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*Debate*

# Insuring Climate Change: New Risks and the Financialization of Nature

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**ABSTRACT**

Insurance is a central institution in modern societies. Economic and technological developments generate 'new risks', which are often covered by new forms of insurance. Because of its underlying uncertainty — the difficulty both of predicting its effects and evaluating its costs — climate change represents a major challenge for the insurance industry. It also represents a challenge for states, who have historically played the role of insurers 'of last resort' in the event of catastrophes. This article examines the ongoing financialization of climate risk insurance, which is part of a larger trend of financialization of nature. Financialization, through measures such as 'catastrophe bonds', is the neoliberal solution to the rising costs of natural disasters which the insurance industry has experienced since the 1990s. The article analyses the effects of financialization on the insurance industry, on the state's role as insurer 'of last resort', and on associated forms of knowledge production (big data), critiquing the process of financialization on both economic and political grounds.

## INTRODUCTION: INSURERS IN A CHANGING CLIMATE

In a letter sent to the shareholders of his investment fund, Berkshire Hathaway, in February 2016, Warren Buffett wrote: 'As a citizen, you may understandably find climate change keeping you up at nights. As a homeowner in a low-lying area, you may wish to consider moving. But when you are thinking only as a shareholder of a major insurer, climate change should not be on your list of worries' (Buffett, 2016: 26). According to Buffett, climate change will increase the number and severity of natural disasters in the years to come. In fact, it has already begun to do so. This in turn

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will raise the volume of insurance payouts to the victims of these disasters. But premiums will rise accordingly: this will make investment in insurance possibly more profitable than it is today. Consequently, climate change may well be good news for insurers and investors — although clearly not for citizens.

Buffett's reflections about the financial consequences of climate change can be found in a section of his letter to the shareholders entitled 'Important Risks'. Every year, the US Securities and Exchange Commission (SEC) urges major corporations and investment funds to state what they see as their 'risk factors', that is, the risks that could put them in jeopardy, and the means they intend to use to reduce these risks. In his 2016 letter, Buffett mentions two risks that may have an impact on the insurance industry: terrorism and climate change. The focus of this contribution will be on the latter.

How do insurers react to the already perceptible effects of climate change throughout the world? How do they anticipate a future in which environmental risk will grow? A risk, environmental or otherwise, represents a potential cost to insurers. Foresight — that is, measuring and pricing risk — is the foundation of insurance. This implies, first, gathering the most precise information possible about the risk itself and the objects and persons it could damage; and, second, implementing — or compelling the insured to implement — risk-reduction measures. This explains why insurance companies, contrary to other branches of the economy, have been (relatively) quick in admitting the reality of climate change, and in thinking about its effects on their industry. Indeed, climate change has recently been called the 'mother of all risks' by a group of insurers (Bacani, 2016).

A report published by the French Federation of Insurers on the occasion of the 21st UN Conference of Parties that took place in Paris in December 2015, predicts an increase of 90 per cent in the cost of environmental hazards (droughts, floods, storms and marine submersions) in France in the period 2014–40, as compared to the period 1988–2013 (FFA, 2015). It also anticipates that climate change will be the second explanatory factor behind this increase, the first being the rise in the 'global wealth' of the country. A rise in the density and value of housing, for instance, automatically increases insurance costs in the case of a disaster: the more there is to destroy, the higher the payouts.

Warren Buffett's prediction may of course turn out to be wrong. Natural catastrophes may be so severe in the future that a rise in premiums would not compensate for them. In this case, investing in insurance companies will cease to be profitable. According to Frank Nutter, the President of the Reinsurance Association of America, 'It is clear that global warming could bankrupt the industry' (quoted in Linden, 2014). Another possible scenario is that increases in premiums will have 'exclusionary effects', meaning that climate risk insurance will become too expensive for the lower-income segments of the population. These segments would thus remain unprotected

from climate risk, or protected only by state intervention and humanitarian aid. This would increase premiums even further, since the level of premiums depends *ceteris paribus* on the number of insured.

According to French philosopher François Ewald, modern societies are defined by the process of *assurantialisation*, that is, the coverage by insurance of ever more risks: climate, professional, technological, commercial and so on (Ewald, 1986, 2011). Economic and technological developments give rise to new risks, but they also lead to the creation of new forms of protection, private and/or public. Because of its global character and the uncertainties attached to it, climate change represents a major challenge for modern societies, and for the insurance industry in particular. As I will see, it also alters the existing relationship between capitalism and the state.

