Policy Recommendations

The Missing Link

Linking Financial Stability with Environmental Stability

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This paper summarizes discussions that took place during the OECD Forum on Green Finance and Investment as well as ecos research. The key messages of this paper are the responsibility of ecos and do not reflect the views of the OECD Secretariat or its member countries.

Executive Summary

In 2016, ecos (a sustainability consulting company) and WWF conducted three research studies about the potential impact of environmental and climate-policy risks on the financial system. The results of these studies indicated a correlation between environmental and climate-related risks and the stability of the financial system and have hence triggered questions about the role of prudential authorities in managing climate-related transition risks in a post Paris-Climate-Agreement world. To discuss and debate these findings with critically important financial sector stakeholders, ecos engaged in the OECD Forum on Green Finance and Investment 2018 in Paris on 13 and 14 November 2018.

The discussions at the OECD Forum on Green Finance and Investment has shown how the debate about the role of prudential authorities in mitigating systemic climate-related risk has shifted in 2018 and has reached main actors and decision makers across central banks, financial supervisory authorities, standard setters and financial institutions alike.

Traditionally, the climate challenge has been perceived mainly as an environmental policy challenge, and consequently as a topic for governmental legislative action, rather than a risk subject for prudential authorities mandated to conduct a country's monetary policy and to manage material systemic risks. This notion has recently been challenged by key standard setters (e.g. Bank for International Settlements) and central banks (e.g. Banque de France). There is a growing perception among these prudential authorities that climate-related risks are relevant and provide material risks for monetary policy and credit and market risk control. The duty to assess, understand and mitigate such risks is therefore perceived to fall at least in parts into the mandates of prudential authorities.

What precise role prudential authorities should play in mitigating climate-related risks, however, is still subject to debate and as yet there is no consolidated global view on this issue emerging. Most financial authorities, however, support private market or governmental efforts to establish more transparency about climate-related risks as well as academic and private sector efforts to assess climate-related financial risks.

The question whether prudential authorities should act more pro-actively and assess, quantify and mitigate such risks by setting standards themselves (e.g. risk stress testing, scenario assessments or disclosure requirements) is still debated. While rule-based prudential authorities in Europe (e.g. Banque de France) tend to support more pro-active approaches and are starting to integrate climate

risks into their practices, principle-based authorities (such as Switzerland and Japan) tend to focus more on promoting voluntary, market-led actions.

In light of increasing concerns by leading prudential institutions about the potential risks of climate change for monetary policy and the stability of the financial system, it would be desirable, without questioning the independence of prudential authorities from governmental legislation, to see more pro-active actions aimed at assessing and integrating climate-related risks.

The OECD, by means of its Centre on Green Finance and Investment, is continuing policy dialogue and stakeholder engagement on green finance and investment issues, including topics covered at the 5th Forum on GFI.

Index

Introduction and Background

In 2016, ecos (a sustainability consulting company) and WWF conducted three research studies about the potential impact of environmental and climate-policy risks on the financial system.

The first study by Von Dahlen (2016)[1] described the impact of physical environmental risks on the economy and the financial sector, the other two studies by Kiose and Keen (2017)[2] and Battiston et al. (2016[3]) described the impact of climate-related transition risks on individual companies and on the banking system and the stability of the financial system overall.

The research was published in a white paper early in 2018 under the title: «The Missing Link - Linking Climate Risk with Financial Stability». It showed clear links between environmental risk and financial risk. The main findings were the following:

1. Climate-policy risk poses a threat to the solvency of the European banking sector via network effects.
2. There is a negative correlation between climate change-related natural catastrophes and financial market resilience.
3. Environmentally unfriendly infrastructure debt commands a higher risk premium.

To debate these findings with critically important financial sector stakeholders, i.e. central banks, financial supervisors, finance and environmental ministries, and financial institutions, ecos participated in the OECD Forum on Green Finance and Investment 2018 in Paris on 13 and 14 November 2018.

The following chapters give an overview about these discussions and related international actions.

