



Horizon 2020 Societal challenge 5: Climate action, environment, resource efficiency and raw materials

**COP21 RPPLES – COP21: Results and Implications for
Pathways and Policies for Low Emissions European Societies**

From transformational climate finance to transforming the financial system for climate

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Contents

1	Introduction.....	4
2	Context for the transformation: pathways for Paris Agreement-compatible finance.....	6
2.1	The Paris Agreement's Article 2.1(c): the case for a climate-based financial transformation (Setting out the legal context of the Paris Agreement and the Katowice rulebook)	6
2.1.1	Operationalization of Article 2.1(c) through the PA rule-book	9
2.1.1.1	Gaps and limitations.....	10
2.1.2	Existing knowledge and the status of Article 2.1(c)	11
2.2	1.5°C compatible pathways as scientific context for the financial transformation	12
2.2.1	Key messages from the IPCC 1.5°C Special Report guiding the financial transformation.....	13
2.2.2	Current state of research in scientific approaches towards climate targets and the necessary financial sector transformation.....	15
2.2.2.1	Energy investment needs in line with 1.5°C.....	16
2.2.2.2	Investment gap between current energy policies and 1.5°C	18
2.2.2.3	Disinvestment needs in the financial sector in line with 1.5°C	18
2.2.3	Linkages to RIPPLES Modelling Work Packages.....	19
2.2.3.1	Work package 2: D2.3 Report on implications of 1.5°C versus 2°C for global transformation pathways	19
2.2.3.2	Work package 3: D3.5 Report on quantitative and qualitative analysis of the financial system implications of decarbonisation pathways	22
2.2.4	Conclusions on the existing science	22
2.2.5	Remaining gaps for understanding 1.5°C investment pathways in line with Article 2.1(c) PA	23
3	The financial system after the Paris Agreement: Theoretical and governance elements/paradigms called upon by financial regulators and practitioners	24
3.1	A conceptual dichotomy: pushing vs. pulling the financial markets	25
3.2	A theoretical dichotomy: Free markets vs. regulated markets	27
3.2.1	Free markets and efficiency: theoretical elements	28
3.2.2	Regulated markets: theoretical elements	30
3.3	A brief history of central banking priorities: systemic risks, climate change and the return of macro-prudential approaches.....	32
3.4	A broader financial paradigm shift for fighting climate change: from thinking a niche to thinking a system	35
3.5	Polycentric governance for a climate transformation of the financial system: levels and modes.....	39
3.5.1	Governance levels: subnational, national and international.....	40
3.5.2	Governance modes: between binding norms, soft-law voluntarism and self-regulation.....	45
4	Description and decryption of current narratives	50
4.1	The main current narrative families	50
4.2	Analysis of climate-related finance policies through our theoretical and governance framework.....	51

4.3	Analysis of the European sustainable finance action plan.....	52
4.4	Analysis of the Chinese Guidelines for Establishing the Green Financial System	59
4.5	Comparison between the key policy strategies for EU and China	66
4.5.1	Overview of results for the EU	67
4.5.2	Overview of results for China	68
4.5.3	Comparison between the EU and China.....	69
5	Recommendations.....	70
5.1	Policy.....	70
5.2	Research	72
6	Conclusion	77
7	References	79
ANNEXES.....		87
ANNEX 1. The European Commission sustainable finance action plan.....		87
ANNEX 2. Chinese Guidelines for Establishing the Green Financial System.....		90
ANNEX 3. Framework		95

1 Introduction

The Paris Agreement (PA) has introduced a new overarching financial objective of *making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development* (PA, 2016, article 2.1.c). This was a game changer, since it has brought a commitment to all financial flows as one of the three key objectives of the agreement. The article 2.1.c goes way beyond the previous UNFCCC focus on support to developing and most vulnerable countries, creating a collective responsibility to restructure the whole financial system. It means to say that if our mitigation goal has been set to stay within 1.5°C of average warming, then we have a small and finite global carbon budget left. In the scenario of reaching the limit of our carbon budget, no more greenhouse gas emissions will be acceptable into the system. In that case, no financial flow, national, bilateral or international, within or across countries in different or similar development stages, will be possibly be allowed to fund additional net emissions. Finance can no longer be limited to a means of implementation in order to obtain additional emission reductions. From now on, all of it must start shifting towards net-zero emissions. But achieving such a transformational shift requires a thorough understanding of the financial system, in order to be really effective at global scale and avoid inconsistencies and conflicting effects.