As part of the Forum issue Debate on rentier capitalism and economic development, this contribution examines the ongoing transformations of climate risk insurance. It first describes the structure of modern natural risk insurance and reinsurance — a structure that is currently undergoing profound changes due to the combined impact of two processes, financialization and the emergence of new risks, including climate change. Secondly, the article discusses one response to the challenges of climate change experienced by the insurance industry since the 1990s: so-called 'catastrophe bonds', a financial mechanism meant to insure against possible natural disasters. Thirdly, it shows that financialization and new risks alter the role of insurer 'of last resort' that the state has played since the 19th century. In the context of the 'fiscal crisis of the state', part of the state's insuring capacity has been transformed into financial mechanisms such as sovereign catastrophe bonds and microinsurance. The last two sections reflect on the growing role of big data and financial modelling in climate risk insurance and, finally, present a critique of the process of financialization on both economic and political grounds.

## FINANCIALIZATION AND 'NEW RISKS'

Insurance against natural risks has a long history (Borsheid and Haueter, 2012: Ch. 1 and 2). It dates back to the threshold of the modern age and probably beyond. In the 16th century, after the discovery of the Americas and the improvement of navigation techniques had propelled European ships across the oceans, vessels and their cargoes began to be insured against the possibility of shipwreck. What was then called *respondentia* allowed ship owners to avoid being bankrupted by losing a ship (Kindleberger, 1984/2006: 183–84). The principle was a simple one: the lender provided a certain amount to the ship owner, of the order of the price of the cargo. If the cargo arrived at its proper destination the ship owner would hand back the lender's money, with interest. In the event of a shipwreck, he would keep it. The seas were still far from secure at the time, to the extent of posing a constant risk

to the international circulation of commodities. The increase in the flows of goods and people over the following centuries, with the expansion of capitalism, gave rise to a growing sophistication in insurance techniques. The emergence of a world market, the imperialism to which it gave rise, and the phenomenon of insurance against natural risks were, in this sense, inextricably linked (Baucom, 2005: Ch. 3).

Insuring natural risks is not confined to the maritime sector. Other types of (natural and/or social) disasters have long been the object of insurance, from hurricanes to earthquakes, floods, droughts and fires, and pandemics like influenza. As economies grew in the wake of the industrial revolution, the value of what was susceptible to loss and thus insurance continually increased. As well as an exchange value and a use value, commodities have an 'insurance value'. Insured commodities generate capital, since the moment of their possible destruction is anticipated in advance.

Modern insurance is inextricably bound up with reinsurance. Reinsurance is 'the insurers' insurance'. It supposes a higher degree of mutualization of risks than does insurance. This mutualization, in principle, makes it possible to push down the overall cost of insurance, since when insurers reinsure — thus protecting themselves against the risks of particularly high losses — they are able to reduce the premium levels they demand of those who take out policies with them. Reinsurers count among the earliest globalized companies (Jarzabkowski et al., 2015: Ch. 1). Their capacity to deal with high indemnities is the fruit of a strategy of diversifying contracts across geographical areas and economic sectors.

The biggest reinsurers in the world today are Munich Re, founded in 1880, and Swiss Re, founded in 1863. Other top reinsurance companies include Lloyd's, Hanover Re, Gen Re/Berkshire Hathaway and SCOR. Reinsurers first emerged following a series of fires that ravaged a number of the great modern cities in the first half of the 19$^{th}$ century: the founding period of modern reinsurance thus corresponds to the era of the industrial revolution. A rise in costs due to economic development and demographic changes (urbanization) led to innovation in the field of insurance. As I will see, this tendency to innovate as a consequence of rising costs can also be observed today.

Although insurance for natural disasters has a long history, it is currently undergoing a rapid transformation. This transformation results from the interweaving of two processes, the first of which is *financialization*. Although there are numerous debates about the definition of financialization (Durand, 2017), it has been characterized by Robert Brenner as follows. In the first half of the 1970s, capitalism entered into a crisis, as the long post-war growth period faltered. This 'long downturn', as Robert Brenner put it, led to a crisis in profit rates, which have continued to be depressed ever since (Brenner, 2006). Capitalism reacted to this fall in profitability in two ways: by seeking to privatize things that had previously escaped market control, such as public services, biodiversity, forms of knowledge, the human

genome, etc., on the one hand;[1] and through financialization on the other hand, that is, investing not in the so-called 'real' or 'productive' economy, but rather in finance, which allows for the realization of 'fictitious' profits. Financialization is evidenced by the fact that even the profits of industrial companies increasingly result from financial operations. Insurance in general, and insurance for natural disasters in particular, have been captured by capitalism's dual movement of privatization and financialization. There is a neoliberal regime in insurance, just as in other domains: pensions, scientific research, enterprise management or global trade (Ericson et al., 2003). The financialization of climate risk insurance described below is a manifestation of this regime.