[1] von Dahlen, S. (2016): The missing link? Assessing the correlation between climate change-related catastrophes and financial market resilience. Working Paper.
[2] Kiose, D. & Keen, S. (2016): Understanding the relationships between environmental and social risk factors and financial performance of global infrastructure projects. Kingston University.
[3] Battiston, S. et al. (2016): A climate stress-test of the financial system. Nature Climate Change, 7, 283-88.

OECD Discussions

The OECD Forum on Green Finance and Investment was organized with the support of the Japanese government and brought together leading actors from the green finance and investment community to promote effective engagement, collaboration and action on green finance and investment. It included institutional investors, asset managers, ministries of finance and central banks, financial regulators, commercial and investment banks, international climate funds, multilateral development banks, green investment banks, corporations, civil society, the philanthropic sector and more.

In the first keynote presentation Angel Gurría (Secretary-General OECD) reiterated the urgency of the climate challenge. He mentioned specifically that (as per IPCC 2018, p.6), "human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate."

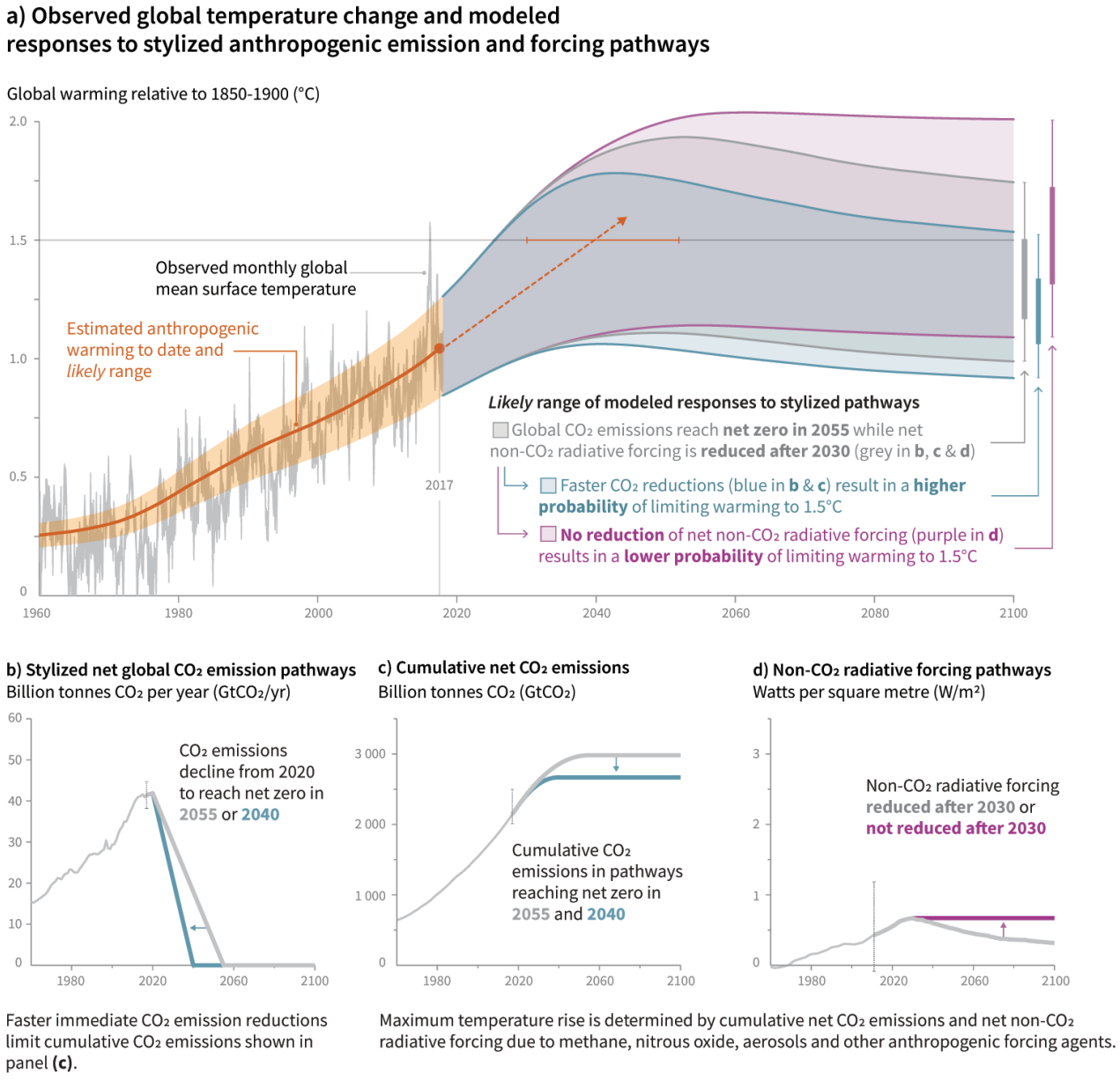
Furthermore, the IPCC report stated that countries' current pledges to reduce their emissions are not in line with limiting global warming to 1.5°C (IPCC 2018, D1, p.20), in fact, "pathways reflecting current nationally stated mitigation ambitions until 2030 are broadly consistent with cost-effective pathways that result in a global warming of about 3°C by 2100" (IPCC 2018, D.1.1., p.20). Pathways limiting global warming to 1.5°C with no or limited overshoot would require "rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems" (IPCC 2018, C2, p. 17).