Thus far, finance has been mostly understood within the international climate community as a system in equilibrium that can efficiently allocate capital according to perfectly informed prices. In this line of thought, by addressing the energy sector through actions such as to reduce the cost of capital and to increase the competitiveness of renewables, money should naturally flow to these activities and away from carbon intensive ones, that would start losing competitiveness. However, financial actors might be more comfortable with the established fossil fuel industry, which also holds a larger penetration with governments worldwide and can mobilise its lobbying structures to avoid disruptive changes. These same actors can perceive higher risks in the strong but newly established renewables market, decide based on individual bias pro and against certain countries and sectors, rely on quantitative structures that disregard environmental concerns altogether for decision allocations etc. Beyond assessing only the positive *alignment* part of the picture, growth of investments in renewables might also be entirely neutralized by a corresponding increase of capital into misaligned and carbon-intensive activities. To cover these blind spots, looking at finance as a sectoral system allows us to take a step back and try to understand why, for example, despite increased competitiveness in renewables and numberless pledges by financial actors since the signature of the Paris Agreement, most of the leading institutional managers in the world have expanded their equity stakes in the oil & gas majors between 2014-2017 (IEA, 2018). Or why in detriment to climate action and against the imminent financial risk of stranded assets, the largest investors in the world have ramped up their holdings in coal in more than a fifth between 2016 and 2018 (Mooney, Hook and McCormick, 2019). These are questions that require a deep understanding not only of the energy sector, but also on how the financial system is structured and how it takes its decision.

The present study was imagined as an exercise to clarify this financial sectoral system, particularly focusing on mitigation, but with a deeper understanding between climate and finance governance that can also become essential for areas such as adaptation to climate change and finance for loss and damage. **Section 2** will provide the context for the transformation of the financial system, expanding on the disruptive and paradigmatic shift that the Paris Agreement's article 2.1.c has brought to the international climate governance and to governments in relation to their approaches to finance. It will also assess how this has been evolving within the UNFCCC system. The section will build on how far the science has come in terms of linking climate science with the financial world, and vice-versa, using the latest IPCC Special Report on 1.5°C as our example of state of the art's report to indicate what has been produced and what gaps remain when considering the sector as a whole and all-encompassing system on its own. As an initial exploration of how to unveil this systemicity in finance, **Section 3** will focus on the analysis of a few selected financial paradigms in terms of theories, policy types and governance approaches, describing perceived "consensus" and established dogmas within finance. We will specifically analyse how financial policies are developed in order to articulate the climate change issue with the broader financial goals and the role of the financial system in producing public goods. After all, the way that a given developed European country will address the need for finance for climate goals on the municipal level will be quite different from the approach chosen by a developing island State with high vulnerability and limited access to international commercial funding. Making explicit that not all countries should behave equally in terms of financing for climate change is paramount to the development of tailored solutions that will support all countries in the long term, also informing future negotiations on the topic and avoiding the use of climate change as an exchange coin for the imposition of other types of economic and financial interests. Under **Section 4** we will turn the broader theoretical, policy and governance analyses into an initial and exploratory framework to assess different climate-related financial regulation strategies. The choice has been to understand more in-depth the European Union Action Plan in Sustainable Finance and the Chinese Guidelines for Establishing the Green Financial System, then turning to their comparison in terms of approaches, weaknesses and strengths. Initially, the framework has been conceived to provide the big picture of how different countries have been approaching the fight against climate change from a financial perspective. In later stages, these initial comparisons can be brought to updates in how different approaches or financial traditions might contribute to effectiveness in climate emission reductions, bringing some more light on how these plethora of financial interconnections might support countries' Nationally Determined Contributions (NDCs) and the collective efforts to remain within 1.5°C of warming. Section 5 will build on these spotted gaps and provide a set of recommendations both for policy and science.

