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Keenan, Jesse; Chu, Eric; Peterson, Jacqueline

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**From Funding to Financing:
Perspectives Shaping a Research Agenda for Investment in Urban Climate Adaptation**

Abstract: There is growing recognition of the importance of funding and financing arrangements to enable climate change adaptation in cities. However, there has been little critical analysis into the underwriting and governance mechanisms necessary support broader scaled application. Through surveying recent literature, this article offers conceptual clarity for understanding emerging adaptation finance mechanisms that intersect with urban governance, planning, and management functions. The article assesses two key conceptual domains: (i) the distinction between adaptation funding and financing and (ii) the synergies, conflicts, and trade-offs associated with mobilizing adaptation investments in the private sector. The article argues that a clearer delineation of these two domains will clarify the objectives, mechanisms, and larger governance implications of investment in urban adaptation. This article provides a roadmap for future scholarly inquiries that may advance the conceptual and analytical discipline necessary to evaluate the feasibility and desirability of investments from often-conflicting perspectives, interests, and actors.

Keywords: Climate change adaptation; cities; adaptation finance; funding; urban governance; social equity

1. Introduction

Many cities across the global North and South are resourcing adaptation interventions and projects that seek to address climate change impacts (Revi et al. 2014). Early literature focused on the importance of garnering political recognition of the issue; building effective science-policy coalitions; designing participatory arenas to account for differential interests; and delineating how the governance of adaptation intersects, overlaps, or contradicts with concurrent urban development priorities (Carmin et al. 2013). This literature spoke to addressing scientific and social uncertainty in developing adaptation policies (Carmin and Dodman 2013; Chaffin et al. 2014); articulating beneficiaries of adaptation plans (e.g., UNFCCC 2011); and circumscribing political agents and interest groups in pipeline and forthcoming adaptation strategies (Chu et al. 2016). Previously, these research priorities were important because climate change was a politically contentious issue, while knowledge of potential impacts was comparatively low. Likewise, it can be argued that the costs of such adaptation were assumed to be borne by existing conduits, market mechanisms, producers, consumers, and taxpayers that balance current flows of capital with urban agglomerations. This assumption is now highly contested due to the efficiency, effectiveness, and fairness of relying on contemporary urban economic structures that are often blamed for perpetuating existing affordability, accessibility, and inequality challenges.

Over the past decade, scholarship on urban climate adaptation has increased exponentially with many studies providing empirical cases on existing approaches, diagnosing governance deficiencies, and highlighting the justice and equity implications of proposed interventions. The emergence of case studies and analyses of broad trends have informed different implementation approaches, and many of these studies highlighted issues of funding as a central constraint to sustained action (Flåm and Skjærseth 2009; UNEP 2016). These constraints stem from a recognition that adaptation requires resource-intensive maintenance or upgrading of existing infrastructure and that local governments tend to be cyclically resource-constrained (Ayers 2009). As a result, much attention has been placed on the role of private, philanthropic, and multilateral agents to support adaptation in cities where public sources of capital have fallen short. These sources often seek to bypass the institutional requirements associated with public funds while allowing for flexibility and autonomy to more comprehensively address multi-sectoral climate and development priorities. At the same time,

however, many non-state funding sources have been critiqued for unclear accountability mechanisms, opportunities for elite capture, and limited capacities to provide consistent and sustained funding flows over time (Chu 2018). Although the diversity of funding sources and financing arrangements have catalyzed numerous opportunities for cities, this has also created confusion due to differences in how different funders quantify adaptation needs, delineate financing mechanisms, regulate accountable schemes, and support long-term public service provision. Despite the importance of funding and financing arrangements to cities' adaptation strategies, there has been little analysis of the structural incentives and governance implications associated with the adaptation funding and financing mechanisms themselves.

This article offers conceptual clarity for understanding emerging adaptation finance mechanisms that intersect with urban governance, planning, and public management functions. The article explores the particularities of adaptation finance by assessing two key conceptual domains prone to undisciplined analysis and theoretical oversight: (i) the distinction between adaptation funding and financing; and (ii) the synergies, conflicts, and trade-offs associated with mobilizing adaptation investments in the private sector. A clearer delineation of these two conceptual domains will aid in clarifying the objectives, mechanisms, and larger governance implications of funding and financing climate adaptation in cities. To this end, this article provides a roadmap for future scholarly inquiries that may advance the conceptual and analytical discipline necessary to evaluate the feasibility and desirability of adaptation investments from often conflicting perspectives, interests, and actors.