It has been estimated by McGlade & Paul Ekins (2015)[4] that, globally, a third of all oil reserves, half of all gas reserves and over 80 percent of current coal reserves should remain unused from 2010 to 2050 in order to meet the target of 2 °C. In other words, a large proportion of fossil energy reserves would become "stranded assets", posing potential systemic risks to the financial sector. The

[4] McGlade & Paul Ekins (2015). The geographical distribution of fossil fuels unused when limiting global warming to 2 °C. Nature volume 517, pages 187–190. https://www.nature.com/articles/nature14016

exposure of the European financial sector (banks, insurance companies, and pension funds) to fossil energy assets has been estimated by Weyzig et al. (2014) to amount to more than €1 trillion[5].

Cumulative emissions of CO_2 and future non-CO_2 radiative forcing determine the probability of limiting warming to 1.5°C



Source: IPCC, www.ipcc.ch/sr15/graphics/#cid_603

[5] Weyzig et al.(2014): The Price of Doing Too Little Too Late. The impact of the carbon bubble on the EU financial system. A report prepared for the Greens/EFA Group – European Parliament. https://reinhardbuetikofer.eu/wp-content/uploads/2014/03/GND-Carbon-Bubble-web1.pdf

According to IPCC, “future climate-related risks depend on the rate, peak and duration of warming. In the aggregate, they are larger if global warming exceeds 1.5°C before returning to that level by 2100 than if global warming gradually stabilizes at 1.5°C, especially if the peak temperature is high (e.g., about 2°C).” Some impacts, however, ”may be long-lasting or irreversible, such as the loss of some ecosystems” like warm water corals (IPCC, 2018, A.3.2, p.7).

To avoid such large-scale effects, Gurría has suggested that “We need to put a price on carbon, reform fossil fuel subsidies and increase carbon policy and regulation globally”.

The Role of Prudential Authorities in Mitigating Climate Change Risks

In the following discussions at the OECD Forum on Green Finance and Investment, the role of central banks and financial supervisors in mitigating climate risks was debated. Before highlighting the latest developments and discussions, however, it is important to understand their traditional roles.

Briefly put, the main role of central banks is to conduct a country's monetary policy as an independent institution, to ensure price stability and create an appropriate environment for economic growth. In addition, central banks are responsible for cash supply and distribution, settlement of cashless payments, managing currency reserves and contributing to the stability of the financial system by analyzing sources of risk to the financial system and identifying areas where action is needed. Furthermore, central banks help to create and implement a regulatory framework for the financial sector and oversee systemically important financial market infrastructures.