The other process with which financialization is interwoven is the emergence, since the latter part of the 20th century, of so-called *new risks*, including nuclear disasters, global terrorism and climate change. As with financialization, the definition of new risks has led to numerous debates (Beck, 1992; Curran, 2013). Indeed, history teaches us that claims of novelty should always be treated with some caution: more often than not, the alleged novelty results from intensification, hybridization and the making visible of processes that were already at work, rather than radical innovations. One way of defining new risks is through the phenomenon of 'hypercorrelation' (Godard et al., 2002). The risks that an insurer takes on must be sufficiently uncorrelated so that it does not have to pay out to too many insured parties all at once. With new risks, this principle of non-correlation no longer functions. New risks affect thousands or even hundreds of thousands of people at the same time, and involve colossal volumes of material assets. New risks involve many lines of insurance simultaneously: life insurance, disability annuities, the interruption of economic activities and damage to both assets and people. Systemic financial risk of the sort brought about by structured finance (Coval et al., 2009) reinforces hypercorrelation, as shown by the subprime crisis of 2007–08. More fundamentally, hypercorrelation is an ontological feature of large-scale catastrophes which disrupt human activity on whole territories.

This forces insurers to deal with costs that are often beyond their capabilities and sometimes to pull back from the market. That is what happened in the USA following the 11 September 2001 attacks, when insurers dropped terrorism coverage from their contracts. Insurance is all about power relations between contracting parties: the retreat of insurers in the wake of 9/11 was an attempt to compel the state to take on a greater share of insuring against such attacks. It was not successful, however, as the state forcibly pushed the insurers back onto this market (Ericson and Doyle, 2004). In sum, hypercorrelation may lead to a crisis of insurability.

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1. 'Accumulation by dispossession' is the concept elaborated by David Harvey to describe this process (Harvey, 2005).

As in the 19th century when modern reinsurance was founded, the multiplication of new risks in the last decades of the 20th century led the insurance industry to innovate. This was an era of triumphant neoliberalism. Thus, unsurprisingly, the insurance industry turned to the global financial markets in order to increase both its potential for indemnification and its profits. The financialization of climate risk insurance is a response to an 'objective' problem the industry was facing: the rising costs of natural catastrophes. However, as is often the case in the history of capitalism, the response to one problem generates its own, new problems.

## CATASTROPHE BONDS: THE FINANCIALIZATION OF CLIMATE RISK INSURANCE

The insurance industry has created one of the most fascinating financial instruments of the past decades: catastrophe bonds, or 'cat bonds' (Jarzabkowski et al., 2015: Ch. 6; Keucheyan, 2016: Ch. 2). This instrument allows insurers and reinsurers to manage the rising costs of new risks, climate change among them. The object of a cat bond is a natural disaster that has not yet occurred; that, while possible, may not occur; and that will bring major human and material damage if it does occur. The purpose of cat bonds is to spread risks in space and time, so as to diminish their financial effect. Since financial markets today extend across a global scale, securitization spreads out these risks to a maximum. Cat bonds, thus, amount to a financialization of *possible* natural disasters.

A cat bond works as follows. Some authority — an insurer, a reinsurer, a state or a corporation — issues a bond through an investment bank, which the latter sells to investors. As with any bond, the authority in question pays interest to the investors (the coupon), in exchange for the money that they loan it. If the catastrophe occurs, inside predetermined spatial and temporal coordinates, then the investors lose their money (the principal), which serves to reimburse those affected — or more precisely, to pay the insurers and reinsurers who themselves reimburse those affected. If it does not take place, the investors pocket the interest, and get the principal back once the bond reaches its maturity date. The basic structure of a cat bond is not very different from the early-modern *respondentia*.

The entity that issues a cat bond creates a special purpose vehicle (SPV), which will typically be located in a tax haven, for instance in the Bahamas or the Cayman Islands. It sets out in search of investors, placing the amounts that they lend it in bonds. If there is a catastrophic event, then the principal and the profits emerging from the investment go to the issuing authority. Several types of 'triggers' exist. It can be a catastrophic event of a certain kind, damages that exceed some pre-determined threshold, or a rapid series of events (for example, three cyclones hitting the same area within a brief time frame). The maturity date of cat bonds is generally three years.

