

How Does Climate Change Interact with the Financial System? A Survey

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Disclaimer: The views expressed in this paper are those of the authors and do not necessarily reflect the official views of the Bank of Japan.

Introduction (1)

- A growing interest in climate change
 - It is likely associated with a growing intensity and frequency of natural disasters
- Financial authorities, including central banks, and international bodies have launched a range of initiatives
 - In 2015, the FSB formed the TCFD
 - In 2017, central banks and supervisors launched the NGFS
 - In 2020, both the BCBS and the FSB published their first stocktake reports
- They also have conducted a range of research
 - E.g., Batten, Sowerbutts, and Tanaka (2016), Krogstrup and Oman (2019), and Bolton et al. (2020) survey the literature on climate change and its impacts on the economy and discuss how climate change affects the financial system through the economy and how policy makers can address the problem

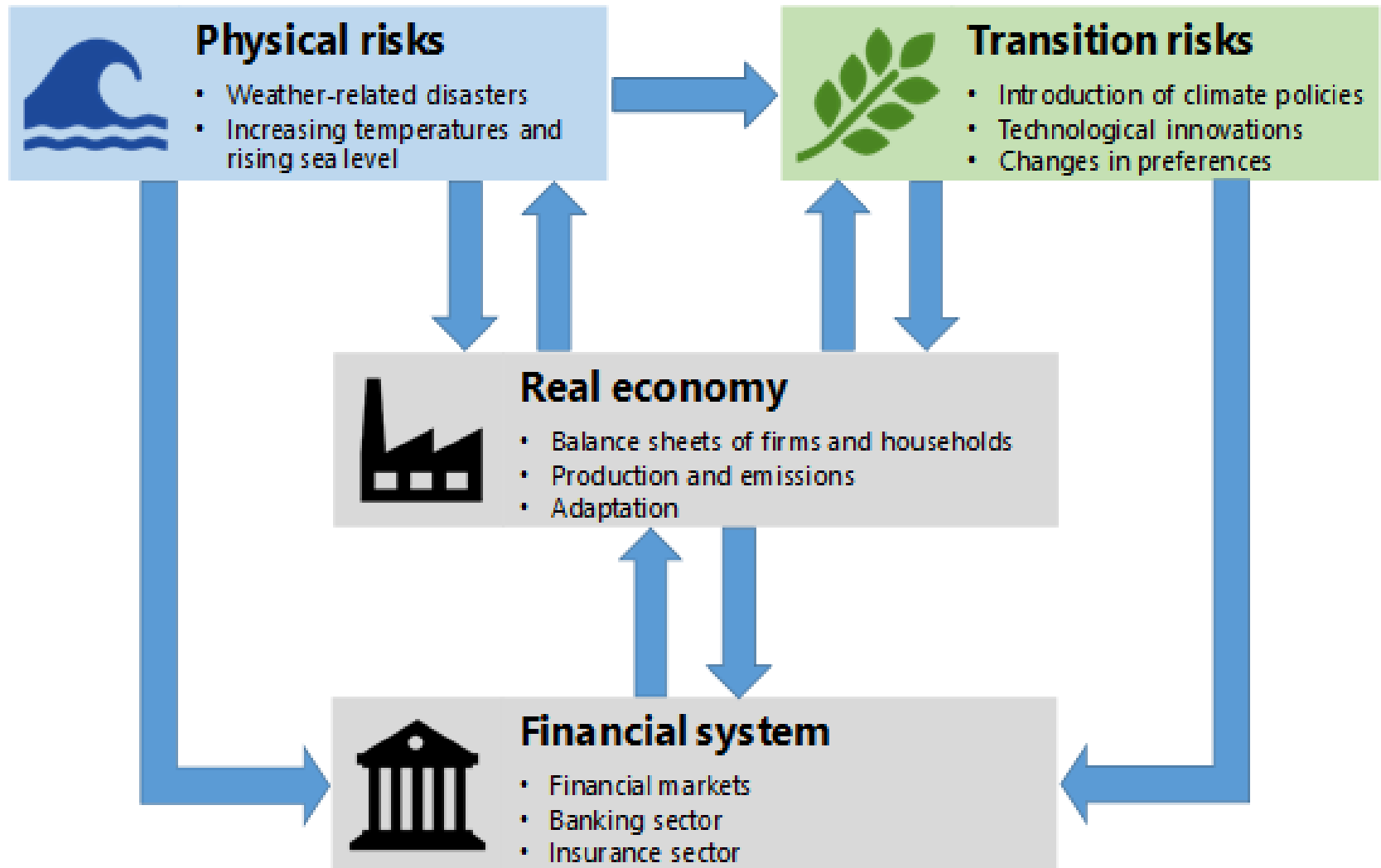
Introduction (2)