2 Context for the transformation: pathways for Paris Agreement-compatible finance

Section 2 will provide an analysis of the necessary financial transformation required in the context of the 2015 Paris Agreement (PA) and its implications for the financial sector. In line with the COP21 RPPLES project's overall focus on mitigation and sectoral decarbonisation, the starting point is the PA's long-term goals relevant for financial decarbonisation, including the 1.5°C long-term temperature limit and the long-term financial goal contained in Article 2, paragraph 1 (c) PA (Article 2.1c). We argue that the PA breaks new ground in reflecting the implications of tackling climate change within international financial and climate governance. This section explores the concept of consistency between finance flows and long-term climate objectives to provide the context for the required transformations within the financial sector. We thereby build on the previous COP21 RPPLES deliverable 4.2 which provides the analytical foundation for a sectoral perspective on international climate governance and argues that finance provides an important sectoral system in need of transformation to enable the climate transition. This report aims to further broaden and enhance the understanding about the nature and scope of the required sectoral transformation. To this end, this section will identify the compatibility of 1.5°C pathways for finance, as well as existing analytical and knowledge on 1.5°C consistent finance and investments. It will also seek to incorporate inputs from other parts of the COP21 RPPLES project, such as tasks 2.3 and 3.3 to inform investment needs and pathways under 1.5°C compatible scenarios.

2.1 The Paris Agreement's Article 2.1(c): the case for a climate-based financial transformation (Setting out the legal context of the Paris Agreement and the Katowice rulebook)

The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) and any related legal instruments is "the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNFCCC, 1992, Article 2). The topic of finance was originally brought into the UNFCCC system as the necessary *means* for countries to bring additionality and achieve this stabilization goal. In light of the "common but differentiated responsibilities and capabilities" principle, historical emissions and present-to-future capabilities cemented the understanding that developed countries possess a financial responsibility to support developing nations to implement policies to curb greenhouse gas emissions and to increase resilience to climate extremes (Tian and Xiang, 2018). Climate science and the history of climate negotiations have shown, however, a mismatch between this binary system of yes/no responsibilities — yes to Annex I, no to non-Annex I countries — and the need to remain within a specific threshold of average global warming — a global effort. Increasingly people have understood that although having contributed differently to current levels of GHG in the atmosphere, the challenge forward has become so urgent that we can only succeed by acting collectively, with

every signatory Party on board, albeit while still recognizing the higher responsibilities by some to provide the means to the transition.

Assessing finance only as *means of implementation* departs from a quest for free markets and equates it to the concept of mobilized money. In an idealized system of free market, money should flow freely and unchallenged in every direction, but governments might find ways to nudge flows towards projects that will bring additionality for public goals, in our case in the fight against climate change and to achieve a green economy. The problem is that while we may have more money flowing into climate projects in developing and developed countries, those emission reductions might still be entirely neutralized by continued flows into carbon-intensive activities. Such carbon-intensive flows can undermine additionality obtained elsewhere and keep us in a high-emitting or slowly decreasing trajectory that will not be sufficient to keep the planet below specific temperature targets. However, with the Paris Agreement's clear temperature goal of 1.5°C, obtaining "some" emission decrease is no longer sufficient. 1.5°C scenarios show that we must now reach a full decarbonisation and within a specific -short- period of time. Having financial flows from developed to developing countries is essential to avoid locking-in those developing nations into high-carbon development trajectories, but is that enough? What about the national finance still being invested nationally and across those developing countries, or nationally and bilaterally across developed ones? If our carbon budget is finite and cannot accept further GHG additions after some point in time, with the rational consequence of necessary full decarbonisation of our entire economy, then ultimately no money should be used anywhere in the globe in carbon intensive activities from some point in time. If finance can be used to fund emissions, and we must go down to zero or negative emissions to have any chance of remaining below the 1.5°C temperature goal, then absolutely no more finance can generate greenhouse gas emissions after a certain date. That means to say that finance can no longer be considered as some additional money for "incremental" emission reductions, with no specific deadline. Instead, it must be thought as a system that will have to undergo a complete transformation, attentive of time and possible pathways towards decarbonisation.

Article 2 of the UNFCCC's Paris Agreement (PA) establishes the objective of the PA as "enhancing the implementation of the Convention" with the aim "to strengthen the global response to the threat of climate change" (UNFCCC, 2015, Article 2, paragraph 1) by pursuing three long-term goals, namely the 1.5°C long-term temperature limit (ibid, paragraph 1(a)), a goal on enhancing adaptation and resilience (ibid, paragraph 1(b)), as well as the long-term financial goal of "making finance flows consistent with a pathway towards low-greenhouse gas (GHG) emissions and climate-resilient development" (ibid, paragraph 1(c)). This places the long-term financial goal on equal footing with the other two goals related to climate mitigation and adaptation. It also provides important context for the new concept of consistency between finance flows and "a pathway towards low-GHG and climate-resilient development". In the context of Article 2.1 (a) and (b), Article 2.1(c) can be understood as the goal of aligning finance flows with the 1.5°C temperature limit and the adaptation goal.