2. Conceptual Distinctions in Urban Climate Adaptation Investment

For many cities, the question for adaptation is often framed in terms of absolute amounts of funding available for initial investment. This stems from a tradition of general resource deficiency, often attributed to local political corruption, short-term discretionary preferences among elected politicians, inadequate intergovernmental transfer pathways, lack of local taxing powers, or a persistent deconstruction of public governing functions. Such structural constraints create a governance context in which cities are reliant upon external actors—including non-state, private, and multilateral agents—to support general development functions (Bulkeley and Betsill 2005). Within the context of the political intersection of disaster, climate change and international development, these multilateral agents include not only national but also global

actors, including foundations, non-governmental organizations and private sector conglomerates (Bulkeley and Betsill 2013). As climate adaptation requires multi-sectoral networking, long-term engagement, and sourcing reliable intelligence models, cities are reliant (or even dependent) on external support (Carmin et al. 2013). In this context, climate adaptation is seldom high on any spatial or capital planning agenda, or, if it is, adaptation plans are often small-scale, episodic, or otherwise opportunistic in generically addressing other challenges such as those concerning affordability and mobility, as found among the development-driven framing of urban resilience (Chelleri et al. 2015). This reflects the institutional prerequisites of many funders who tend to focus on projects with short-term quantifiable results, a high cost-benefit ratio, clear social impact potential, and, at times, a structured strategy for future investment (Chu et al. 2017). However, for cities that are recipients of such forms of external support, the episodic and impacted nature of adaptation funds yield uncertainties around long-term skills building, internal bureaucratic capacity, and the ability to account for inter-generational and multi-scalar collective interests. In the case where adaptation interventions have been designed with their investment potential in mind, questions have emerged regarding the fairness of who pays, who benefits, and who participates in the process (Burton and van Aalst, 2004; Tanner et al. 2017).

In this section, we offer two concepts to unpack the governance ambiguities associated with urban adaptation finance. First, a conceptual delineation between adaptation funding and adaptation finance is proposed to distinguish between the quantitative components of funds versus the operational components of administering and accounting for such funds. Second, the tensions inherent in advancing market-based private sector investment in climate adaptation are highlighted to illustrate the range of synergies, conflicts, and trade-offs that shape the political landscape for the allocation of limited resources in both the public and private sector. These conceptual distinctions illustrate the sensitivity of adaptation finance to government incentives and structural forces, which in turn allows for clarity surrounding the roles, functions, and implications of adaptation finance in urban contexts.

2.1 From Funding to Financing

Funding may be defined as direct payments made by, often local, public and/or private actors for the purposes of investing in preparation for or response to climate change impacts. By contrast, financing includes the utilization of market-based instruments that may or may not utilize third-

party funding as a means to leverage what is otherwise underwritten to be an independently feasible project investment. The categorical distinctions between funding and financing offer the requisite sensitivity to understanding the trade-offs that come with the associated delivery models of either funding and/or financing adaptation investments. Both concepts represent latent economic belief systems that mirror different models for the determination and pricing of risks and returns, as well as the determination of who benefits and who pays. Investments in climate adaptation occur at a variety of scales among a variety of actors with often divergent interests. The challenge is to find alignment of these interests in a manner that allows for the aggregation of capital necessary to make adaptation investments that serve the requisite goals of reducing social vulnerability and biophysical exposure, as well as taking advantage of the relative opportunities associated with transformative adaptation of societies and markets.

Most investments are not undertaken in the name of adaptation for purposes of reducing vulnerability and exposure, but, rather, they are incidental to regularized behavior (Brugmann 2012; Wright and Nyberg 2017). Like many economic transactions, these investments are based on incomplete information and often represent some measure of informational asymmetry that drives game playing (Caparrós et al. 2004). However, as greater awareness of climate change impacts are diffused across economic actors, this awareness is shaping preferences that include a range of motivations for facilitating adaptation investments (Ford et al. 2011). For some actors, *ex ante* adaptation investments are a function of managing risk that operates on the margins of a portfolio of assets (e.g., multi-national corporations). Yet, for others, *ex post* adaptation investments are necessary for the maintenance of fiscal and financial solvency (e.g., small municipalities). Absent such investments, some actors are destined for bankruptcy, dissolution or state receivership.