- There is a large volume of academic literature that is not covered in the previous survey papers, in part because of the rapid growth of the literature
 - The special issue on "Climate Finance" of the Review of Financial Studies in 2020
- We provide an extensive survey of the literature on the interaction between climate change and the financial system
 - While recent discussions often focus on the relatively long-term impacts of climate change on the financial system, our survey highlights the shorter-term impacts of climate-related natural disasters and the causal link from the financial system
 - We cover non-climate-related disasters (e.g., earthquake) and environmental performance (e.g., toxic emission)

Structure

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2. Recent discussions on climate-related financial risks
 - Transmission channels
 - Potential policy measures
3. Do asset prices reflect climate-related risks?
4. Natural disasters and bank behavior
5. The role of insurance and related challenges
6. Conclusion

Transmission channels



The causality from the financial system

- Mitigation and adaptation efforts
 - Mitigation focuses on containing climate change itself, for instance through the reduction of greenhouse gas emissions
 - Adaptation reduces the impact of climate change, for instance through the construction of better flood defenses
- The financial system may impede such efforts for a variety of reasons
 - If stock markets do not adequately distinguish between firms with high and low carbon emissions, this can deter efforts to reduce emissions
 - If property markets fail to incorporate climate change risks, they may induce excessive investment in areas that are exposed to high risks of natural disasters (Anderson et al. 2019)
 - Public policy, such as the provision of public disaster insurance at subsidized rates, can induce moral hazard and distort resource allocation
 - Tight financial conditions are bad for environmental performance because they prevent firms from taking action (e.g., Howell 2017; Brown, Martinsson, and Thomann 2018; IMF 2020a)
 - Divestment, disclosure, equity/debt finance, and private/public firms

Potential policy measures

- Carbon pricing is widely regarded as the first best option, but insufficient in the eyes of leading economists
 - Fiscal tools are first in line, but can and may need to be complemented by other policy instruments (Krogstrup and Oman 2019)
- Some support for the use of financial measures
 - Stress tests: some central banks have already started to conduct them, although they rely on arbitrary scenarios and unrealistic assumptions (NGFS 2020a)
 - Disclosures
- Policy makers and scholars are more cautious about policies to actively promote greening, such as lower and higher risk weights for "green" and "brown" loans, respectively
 - For a majority of central banks, active contribution to greening of the financial system is not covered by their mandate (Dikau and Volz 2019)
 - Risk weights could affect the safety of financial institutions and investment in emission-reducing technologies (Batten, Sowerbutts, and Tanaka 2016)
 - Risk weight adjustments could lead to double-counting of climate-related risks, resulting in distortions (NGFS 2020b)

Do asset prices reflect climate-related risks? (1)

- Property prices do not adequately reflect the physical risks, such as a rise in sea levels and floods (e.g., Bernstein, Gustafson, and Lewis 2019; Murfin and Spiegel 2020; Hino and Burke 2020)
- Many studies show that stock markets price in transition risks to some extent (e.g., Hsu, Li, and Tsou 2020; Bolton and Kacperczyk 2020a, b), although several studies find evidence for mispricing of physical risks (e.g., Hong, Li, and Xu 2019)
- A number of studies examine other asset classes such as corporate and municipal bonds, green bonds, syndicated loans, and weather derivatives and essentially find that the prices of such assets appear to incorporate some types of climate change risks to some extent (e.g., Delis, de Greiff, and Ongena 2020)

Do asset prices reflect climate-related risks? (2)