This marks a new development in international climate governance. For the first time, Parties to the UNFCCC have set a collective finance goal that targets *all* financial flows. In fact, the term “finance flows” in Article 2.1(c) is broader in scope than terms previously used by the UNFCCC such as “global climate finance flows”, “all financial flows from developed countries” or “flows to developing countries” (UNFCCC, 2014). This goal is overarching and in addition to the existing goal by industrialized countries “of mobilizing jointly USD 100 billion per year by 2020 to address the need of developing countries”, which “may come from a wide variety of sources, public and private, bilateral and multi-lateral, including alternative sources” (UNFCCC, 2011, paras 38, 39). In order to achieve the full decarbonisation demanded to stay within 1.5°C of average warming, we now have an intertwined and overarching financial goal that brings largest emitters into responsibility also about financial flows related to their own emissions, thus addressing their national inward and outward investments even when unrelated with international North-South development. This is broader in scope than the USD 100 billion goal for mitigation and adaptation to developing countries, which was crystalized under Article 9 of the PA and its related provisions. The 2.1.c does not reduce the responsibility of support by developed countries, but rather strengthen its implementation and transformational potential by requiring a more systemic shift of the entire global financial system, rethinking how to couple the entirety of financial structures and institutions to our new collective climate commitments. In this sense, both placement and wording of Article 2.1(c), above Article 9, make it clear that the new long-term financial goal targets the climate-consistency of *all* international and domestic financial flows, going far beyond climate-related bilateral and multilateral development finance.

This new concept also reflects the emerging scientific evidence on low-carbon finance and investments prior to the adoption of the PA. The 2014 Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) was the first report by the IPCC to include a finance and investment chapter, which finds that “the stabilization of GHG concentrations will ultimately require [...] significant shifts in global investment” (Gupta et al., 2014, p. 1217) and a “supportive enabling environment in facilitating low-carbon investments” (ibid, 1223). During the negotiation of the Paris Agreement, the EU has promoted the creation of enabling environments as a new objective of the provision of means of implementation, as reflected in the EU submission on the “scope, design, and structure of the 2015 agreement” (our underline):

“It will be crucial to achieve the necessary transformation and redirection of investment and financial flows towards low-emission climate-resilient economies and societies. [...] Enabling environments are crucial for both developed and developing countries to mobilise effective climate finance. A carbon price, reform of subsidies and low emission development strategies and institutional capacity (in government and financial markets) are all components of enabling environments. Much of the transformational investment will be private. The 2015 Agreement will have to encourage, facilitate and incentivise private sector action and investment. Public climate finance support to developing countries has played and will contin-

ue to play an important role. Additionally all Parties should be encouraged to think more broadly about how to mobilise domestic and international investment [...]” (EU, 2014).

In light of this clear temperature goal, coupled with the awareness that our carbon budget is also linked to the element of time, the Paris Agreement brought an overarching financial objective inscribed under article 2.1.c. This article is no longer about development, but about shifting all financial flows in the whole financial system. In the following section we assess how the international climate governance has been evolving in order to adapt to and operationalise Article 2.1.c.

2.1.1 Operationalization of Article 2.1(c) through the PA rule-book

The goal in Article 2.1(c) PA has been further operationalized through the so-called “Paris Agreement Work Programme”, adopted in December 2018 in Katowice, Poland, by Parties to serve as the “rule-book” for the implementation of the PA. The PA rule-book puts in place a framework for the collective tracking of global financial flows in the context of Article 2.1(c) PA:

- Most notably, the collective tracking of finance flows is an integral part of the so-called “global stocktake”, which is mandated to regularly “assess the collective progress towards achieving the purpose of this Agreement and its long-term goals” (Article 14.1 PA) and which will take place every five years starting in 2023 (Article 14.2 PA) “to inform Parties in updating and enhancing [...] their actions and support” (Article 14.3 PA). While adopting the PA rule-book, Parties to the PA recognized that the global stocktake “is crucial for enhancing the collective ambition of action and support towards achieving the purpose and long-term goals of the Paris Agreement” (UNFCCC, 2018a, decision 19/CMA.1, preamble). It will collect and synthesize relevant inputs of information, conduct a technical assessment including on opportunities for enhanced action and support, and will consider the outputs to discuss the implications of the findings (ibid, para. 3).
- Accordingly, the Standing Committee on Finance has been mandated to include information on Article 2.1(c) in its biennial assessment and overview of climate finance flows (UNFCCC, 2018b, decision 4/CP.24).
- In addition to the global stocktake process, formal deliberations on the new long-term finance goal in Article 2.1(c) will take place starting from 2020. The development part contained in this broader process will focus on setting a new collective target for financial support to developing countries from a floor of USD 100 billion a year for the period after 2025 (UNFCCC, 2018a, decision 14/CMA.1). However, the decision does not specify the purpose or scope of the deliberations on Article 2.1(c), which presents an opportunity for PA Parties to define further action for thinking from a system’s perspective about how to make all finance flows climate-consistent.

