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## Article

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# Prudential regulations for greening the financial system: Coping with climate disasters

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## A B S T R A C T

Prudential financial regulators, central banks, and regulatory authorities have increasingly come to recognize that they have a role to play in dealing with climate change, including climate disasters such as storms, tornados, tsunamis, and so on. Such climate events impact the real economy by destroying physical assets, income opportunities, credit worthiness, and the fiscal base. In turn, the financial system is impacted by destruction of collateral and of the ability to pay, an increase in defaults, required insurance payouts, and a flip in the fiscal balance. Regulators' policy options can usefully be classified into those that *provide* direct support, *promote* supporting responses by the system, *protect* from the effects, and *prevent* the consequences as much as possible. Regulators also have a role to play in turning prospective (and past) climate disasters into an advantage by inducing assets to become more resistant in the face of climate change, supporting technological change, and supporting *behavioral change*. Specific regulatory policy toward climate disasters involves some general climate change-related regulations, such as requiring improved building codes for writing mortgages, but also includes repositioning regulations to become activated in the climate emergency and a second set to become activated in the recovery period. Fortunately, the regulatory instruments involved are all well within the current established practice.

## 1. Introduction

Prudential financial regulators, central banks, and regulatory authorities have increasingly come to recognize that they have a role to play in dealing with climate change.<sup>1</sup> This should not be surprising, considering the extent to which finance plays a role in the everyday life of any society. By the same token, small changes in financial regulation should be expected to have a large impact on financial flows and hence on the real economy. Again, this should not be surprising, since financial regulations are designed to have a large leverage effect.<sup>2</sup>

In addition, it is worth noting that there are technical reasons why it is appropriate for the financial regulators to have concern and *responsibility* for responding to issues of climate change. First, climate change involves a massive externality. Second, when a climate disaster is involved, there is an externality *with acute effects*. Third, it is well established that individual, decentralized decisions in the face of externalities are most likely to be suboptimal. Fourth, in response to the massiveness of climate change, an answer is needed that can *permeate* the whole economy. Finance permeates the economy, and therefore financial regulation is such a response. Fifth, the response needs to be actively managed. The financial regulators are equipped to do precisely that.

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<sup>1</sup> Bank of England Governor Carney has been a leader in advocating for such a role. See [Bank of England \(2015\)](#) and [\(2019\)](#). See also the survey results cited in [Basel Committee on Banking Supervision \(2020\)](#).

<sup>2</sup> The Network for Greening the Financial System (NGFS) is the home of the regulator's efforts on climate change and related issues. See <https://www.banque-france.fr/en/financial-stability/international-role/network-greening-financial-system>. It has interacted fruitfully with the Financial Stability Board's Task Force on Climate-related Financial Disclosures.

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Early efforts to relate climate issues to finance and regulation centered around creating markets for carbon credits and green bonds. At a later stage, interest developed in understanding the consequences of climate change for the financial system, especially banks and insurance companies,<sup>3</sup> by focusing on issues such as sequestered assets resulting from needed changes in the structure of production and, hence, in the mix of assets financed.<sup>4</sup> In these instances, the concern has been to identify the effect of changes in the real economy on the financial sector, with a view to ensuring that the financial system continues to be safe and sound, which is a concern consistent with the core responsibility of financial regulators.<sup>5,6,7</sup> Only more recently has interest developed about the potential for financial regulation to actively support (and perhaps sometimes lead) adaptation to the requirements of climate change. This involves inverting the causal relationship, moving from assessing the impact of climate change on the financial system to exploring how changes in financial regulation can be an instrument in facilitating the needed adaptation of the real economy to the requirements of climate change.<sup>8</sup>

The specific purpose of this paper is to present ways in which prudential regulation can be recruited to improve how societies deal with climate disasters. Storms, tornados, tsunamis, floods, and other climate-originated disasters have recently increased in frequency and severity. There is some debate about the causes of this increase and whether it will indeed be lasting.<sup>9</sup> What is becoming increasingly accepted, however, is that it behooves policy makers, including financial prudential regulators, to improve the manner in which they deal with this challenge. This paper, therefore, joins the most recent interest in exploring how financial regulation can play a useful role in addressing climate change concerns.<sup>10</sup>

The first section of the paper summarizes the salient effects of climate disasters on the real economy<sup>11</sup>; the second section addresses the immediate consequences of the former on the financial system. The next section provides a typology of potential policy responses on the part of financial regulators, concentrating on *existing tools* that can be applied to new objectives. Thereafter, the potential for turning adversity into opportunity is addressed. The following section presents policies specifically pertinent to climate disasters. Thereafter, some specific implementation issues are addressed, which show, once again, that the devil is in the details. The concluding section ends on a positive note: *prepositioning the policy responses is the key*; the tools are there to be used.

## 2. Climate disaster impacts on the real economy

When a climate disaster strikes, several distinct consequences follow for the real economy.

### 2.1. Physical asset destruction<sup>12</sup>

Windstorms of various types destroy houses, knock down power lines; floods uproot bridges, make buildings uninhabitable, and destroy agricultural infrastructure including existing plantings; and the combination of wind and water spells great destruction. Climate disasters invariably involve significant loss of physical assets, private as well as public.<sup>13</sup>

<sup>3</sup> The seminal push was given by Governor Carney of the [Bank of England \(2015\)](#). Given the importance of the UK as a worldwide insurance center, it is not surprising that insurance was given a similar role to banking. For other jurisdictions, that does not usually hold, especially not for developing and emerging economies.