Like all financial securities, cat bonds are evaluated by ratings agencies. These bonds are often rated BB. The cat bonds market is tracked by the Swiss Re Global Cat Bonds Index.[2] The value of a cat bond fluctuates on the market as a function of the greater or lesser probability of the catastrophe occurring and as a function of the supply and demand for the relevant security. Sometimes these bonds continue to be exchanged as a catastrophe approaches or even while it is underway, for example during a heatwave in Europe or as a hurricane hits Florida. That is what traders who specialize in this domain call 'live cat bond trading' (Lewis, 2007).

Not all the effects of climate change can be insured against. For example, desertification or rising sea levels cannot in themselves be the object of insurance coverage, because these phenomena cannot be located spatially or temporally — spatio-temporal localization being the very condition of insurability. They are gradual rather than one-off and, in varying degrees, they concern very large regions. They can, however, interact with more local phenomena and give rise to catastrophes that are insurable. Thus desertification contributes to the proliferation of droughts and the destruction of harvests, which can be covered by insurance.

Catastrophe bonds are part of a larger trend in the financialization of nature, that is, the creation of financial instruments 'plugged into' nature. Nature has become a form of investment (Lohmann, 2009), or an accumulation strategy (Smith, 2007). Carbon markets are the best known of these instruments, but there are other such mechanisms including weather derivatives[3] (Randalls, 2010) and biodiversity banking (Sullivan, 2013). Some of these instruments, like carbon markets, are part of climate change *mitigation* policies — although, to date, carbon markets have failed in their stated purpose of reducing greenhouse emissions. The European Union's Emission Trading Scheme (EU ETS), for instance, has encountered structural problems since it was launched in 2005 (Vlachou, 2014). Other instruments, such as cat bonds, are part of *adaptation* policies, in that they deal with the effects rather than the causes of climate change.

What is investors' interest in investing in cat bonds? The main attraction is risk diversification. Natural risks are not directly correlated with more traditional asset classes, such as equities and treasury bonds. In times of financial crisis, this diversification is important. Of course, a catastrophe could potentially have a negative effect, for example, on the shares of a company whose headquarters is located where the event occurs, or on crops. Overall, however, the chance of a cat bond being triggered is low; it has been estimated at around 1–2 per cent in any year (Mortimer, 2012). Cat bonds do therefore play a role in investors' strategies of diversifying their portfolios.

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2. See: www.swissre.com/library/Swiss_Re_Cat_Bond_Indices_Methodology.html
3. Although the financialization of nature is a manifestation of the more general rise of finance mentioned earlier, some of these instruments — especially weather derivatives — have a long history, dating back to the 19th century (Cronon, 1992).

Since the European sovereign debt crisis broke out in 2010, investors have been buying cat bonds in great numbers (Deloitte, 2016; Whittaker, 2011).

Cat bonds are one example of a more general category of securities, namely insurance-linked securities (ILS), which are linked to risks of various kinds: credit, biotech, civil liability and so on. They are also known under the label of alternative risk transfer (ART). The first half of the 1990s was a turning point for the insurance industry. A series of unusually costly natural events, including Hurricane Andrew in Florida in 1992 and the Kobe earthquake in Japan in 1995, occurred within a short period of time, thus compelling the industry to find new resources. Since then, around 500 cat bonds have been issued, principally by insurers and reinsurers wanting to protect themselves from high insurance costs that could not be insured through more classical insurance mechanisms.[4] Some cat bonds have also been issued by states, a point that I will return to later.

In 2016, some US$ 75 billion were invested in ILS, a rise of 7 per cent from the previous year (Ralph, 2017). The annual returns for an investor can range from 5 to 15 per cent. Pension funds have been increasingly interested in ILS, since they are not correlated with their more traditional investments. Other investors include specialist ILS and cat bond funds, hedge funds, private equity funds and sovereign funds. Quantitative easing policies implemented by central banks since the beginning of the global financial crisis have led to a quest for higher yields by investors, resulting in investment in ILS and ART (Tett, 2014). The level of investment in cat bonds is also affected by traditional reinsurance and whether this can offer competitive returns.