2.1.1.1 *Gaps and limitations*

Despite the significance and potential of the PA's long-term finance goal, there are a number of remaining limitations and unclarities that currently hinder its full operationalization and implementation under the PA:

No supporting provisions for individual implementation

The long-term finance goal in Article 2.1(c) is collective in nature and lacks an explicit supporting legal architecture for communicating and reporting on individual member states' action towards the collective goal. For example, in relation to the long-term temperature goal in Article 2.1(a), Article 4.1 PA further specifies how the goal is to be achieved, namely through the "global peaking of GHG emissions as soon as possible" and undertaking "rapid reductions thereafter" to achieve net-zero GHG emissions "in the second half of this century" (UNFCCC, 2015). Towards this collective goal, according to Article 4.2 PA, each member state is legally required to "prepare, communicate and maintain successive nationally determined contributions that it intends to achieve" (ibid). The PA rule-book further stipulates that when communicating their NDCs, member states are required to provide information on how the NDC contributes towards Article 2.1(a) and Article 4.1 PA (UNFCCC, 2018a, decision 4/CMA.1). While the rule-book does not contain specific guidance on providing information on how the NDC contributes towards Article 2.1(c), member states could provide such information on a voluntary basis since action and policies on shifting financial flows would be strongly relevant for achieving GHG emission reductions. The reporting on such actions would facilitate the tracking of financial flows in the context of Article 2.1(c).

Scope of Article 2.1(c) and finance tracking

Due to the lack of tracking of individual efforts, as mentioned above, Parties to the UNFCCC and PA will continue to report only climate-relevant international financial flows provided to developing countries (see Figure 1 below). However, the scope of Article 2.1(c) includes all domestic and international financial flows, including for activities that undermine, provide co-benefits or have no impact on climate objectives. Hence there is a big gap within the PA in terms of reporting of domestic flows (climate-aligned and non-aligned), as well as international support flows that undermine climate objectives, such as the funding of overseas fossil fuel development projects. While financial institutions around the world are moving away from coal to limit exposure to increasing stranded asset risks, several countries who are global renewable energy champions simultaneously fund large portions of new fossil fuel developments in developing countries. China, Japan and South Korea are the three largest sponsors of overseas coal development. China alone is funding over one-quarter of coal plants currently under development outside the country (IEEFA, 2019).

There are currently various competing approaches to classifying investment flows that contribute to climate objectives, such as green and brown taxonomies, transition pathways, and sector-specific scenarios (Jachnik et al., 2019). However, the absence of internationally-agreed classifications that go

beyond and try to capture the whole system, such as by including activities that contribute to, produce co-benefits, undermine, or have no impact whatsoever to climate objectives further limits the complete and consistent tracking of global finance flows in line with Article 2.1(c).

Current scope of UNFCCC climate finance tracking	Finance to activities aimed to contribute to climate objectives	Full scope of Article 2.1(c) PA
	Finance to activities with climate-related co-benefits	
	Finance to activities with no particular climate-related impact	
	Finance to activities that undermine climate objectives	

Figure 1 Scope of financial tracking (*Jachnik et al., 2019*)

2.1.2 Existing knowledge and the status of Article 2.1(c)

The *2018 Biennial Assessment and Overview of Climate Finance Flows* by the UNFCCC's Standing Committee on Finance contains an assessment on the current status of tracking consistency of finance flows with Article 2.1(c) PA, including methods and metrics, and data sets on flows, stocks and considerations for data integration. It also discusses climate finance flows (i.e. international and domestic finance flows with climate-benefits) in the broader context of finance flows and stocks. It finds an increased awareness of the need to align the financial system with climate objectives as well as a number of existing challenges (our underline):