<sup>4</sup> There is a natural follow-on from the concern with sequestered assets. Any required change in the mix of capital stock will bring with it a required change in the level and the mix of labor employed. Changes in the geographic, functional, and size distributions of income and wealth will follow. However, such changes typically generate resistance and have political consequences that are difficult to predict. Thus, a central bank wishing to map the effects of climate-required changes in capital stock faces not only a complex enterprise but also one fraught with uncertainty.

<sup>5</sup> [Basel Committee on Banking Supervision \(2020\)](#) pp. 3-6, Survey Results. How this translates into practice for a particular country, Mexico, can be found in [United Nations Environment Programme \(2020\)](#).

<sup>6</sup> Following BoE precedent, a distinction is usually drawn between physical climate impacts (of which climate disasters are a part) and transition issues (which group the long-term economic adjustment needs). In addition, liability issues are sometimes treated.

<sup>7</sup> A separate strand of research has concerned itself with how to coordinate carbon pricing policies with monetary policy. See [Mckibbin et al. \(2017\)](#).

<sup>8</sup> [Batten et al. \(2019\)](#) p. 6 mention this possibility, but mostly to dismiss it. However, [Basel Committee on Banking Supervision \(2020\)](#) pp. 7-8, Survey Results, indicates a number of jurisdictions actively considering such alternatives. [Alliance for Financial Inclusion \(AFI\) \(2020\)](#), covering the developing and emerging economies, shows a very different picture, with some of the member jurisdictions, albeit only a few, already having policies of this sort in place. [NFGS \(2020\)](#) also lists some departures in this regard.

<sup>9</sup> The [IPCC \(2014\)](#) states that "...A changing climate leads to changes in the frequency, intensity, spatial extent, duration and timing of extreme weather and climate events, and can result in unprecedented extreme weather and climate events [...]"

<sup>10</sup> See [Meenan et al. \(2019\)](#) for a different but complementary take on the same subject. [Beck et al. \(2019\)](#) address some of these challenges from an insurance perspective.

<sup>11</sup> It should be noted that there are some non-climate events that can bring about similar real effects. For instance, earthquakes will cause physical destruction and its economic and financial corollaries; socio-environmental conflicts can cause these same corollaries without the destruction of physical assets.

<sup>12</sup> Natural disasters in the LAC area in 2000-2019 have included 548 floods, 330 storms, 74 droughts, and 66 landslides. They are referenced in [OCHA \(2020\)](#) and in [CRED](#). For a contemporaneous statement, see [Barcena \(2020\)](#). Earlier statements are made in [ECLA \(2014\)](#) and [Charvériat \(2000\)](#).

<sup>13</sup> Response to physical disasters by the United Nations is coordinated by the Office for the Coordination of Humanitarian Affairs (OCHA).

## 2.2. Income destruction

With the destruction of physical assets comes the disappearance of employment opportunities. No capital assets: no jobs! True enough, new jobs will appear as a result of the reconstruction, but these are (a) different jobs requiring different skills, and (b) they will only appear later and typically need new funding. The early impact of climate disasters is clearly the loss of income.

## 2.3. Credit worthiness destruction

The disappearance of physical assets and income spells a reduction in credit worthiness. With fewer assets to pledge and less expected income to show, potential credit shrinks.

## 2.4. Fiscal base destruction

The revenue base of local, regional, or even national governments is also affected by the climate disaster. As physical assets are wiped out, so is the real estate tax base; as incomes disappear, so does the income tax base. Hence, climate disasters affect public resources, just when the call upon those resources becomes particularly large.

The most immediate needs identified after a disaster strikes are food and shelter. However, a very close third is money, in the form of ready liquidity. When disaster strikes, it becomes necessary to provide immediate substitutes for goods lost (this implies needed purchases), and/or it becomes necessary to hire new services (e.g. transport or shelter). Both of these categories require payment, mostly in cash. Hence, the availability of cash can become a crucial need indeed.

A particular case of disasters is one in which the installations of financial institutions are affected. If bank offices and/or ATMs are destroyed, the access to cash is made more difficult. Similarly, if phone lines are down, and cellphones are not ubiquitous, determining what cash is needed and where becomes more difficult.

Some of the immediate needs felt by those affected are typically provided for by relatives or friends. First responders are therefore often relatives and kinsmen, especially in more traditional societies. However, *organized, professional* first responders always have an important role to play, in good part because devastation requires collective effort. In addition, as infrastructure is wiped out, the destruction exceeds the capacity of decentralized efforts to cope.<sup>14</sup>

## 3. Consequences for the financial system (banking, insurance, retirement)

The various components of the financial system will be impacted by a climate disaster. This impact will differ by jurisdiction depending, inter alia, on the extent of the climate disaster, the depth of financial inclusion, and the industrial organization of its financial system.<sup>15</sup> Moreover, the nature and extent of the impact will be different, as between banks, insurance companies, and retirement funds. There will be a direct relationship between the impacts of the disaster on the real economy mentioned in the preceding section and the impacts on the financial system being reviewed here.

### 3.1. Owned physical asset destruction

Here we are dealing with the destruction of installations or equipment owned directly by financial institutions, such as the actual destruction of offices where headquarters or branches of financial institutions are located, the damage to automatic teller machines through flooding or collapsed ceilings, or the harm to real estate owned outright by the financial institution (e.g. rental housing, stores, or offices). In this respect, the financial institution is no different from any other property owner.