The historical development of adaptation funding and financing has largely tracked the discourses of sustainable development (Bouwer and Aerts 2006) and has been understood within conventional international conduits for international development (Biagini et al. 2014). However, in recent years, adaptation planning regimes have matured to the extent that there is now a greater focus on implementation (Woodruff and Stults 2016), including the financing and funding of adaptation investments (Moser et al. 2017; Runhaar et al. 2018). The reference point of ‘funding’ adaptation has been expanded to include the ‘financing’ of adaptation with the implicit assumption that the scale of investment necessary for societal adaptation is beyond the

capacity of either the public or private sector in isolation. Likewise, this diversity of language acknowledges not only a capitalist realism point of view (Shonkwiler and La Berge 2014), but it also acknowledges that local sources of capital are often inadequate to accommodate local needs (Ayers 2009). In many ways, this state of under-capitalization has provided the impetus for broader global agreements concerning the equitable distribution of adaptation investments, particularly in and among countries who disproportionately bear the consequences of climate change impacts relative to their own contributions (Ciplet et al. 2013).

While there has been some innovation in the development of conduits (e.g., development banks, international funds) and products to finance adaptation, it can be argued that the underlying mechanics of the financing are fairly conventional. The core challenge involves the assumptions and models associated with credits underwriting that recognize and realize associated risks and benefits that accurately price investments (Keenan 2018). In this sense, capital structures for project finance are still defined by allocations of debt and equity. There is nothing particularly innovative in discrete terms about adaptation financing other than the novelty of the intent of the investments in terms of sources and uses. As such, the language of adaptation financing is fundamentally more about a new form of capitalism often associated with disaster capitalism (Klein 2007, 2015). Within the context of public investment, some have argued that a framing of the necessity of private capital mobilization is a ‘slippery slope’ to a neoliberal manifestation of public-private partnerships that have been observed to prioritize profitability over the maximization of social welfare (Leigland 2018).

Considerations of social welfare are subject to a certain paradox concerning the nature of the cost burden of who pays and who benefits from adaptation investments (Sovacool et al. 2015). The paradox is center on the proposition that one will pay for the costs of climate either through taxes or through market prices—or, in the most wicked but realistic of scenarios, both. This paradox of adaptation costs suggests that among alternative adaptation investment options, there is almost always the option of doing nothing and maintaining the status quo. This might be an acceptable adaptation strategy if a real options analysis—among other approaches—is undertaken to estimate the costs and benefits of maintaining flexible pathways in the face of uncertainty (Buurman and Babovic 2016; Ryu et al. 2018). However, this might be an incomplete methodological approach given limited information. Inherent in this paradox is that households will bear the costs of adaptation one way or another, either as consumers or

taxpayers. Private adaptation costs are imposed even in the face of public inaction. It can be argued that the greater the degree of inaction, the greater the extent to which private markets are left to determine the distribution of costs and benefits in their own sectorial adaptations. In theory, *ex ante* adaptation by public actors allows for the opportunity to more widely distribute costs and/or to cross subsidize households of lesser means through the redistribution of resources (Paavola and Adger 2006). By this logic, public actors are incentivized to crowd out or regulate some market activities in order to set the course for the distribution of costs and benefits, even if that means public investments and adaptation activities are not as efficient or effective as private markets who arguably yield greater capacities for the intelligence necessary to price risks. The counter point is that private markets yield no real net advantage because both public and private actors are subject to moral determinations of resource distributions by political processes even though they are not equivocal in their intent to reduce social vulnerability and environmental exposure.

Distinctions between public and private sources of capital for adaptation investments are perhaps illusory by some measure given the dominant role of global capital markets for municipal bonds and sovereign treasury debt in the determination of relative economic capacity (Ladeur 2004; Chorafas 2009). By extension, financial analysts in London or New York will often have as much impact on the determination of the viability, scale, and scope of an adaptation investment than a local or state government. Global climate accords have sought to utilize transnational subsidization as a means to restore some measure of sovereignty — an intent often hidden in the language of adaptive capacity building (Ciplet and Roberts 2017). Likewise, with a growth (as opposed to de-growth) framing of development economics, both public and private actors are united in their ambition to create value from adaptation investments (Dodson 2017). They only differ in the extent to which they seek to capture and redistribute elements of that value. However, inherent in that value creation and capture is some measure of exploitation and extraction consistent with the aforementioned paradox of adaptation costs.