- “Ongoing voluntary efforts to develop approaches for tracking and reporting on consistency of public and private sector finance with the PA are important for enhancing the collective understanding of the consistency of the broader finance and investment flows with Article 2.1(c) of the Paris Agreement. Some financial actors, such as Multilateral Development Banks and bilateral Development Finance Institutions have started to develop approaches for tracking the integration of climate change considerations into their operations” (UNFCCC, 2018c, p. 4).
- “Across the financial sector, both the reporting of data on financial flows and stocks consistent with low GHG-emissions and climate-resilient pathways, and the integration of climate considerations into decision-making are at a nascent stage. [...] With regard to integrating climate change considerations into investment decision-making, some market segments such as listed corporations and institutional investors are participating in emerging reporting initiatives, including through target-setting processes, that will likely improve the availability of data over time” (ibid, p. 7).
- “Climate finance continues to account for just a small proportion of overall finance flows (see figure 2); the level of climate finance is considerably below what one would expect given the investment opportunities and needs that have been identified. However, although climate

finance flows must obviously be scaled up, it is also important to ensure the consistency of finance flows as a whole (and of capital stock) pursuant to Article 2.1(c) PA. This does not mean that all finance flows have to achieve explicitly beneficial climate outcomes, but that they must reduce the likelihood of negative climate outcomes” (ibid, p. 9).

For example, the figure 2 below shows with regards to stocks that only USD 203 billion out of the total USD 71 trillion of global assets under management can be accounted as low-carbon investments. Meanwhile we have somewhere around USD 895 billion of green bonds and climate-aligned bonds outstanding in a universe of USD 91.92 trillion in global debt securities outstanding (UNFCCC, 2018). Clearly, this only shows a tiny and to certain degree an insignificant picture of the whole, since it doesn’t say much about finance that is neutral or which provides co-benefits for climate change, as well as the total flows producing negative effects to climate action.



Figure 2 Climate finance stocks in the context of broader finance (UNFCCC 2018, 10)

This huge gap between alignment and misalignment is quite noteworthy and the UNFCCC has acknowledged that current patterns of financial flows and stocks fail to demonstrate the shift of capital required for the transition to a 1.5°C pathway. In the case of energy, while investments in fossil fuels and fossil fuel subsidies add up to 1.1 trillion dollars, investments in renewable energy and renewable energy subsidies account only for 445 billion, representing a mere 39% of what is currently flowing to fossil fuels. This points to the urgency of redirecting financing flows and stocks towards low-GHG infrastructure and investments.

2.2 1.5°C compatible pathways as scientific context for the financial transformation

Article 2.1(c) the PA has established a new objective of making all finance flows consistent with international climate goals, in particular the 1.5°C long-term temperature limit. This can be seen as an important signal to public and private financial decision-makers on shifting and transforming financ-

ing patterns towards 1.5°C pathways. Within the UNFCCC and the financial sector, efforts are underway to track and report on the climate-consistency of finance flows but are in a nascent stage with remaining gaps and challenges. This could pose limitations for tracking progress towards aligning finance flows with the PA as part of the PA's global stocktake process.

In the absence of internationally agreed approaches for defining and tracking financing that contributes to, undermines, or has no impact for staying below 1.5°C global warming, more guidance from 1.5°C pathways is needed to inform individual country actions for consistency of their flows with such a pathway. This section aims to provide some scientific context on the required scale and speed of the financial transformation on the basis of 1.5°C consistent emission and financial pathways.

2.2.1 Key messages from the IPCC 1.5°C Special Report guiding the financial transformation

For guiding the PA implementation, the Intergovernmental Panel on Climate Change (IPCC) has published its Special Report on 1.5°C of Global Warming (SR15). The SR15 assessed the best available science on how global temperature rise can be limited to 1.5°C and what transformations at global and sectoral levels are necessary for achieving the 1.5°C goal (Schaeffer et al., 2019). The previous IPCC AR5 report contained some insights on the finance and investment needs for reaching the 2°C limit. The landmark SR15 report assesses for the first time the best available science for finance and investments under 1.5°C pathways. Box 1 below summarises the key messages on the financial transformation from the report's Summary for Policymakers (SPM), Chapter 2 on 1.5°C mitigation pathways (Rogelj *et al.*, 2018) and Chapter 4 on strengthening the global response to keep warming below 1.5°C (de Coninck *et al.*, 2018).