### 3.2. Collateral destruction

Here we have a potential loss that may or may not be realized. Collateral guarantees repayment of a loan. Having it become less valuable does not necessarily imply that the respective loan will not be repaid.<sup>16</sup> However, there is no question that the risk of default increases when the collateral becomes worth less.

Banks are directly exposed to the reduction in value of collateral. Insurance companies are indirectly exposed, insofar as they own paper backed by such collateral. In sophisticated markets, where mortgages are packaged and then sold to insurance companies *without recourse*, the insurance industry is exposed directly to the change in value of the properties subject to mortgage. In less sophisticated markets, insurance companies may own paper issued by banks that is used to fund mortgages held on the banks' own balance sheets. Furthermore, insurance companies may own bank stocks or bonds that are subject to a decrease in value as a result of a climate disaster.

<sup>14</sup> Cf. United Nations Emergency Response Fund. <https://cerf.un.org/about-us/who-we-are>

<sup>15</sup> For a review of a range of possibilities, see Batten et al. (2016).

<sup>16</sup> If the collateral taken has been considerably greater than the loan, it may well be that there is still enough value left to pay off the loan after the disaster has struck.

However, insurance companies, especially in smaller jurisdictions and with less mature markets, tend to use reinsurance extensively. As a result, they collect less premium income but also divest the risk onto one or more foreign insurance entities or insurance pools. When a climate disaster hits and the respective underlying collateral becomes worth less, foreign insurance companies or pools bear a major part of the brunt.<sup>17</sup>

Retirement funds present a third type of situation. Typically, the retirement fund is distinct from its management company. Thus, losses in the retirement fund portfolio arising from climate disasters are mostly borne by the collectivity of depositors in the respective retirement fund. Only if the legislation specifies that the management company participates in the gains or losses of the fund portfolio would the management company be exposed to the effects of climate disasters.

### 3.3. Ability to pay destruction

Reductions in income can be expected to have a direct correlation with the ability to service existing financial commitments as well as new ones. However, the impact on freely disposable income may be much larger than the reduction of income itself. Consider the typical situation of a family of two income earners, one of whom has a salary and another who operates a family business. The salary constitutes 60% of the income and the family business 40%. Now, as a result of a hurricane, the family business loses half of its sales. Family income is now 80% of what it was before. However, now there are new required payments for repair of the family store of 10% of the original family income per period. So, if the net freely disposable income before the disaster was 30% of income, it is now zero: 20% of income lost, and 10% of income now committed to recovery finance.

Accordingly, the capacity to pay under conditions of climate disaster becomes reduced more than proportionately.

### 3.4. Default increases

Defaults are the consequence of either the inability or unwillingness to pay. In the presence of climate disasters, both types of default increase substantially. Debtors' *inability* to meet commitments increases as freely disposable income shrinks. However, the *unwillingness to pay* increases as well, as debtors feel more justified in assigning lower priority to paying debts than to other survival needs.

In banks, the increase in defaults expresses itself directly in the reduction of debt payments. In insurance companies, payment of premiums will be late, eventually leading to a lapse in coverage. In retirement funds, there will be a reduction of payments into such funds, with the commission base falling accordingly.

### 3.5. Insurance payout obligations

Insurance cover for natural disasters in jurisdictions without developed financial markets may be limited, possibly restricted to insurance on some structures, on vehicles, and for medical care. As a result, insurance companies may not be enormously impacted in absolute terms, but an undeveloped insurance market also means a low premium revenue base. Hence, even a low payout resulting from a climate disaster can significantly affect the industry. Recall, however, that reinsurance always mitigates this loss.

### 3.6. Fiscal balance flip

Fiscal revenue is directly related to the tax base. As a climate disaster causes this base to shrink, due to asset and income reductions, so will fiscal revenue. On the other hand, this is precisely when the State will be called upon to provide succor to its citizens, thus increasing its expenditure. Hence, the fiscal balance will inevitably deteriorate, even considering possible contributions from abroad. This implies an increase in the public debt, both domestic and foreign, consequent to the climate disaster.

The impact of climate disasters on financial institutions thus goes well beyond the effect on the physical assets the institutions may own. As the society and economy around the financial institutions are impacted, so too are those institutions. Values of collateral, willingness and ability to pay, default rates, coverage payouts, and fiscal balance will all be affected.<sup>18</sup>

## 4. Policy options for response

The tools that prudential financial regulators have available to respond to climate risk, particularly to climate disaster risk, come in many shapes and forms. It is useful to classify them into four types of policies as follows<sup>19</sup>:

<sup>17</sup> For a British view of the exposure of insurance companies, as well as data relevant to sophisticated insurance markets, Cf. [Batten et al. \(2016\)](#). See also [Cleary et al. \(2019\)](#).

<sup>18</sup> The "natural" response to a greater "at risk" position is to reduce exposure by cutting back lending. The regulatory framework may indeed require that response. However, such procyclical action will aggravate the problem. In the face of a disaster, credit must be expanded, not reduced. Forward-looking regulation will induce the appropriate behavior.

<sup>19</sup> This classification is adopted from The [Alliance for Financial Inclusion \(AFI\) \(2019\)](#).

#### 4.1. Provide

These are tools in which the financial regulators *provide* direct support in response to the climate challenge. This might be a direct credit program in the central bank for loans to residents of the affected areas; it might be low-interest credit facilities for businesses in the affected areas on the part of a state-owned development bank; or it might be exceptional credit to the relevant local authority in view of its disaster-related expenditures.