The role of financial supervisors, in comparison, is to supervise financial institutions and intermediaries to protect creditors, investors and policyholders, and they are responsible for ensuring the effective functioning of financial markets and promoting the reputation of the financial marketplace. Financial supervisory authorities also participate in the work of international organizations and associations and work with foreign supervisory authorities as part of international supervisory cooperation efforts, particularly in supervisory or enforcement proceedings, as well as the resolution of financial institutions. Financial supervisory authorities also participate in the activities of international standard-setting bodies and make regular contributions to their work with a view to shaping developments at an international level.

Given the prudential authorities' mandate to assess material financial risks potentially affecting the stability of the financial system, they are in principle obliged to consider newly emerging risks such as climate change as well (UNEP Inquiry, 2017[6]). Furthermore, according to the UNEP Inquiry (2017), they would have powerful tools available to influence the flow of capital as part of their

[6] UNEP Inquiry (2017). On the role of central banks in enhancing green finance. http://unepinquiry.org/wp-content/uploads/2017/02/On_the_Role_of_Central_Banks_in_Enhancing_Green_Finance.pdf

monetary and macro-prudential role (e.g. via setting climate-related disclosure standards, green macroprudential regulation, climate stress testing, differentiated credit policy instruments, reserve requirements, capital requirements and more).

The main role of prudential institutions in the mitigation of climate change, however, is limited to managing risks rather than setting environmental policy, which is the role of governments, i.e. environmental and finance offices. Given this mandate, the definition of materiality becomes an important factor. The critical question surrounding climate risks is how prudential institutions are dealing with slowly emerging risks such as climate change.

Until recently, the generally pursued approach of central banks and financial supervisors was to focus on more short- and medium-term monetary risks and financial institutions-related credit and market risk exposures, which can be quantified based on generally accepted risk models and risk ratings from internationally accepted rating agencies. Climate risks are often still perceived as less relevant from that more short-term perspective as they are expected to emerge over a longer period. Related risks cannot be quantified easily by currently available, traditional risk tools as relevant data is often not yet available to the extent needed and adequate risk models to assess physical and transition risks are missing. In other words, there is a blind spot from a prudential perspective when it comes to dealing with slow burning climate risks with ill-defined effects and possible tipping points.

In recent months, however, the debate among prudential actors on this aspect has moved forward significantly.

Major Prudential Authorities Acknowledge that Climate Change is a Source of Financial Risk in Need of Further Assessment

On 11 October 2018, the Network of Central Banks and Supervisors for Greening the Financial System (Banque de France, 2018)[7] published its first progress report. As part of this update, NGFS Members acknowledged that "climate-related risks are a source of financial risk" and hence "managing these risks is within the mandates of central banks and financial supervisors to ensure the financial system is resilient to these risks." Furthermore, they stated that central banks and supervisors as well as financial institutions "are deepening their understanding of these risks and the need for an improved approach. The tools and methodologies, however, are still at an early stage and there are a number of analytical challenges." As next steps, they concluded that central banks and supervisors as well as financial institutions "need to develop new analytical and supervisory approaches, including those based on forward looking scenario analysis and stress tests."

On 8 November 2018, the NGFS and the Council on Economic Policies jointly organized a conference on the topic of "Scaling up Green Finance: The Role of Central Banks", which was hosted by the German Bundesbank. At this occasion, Benoît Cœuré, Member of the Executive Board of the ECB, highlighted the impact of climate change on the conduct of monetary policy (ECB 2018)[8].

As an example, he mentioned second order supply effects. These can take different forms, such as droughts and heatwaves that lead to crop shortfalls and put upward pressure on food prices; or hurricanes and floods that destroy production capacity, thereby raising input and output prices; and

[7] Banque de France (2018) : First Progress Report. https://www.banque-france.fr/en/financial-stability/international-role/network-greening-financial-system/first-ngfs-progress-report

[8] ECB (2018): Speech by Benoît Cœuré, Member of the Executive Board of the ECB, at a conference on "Scaling up Green Finance: The Role of Central Banks", organised by the Network for Greening the Financial System, the Deutsche Bundesbank and the Council on Economic Policies, Berlin, 8 November 2018 https://www.ecb.europa.eu/press/key/date/2018/html/ecb.sp181108.en.html

unusually cold winters that cause productivity shocks and raise input prices for the same level of output. He stated that these "supply shocks, such as weather-related disturbances, typically pose a dilemma for central banks, which may then have to choose between stabilizing inflation or economic activity."