Aside from the interactions between public and private actors, existing research suggests that the dichotomy between developed and developing sources of capital is increasingly irrelevant, as domestic sources of capital have often been adequate in their availability and competitive in their pricing to accommodate local adaptation investments. In one example, according to an anonymous interviewee from a United Nation's fund, a global adaptation

focused fund (with a near 0% cost-of-funds) was outbid by a regional deposit bank in Africa that offered a more competitive debt product in terms of pricing and loan terms. To the contrary, many have argued that it is not a lack of capital that is preventing the development and advancement of new assets classes, products, and services to accommodate adaptation. It is in fact attributed to a lack of projects. If this is the case, the question is whether there is an absolute lack of project development or a lack of projects that fit within the parameters of conventional underwriting? If it is a lack of project development in absolute terms, then the question is whether it can be explained by a lack of institutional and regulatory innovation; political will or moral authority; and/or, early stage financial resources necessary for project development?

These questions are central to a future research agenda in adaptation investment. By some measure, the distinctions between funding and financing are defined by coded language for economic views of the world by and between public and private actors that are unified by a certain paradox of who really pays for the costs of adaptation and under what terms. A capitalism realist perspective would suggest that highly regulated markets are the most efficient, effective, and maybe even ethical pathway for value creation that yields negotiated returns in terms of co-benefits that inure to private investors and the public interest (Bloom 2017). This negotiation of limited returns for purposes of mutual public and private interests has a well-developed history prior to the waves of deregulation that accompanied globalization. In the U.S., in particular, limited return corporate entities were established that were allowed to gain access to a market or otherwise maintain a monopoly in favor of limited returns. This may well prove to be an adequate governance and financial conduit model for mobilizing private capital for the benefit of the public good. It more or less depends on the relative negotiating power of the respective parties. If the private sector yields too much power, then limited return vehicles may simply be illusory to more contemporary public-private partnerships where the public sectors serve as the ultimate backstop. However, with a strong regulatory position, the public sector could create a platform by which products and services could be regulated in order to maximize the distribution of resources in a manner that serves equitable ends as determined by public authorities and electorates.

The procedural justice sensitivities associated with methodologies in the assessment of vulnerability and corresponding investment underwriting are a critical knowledge gap. This article seeks to provide some sensitivity in this regard as it relates to governance and planning.

Arguably, this is a necessary step in the development of more resolute and feasible projects that are able to feed a pipeline necessary for the scaled development of efficient capital allocation. However, from another perspective, the distinction between funding and financing highlights a variety of moral and ethical challenges that are somewhat external to the interests of current constituencies—that is the welfare of the present generation. The proposition for funding adaptation belies as a present value commitment to bear the responsibility and oversight of adaptation needs and interventions. The fundamental problem of adaptation financing is that one runs the risk of passing along greater and greater debt burdens to subsequent generations. To complicate this problem, the present determination of what to invest in and what to de-invest in are clouded by present interests that are likely to be quite different from those in the future.

These current adaptation pathways will be reinforced by sunken capital and other allocations of financial, human, and environmental capital that will reinforce stationarity in any given geography, settlement pattern, or economic mobilization. As an additional stressor to these stable regimes (e.g., economic returns or social welfare outcomes), the very concept of stationarity in deterministic assignments of net present values is undermined by the inherent variability associated with climate change outcomes and direct and indirect impacts (Downing 2012). The broader analytical concept of path dependencies in adaptation investments is grossly under-developed in both scholarship and practice (Buurman and Babovic 2016; Manocha and Babovic 2017). However, there are early signs that such analyses are beginning to inform credit rating agencies in their determination of debt capacity and creditworthiness.

Moving forward, it is critical that distinctions and elections be made between funding and financing. Thinking about the various pathways is critical not simply for project development but also for a long-term strategy that balances efficiency, effectiveness, robustness, and the corresponding assignment of who bears what costs and benefits over what time horizon. Financing offers short-term access but arguably less control over the long-term. Funding offers a present commitment that may galvanize a broader political and fiscal commitment, but it might be inadequate to address the scale of the problem absent interventions by the private sector. The trade-offs between these categorical framings are key to the development of projects and policies. In the interim, it is critical that we create sensitivities to these trade-offs and are able to communicate them to relevant stakeholders so that they can make better informed and more equitable decisions concerning their adaptation investments.