#### 4.2. Promote

These are tools by which the financial regulators *promote* actions on the part of institutions in the financial system to abate the consequences of climate disasters. An example would be capital adequacy requirements weighted in favor of climate-friendly activities. Another would be differential provisioning of climate disaster-related lending. Special definitions of credit worthiness in the face of a climate disaster would be another. Creation or authorization of special insurance instruments for a climate disaster would also qualify.

#### 4.3. Protect

These are tools that provide loss absorption or compensation. A classic example is disaster insurance, which spreads the loss horizontally over a broad pool of insured individuals but may need specific regulatory approval. Another example is specially designed finance of the loss, which spreads the impact over time and thus makes it more bearable. Another is preinstalled emergency access to retirement funds. All of these can be combined in many different proportions.

#### 4.4. Prevent

Preventing climate disasters is obviously not possible. However, under this rubric, prudential financial regulators take preemptive action to *prevent*, as much as possible, the undesirable consequences of climatic disasters. This involves requiring the financial institutions to develop awareness of the climate risk they are running through suitable reclassification of their loans and their collaterals along an unconventional (to them) dimension. The requirement to install systems of environmental and social risk management (ESRM) is the canonical example of this type of policy.<sup>20</sup> A *prevention approach* then leads to the development of policies and programs that contain and mitigate the effects of the disaster.<sup>21</sup>

As usual, what specific policies are appropriate for a particular jurisdiction to adopt depends on its institutional circumstances, its policy traditions, and the exigencies of its particular situation.<sup>22</sup> Before adopting any of the policies mentioned, a careful analysis of the consequences should be undertaken, especially to identify any undesired collateral consequences.<sup>23</sup>

It should be noted that financial regulators have many tools that can be used for the task at hand; it is not an issue of inventing or designing new tools; rather, it is an issue of using existing tools for a new purpose. By the same token, these tools are likely to be useful for purposes that may partially or totally overlap the intent to cope with climate disasters. For instance, the adoption of a compulsory environmental and social risk management regulation may well be designed primarily to cope with socio-environmental conflicts, but by its very nature, it will also serve to assist in implementing a system that is better ready to spring into action when a climate disaster occurs.

Indeed, the new climate-related concern can be thought of as part of the financial regulator's responsibility in maintaining a healthy financial system in the long run, capable of an improved handling of climate disasters and climate change in general. From this point of view, any innovation in financial regulation will be in the interest of the financial system itself. Finally, it is important to note that coordination of financial regulators' actions with those of others concerned with climate disasters will leverage all of the applied policies to greater advantage.<sup>24</sup>

<sup>20</sup> The first countries to install such a policy have been Brazil and Peru. See [Banco Central do Brasil \(2014\)](#), [Schydlofsky and Thompson \(2014\)](#), and [SBS \(2015\)](#).

<sup>21</sup> See the description in [Bank of England \(2019\)](#) pp. 37ff for the expectations of the BRA. [NGFS \(2020\)](#) broadens this approach further.

<sup>22</sup> [AFI \(2019\)](#) provides an overview of policies adopted in its 90+ member jurisdictions. [Frisari et al. \(2019\)](#) provide an overview for Latin America.

<sup>23</sup> For instance, capital requirements are currently weighted with particular kinds of risks in mind. Incorporating climate risks into this mix requires forecasting the consequences for bank behavior and evaluating whether the same effect can perhaps be achieved with another tool such as provisioning. The same is true, in turn, for provisioning, which also has a direct effect on bank lending incentives. Evaluating both together may yield a superior mix to applying each of them separately. Always depending on the particular nature of bank behavior in the respective jurisdiction. See [NGFS \(2020\)](#) for a review of the current state of the discussion on applying weighted capital requirements to climate issues.

<sup>24</sup> The possibility and extent of coordination of bank regulation regarding climate disasters (or other climate change) with other public policy instruments will depend on the institutional arrangements in the relevant jurisdiction. In general, a wider coordination should produce better overall results; however, where timing is important, it may well be that the financial authorities are able to act more quickly and decisively than other parts of the body politic, and their proceeding in advance, or in the absence of others, may be beneficial for the collectivity.

Before leaving this review of potentially useful policies, it is important to consider the consequence of adopting *any such policy* on a potential increase in the moral hazard involved. Might it be that such policy “improvements” will be self-defeating by increasing risky behavior on the part of a public now newly expecting to be rescued from its own risk taking?

There is little doubt that an expectation of a rescue should, in principle, affect behavior. However, in many jurisdictions, citizens do not have more than a generic expectation that their government will come to their aid when disaster strikes.<sup>25</sup> Many times, they have also experienced that such rescue falls far short of being effective. Hence, they have learned not to trust such declarations or to rely on them. Moreover, most citizens are unlikely to understand the details of such policies and, therefore, most probably will not pay attention to them. Consider what is involved in a resident of the backwoods of a developing economy understanding the adoption of a package of financial regulation tools! The empirical reality in a majority of developing country jurisdictions around the world, is, therefore, that adopting even well-crafted “rescue” policies will not generate an increase in moral hazard, at least until time has proven that they are indeed much more effective than the citizenry expects.

## 5. Turning adversity to advantage

Adversity always has a flip side: it offers opportunity. Financial regulators also have a role in boosting society’s ability to turn adversity into an advantage. Here are some major possibilities.

### 5.1. Making fixed assets more climate friendly/climate disaster resistant

#### 5.1.1. Housing

Building codes are a major determinant in the capacity of housing to resist major climate disasters. Properly anchored roofs are less likely to blow off. In addition, double- and triple-glazed window have substantially greater resistance to storm-level winds. Thresholds on doors have the capacity to prevent low-level flooding. Furthermore, gutters or overhangs designed for heavy rains and proper runoff can also reduce damage.