He therefore concluded that "more frequent climate-related shocks may increasingly blur the analysis of the medium-term inflationary pressures relevant for monetary policy. More fat-tailed shocks may erode central banks' conventional policy space more often in the future. And uncertainties surrounding the speed and scope of the transition towards a low-carbon economy can potentially impact medium-term inflation expectations, posing challenges to central banks as the horizon of monetary policy is stretchable but not infinite."

Consequently, he stated that the European Central Bank (ECB) "will concentrate its efforts on supporting market participants, legislators and standard-setting bodies in identifying the risks emerging from climate change and providing a clear framework to reorient financial flows and reduce such risks. A unified framework is the gravitational force needed to finance the greening of our economy. And it is the precondition for central banks themselves to expand the use of ESG criteria in the build-up and management of their own asset portfolios."

In line with such concerns and planned activities, Nathalie Aufauvre (Director-General, Financial Stability and Operations, Banque de France) stated at the OECD Forum on Green Finance and Investment that the "Bank of France considers climate change a risk to the stability of the financial system" as well and furthermore "to support private disclosure efforts such as the TCFD requirements, the Bank of France will adopt similar transparency standards."

While members of the NGFS are increasingly gravitating towards accepting climate change as a material financial risk affecting the stability of the financial system and acknowledge their role in mitigating such risks, the more principle-based prudential authorities in Switzerland and Japan, for instance, presented a softer approach to climate risk mitigation. Mr. Koichi Ishikura (Director and Chief Officer, International Affairs and Research, Japan Securities Dealers' Association (JSDA)) and Mr. René Weber (Head, Policy Coordination Division, State Secretariat for International Finance (SIF) Switzerland) were both present at different sessions of the OECD Forum on Green Finance and Investment. During these sessions, it was mentioned that in many areas of Europe, there is an increasing focus on incorporating climate risks into regulation. By contrast, in Japan and Switzerland, there is a greater focus is on promoting voluntary actions by the financial sector. For instance, in 2017, investors were invited to test the alignment of their investments with the Paris Climate Agreement. In the long term, however, financial market policies and environmental policies will need to be better reconciled and aligned with one another.

Voluntary Market-Led Efforts are not Delivering Decision-Useful, Climate-Related Information

In September 2018, the Taskforce on Climate-related Financial Disclosures released its status report (TCFD 2018)[9] of the first disclosure period 2018. The Task Force found that "climate-related disclosures are still in early stages and further work is still needed for disclosures to contain more decision-useful, climate-related information." Key takeaways included the following:

- "Most companies disclosed information aligned with at least one recommended disclosure, usually in sustainability reports.
- Few companies describe the resilience of their strategies under different climate-related scenarios, including a 2°C or lower scenario, which is a key focus area for the Task Force.
- Companies often provide information aligned with the TCFD recommendations in multiple reports – financial filings, annual reports, and sustainability reports.
- While many companies disclose climate-related financial information, few disclose the financial impact of climate change on the company.
- The companies' areas of focus in terms of climate-related financial disclosures vary significantly. For example, a higher percentage of non-financial companies reported information on their climate-related metrics and targets compared to financial companies, but a higher percentage of financial companies indicated their enterprise risk management processes included climate-related risks."

