects" to ensure that they could make the strongest possible argument for an improved rating and lower insurance premiums. (R. Mast, personal communication, 6 September 2019)

Changing premiums on individual homeowner policies are also central to large climate risk reduction projects in the City of Miami. In 2017, city officials formulated a capital finance plan to prioritize spending on flood protection. The Miami Forever Bond, discussed above, provides a first round of financing for these projects. Officials identified reduced insurance premiums and the continued availability of insurance cover as key considerations in selecting projects for bond funding (Robbins, 2017). In November 2017, immediately following Hurricane Irma, Miami voters approved the \$400 million bond, which will finance vulnerability reduction measures such as storm water pumps and neighbourhood sea walls. Wayne Pathman, former Chair of the Miami Climate Resilience Committee, told us that resilient infrastructure projects 'will help in dealing with the insurance world ... which thinks that Miami is at great risk' (personal communication, 22 June 2018; see also Grove *et al.*, 2020).

Beyond this concern with providing community-level risk reduction, city officials also see insurance affordability for low-income residents as a key aim of urban resilience measures. In New Orleans, this issue is particularly salient given the still-fresh memory of Hurricane Katrina, which displaced many longtime homeowners who did not carry insurance and therefore had no money to rebuild. Today, the lowest levels of flood insurance coverage are among low-income residents in some of the most flood-prone areas, leaving these residents exposed to financial ruin and displacement in the event of another large flood. One official told us that many residents are caught in a vulnerability trap. As premiums rise, due to NFIP reforms and changing risk, homeowners try to drop their insurance if they can.¹² If they cannot drop their coverage, they get ‘really burnt on their annual premiums. And when they get an annual burn on that, they’re going to try and … sell their house’. But rising risk and higher insurance rates mean that ‘the value of the house is going to go down over time’ (R. Mast, personal communication, 6 September 2019). In short, homeowners in New Orleans are either stuck with no insurance coverage or with a house they can neither afford nor sell.

In New Orleans and New York, elected officials have identified flood insurance affordability for low-income residents as a key *collective* priority in undertaking urban resilience measures. Some officials accept and even welcome NFIP reforms that will bring rates up to levels that reflect risk, since such reforms can provide a rationale for investing in resilience policies.¹³ But they are also pushing for household-level risk reduction measures and a new system of targeted subsidies to ensure access to affordable insurance protection. In New Orleans, \$7 million of National Disaster Resilience Competition funds are being targeted to flood-proofing the homes of low-income residents through landscaping, home elevation and other measures (LaRose, 2016). In New York, officials point to insurance affordability as a key rationale for flood-proofing measures that target low-income residents. City Council Member Carlos Menchaca, arguing for such measures, referred to flood insurance as a ‘lifeline in vulnerable areas of the city’. Calling on the NFIP to ‘preserve affordability’, he argued that ‘if flood insurance is inaccessible, we will not build a resilient city especially for low-income New Yorkers for whom flood insurance is already an extreme burden’ (City of New York, 2017).

IV. Insurance and the politics of resilience

What are the implications of our analysis for broader discussions of the politics of resilience? Over the last decade, a significant body of scholarship has argued that, as Walker and Cooper (2011, p. 144) put it, resilience is a ‘mode of governance’ that has an ‘intuitive ideological fit’ with what they refer to as ‘neoliberal philosophy’. This scholarship argues that resilience transfers risk from governments to private markets and shifts the burden of security to individuals (Evans & Reid, 2014; Leitner *et al.*, 2018). A number of scholars have analysed

insurance and other financial mechanisms in light of this broader diagnosis. O'Hare *et al.* (2016, p. 1176) argue that 'insurance represents an outsourcing of resilience to the private sector, where risk management is privatized and commodified'. Lucas and Booth (2020, p. 2), meanwhile, suggest that the insurance sector is 'instrumental in the shift to a market approach to adaptation'. They understand insurance as part of a broader 'neoliberal governmentality in which individuals are positioned as responsible for climate change' and in which 'non-market solutions' are '[shut] out of consideration' (Lucas & Booth, 2020, p. 7; see also Christophers, 2019).

Such analyses are hard to reconcile with the roles that insurance is playing in the urban resilience initiatives in New York, New Orleans and Greater Miami that we have discussed. It is true that, in some instances, insurantal mechanisms transfer risk to private markets or individuals. But public officials in these cities are not 'outsourcing' resilience in a way that precludes consideration of 'non-market solutions'. Rather, we have argued that in the United States, the multi-decade experience of such non-market 'solutions' has led policy-makers to look to the tools and techniques of private markets as *means of* public intervention. Moreover, in the cities we examined, insurantal techniques are being mobilized in interventions that collectivize and *de-commodify* risk, whether through investments in infrastructures that provide security as a public good or through programmes to reduce insurance costs for low-income residents.¹⁴

The question nonetheless remains: what sorts of collective goods and what kinds of public interventions are officials pursuing as they institute resilience measures that draw on the tools and practices of insurance? Some scholars have suggested that, with its emphasis on compensation for loss, insurance is largely conservative, working to restore and preserve existing systems and structures. Thus, O'Hare *et al.* (2016, p. 1176) write that the 'ambitions of insurance as a mode of resilience are overwhelmingly stability orientated, rebounding to a preshock "normality" where risk is absorbed by a system, but rarely avoided or reduced'. Here, too, our analysis complicates the picture. In New York, New Orleans and Greater Miami, insurance and other practices of financial risk assessment are among the 'first movers' in transforming many urban systems (such as property markets and land use) in anticipation of the effects of climate change (see, e.g. Cox, 2019; Lucas & Booth, 2020). On the one hand, these changes in financial risk rating and management are pushing cities to address climate vulnerability. As one risk management expert told us, market concerns about climate risk – as reflected in insurance premium hikes, property devaluations and bond rating downgrades – are forcing cities to grapple with the economic consequences of climate change 'long before [cities] are properly wet' (D. Stander, personal communication, 14 June 2019). On the other hand, in a context in which cities are struggling to act on climate risks, insurantal knowledge practices and risk transfer mechanisms are providing tools to assess such risks and to plan and finance interventions to address them.