2.2 Trade-offs for Mobilizing Market-based Investments

The conventional discourse observes that traditional investment principles and assessment criteria – such as return on investment (ROI) or cost-benefit analysis (CBA) – are challenged to fully capture the long-term and often non-monetary benefits of climate adaptation. As such, they often fail to incentivize scaled private investment. Public interventions are thus common, even if they are incomplete or under-scaled. Still, the incentives and criteria guiding these investments can be vague, contested, and potentially inconsistent with desired publicly determined outcomes. Furthermore, while investment dynamics differ in the global North and South, they are rarely theorized in a comparative context. Doing so highlights key challenges and tensions common across the climate adaptation investment landscape.

Investments are generally assessed based on anticipated returns and the accrual of appreciable, stable, and liquid value. Private firms will tend to prioritize profits or increased productive capacities, whereas public entities may place greater emphasis on balancing broader social, economic, and development gains. However, the reality is not so simple, as the purchasing power of public actors are often dependent on market assessments. Likewise, private sector actors increasingly seek to diversify portfolios that are inclusive of optimizing social and environmental welfare through impact investment (Tompkins and Eakin 2012; Harman et al. 2015).

All investments entail degrees of risk and uncertainty, which are modeled and underwritten by insurers and other financial institutions accordingly. Investments in climate adaptation, however, typically have longer maturities, higher levels of both risk and uncertainty, and limited immediate returns. While adaptation investments are designed to reduce the probability of future economic and property loss, they rarely have the immediate productivity gains or revenue streams associated with other (development) investments, which may discourage venture capital and other private investors. Traditionally, firms are reluctant to innovate and invest in new technologies when returns are both incremental and uncertain, especially if liquidity options or exit strategies are limited (McDonald and Siegel 1986).

When assessing the investment incentives for climate adaptation initiatives, it is important to distinguish investments in adaptation from investments in climate mitigation. The two sets of investments are of course linked (indeed many of these investments are funded

through the same global funds such as the GCF or CIF), but they are subject to different sets of investment incentives. Specifically, investors in climate mitigation can draw on carbon markets and can often expect immediate returns. This timing problem was highlighted by the proposition that “[t]he broader economic problem with adaptation investments is that, unlike clean energy, they reduce the risk of future losses but do not generate substantial cash flows or innovation... In fact, almost all the economic benefits documented [among climate investments] were associated with energy efficiency rather than resilience” (Wissman-Weber and Levy 2018, p. 509-510). In this regard, the lack of a clear measurement for many potential post-adaptation investment outcomes is a significant course of unmanaged risk for investors.

Since the benefits associated with climate adaptation projects stem primarily from avoided losses, accurately calculating vulnerability – i.e., exposure to hazards vis-à-vis adaptive capacities – is central to properly assessing the value of such investments (Smit and Wandel 2006). However, climate change risk and vulnerability are difficult to fully measure and often go underestimated (Kaufman 2014; Thornton et al. 2014). Assessments of vulnerability to natural hazards often focus on monetary factors and are evaluated on expected annual damages (EAD). However, these models fail to fully capture “risk aversion, impacts on household incomes, equity, and social vulnerability” (Kind et al. 2017, p. 2). Recognition of the growing vulnerability of marginalized communities to the effects of climate change has led to the development of new models and frameworks designed to integrate equity and social welfare concerns into risk assessments (Heltberg et al. 2009; Islam et al. 2013; Kind et al. 2017). Subsequent evidence has shown that international funds, such as the Least Developed Countries Fund, do in fact consider equity and efficiency when making adaptation investment decisions (Chen et al. 2018). However, equity is oriented in favor of procedural engagement and not necessarily an equitable redistribution of resources as a matter of policy.

Given the uncertainties involved in assessing vulnerability, data is especially important — and yet often unavailable. The data that does exist is increasingly developed for the benefit of proprietary analysis of private actors. Improved data and climate monitoring is necessary to better assess vulnerability and account for the impacts of climate variability on different factors, including social welfare (Thornton et al. 2014). Still, despite advances in the modeling and assessment of vulnerability in recent years, it is questionable how compatible these criteria are with investment opportunities and established assessment processes. While public or non-profit

entities may be able to account for a broader range of vulnerability factors in their investment criteria, there is less incentive for private investors to do the same.