These findings were also reflected at the OECD Forum on Green Finance and Investment. Anne-Sophie Castelnau (Director-General, Wholesale Banking, ING France) for instance, stated that ING supports TCFD recommendations and mentioned when you make something mandatory the quality of the reporting is getting much better. Eric Usher (Head, UN Environment Programme

[9] TCFD (2018): 2018 Status Report. Link: https://www.fsb-tcfd.org/publications/tcfd-2018-status-report/

Finance Initiative (UNEP FI)) supported this view and stated that TCFD should become compulsory to firm up disclosures. Catherine Howarth (Chief Executive, ShareAction) supported the view, that TCFD requirements should become mandatory. In addition, Adam Matthews (Director, Ethics & Engagement, Church of England Pensions Board and Co-Chair, Transition Pathway Initiative (TPI)) supported this view as well. He stated that there is an enormous gap in climate risk disclosure regulation.

Actions to Develop an EU-Wide Strategy on Sustainable Financing Including Regulatory Aspects Relevant for Financial Institutions

In recent years and particularly in 2018, the EU-wide legislative process to define sustainable finance regulation has entered a dynamic transition phase. The EU Commission has decided to develop an EU-wide strategy on sustainable financing (EU Sustainable Finance, 2018)[10] which aims at strengthening the financial contribution towards a transition to a low carbon and sustainable and circular economy and the stability of the financial system by integrating ESG factors into the investment decision making process. Its key actions include establishing a green taxonomy and labels for green financial products, introducing measures to clarify fiduciary duties of institutional investors, strengthening the transparency of companies in relation to ESG issues and introducing a "green supporting factor" in the EU prudential rules for financial institutions, meaning incorporating climate risks into financial institutions' risk management policies and supporting institutions that contribute to fund sustainable projects.

Furthermore, current EU actions include a proposal for a regulation on disclosures relating to sustainable investments and sustainability risks and amending Directive (EU)2016/2341 and by amending either existing delegated acts under the UCITS Directive 2009/65/EC, the AIFM Directive 2011/61/EU, the MiFID II Directive 2014/65/EU, the Solvency II Directive 2009/138/EC and the IDD Directive 2016/97, or by adopting new delegated acts under the same Directives. Directorate-General for Financial Stability, Financial Services and Capital Markets Union sent a formal request to the European Insurance and Occupational Pensions Authority (EIOPA) and the European Securities and Markets Authority (ESMA) for technical advice in this respect.

Given these developments on EU level, the role of financial regulation in controlling climate-related risks is likely to change significantly over the next years. At the OECD Forum on Green Finance and

[10] EU Sustainable Finance (2018): https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance_de#overview

Investment in Paris, Olivier Guersent (Director-General, Directorate-General for Financial Stability, Financial Services and Capital Markets Union (DG FISMA), European Commission) supported the view that climate-related factors should be integrated into the investment process. Serge Harry (Special Advisor to the Group CEO and Group Country Head, France, Benelux and Germany, London Stock Exchange Group (LSEG)) was more cautious about the scope and speed of implementation. He stated that whilst LSEG supports the EU action plan, its implementation should not become too prescriptive too early.

International Initiatives for Sustainable Infrastructure Financing and Investment

The next 10-15 years will be crucially important for climate mitigation as the global infrastructure investments are estimated to amount to about USD 90 trillion by 2030 (The New Climate economy, 2018)[11]. Hence, it will become crucial to make sure these investments are sustainable.

In a recent effort, the OECD, UN Environment and the World Bank Group have joined forces under a new initiative – Financing Climate Futures: Rethinking Infrastructure. The initiative explores what public and private actors should do to trigger the radical transformation needed to align financial flows in infrastructure for a low-emission, resilient development. The initiative, supported by the German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU), stems from the 2017 G20 Hamburg Climate and Energy Action Plan which called on the three organizations to "compile ongoing public and private activities within the G20 making financial flows consistent with the Paris goals and, building on this, to analyze potential opportunities for strengthening these efforts".

In September 2018, the initiative published a synthesis report (OECD 2018)[12] which identified six transformative areas that have the potential to "help the different financial actors move beyond an incremental approach to the low-carbon transition towards the transformational agenda needed for decisive action." The six areas of action include: planning, budgeting, innovation, finance, development and cities.