- When asset prices do not adequately factor in risks, they can hinder adaptation and mitigation actions
- Investor behavior and asset prices have changed due to revised perceptions of risks as a result of...
 - Hurricanes that did not damage the property (e.g., Ortega and Taşpınar 2018)
 - Abnormally warm temperatures (Choi, Gao, and Jiang 2020b)
 - Major disasters (Alok, Kumar, and Wermers 2020)
- Disclosure
 - A lack of disclosure leads to the overpricing of properties (Giglio et al. 2018; Hino and Burke 2020)
 - Market capitalizations of firms that disclose their carbon emissions are higher than those of comparable non-disclosing firms (e.g., Matsumura, Prakash, and Vera-Muñoz 2014)
 - When firms disclose their carbon emissions for the first time, low emission firms enjoy higher stock returns than high emission firms (Jouvenot and Krueger 2020)

Natural disasters and bank behavior (1)

- When the area in which banks operate is affected by a natural disaster, banks' health deteriorates
 - Non-performing loans and z-score (e.g., Noth and Schüwer 2018)
 - Delinquency, foreclosure, and credit scores (Gallagher and Hartley 2017; Issler et al. 2020)
- Demand for borrowing increases (e.g., Berg and Schrader 2012)
- Supply of loans falls
 - Damage to firms' tangible assets and to the net worth of their primary banks leads to borrowing constraints (Uesugi et al. 2018)
 - Higher interest rates and the need to secure loans with collateral (Collier et al. 2019; Brown, Gustafson, and Ivanov 2020)
 - Transmission of negative shocks to loan supply in distant unaffected areas (e.g., Cortés and Strahan 2017; Rehbein and Ongena 2020)

Natural disasters and bank behavior (2)

- Heterogeneity in the impact of a natural disaster
 - Young and small firms (Uesugi et al. 2018; Collier et al. 2019)
 - Bank capital (Schüwer, Lambert, and North 2019; Rehbein and Ongena 2020; Ivanov, Macchiavelli, and Santos 2020)
 - Capital regulation and supervision (Klomp 2014)
 - Local banks (Gallagher and Hartley 2017; Chavaz 2016), in particular for young and small firms (Cortés 2014).
 - Currently unaffected but generally disaster-prone areas (Rehbein and Ongena 2020)
 - Relationships between a financial institution and its clients (Berg and Schrader 2012)
- Public support mitigates the impact of a disaster, but distorts resource allocation
 - GSEs (Cortés and Strahan 2017; Ouazad and Kahn 2020)
 - Capital injections into affected banks (Uchida et al. 2015)

The role of insurance and related challenges

- Insurance mitigates the impact of disasters and complements bank finance
 - E.g., households use insurance to repay (Gallagher and Hartley 2017)
- Low insurance coverage
 - According to Swiss Re, worldwide, more than 70 percent of natural disaster losses are not covered by insurance (Holzheu and Turner, 2018)
 - Particularly low among low-income households and young and small businesses (Botzen, Kunreuther, and Michel-Kerjan 2019; Collier et al. 2019)
 - It is due to both supply and demand factors and could be improved with better communication (e.g., Botzen and van den Bergh 2012)
- Financial health of insurers
 - Fire-sale (Massa and Zhang 2020)
 - Higher fees and a reduced supply of insurance (e.g., Froot 2001)
- Moral hazard
 - Public insurance (e.g., Annan and Schlenker 2015; Kahn and Smith 2017)
 - Can properly designed private insurance encourage risk-reducing activities?

Conclusion

- First, asset prices, in particular properties, do not adequately price in physical risks. Asset prices may decline significantly as climate change risks materialize. Mispricing of assets can distort incentives. Disclosure helps alleviate these problems, although there are associated costs.
- Second, natural disasters restrict the credit supply of banks even in unaffected areas. Public support potentially distorts resource allocation. The impact of a disaster is less severe for banks with a higher capital ratio. Regulatory frameworks originally intended to be against non-climate shocks are also effective with regard to climate change risks.
- Third, while insurance mitigates the effects of climate change, there are also challenges. It is important for policy makers to be aware of the benefits and challenges when they design monitoring and supervisory framework.
- A great deal of work remains to fill the remaining gaps in our knowledge. It is important to ensure that policy discussions are evidence-based and incorporate the growing body of research findings.