Box 1: IPCC 1.5 °C Special Report: Key messages on the financial transformation for 1.5°C

IPCC Summary for Policymakers

- Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in all sectors. "These systems transitions [...] imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options."
- "Additional annual average energy-related investments for the period 2016 to 2050 in pathways limiting warming to 1.5°C compared to pathways without new climate policies beyond those in place today are estimated to be around 830 billion USD. [...] Total energy-related investments increase by about 12% [...] in 1.5°C pathways relative to 2°C pathways. Annual investments in low-carbon energy technologies and energy efficiency are upscaled by roughly a factor of six by 2050 compared to 2015."
- Under 1.5°C pathways "annual average investment needs in the energy system of around USD 2.4 trillion between 2016 and 2035, representing about 2.5% of the world GDP". By 2050, "annual investment in low-carbon energy technologies and energy efficiency need to be upscaled by

roughly a factor of five” compared to today in 1.5°C pathways.

Chapter 2 on 1.5°C mitigation pathways (Rogelj et al., 2018)

- Realising the transformations towards a 1.5°C world requires a major shift in investment patterns. Literature on global climate-change mitigation investments is relatively sparse with most detailed literature having focused on 2°C pathways (p. 81).
- Research carried out by six global IAM teams found that 1.5°C-consistent climate policies would require a marked upscaling of energy system supply-side investments (resource extraction, power generation, fuel conversion, pipelines/transmission, and energy storage) between now and mid-century, reaching levels of between 1.6–3.8 trillion USD globally on average over the 2016–2050 timeframe (p. 82).
- Some trends are robust across scenarios. First, pursuing 1.5°C mitigation efforts requires a major reallocation of the investment portfolio, implying a financial system aligned to mitigation challenges. The path laid out by countries’ current NDCs until 2030 will not drive these structural changes; and despite increasing low-carbon investments in recent years, these are not yet aligned with 1.5°C (p. 82).
- Specifically, annual investments in low-carbon energy are projected to average 0.8–2.9 trillion USD globally to 2050 in 1.5 °C pathways, overtaking fossil investments globally already by around 2025 (p. 82).
- 1.5°C pathways see a reduction in annual investments for fossil-fuel extraction and unabated fossil electricity generation (to 0.3–0.85 trillion USD on average over the 2016–2050 period). Investments in unabated coal are halted by 2030 in most 1.5°C projections. Furthermore, some fossil investments made over the next few years – or those made in the last few – will likely need to be retired prior to fully recovering their capital investment or before the end of their operational lifetime (p. 82).
- Assumptions in modelling studies indicate a number of challenges. For instance, access to finance and mobilisation of funds are critical. In turn, policy efforts need to be effective in redirecting financial resources and reduce transaction costs for bankable mitigation projects. Assumptions also imply that policy certainty, regulatory oversight mechanisms and fiduciary duty need to be robust and effective to safeguard credible and stable financial markets and de-risk mitigation investments in the long term (p. 83).
- In summary and despite inherent uncertainties, the emerging literature indicates a gap between current investment patterns and those compatible with 1.5°C (or 2°C) pathways. Estimates and assumptions from modelling frameworks suggest a major shift in investment patterns and entail a financial system effectively aligned with mitigation challenges (p. 83).

Chapter 4 on Strengthening the Global Response to keep warming below 1.5°C (de Coninck et al., 2018)

- The rapid and far-reaching response required to keep warming below 1.5°C would require large increases of investments in low-emission infrastructure along with a redirection of financial flows towards low-emission investments (p. 317).
- Enabling this investment requires the mobilization and better integration of a range of policy instruments that include the reduction of socially inefficient fossil fuel subsidy regimes and innovative price and non-price national and international policy instruments. [...] These instruments would aim to reduce the demand for carbon-intensive services and shift market preferences away from fossil fuel-based technology (p. 317).
- Increasing evidence suggests that a climate-sensitive realignment of savings and expenditure towards low-emission, climate-resilient infrastructure and services requires an evolution of global and national financial systems (p.317).
- Staying below 1.5°C would entail significantly greater transformation in terms of scale and speed in investment patterns compared even to 2°C-consistent pathways (p. 321).