At the OECD Forum on Green Finance and Investment in Paris the discussion focused on the role and importance of project pipelines in planning and delivering sustainable infrastructure and the

[11] The New Climate Economy (2018): The 2018 Report of the Global Commission on the Economy and Climate. Link: https://newclimateeconomy.report/2018/key-findings/

[12] OECD (2018): UN Environment and the World Bank Group (2018), Financing Climate Futures – Rethinking Infrastructure. Link: http://www.oecd.org/environment/cc/climate-futures/synthesis-financing-climate-futures.pdf; Developing Robust Project Pipelines for Low-Carbon Infrastructure. Link: https://www.oecd-ilibrary.org/environment/developing-robust-project-pipelines-for-low-carbon-infrastructure_9789264307827-en

role of project developers, governments and financing institutions. A panel of international experts discussed initiatives linked to sustainable infrastructure financing and related issues.

The key takeaways from this discussion can be summarized as follows:

Amal-Lee Amin (Chief of Climate Change, Inter-American Development Bank (IDB)) explained the importance of policy coherence across economic and financial, capital, social, environmental (biodiversity, climate resilience) and institutional (alignment with other priorities) dimensions. Taking the example of Mexico, she provided an overview of related activities, including: (i) establishing and maintaining a good dialogue between public and private stakeholders to clarify roles, (ii) up-stream engagements working with the Treasury Office to discuss the infrastructure planning process, (iii) developing a project platform at national level (including a database to ensure transparency about projects coming fourth and working with project developer), and (iv) closing resources and regulatory gaps and focusing on mobilization efforts. She mentioned that significant collaboration among multilateral development banks is needed to help satisfy investors' requirements for transparency and low corruption risks.

As a good example she mentions the work of the Public-Private Infrastructure Advisory Facility (PPIAF)[13], a multi-donor technical assistance facility that is financed by eleven multilateral and bilateral donors. Established in 1999 as a joint initiative of the governments of Japan and the United Kingdom, working closely with and housed inside the World Bank Group, PPIAF is a catalyst for increasing private sector participation in emerging markets. The mission is to help eliminate poverty and increase shared prosperity in developing countries by facilitating private sector involvement in infrastructure.

Andrea Colnes (International Director, Coalition for Green Capital) reiterated similar challenges, namely the importance of more coherent links between project development and policy / government actions. Recently, the Coalition for Green Capital[14] created a new green bank in South Africa, a financing facility for smaller infrastructure projects, which are not bankable, for instance small power or clean water projects.

André Laboul (Special Financial Advisor to the OECD G20 Sherpa and Senior Counsellor, Financial and Enterprise Affairs Directorate, OECD) summarized several key challenges for financing global sustainable infrastructure, namely the need for regulatory and political certainty, corruption risks and lack of data. He also emphasized the importance of following a multi-stakeholder approach, involving project developers, political actors and financing institutions from the start.

[13] https://ppiaf.org/about-us
[14] http://coalitionforgreencapital.com/about-us/

Marc Sadler (Practice Manager, Climate Change Group, the World Bank) explained the latest initiative at the World Bank. Firstly, the World Bank implemented a climate change action plan that defines the ambitions, the focus of action and clarifies related targets. He also mentioned that the World Bank developed a sustainability framework to minimize sustainability risks (violations of environmental, social and governance norms and related reputational risks) across all infrastructure projects. He also described key requirements for attracting investors, namely, projects need to be combined and securitized in order to meet liquidity and investment size expectations by global institutional investors (e.g. big pension funds or similar asset owners). Ideally, infrastructure investments should be structured in dedicated securities, traded large scale on the capital market.

Daniel Wiener (President of the Board, Global Infrastructure Basel Foundation (GIB)) gave information about quality related issues of infrastructure investments, namely the fact that in many cases, project developers, governments and financing institutions are not focusing enough on quality standards that ensure long-term sustainability of projects and alignment with international climate or economic development related policies. Very often, the main criteria for financing experts is the procurement price, rather than long-term quality risk factors which would paint a different picture for investors. To avoid such risks, applying quality standards early in the financing process is very important. In this respect, he mentioned SuRe® – The Standard for Sustainable and Resilient Infrastructure[15], a global voluntary standard which integrates key criteria of sustainability and resilience into infrastructure development and upgrade.