Of course, the recent developments we have described in New York, New Orleans and Greater Miami – and in US catastrophe insurance more broadly – are not necessarily typical. Given their massive exposure to the effects of sea-level rise, coastal storms and pluvial flooding, these are among the first US cities that are being forced to address vulnerability to climate change. Moreover, the mechanisms of financial risk assessment (such as bond rating) that have driven many of the major resilience interventions we have examined are particularly widespread in the United States. In other countries, these mechanisms are generally less prevalent, though they are spreading rapidly as losses from catastrophes mount, and as governments and insurance industry actors anticipate even greater losses with a changing climate.¹⁵ Our suggestion is that as bellwethers of climate change and climate adaptation in a country with a long history of publicly and privately provided catastrophe insurance, these cities may not be typical so much as they are exemplary. The governmental forms and political problems that we already observe in New York, New Orleans and Greater Miami may presage processes that will take shape around the world in coming years. In these cases, we see a dynamic interplay between government intervention and the ‘simultaneous collapse and expansion’ of private catastrophe insurance that will likely transpire in other countries. These cases show us how rising insurance premiums are changing urban land use patterns and property markets, and how local governments may respond to such changes. And they suggest how some of the crucial moral and political questions around climate adaptation – relating to the distribution of security, vulnerability, risk and responsibility – will be worked out through the technical details of insurantial risk assessment and rate making.

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Notes

1 Greater Miami includes the City of Miami, the City of Miami Beach and other municipalities in Miami-Dade County.

2 In the US context, the term ‘state’ is not generally used to refer to the organizations engaged in the exercise of political sovereignty, which are more commonly referred to as ‘government’. Instead, ‘state’ refers to a particular territorial scale in the US federal system. We use ‘governing’ or ‘technologies of governing’ to refer to the functions

analyzed in the Foucauldian literature on governmentality – which operate both through and outside the state – and limit use of the substantive ‘government’ to the actual institutions of public administration, whether these are territorial-administrative entities or public authorities, like a power or water utility.

3 This concern with the breakdowns and unintended consequences of government measures to manage catastrophe risk parallels a broader tendency described by Baker and Simon (2002, p. 4) in their analysis of ‘embracing risk’.

4 On this point, our account is in tension with scholars who associate the increasing prominence of insurance with a broad turn to market-based forms of adaptation, and consistent with the account of Baker and Simon (2002) who also argue that recent changes in risk governance cannot be understood simply as a matter of ‘more market, less state’. See Section IV of this paper.

5 Problematization might include the calling-into-question of existing practices and understandings (e.g. Bridge *et al.*, 2020). But Callon’s (2009, p. 544) emphasis is elsewhere: on the ways that undefined issues are made ‘manipulable and manageable’. Although pitched at a different register, this emphasis in Callon is resonant with Foucault’s definition of problematization as ‘the ensemble of discursive and nondiscursive practices that make something enter into the play of true and false and constitute it as an object of thought (whether in the form of moral reflection, scientific knowledge, political analysis, etc.)’ (quoted in Rabinow, 2003, p. 18; see also Koopman, 2013).

6 The task of linking Callon’s analysis to government and politics was taken up by a number of other authors (e.g., Barry, 2002; Marres, 2007; Mitchell, 2008). On this point see Barry (2021).

7 Callon *et al.*’s (2009) *Acting in an uncertain world*, published in the same year as the essay on carbon markets, indicates a more general concern with the governmental and the political.

8 In this sense it provides useful tools to address a tendency in some studies of ‘governmentality’ to treat governing as a kind of impersonal and agent-less process, and to portray history in terms of a succession of forms of ‘governmental rationality’ rather than in terms of contingent, situated processes (see Collier, 2009).

9 Covariation refers to situations in which many policies in an insurer’s portfolio are exposed to a single event.

10 For a description of catastrophe bonds, see Bougen (2003) and Johnson (2015).

11 Yields are beginning to decline as the MTA undertakes vulnerability reduction initiatives (Artemis, 2017).

12 Homeowners with federally insured mortgages must carry flood insurance, though compliance rates are low.

13 This is not true in all cases – some officials have sought to defend existing subsidies that benefit their constituents (see Elliott, 2021).

14 Our claim is not that our findings point to a better definition of resilience. Rather, we follow Anderson (2015) and Grove (2018), among others, who suggest that resilience has no inherent ontology or politics but may take diverse forms and be mobilized in various political projects.

15 Our case stands in contrast to Lucas and Booth’s (2020) account of Australia, where catastrophe insurance is dominated by private providers. Lucas and Booth report that government ‘solutions’ are now being considered in Australia in light of persistent

market failure, a development we might expect given Beck's (1992) theoretical analysis and our empirical account of the US case. Indeed, we would anticipate that the future of Australian catastrophe insurance will look more like the US case, rather than the other way around.

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