Adequately formulated and fully enforced building codes are a very effective response to recurrent climate disasters.

Taking building codes into account when writing mortgages will go a long way in furthering climate-resistant<sup>26</sup> designs.

#### 5.1.2. Other construction

What holds for housing also holds for commercial construction, from hotels to office buildings and warehouses. Building codes that result in climate disaster-resistant construction are a reflection of incorporated learning.

Construction of disaster-resistant roads also presents opportunities. Incorporating a slight curvature, installing lateral runoffs, and foreseeing and remedying low points where water will collect represent improvements in road design that can be reviewed when finance for the road is being considered. In addition, if reconstruction is involved, these improvements can be reviewed when financing for the reconstruction is put in place.

### 5.2. Updating technology – building for the longer term

New ways of doing things are continuously being invented, and older inventions are continuously being converted into innovations. Some of these are pertinent for mitigating the effects of climate change-related disasters. Note that financial regulation plays a role in making such innovations amenable to financing.<sup>27</sup>

A pertinent example may be construction with Styrofoam blocks. These have a very high insulation factor and thus are effective in situations involving both high and low temperatures. They also have adequate tensile strength. However, they do not have hard surfaces and thus require both internal and external coverings for durability and consumer acceptability. In addition, when they are used, economies of scale apply in production.

A regulatory “sandbox” that authorizes banks to finance “experimental” construction might have just the right effect to stimulate the adoption of this heretofore neglected technology, as well as other technologies.<sup>28</sup>

### 5.3. Generating behavioral change

Climate disasters are events that have major impacts. Nobody is unaware of major storms, tornados, floods, or tsunamis, as the press covers them extensively. As a consequence, citizens generally reexamine their behaviors to see if they adequately incorporate the possibility that such catastrophes may affect each of them at some point. Traditional behaviors may then change.

<sup>25</sup> See the discussion below under Participation in Civil Society and under Citizenship.

<sup>26</sup> See Section 6 (a) for further details on such possibilities.

<sup>27</sup> See FAO (2019) for specific alternatives in agriculture.

<sup>28</sup> The sandbox possibility may be useful for other regulatory innovations that need to be “ring-fenced” as well. For fuller discussions of this regulatory instrument, see Herrera and Sonia Vadillo (2020), Wechsler et al. (2018), and Columbia Institute for Teleinformation (2020).

### 5.3.1. Insurance

One would expect losses to make the advantage of being insured much clearer. However, for a citizen or business to become insured, three essential conditions need to be met: (i) the citizen must have a sufficient level of financial education to understand what is involved in insurance, as well as its relative costs and benefits; (ii) appropriate insurance must be on offer, and (iii) the price must be affordable and the payout attractive. In many jurisdictions, one or more of these conditions fail to hold in major sectors of the economy.<sup>29</sup>

Because insurance is a highly regulated industry, regulatory action can certainly affect the availability of insurance that is relevant to climate disasters. Furthermore, the cost of insurance is related in part to the expected losses, but it is also averaged over time, over coverage elsewhere, and over a range of various risks. Insurance essentially involves pooling many risks in many places and at many times.<sup>30</sup> That is the diversification that makes insurance sustainable. Seen from a particular jurisdiction, however, it is reinsurance that allows for tapping into the worldwide system. Accordingly, the insurance regulator needs to institute appropriate and effective reinsurance regulations<sup>31</sup>.

### 5.3.2. Savings

Having resources available “for a rainy day,” when storms are increasingly frequent, seems to be a natural precaution. However, it is not enough for an individual to realize that having precautionary savings would be expedient. An institutional opportunity to put these savings aside reliably and with reasonable returns should exist. Here is where *financial inclusion* comes in—a topic that currently receives attention in many jurisdictions.<sup>32</sup>

### 5.3.3. Participation in civil society

When a climate disaster strikes, the individual cannot usually cope with it by himself or herself. A collective, organized effort is needed. This implies that lateral ties must exist and become activated when the need arises. Traditional societies have intense ties that have precisely this purpose. With development, some of these ties become weakened. Climate disasters demonstrate the need for communities to come together. Dormant civil society institutions reawaken, mutual help becomes more common, and the consciousness of a shared danger and destiny weld communities together. The long-term effect is more effective communities and greater participation in civil society organizations.

### 5.3.4. Citizenship

When a climate disaster strikes, governments at all levels get called upon. Citizens discover very quickly whether their authorities are up to the challenge. They also discover that their role as *citizens* is enormously important, especially when they feel that they have governments that *are less effective than they deserve!* Citizen participation then changes.

The role and effectiveness of financial regulators may then also be called into question. Have they been adequately sensitive to the need to be proactive in relation to possible climate disasters? Have they done all they could? And in a timely fashion?

During times of political activism of citizens, the traditional insulation of financial regulators may wear a bit thin.

## 6. Available regulatory instruments

In [Section 4](#) above, a general typology and overview of instruments were offered. Here, the purpose is to become specific regarding general and specific instruments that are pertinent to the handling of climate disasters.

### 6.1. General climate change abatement instruments

The implementation of policies that are relevant for climate change in general would also make dealing with climate disasters easier. For instance, if directed credit is available, it can be focused on disaster support and remediation; if weighted capital requirements take into account climate issues, they could be tailored to provide relief to disaster remediation; if provisioning is related to friendliness toward climate issues, provisioning in the case of disaster remediation could be reduced; and so on.