Of course, private actors do have incentives to invest in climate adaptation. Privately owned assets may be at-risk from the effects of climate change, requiring upgrades and additional capitalization in terms of responsible asset management. Institutional investors have become increasingly concerned about the impact of climate change on their investments, leading to the establishment of groups such as the Carbon Disclosure Project (CDP) and Investors' Network on Climate Risk (INCR) to more accurately assess and screen the risks and opportunities associated with their investments, particularly when it comes to municipal bonds, infrastructure funds, real estate, and the like (Herweijer et al. 2009). At the same time of course, many real estate investors may be more concerned with 'flipping' properties than making long-term investments in their assets' adaptive capacities (Wissman-Weber and Levy 2018).

Climate change is increasingly being integrated by insurers as part of their assessment criteria, providing firms and individuals with incentives for making investments in climate adaptation —often to reduce exposure and buy down risk. Given the costs and uncertainties associated with adaptation investments, the insurance industry is acutely impacted by climate change and can play an important role in shaping the investment landscape. Herweijer et al. (2009) note that “adaptation, or lack thereof, is particularly critical to the insurance industry as it directly affects the very core of their property and casualty businesses; the risk landscape that they insure and the concept of ‘insurability’ itself” (p. 360). This, in turn, can impact underwriting and asset management practices, as well as the very “affordability and availability” of coverage (ibid.). These concerns may lead the insurance industry to become more directly involved in policy advocacy and more engaged in heightening public risk awareness, as well as leading large insurers to invest directly in climate adaptation technologies (Herweijer et al. 2009; Starominski-Uehara and Keskitalo 2014). The insurance and reinsurance industry has the capacity — in its ability to set price signals — to incentivize broad public behavioral change towards more climate-aware practices (Johnsgard 2012). However, as the costs associated with climate change rise, insurers may find it ultimately too expensive to provide coverage, leaving governments as insurers last resort (Starominski-Uehara and Keskitalo 2014).

While the private and public sectors may make investments in climate adaptation independent of one another, their actions are typically closely intertwined. Governments will at

times prioritize and fund investments outright, yet they frequently seek private partnerships and financing to support their initiatives. Similarly, private investment often hinges on public interventions to reduce risk and increase the profitability and viability of climate adaptation investments. Indeed, public interventions and changes in public policy are frequently applied in order to overcome the investment challenges highlighted above and create a more attractive investment climate for private investors. Different financial actors are often better poised to invest in different ways and at different stages: public grants, philanthropy, and “angel investors” maybe needed in the initial stages of technological development in order to reduce risks and costs of capital prior to the entrance of venture capital, private equity, and various institutional investors (Brown and Granoff 2018). Public interventions can take various forms – research and development (R&D) can help accelerate investments. Evidence has shown that investments in R&D in the global North can provide “spillover” benefits to the global South (Aghion and Jaravel 2015). Public subsidies can also be used to reduce private sector costs and encourage competition (Bodnar et al. 2018). Still, while numerous funds and market mechanisms are in place to encourage investments in climate mitigation (see Bodnar et al. 2018), there has been considerably less development with respect to developing similar instruments for climate adaptation (Schultz 2012).

In many cases, investments in climate adaptation are driven primarily by higher levels of government, and – especially in the case of the global South – by transnational organizations and multilateral development agencies. Funding from these groups, when available, is often provided in the form of concessional loans or (conditional) grants, where investments are evaluated and funds are distributed based on a range of different criteria (Hallegatte et al. 2012). Main multilateral climate finance actors include the Green Climate Fund (GCF), Climate Investment Funds (CIF), and Adaptation Fund (AF), among others. Grants may also be available for adaptation investments in the global North (examples include Canada’s Municipalities for Climate Innovation Program or through the European Structural and Investment Funds). The involvement of higher levels of government and outside agencies can also serve to improve local capacity and attract private investment. In the global South, for instance, multilateral agencies will often provide public investment guarantees to investors willing to issue loans or buy bonds (Kaul and Conceição 2006). Concessional financing in developing countries may help unlock

‘climate-smart’ investments that may be too risky for private investors, but that may have the capacity to advance new technologies and markets.