Cat bonds are not only issued to cover natural disasters. Insurers and reinsurers have protected themselves against all types of 'extreme mortality', to use the jargon in vogue in this sector. Flu pandemics — bird flu since 2003 and swine flu in 2009 — have led to the issuing of cat bonds covering the insurers in case of a mass death toll. Swiss Re has set up a securitization programme called 'Vita Capital', which would allow it to receive more than US$ 2 billion in damages in the case of excess mortality linked to this type of disease. The French insurer Axa, one of the 10 so-called 'systemic insurers' listed by the Financial Stability Board, has a similar programme called 'Osiris Capital'.

In the second part of its Fifth Assessment Report published in 2014, entitled 'Impacts, Adaptation, and Vulnerability', the Intergovernmental Panel on Climate Change (IPCC) encouraged the implementation of cat bonds as a form of economic adaptation to climate change (IPCC, 2014: Ch. 10.7). Interestingly, one of the lead authors of the relevant chapter of the report happens to be Head of Climate Risk in the R&D department at Munich Re. Munich Re is an important operator on the cat bonds market, and a supporter of the financialization of climate risk insurance. It is also one of the most

4. See the insurance-linked security and catastrophe bonds directory, available at Artemis: www.artemis.bm/deal_directory/

important producers of ideas concerning the future of insurance, often in collaboration with international organizations such as the International Labour Organization or the World Bank (Churchill, 2006). When it comes to finding solutions to climate change, the IPCC has thus not entirely escaped the neoliberal zeitgeist, and especially the tendency to see in financial markets an answer, rather than a source of economic and social problems.

Until the 1990s, climate risk insurance was composed of three layers: insurers, reinsurers and the state. Since the 19th century, the state has played the role of insurer 'of last resort', especially in the case of major catastrophes. It also plays the role of legal regulator of the insurance market, including of risk pooling practices by insurers. With cat bonds, a fourth layer was added to this scheme: global finance. This addition has not left the other three layers unaffected. In particular, the financialization of climate risk insurance has impacted on the role of the state as insurer of last resort.

## NATURAL DISASTERS AND THE 'FISCAL CRISIS OF THE STATE'

### Sovereign Cat Bonds: An Alternative to the Insurer of Last Resort

Most cat bonds to date have been issued by insurers and reinsurers who want to protect themselves from the rising costs of catastrophic events. However, since the mid-2000s states have also issued these securities. This is what insurers and experts call 'sovereign' cat bonds (Borensztein et al., 2017; Croson and Richter, 2003; Haas, 2011). This evolution is actively encouraged by international organizations, among them the World Bank and the OECD (the role of states and other policy-making institutions in financialization is emphasized in Epstein, this issue). In 2014, the World Bank itself issued a cat bond to cover a group of 16 Caribbean islands in the event of earthquakes and hurricanes (Harding, 2014).

How do sovereign cat bonds work? In 2006 the Mexican state issued a bond allowing it to cover itself for earthquakes (Michel-Kerjan et al., 2011; World Bank, 2011). In 2009, it decided to include hurricanes in the same mechanism, thus giving rise to a so-called 'multi-cat' programme, namely, one that covers multiple potential catastrophes. Mexico is vulnerable to a variety of hazards, both natural and otherwise. These include hurricanes, particularly in the Gulf of Mexico region, but also earthquakes, landslides and volcanic activity. In Mexico, as elsewhere, the state is the insurer of last resort in the event of natural disaster. The indemnification of the victims is paid out of the state budget, meaning that it comes, ultimately, from taxation, on the basis of a principle of national solidarity consistent with the modern nation state. This principle is built on the idea that citizens of the same country should be united in the face of natural disasters (Nussbaum, 2013).

The large number of natural disasters in Mexico led the government to set up a natural disasters fund, Fondo de Desastres Naturales (FONDEN).

The fund makes both short- and long-term interventions: it provides emergency financial aid to victims immediately following a catastrophe and subsequently finances the rebuilding of infrastructure. FONDEN is a legally independent fund, but is financed by the state budget. Until the early 2000s the system worked effectively, given the relatively low cost of the natural disasters it faced. However, a series of costly disasters then struck the country. In 2005, for example, a federal government that had predicted that it would have to devote US$ 50 million to disaster relief instead ended up spending US$ 800 million (Michel-Kerjan at al., 2011: 24). It was in this context that the idea of securitizing Mexico's climate disaster insurance saw the light of day.