One general policy that is particularly relevant to climate disasters relates to the building code standards required for writing mortgages. Because a large fraction of construction is financed directly or indirectly by the financial system, the leverage that the system has to require upgraded building standards is very substantial. With improved building codes, the corresponding structures will be more disaster resistant, and numerous benefits will flow therefrom.

Consider, for instance, a regulatory change that consists of raising provisioning requirements for construction mortgages in storm-prone areas if construction codes are left unchanged while reducing such requirements for areas where construction codes have been

<sup>29</sup> In some jurisdictions, and for certain purposes, insurance may be mandatory (Cf. [Bank of England \(2019\)](#), Box 6, p. 35). However, among developing and emerging economies, this is more likely to be the exception than the rule.

<sup>30</sup> For a review of some attempts to generate the specific pooling of risks across countries, see [Martinez-Diaz et al. \(2019\)](#).

<sup>31</sup> For instance, “nationalistic” arguments in favor of “keeping the insurance premia at home”, at a national reinsurance company, or putting maxima on reinsurance allowed via regulations, as alleged benefits to local insurance companies may not be beneficial at all.

<sup>32</sup> The Alliance for Financial Inclusion, AFI, is an institution grouping some 100 Regulators from 90 developing and emerging economies that have been assiduously working to increase the financial inclusion around the world. The World Bank’s FINDEX report chronicles the progress achieved.

updated to the latest standards. Individual jurisdictions that have control over building codes would now have a strong incentive to update their codes to avoid an increase in mortgage costs.<sup>33,34,35</sup>

Most policies that are capable of taking into account climate change can also be made to assist in situations involving climate disasters. At the same time, some policy instruments deal specifically with climate disasters and recovery from them. It is these that the following sections address.

## 6.2. Specific anti-climate disaster measures

### 6.2.1. Prepositioning emergency response

*Access to emergency cash:* this is one of the most essential functions, and it can have a variety of implementation modalities depending on the particular situation. For example, if an effective digital wallet system is in place, then access to emergency cash is almost automatic. All that may be required is to have the cellphone system working and for anyone NOT on the digital wallet system to be issued digital accounts rapidly. If no such digital wallet system is in operation, then much depends on whether automated teller machines and bank branches are operating in the geographical space of the disaster, or close enough for affected citizens to have access to such establishments. If not, it may require emergency arrangements with supermarkets or pharmacies, which are the main repositories of cash locally, to function as bank agents and provide cash against suitable documentation. Evidently, such a mechanism needs to be prepositioned; it cannot be invented ad-hoc when the disaster strikes.

*Access to own funds on an emergency basis:* many affected individuals will have liquid or quasi-liquid assets that they are not entitled to access on short notice. An example would be a time deposit requiring permanence for a given period. Another is a bond that is convertible to cash but only with a waiting period. A third is a retirement fund accessible only at age 65. All of these can be made accessible by regulation when a climate disaster hits. However, the terms of access need to be pre-established for the purposes of proper anticipatory planning on the part of the citizen but also on the part of the financial institution holding the deposit.

*Accelerated transfer payments from government:* where transfer payments are in existence, be they conditional transfer payments to mothers, or old-age pensions, the argument for disbursing them on an accelerated basis and while disregarding normal payment schedules is very strong.

*Expedited partial insurance payouts:* insurance payouts typically take time. An adjuster has to come out, view the damage, and assess what is to be paid. Then, the back office needs to process the payment. None of this is compatible with an emergency situation. The obvious remedy is to have an immediate partial payout, with the balance being processed in the normal way. Such an emergency payout could be as high as 30% depending on the seriousness of the climate event. No individual damage assessment should be required for this initial payout. Moreover, it should be made liquid through any of the channels that handle emergency liquidity.<sup>36</sup>

*Lending programs:* citizens affected by a climate disaster will have illiquid assets of various sorts, from land to vehicles and fixed assets. Under emergency conditions, it makes sense for loans to be available under preferential conditions against the pledge of these assets.

There will also be citizens whose assets are completely destroyed in a climate disaster. A case in point would be the destruction of a house and vehicles for a person who does not own any land. However, such an individual would nevertheless have human capital, a skill that enabled him or her to have income in the past. It would not be equitable to lend only against physical assets. Human capital must also, under such circumstances, be proper collateral.<sup>37</sup>

It is clear that the rules for such lending need to be pre-established. This again allows for proper advance planning on the part of the citizen as well as on the part of the institution.

*Local government finance:* when disaster strikes, the local government has a role to play even when it is likely that the national government will have to shoulder most of the burden. However, the local government usually has few human resources and is also typically short of finances. Thus, an emergency finance system must be developed for the local government so that it can respond by, for example, hiring its own citizens as clean-up crews. Creating such an immediate local response solves two problems at the same time: it provides manpower for rescue activities, and it provides a source of income. It should therefore not be underestimated as an important element of "first response."

### 6.2.2. Prepositioning recovery policies

Once a climate disaster has occurred, its effects evidently need to be remedied; that is the role of *recovery policies*. To the extent that they are prepositioned, they will be more easily and quickly implemented, and, most likely, they will also be better designed and more effective.

<sup>33</sup> There would also be an interesting effect on insurance costs, with reductions where building codes have been updated.