Amar Bhattacharya (Senior Fellow at the Global Economy and Development Program at Brookings Institution) mentioned that only very few countries are considering sustainability goals. To ensure the long-term sustainability quality of infrastructure projects, she mentioned the importance of international quality standards, such as SuRe®: "We need to get public finance right to get private finance right."

[15] http://www.gib-foundation.org/sure-standard/

Conclusions

The discussion about the role of prudential authorities and financial institutions in the transition to a low-carbon economy has developed further in the last years and reached main actors and decision makers across central banks, financial supervisory authorities, standard setters and financial institutions alike.

There is a growing perception that climate-related risks are, in fact, relevant and material for monetary policy, credit and market risk control and hence in principle, fall into mandates of central banks and financial supervisory authorities.

The exact role prudential authorities should play, however, is still subject to debate. Most institutions support private market or governmental efforts to establish more transparency about climate-related risks as well as academic and private sector efforts to assess climate-related financial risks.

The question whether prudential authorities should act more pro-actively and set standards, e.g. risk stress testing, scenario assessments is debated still. While rule-based prudential authorities in Europe (for instance Banque de France) tend to support more pro-active approaches and are starting to integrate climate risks into their practices, principle-based authorities (such as Switzerland and Japan) tend to focus more on promoting voluntary, market-led actions by financial institutions.

Given the increasing concerns by leading prudential institutions about the potential effects of climate change on the stability of the financial system, however, it would be desirable to see more pro-active actions by central banks and financial supervisors.

What can and should financial regulators and supervisory authorities do?

First and foremost, central banks and supervisory authorities should accept and acknowledge their role in assessing, understanding, testing and mitigating emerging climate change related risks affecting the financial sector and potentially the stability of the financial system.

A principle-based approach to financial regulation should not mean that efforts to assess and understand climate-related risks are left with financial institutions alone. Otherwise, the 'tragedy of

horizons', i.e. the blindness related to long-term climate risks, could be further aggravated by a 'tragedy of ideology', i.e. a fundamental argument about the role of financial regulators in mitigating climate risks and a narrow definition of material financial risks.

Furthermore, a lack of knowledge, data and models for assessing systemic, often second order effects of climate change should not prevent central banks and financial supervisors from taking pro-active actions.

Reasonable next steps could include the following actions:

1. A good starting point would be, if central banks start conducting climate stress tests to assess the resilience of financial institutions and the financial market under different policy and legal transition pathways and physical risk scenarios.
2. Furthermore, central banks and financial supervisors should encourage voluntary climate-related risk disclosure efforts, as an example the Taskforce on Climate-related Financial Disclosures (TCFD) requirements, and start to consider and develop further compulsory disclosure requirements soon.
3. In addition, central banks should help strengthening the global response required to meet the goals of the Paris Agreement and to enhance the role of the financial system to manage climate-related risks by joining and supporting international discussions and initiatives such as the Network for Greening the Financial System (NGFS)[16].
4. Lastly, central banks could lead by example and apply climate-related factors to their own asset portfolios, such as pension funds and their own investment funds. This could include climate-related benchmarks, exclusion policies and carbon-related weights, which would help to reduce long-term climate risks.

[16] On December 12th 2018, the NGFS consists of the following members: Banco de España, Banco de México, Banco de Portugal, Bank Al Maghrib, Bank of England, Bank of Finland, Bank Negara Malaysia (Central Bank of Malaysia), Banque centrale du Luxembourg, Banque de France / Autorité de Contrôle Prudentiel et de Résolution (ACPR), Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin), De Nederlandsche Bank, Deutsche Bundesbank, European Banking Authority, European Central Bank, Finansinspektionen (Swedish FSA), Japan FSA, Monetary Authority of Singapore, National Bank of Belgium, Norges Bank, Oesterreichische Nationalbank, People's Bank of China, Reserve Bank of Australia, Reserve Bank of New Zealand and Sveriges Riksbank.

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