Climate finance is governed differently in the global North and South, yet there has been little comparative analysis on the implications of these different dynamics on adaptation investment outcomes. While governments in the global North have a number of tools at their disposal to spur investments in climate adaptation, the global South faces challenges when it comes to liquidity and investor confidence, particularly given low fiscal capacities and limited access to markets and other financial resources (Milner and Dietz 2015). Small firms or localities may be unable to borrow from banks to make necessary investments. While global North firms may find access to risk capital particularly challenged in a highly regulated environment that seeks to minimize and mitigate risk taking. In addition to the challenges inherent in attracting climate adaptation investment, the global South faces information barriers and currency-related and regulatory risks (Kaul and Conceição 2006). These challenges are compounded given that those that are most vulnerable to the effects of climate change are likely those least able to invest in climate adaptation initiatives (Adger et al. 2003; Bird and Glennie 2011; Inderberg et al. 2015).

While the investment climates of the global North and South certainly differ in many ways, their comparison nevertheless underscores common tensions and trade-offs requiring further theoretical interrogation. It is clear, for instance, that despite the numerous advantages facilitating adaptation investments in the global North, limits on actual investment remain. Notably, the prioritization of adaptation investments within broader public investment strategies reveals tensions and accountability concerns in both the global North and South. First, there are questions as to which adaptation investments to prioritize over others. This is partly technical in nature, given limited data, and it also reflects differences in vulnerability models and associated assessment criteria, as outlined above. Moreover, the timeframes and scales of adaptation projects are often contested, and trade-offs may be necessary when it comes to the distribution of benefits or losses between present and future interests. There can also be political and electoral incentives for short-term results or particular geographic focus.

At the same time, recent evidence suggests that investors should not just go after the ‘low hanging fruit’ when it comes to investing in climate abatement technologies, and that making large-scale, expensive investments at the outset can spur the additional investment and

innovation needed to meet long-term climate goals (Brown and Granoff 2018; Vogt-Schilb et al. 2018). It is worthwhile to assess the applicability of these findings and logic to investments in climate adaptation as well. In this regard, adaptation pathways for scaled investment may represent significant barriers in the future by virtue of either environmental or technological change. Therefore, the timing and scale of capital deployment may be highly sensitive to path dependence not just for initial capitalization but also for long-term maintenance and operations liabilities.

In terms of public process and oversight, equity concerns are arguably better integrated into the distribution of public funds than through private investment criteria. While equity and other social criteria are often integrated into investment assessments in the global South — given the prominence of multilateral and international agencies and the conditions applied on funding — these factors may not be as robustly considered in the global North, where relations with private markets and investors are established and routinized. Furthermore, equity is not valued or measured the same by all actors. Even within the development community, there is contestation as to how (or indeed whether) equity weights should be applied (Kind et al. 2017). More commonly, local policymakers may not value equity concerns with the same weight as outside actors (or investors) for political, structural, and/or historical reasons, and may resent donor interference in (re-)distributive policy areas (Heltberg et al. 2009; Bodnar et al. 2018). Equity, then, maybe at odds with accountability and responsiveness, should donor and community preferences diverge. Potential disconnects between international experts and local communities and concerns of ‘elite capture’ may similarly involve trade-offs with respect to efficacy, equity, and the distribution of funds. While best practices call for donors and investors to involve local communities in assessment and decision-making processes (Islam et al. 2013), consensus is not guaranteed. Instead, priorities may be highly contested — even within a given community — and outcomes maybe inconsistent with initial objectives. Wissman-Weber and Levy (2018), for example, demonstrate how different actors within Boston have shaped the discourse over risk and associated adaptive activities. Power dynamics shape which concerns and which (economic) solutions are prioritized. Indeed, community actors and business and financial actors are rarely in the same room when decisions are made, and equity discourses are therefore muted.

Second, adaptation investments are assessed not only relative to one another, but are also assessed relative to other types of investment opportunities. Given limited funds, high

uncertainty and the desire for maximum – and often immediate – impact, adaptation investments are frequently viewed as less attractive to investors than investment opportunities with direct development impact or revenue potential. This also applies to policymakers, who may be tempted to defer or table adaptation projects during the agenda-setting and budget-making processes (Starominski-Uehara and Keskitalo 2014). Additionally, public investment priorities must often align across multiple administrative layers for projects to go ahead. In the development community, there is also a debate as to whether to prioritize adaptation projects in less-developed areas over investments in social and economic development that are designed to improve the capacity and institutions of a region and increase investor confidence (Millner and Dietz 2015). Investment dollars may also be effectively spent increasing the ‘readiness’ of vulnerable communities to receive and manage funds prior to making actual investments in climate adaptation (Chen et al. 2018). Even so-called ‘no-regrets’ adaptation investment strategies, where net benefits are projected under all climate change scenarios, invariably involve costs and trade-offs (Wilby 2007; Heltberg et al. 2009).