<sup>34</sup> An interesting comparison also presents itself between a policy to tweak the provisioning requirements on mortgages and another policy to expand, perhaps require, storm insurance on mortgaged properties. The provisioning policy can be expected to change the construction codes, thereby reducing the losses resulting from storms. The insurance expansion will not change the damage, only modify who bears the cost.

<sup>35</sup> An interesting variant of such a regulation has been proposed for UK rental properties; see [Bank of England \(2019\)](#), p. 27. The Central Bank of Hungary is trying out green housing loans that involve requiring certain specifications in construction; see [NFGS \(2020\)](#), Box 24, p. 50.

<sup>36</sup> One of the great advantages of parametric insurance is its rapid payout. However, see fn. 45 for present limits to its implementation.

<sup>37</sup> See also [Section 7 \(d\)](#) for further thorny equity issues that are involved in treating present and future debtors alike.

*Recovery lending:* injecting credit when there has been a climate disaster is an essential element in any recovery program. However, as part of a package of recovery policies, such lending should have some special characteristics:

- 1 Terms: the length of the loans should be carefully calibrated to the capacity of the activity financed to service the loan. If farming is involved, the maturation profile of the crop should be respected. For example, when it comes financing the reinstallation of citrus trees, remember that they will not yield a full crop until the fourth year. If home reconstruction is involved, build in a grace period for the debtor to find replacement employment.
- 2 Flexible servicing dates: when rural and agricultural credit is involved, inflexible due dates may be very costly. This is especially the case when the transport infrastructure may have been affected. Allowing payment in a seven- or ten-day window may allow the debtor to travel to the bank office when transport is more available, or when farm duties are not so pressing. Alternatively, when digital accounts are available (or can be made available), it becomes much easier to comply with payments on unmovable dates.
- 3 Interest rates: the real interest rate charged on loans evidently impacts the true capacity of debtors to service the loans that they take on.<sup>38</sup> Immediately after climate disasters, the urgency of receiving credit will be great. Accordingly, the price elasticity of the demand for loans will have become low. On the other hand, the uncertainties resulting from the disaster will increase the perceived risk for the lender. Furthermore, banks may become more risk averse in such situations and thereby raise the supply price of loans.<sup>39</sup> In addition, the competitiveness of the lending market will have declined, as borrowers will be less able than before to shop around for terms.<sup>40</sup>

At the same time, from a systems-wide perspective, all recovery loans provide positive externalities to each other, but this is not something that individual loan officers are able to take into account routinely. Put a different way, each individual loan is less risky when in the company of many other recovery loans than it would be if it were the only such loan. The net result is that regulatory intervention is needed to bring the market interest rate in line with the proper price of finance.<sup>41</sup>

Given the uncertainties related to recovery, it may also be appropriate to have floating rather than fixed rates. In addition, it may be appropriate for the floats to be related to an indicator that is pertinent to the recovery activities.<sup>42</sup>

- 4 Built-in maturity extensions: under conditions of reconstruction and recovery from disasters, the uncertainty of all timelines becomes greater. Hence, it becomes desirable to build in possible maturity extensions from the outset. Various alternatives exist in this regard: (a) pre-established extension periods at the option of the borrower, and (b) grace periods for principal or interest with the postponed payment added at the end, as an extension. Compensation for any of these features could exist in the form of a slight increase in the interest rate.
- 5 Rollover of emergency loans: once the immediate emergency is over, whatever emergency loans were extended need to be rolled over into more permanent instruments. The aforementioned considerations are relevant here as well.

*Recovery credit worthiness:* recovery credit worthiness must be different from regular or conventional credit worthiness due to the special circumstances surrounding climate disasters. Such recovery credit worthiness could consider the past history of income generation, or it could consider human capital, or it could consider the reconstruction context that the government foresees for the affected area. The financial regulator should establish criteria for such credit worthiness.

*Collection of relevant data for insurance:* without data on insurable assets and future flows that are usable for actuarial calculations, no insurance industry can flourish.<sup>43</sup> Hence, collecting pertinent and up-to-date information on flood, earthquake, and windstorm areas, as well as information on the housing stock, on farms and their yields, and on various types of other assets and infrastructure, all become part of an effective positioning effort in anticipation of climate disasters. In addition, the historical frequency of climate disasters in any particular jurisdiction will need to be recorded. The collection of such information is also important to make the introduction of parametric insurance more feasible.<sup>44</sup>

Different jurisdictions will have different starting points regarding the existence and accessibility of such information. In general, however, a data collection effort of this nature can be thought of as a public good and thus as being in the proper purview of the

<sup>38</sup> Most lenders argue that the rates they charge reflect the risk they incur—a risk that they admit can only be measured very imperfectly. However, as the interest rate charged goes up, the profitability of any given venture goes down. Hence, there exists an interest rate that increases the risk of the loan rather than reflecting it. Absent this recognition at the operating level, a built-in bias to charge higher interest “just to be safe” predominates.

<sup>39</sup> There may also be an unintended regulatory result of capital requirements and provision rules that become more binding on the banks due to the deterioration of their portfolios as a consequence of the climate disaster.

<sup>40</sup> Indeed, it is highly unlikely that it will be possible for a borrower to switch from one lender to another unless there is a specific regulatory policy that makes this possible. Consider only the paperwork and delay involved in transferring collateral from one lender to another.