The Mexican 'multi-cat' bond was triggered at the beginning of 2016, when hurricane Patricia hit the west coast of the country. The trigger of the bond is parametric: if the hurricane exceeded a certain central pressure (measured in millibars), the investors would lose 50 per cent of the principal; if it exceeded a higher central pressure, they would lose 100 per cent. In the case of Patricia, they lost 50 per cent (Artemis, 2016). The cat bond programme also stipulated that an independent scientific institution would measure the pressure of the hurricane — the US National Hurricane Center (NHC). US scientific institutions often play the role of 'justices of the peace' to establish the physical features of a climatic event, and hence decide on the triggering or not of the bond. Science plays a central role in the financialization of climatic risk, in establishing the background information and formal models on which it relies. I will come back to this.

It is clear why insurers and reinsurers would be interested in raising money on financial markets to face the rising costs of natural catastrophes. However, it is less clear why states would choose to do so. To understand why sovereign cat bonds have emerged since the mid-2000s as a climate change adaptation strategy, one has to trace the argument of their promoters, who link together environmental and economic crises, especially crises in public finances. Their argument goes as follows (Michel-Kerjan et al., 2011). Because of the global economic crisis, the public finances of many countries are fragile. This 'fiscal crisis of the state' (O'Connor, 1973/2001) implies that states are less and less able to assume the insurance costs of natural catastrophes by conventional means — national solidarity in the face of a disaster, through taxation. States, in other words, are less and less capable of performing their traditional function of insurer of last resort. And this situation will only worsen as the number and severity of natural catastrophes rise as a result of climate change. This goes for all regions of the world, but especially for the developing world, where states and public finances are in more or less permanent crisis.

Proponents argue that this fiscal crisis of the state is precisely why climate risk insurance should be financialized through financial instruments like sovereign cat bonds. Financialization is conceived as an alternative to taxes and national solidarity in the case of a catastrophe. One declared purpose

of the Mexican multi-cat programme is to 'protect the public finances' of the issuing country, or, in other words, to 'immunize their fiscal policy' (Michel-Kerjan et al., 2011: 3). A similar mechanism for ASEAN countries has been said to strengthen the 'financial resilience' of the member countries, and 'protect the long-term fiscal balance' by financializing insurance for climate risk (World Bank, 2012: 11). Hence, the financialization of natural disasters is seen by the promoters of sovereign cat bonds as a solution to the fiscal crisis of the state, and an alternative to the state's role as insurer of last resort.

**Microinsurance: Insurability as a Political Construct**

Microinsurance is another manifestation of the changing relationship between the state and the insurance industry under the pressure of financialization. When disasters occur, insurers tend to put up premiums, sometimes raising them to prohibitive levels. Rising premiums can discourage individuals from taking out insurance. This, in turn, can shrink the market and force the insurers to increase their premiums still further on account of insufficient demand.

This problem is particularly acute in developing countries, which explains low insurance penetration rates (Cummins and Mahul, 2009: 39–44; OECD, 2016). The existence of an insurance market supposes the presence of a sufficient number of people who have the means available to take out insurance; otherwise, the risks would be insufficiently diversified and the insurers would be unable to pay out in the event of catastrophe. In developing countries this minimum threshold is not always reached. Moreover, the legal framework in developing countries can be weak or defective, and the emergence of an insurance market in the absence of a stable legal framework raises problems.

According to its advocates, the financialization of climate risks is a way for insurance companies and governments to get around these obstacles. The World Food Programme (WFP) thus issued a climate security in 2006 for the benefit of the Ethiopian government, so that it can support its population in the event of droughts and lost harvests (Warner et al., 2009: 5–7). Ethiopia is prey to recurrent droughts, which are aggravated by climate change. Droughts give rise to famines, which the Ethiopian government does not always have the means to handle, so that the international humanitarian aid sector often steps in instead. The WFP security is a form of 'index insurance' (Peterson, 2012): its trigger mechanism is a graded scale, for example a scale of temperature or rainfall, with the indemnity being automatically paid out when a certain threshold is reached. Insurance systems of this kind also exist in Bangladesh, Bolivia, India and Sudan, among other countries, and they are actively promoted by international organizations. They make up part of microinsurance, a system that represents the insurance sector's equivalent of microcredit (Werner, 2007).

Microinsurance is symptomatic of the financialization of daily life that is currently at work, in the global South as well as the North (Martin, 2002). As its name suggests, it involves small amounts of money and poor populations — but ones who risk incurring major losses due to natural disasters. As in the case of microcredit, it is often managed in a communal manner, in the sense that responsibility for paying the premiums is collectively controlled. Microinsurance covers various hazards: health, harvests, livestock, flooding, etc. Currently, around 300 million people are covered by microinsurance schemes (Munich Re, 2017). The stated goal of index insurance is to protect the poorest. However, attracting the premiums (even if they are microscopic) paid by millions of peasants around the world is certainly not alien to the interests of insurers and reinsurers for this sector. According to one author, 'private companies are gaining clients through the action of development agencies, expanding their markets through a similar process of appearing philanthropic while gaining economic advantage' (Peterson, 2012: 577).