Certainly, a core challenge facing stakeholders and policymakers is how to integrate and mainstream adaptive criteria into the investment assessment process while continuing to encourage private investment. Many firms and governments in the global North have adopted ‘triple bottom line’ approaches to investing, yet these may not adequately address sustainability and adaptation concerns (Milne and Gray 2013). Adaptation considerations have also become more mainstream in development assistance (Chen et al. 2018). Still, implementing wide-reaching, integrated and broad conceptions of resilience into planning practices is difficult, especially given limited staff and resources (Wissman-Weber and Levy 2018). Yet, a failure to adapt by the private sector may result in the loss of markets and the obsolescence of any given firm’s market niche.

Ultimately, given the political, contested, and frequently expensive nature of adaptation projects and programs, policymakers may choose to advance initiatives that align with available investment opportunities and fit readily within the criteria set by external investors, such as international development agencies or private firms. Assessment techniques and models of vulnerability can impact which investments are made, as well as the efficacy and equity of adaptation investments. Investment climates in both the global North and South can shift depending on the actors, incentives, and capacities involved, which will shape outcomes in both

direct and indirect ways. As such, existing pathways may attempt to mainstream adaptation investment but such mainstreaming may very well recreate existing patterns of inequality.

3 Conclusions

Despite the advances in diagnosing funding needs and matching these with prospective funders, scholars have seldom interrogated the structural determinants of how urban adaptation actions are actually sourced, implemented, and evaluated in local government contexts. Unfortunately, local actors are arguably the most susceptible to elite capture without any corresponding accountability. With the recent emergence of transnational municipal networks, increasing philanthropic and multilateral interest, and civil society mobilization, the question is no longer about absolute amounts of funds to match growing adaptation needs. Rather, emerging concerns are about whether external funds match local needs, how new sources of finance can be accounted for in local decision-making, which actions are prioritized while others are sidelined, or how funding packages enable particular visions of long-term urban development. Local control over multilateral investments may not be an adequate substitute for national and even global accountability. Yet, adaptation is largely driven by local demand and not global supply. For city governments, these questions raise serious operational concerns as they bring forth complexities regarding who is responsible for sourcing and operationalizing funded projects, how costs and benefits are accounted for, and what counts as an adaptation funding need across the myriad contending priorities within the city.

From a governance perspective, the diversity of actors and complicated mix of interests poses real challenges for city governments (Hughes et al. 2018). As highlighted above, cities are often operationally unprepared to deal with the complex burden of planning for future climate impacts. The cross-sectoral and multi-scalar nature of impacts often overwhelm already resource- and capacity-constrained local governments. As such, the conceptual discourse around urban adaptation finance has been confined to rationally addressing the resource deficit through identifying appropriate funders, including enabling intergovernmental, public-private, or philanthropic sources, as well as articulating the investment potential of different adaptation priorities. This made sense due to the perceived resource gap, but it also highlighted a shift in structural bias away from fully public sector-driven approaches, which are assumed to be bureaucratically burdensome, inefficient, and prone to political capture, towards more

decentralized, public-private, or fully private funding models. As this article highlights, there are a number of trade-offs associated with this mobilization of private markets.

Adaptation finance is a concept that often gets applied loosely, without adequate regard for the varying tensions, actors and dynamics involved. The different dynamics between adaptation funding and financing, for instance, are often overlooked, as are the tradeoffs involved in securing investment in adaptation initiatives. Some adaptation investments may very well be maladaptive to various actors, markets, and urban policies. For instance, the limited value of one short-sighted adaptation investment may create financial path dependencies (e.g., debt burdens) on subsequent generations that may be collectively maladaptive. The absolutism of adaptation has not been fully challenged analytically. It is not enough to note that funding is a challenge for local governments' adaptation strategies. It is incumbent on researchers and practitioners to recognize the implications and trade-offs associated with the various funding sources and financing mechanisms available. Specifically, adaptation financing decisions have potential consequences for local accountability, equity, fiscal sustainability, and effectiveness.

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