<sup>41</sup> One such possible intervention is to run reverse auctions for recovery destined finance packages, where the individual operators compete on who will offer the borrowers the best terms (interest rates, terms, collateral requirements). Such a mechanism has proven useful in the context of emergency covid-19 finance. Cf. <https://gestion.pe/economia/reactiva-peru-2-bcr-subasta-s-2645-millones-a-tasa-promedio-de-166-noticia/>

<sup>42</sup> Most likely one would wish to have low rates initially and then have them increase as recovery proceeds and enterprises regain profitability. An easily verifiable indicator or such as electricity use, or toll road revenues, or contributions to retirement plans, might serve for this purpose.

<sup>43</sup> Batten et al. (2016) Section 6 cite the industry as viewing a lack of data as a major obstacle for a range of climate-related insurance.

<sup>44</sup> Parametric insurance pays out a pre-established amount upon the occurrence of pre-specified events over which the insured has no control and which are certified as having occurred by an independent institution. It is therefore particularly suited to climate-related disasters as well as other disasters. On the other hand, due to its novelty and other characteristics, it is probably suitable at this time mostly for application by governments or other large and sophisticated organizations. In addition, it is unclear what regulatory authorizations may be required in particular jurisdictions (Cf. Brettler and Gosnear (2020)).

financial authorities. If left to private initiative, there are issues of access, of first mover, and of economies of scale that are likely to significantly delay the appearance and widespread dissemination of such information.

*Sub-regional and municipal finance:* reconstruction and recovery will clearly require action at the municipal level. Some part of that will have to be financed at the municipal level and some part at the other sub-regional levels depending on the political system's structure. Moreover, the national government will finance some part. In any case, it is to be expected that the local government units will need to go into debt for and during reconstruction and recovery. Repayment should occur when that period has been completed. Rules and procedures for this purpose should be pre-established so that the financial system and the local governments know the terms based on which this finance will be forthcoming.

## 7. Implementation challenges

Knowing what to do is clearly essential. However, actually getting it done is equally important. It is thus desirable to address some of the more common implementation issues that need to be borne in mind so they can be resolved in advance.

### 7.1. Triggers for beginning and for ending

The onset of a climate disaster is usually easy to determine: nature announces it with far too much clarity. However, often the extent and impact are not immediately clear. Therefore, administrative action is needed to officially trigger the prudential emergency measures that have been prepositioned and to define their scope. What is more, the chain of command for doing this must be clearly established, including substitutes for each stage.<sup>45</sup>

Once initiated, a second decision point will inevitably appear: when is the emergency over? Is it over everywhere in the affected area at the same time? Is the emergency active for some aspects and not for others?

### 7.2. Geographic coverage

The climate disaster may be narrowly focused on a clearly defined geographical area, or it may affect a broad area with different intensities. The availability of benefits requires the definition of a boundary. For instance, the rollover of debts might be related to businesses located in the areas of impact and not other areas. But where exactly does that area end? And what if an active business, say a farm, is partially inside and partially outside of the affected area as defined?

A further issue relates to possible benefits accruing to the *suppliers* of operations in the affected area. Consider a business that sells tractors on credit to farmers in an affected area. Under emergency rollover provisions, the farmers are now allowed to defer the payment of their obligations to a later date. But what, then, happens to the trade credit lender? Is he also authorized to roll over *his* debt to *his* bank under the same regulation?

### 7.3. Magnitude of supports

Are the various supports cumulative? Can all of them be accessed simultaneously? If the emergency approval of credit is involved, how is the amount of that credit determined? On a historical basis, and if so, in what year, or in what average of years? Or should it be based on some estimate of what future revenues can bear?

### 7.4. Equity of supports

When disaster strikes, it is especially important that all persons in similar situations be treated equally. But consider two neighbors whose sowings have been wiped out in a flood. Neighbor A has funded his operations by borrowing from the bank, whereas Neighbor B has used his own capital. Would it be fair, then, for A to get his loan rolled over and to pay it over five years, whereas B gets no credit? Fairness in such cases needs to be defined *ex-ante* and be clearly established so that allegations of undue preference do not undermine the policy's valid purpose.

### 7.5. Channels of support

In emergencies, the bureaucracies designed for normal operations are quickly overloaded, especially if the triggering event has affected them. It is thus to be expected that the financial system will come under operational strain. Can enough bank personnel get into the affected area with enough small-denomination bills to supply the needed cash? Can the needed cellphone calls be made to inform customers that their funds are available? Or would it make sense for the first responders to be able to provide the affected population with the financial information most crucial to them? If so, what would that information be?

It is well known that in matters of regulation, the devil is in the details. But that should not be a reason for not proceeding.

<sup>45</sup> Definition of a clear chain of command is a must when business continuity is at issue, which may well apply to a climate disaster situation.

## 8. Conclusion

Climate disasters are major events. They affect society and the economy. They also affect the financial system. Financial regulations condition how the financial system responds to such events. Hence, financial regulators have an unavoidable responsibility.

Until recently, financial regulators did not explicitly address the policy requirements of climate change and climate disasters. That is now changing due to the pressure of the increasing recognition that all policy-making bodies need to do their share and that financial regulatory instruments have a unique ability to reach deeply into all parts of the economy.

Where climate disasters are concerned, some of the recent events have been exceptionally dramatic and caused very extensive damage. All types of jurisdictions have been affected, from small islands to large and developed countries.

Financial regulations have a role to play in abating and containing the damage from climate disasters. They also have a role to play in the subsequent recovery actions. *Prepositioning* policy responses is absolutely essential for effective action. Fortunately, what is required in terms of specific regulations is well within regulators' familiar toolkit. A quick and effective response to this newly recognized challenge is therefore fully feasible.

## Declaration of Competing Interest

Declares that he does not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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