Microinsurance relies on Warren Buffett's hypothesis: through the rise of either premium levels or the number of insured people, climate change may allow insurers to increase their future profits. In a 2009 report, Lloyd's — the world's oldest insurance company — makes this hypothesis explicit:

> Microinsurance is not charity; it is business, but it will require insurers to change their mindset. How do you sell insurance to someone who has never heard of the concept? How can you adjust claims in remote and inaccessible parts of developing countries, and most crucially, how can you make any money from a policy where the premium is just a few dollars a year? (Lloyd's, 2009: 4).

The answer: it requires that a condition be fulfilled. Markets for the poor have to be arranged on a massive scale, involving millions of individuals. In other words, the aggregate sum of premiums that the insurers collect must be enough for them to cover for disasters, while at the same time pocketing a profit. The amount that peasants of the global South can afford to pay as an insurance premium is indeed 'just a few dollars a year'. Consequently, there has to be a very high number of premiums. It is the fact that the countries to which these mechanisms are applied are densely populated that makes such an operation financially interesting for insurers.

Insurability is a political construct. The integration of the poor into the insurance market often requires state subsidies of insurance premiums, at least to start with. This is the so-called 'public–private partnership' mechanism (Hildyard, 2016); it is one of the pillars of the neoliberal insurance regime. In 2011, for instance, Swiss Re published a report entitled 'Closing the Financial Gap' (Swiss Re, 2011). The financial 'gap' to which the title refers is the gap separating poor peasants in developing countries from insurability. According to Swiss Re, it is up to the state to bridge this 'gap', driving poor peasants or the inhabitants of slums towards the market, so that insurers can insure them. The Swiss reinsurer advances two arguments

to convince states of their 'duty'. First, it argues that an uninsured peasant is less productive. Subject to the vicissitudes of nature or illness, he will tend to invest less in equipment and fertilizers, leading to stagnation in his productivity. Moreover, in the last instance he will be a burden on the state, since if his harvest is destroyed or he falls ill, he will look to the state for help. For Swiss Re, this is justification enough for the state to make such private insurance compulsory.

The insuring company's country of origin may sometimes intervene in the implementation of insurance systems in other countries. For example, the Direction du Développement et de la Coopération, a branch of the Swiss foreign ministry, actively supports Swiss Re in developing countries (Laubscher, 2011). In particular, it tries to make sure that the legal framework for insurance law develops in a manner favourable to the reinsurer. As Panitch and Gindin (2013) have shown, neoliberalism has little to do with 'laissez-faire' and everything to do with permanent state intervention in favour of the market.

## BIG DATA, INSURANCE AND NATURE

Agencies that carry out financial modelling are crucial actors in the financialization of climate risk, including for cat bonds and index insurance. These agencies devote their efforts to 'climatic modelling'. One characteristic of the new risks in general, and climate risks in particular, is their underlying uncertainty, encompassing both the difficulty in predicting their occurrence and the difficulty in evaluating their cost if they do take place (Godard et al., 2002). Traditional bonds, such as state treasury bonds, fluctuate relatively slowly, which makes them fairly reliable securities. Cat bonds are much more difficult to predict, given the complexity of the factors — both natural and social — that have to be taken into account.

The issuing of cat bonds therefore requires the involvement of modellers, whose goal is to reduce the degree of uncertainty as much as possible, partly by gathering extensive data on the history of climatic events in the regions in question. There are a small number of risk-modelling companies worldwide, most of them based in the USA: the main ones are AIR (Applied Insurance Research), Eqecat and RMS (Risk Management Solutions). These agencies develop models in order to determine the probability of a natural event occurring and to calculate its physical characteristics — for example, wind speed, diameter (for hurricanes and cyclones), temperatures and so on. These models also take into account the characteristics of the buildings and material assets of the area at risk, the materials used, the type of terrain, the risk-reduction practices that have been implemented, etc., as these factors clearly have a major bearing on the impact and resulting costs of a catastrophe.

The accumulation of all this information makes it possible to estimate the potential costs of a catastrophe and the indemnities that the insurers would

have to pay out and, consequently, to determine the price of a cat bond. The algorithms developed by the modellers are mathematically sophisticated, reflecting the complexity of calculation practices in the world of finance today (Mackenzie, 2011). The modellers' methods include simulation and counter-history, randomly generating virtual disasters so as to create a representation of their consequences and allow for a range of predictions and calculations to be made.

The interweaving of big data, insurance and nature is particularly advanced in agriculture. In 2016, for instance, the French bank Crédit Agricole created, via its subsidiary Pacifica, a forage insurance intended for breeders (Vergonjeanne, 2015). Airbus Defence and Space, a division of Airbus, provides the Crédit Agricole with satellite images of farming fields, municipality by municipality. The images are updated every 10 days. This alliance between a bank and an aerospace company led to the creation of a fodder production index, which estimates the production of fodder for each breeder, and compares it to production means. If actual production is lower, then the breeder is automatically compensated. This fodder insurance is similar to microinsurance schemes used in the developing world. According to its promoters, it has the benefit of reducing costs for farmers, by reducing administrative overheads (inspections). These new agricultural insurance techniques were originally implemented in the USA (Specter, 2013): the Directorate-General for Agriculture and Rural Development of the European Union has played a key role in importing them into Europe (interview with a high-ranking civil servant from the French Ministry of Agriculture, 8 March 2016).

## CONCLUSION: ADDING FINANCIAL INSTABILITY TO ENVIRONMENTAL INSTABILITY

What will happen to cat bonds in a world of more frequent natural disasters? Will they remain attractive for investors? This brings us back, full circle, to Warren Buffett's hypothesis. The multiplication of catastrophes will mean one of two things: either investors will turn away from cat bonds, because they are triggered more often, implying more frequent losses of their investments; or else the growing risk will increase yields, making cat bonds *more* attractive. A world of climatic turbulence is certainly bad for people, but it remains to be seen if it is bad for capital.

Financializing climate risk insurance — and adaptation to climate change more generally — is a dangerous project for several reasons. First, financialization's implicit promise to reduce the effects of climate change on societies is a false promise, since finance itself is prone to crisis — as amply demonstrated by the collapse of the subprime market in 2007–08. Financializing adaptation would put adaptation policies at the mercy of the erratic behaviour of financial markets. Adding financial instability to

environmental instability can only increase the impact of disasters, while inequalities between those who depend entirely on the market for climate risk insurance and those with other resources (such as savings or property) will grow. And in the event of a financial crisis, the state is once again left to play the role of insurer of last resort. The idea promoted by international organizations that financialization can stand in for the state is thus deceptive: whatever alternatives appear to be on offer, the role of the state remains central.

Moreover, finance is in its very essence undemocratic; it is beyond the control of democratic deliberation. It is a form not only of economic dispossession, but of political dispossession, in which the few choose for the many. More finance means less sovereignty, because finance is the most deterritorialized form of economic relation. It is by nature mobile and globalized. Political dispossession does not mean that states are no longer involved in the insurance process. As I have seen with microinsurance, insurability is a political construct, whereby markets use states to reach profitability. Similarly, if cat bonds were to become financially less attractive in the future, markets might pressure states to subsidize the bonds in order to turn them into profitable investments (for examples of this logic, see Mader, this issue). Thus, political dispossession can be defined as the (neoliberal) restructuring of the state by finance through the privatization of profits, and the socialization of losses.

Sovereign cat bonds, in particular, are not an adequate solution to the difficulties that states will face in exercising their function of insurer of last resort in the context of climate change. States should free themselves from the hold of finance, rather than intensify the process of financialization, so as to be able to protect their populations from climate risk. Rising public debt held by global financial markets is one of the causes of the fiscal crisis of the state. Sovereign debt auditing procedures, which may lead to the cancellation of at least parts of the debt, would enable states to achieve greater autonomy from finance (Millet and Toussaint, 2004). More generally, what is needed is less reliance on the logic of financial markets, and more environmental long-term planning.

Adaptation to climate change will necessitate some fundamental reorganization in our daily lives. It will require the involvement of people, the deepening of the democratic process, and even the invention of new democratic institutions. Without the active commitment, knowledge and know-how of individuals and societies, it is doomed to fail. Adaptation to climate change, from this perspective, may well be an opportunity to revitalize democracy. It will be the task of future coalitions of social and political movements not only to fight the growing connection between finance and climate change, but to imagine sustainable futures freed from the damaging effects of this connection on societies.

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