2.2.2 Current state of research in scientific approaches towards climate targets and the necessary financial sector transformation

Current modelling exercises and quantitative developments to account and track the financial system's role in achieving 1.5°C pathways – i.e. zero net GHG emissions by 2050 - are scarce and lack the systemic perspective of a full alignment in line with Article 2.1c of the PA. First, most of the models are short in scope, such as with sector-focused assessments on the energy sector that look at investments, the sector's cost of capital or policy abatement costs. These quantifications fail to understand the broader context of the financial system, often keeping finance as an exogenous entity that should naturally shift to certain areas after sectoral interventions. Such equilibrium-based approach ignores, for example, imperfect information, decision makers' existing bias, decommissioning and hidden implementation costs, as well as feedbacks from other types of financial flows that can entirely undermine or slow down the transition towards climate objectives. Second, there is limited data availability on finance flows and stocks, therefore IAMs are mostly based on a constructed estimate of total investment values rather than on observed data. A combination of constraints related to confidentiality and difficulties in identifying relevant activities within financial datasets, especially for private finance, compromises the coverage of flows and stocks (Caruso and Jachnik, 2014). IAMs can nonetheless constitute a useful tool that, under a set of idealised conditions (complete information and equilibrium markets), can provide clarity on part of the challenge to achieve a 1.5°C.

In light of the scarce literature on 1.5°C financial pathways, the main underlying data informing the IPCCSR15 findings on the financial implications of 1.5°C pathways in chapter 2 comes from a single study by McCollum et al. (McCollum *et al.*, 2018). McCollum's work is the first multi-model analysis based on six different global energy-economy models or integrated assessment models (IAMs) to

calculate the investments needs in the energy sector for reaching the goals under the Paris Agreement. The models have different objectives ranging from least-cost optimization to computable general equilibrium models and from game-theoretic to recursive-dynamic simulation models. However, as a fundamental common ground, all models share a broad coverage of available technologies in the entire energy system, making it possible to assess different investment portfolios on the supply and demand-sides. These IAMs can consider current policies, NDC, 2°C and 1.5°C scenarios. Investment estimates include two aspects: first, supply-side investments in renewable electricity and hydrogen production, bioenergy extraction and conversion, uranium mining and nuclear power, fossil energy equipped with CCS, and the portion of electricity T&D and storage investments that can be attributed to low-carbon electricity generation. Second, demand-side investments in energy efficiency and conservation. In the following section we have used the underlying data by McCollum *et al.* (McCollum *et al.*, 2018) in order to further analyse investment needs and the current investment gap in the energy sector, as well as dis-investment needs under 1.5°C scenarios.

2.2.2.1 Energy investment needs in line with 1.5°C

The assessment of the six models used by McCollum (McCollum *et al.*, 2018) results in average low-carbon energy investments needs of 1.6 USD 2010 trillion annually by 2030 and 3.5 trillion by 2050. This can be compared to an average of about 764 USD 2010 billions and 1.1 USD 2010 trillion per year over the same period for the current policies scenario (Figure 3).

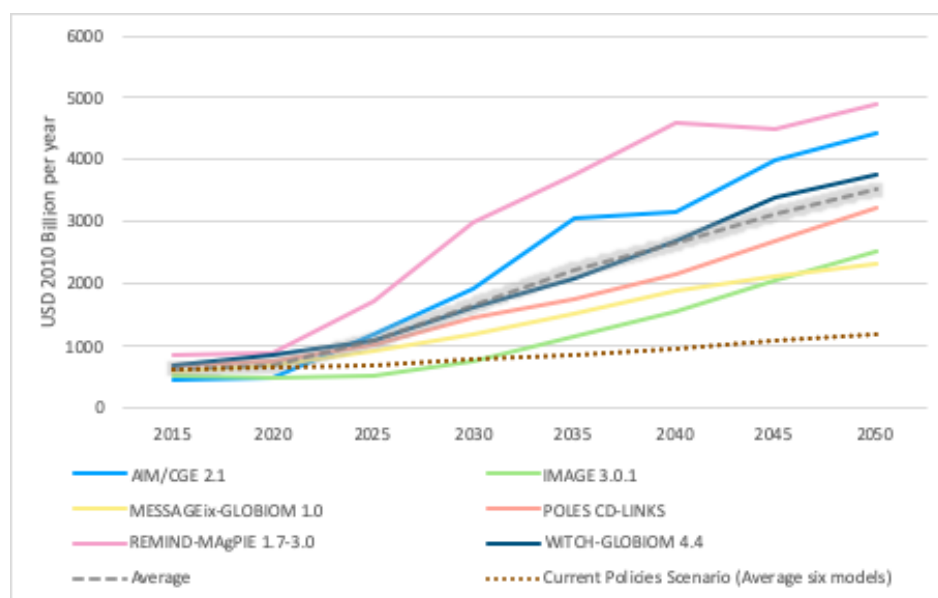


Figure 3 Energy Supply and Demand Low-Carbon Investments under 1.5°C Scenario vs Current policies scenario (own analysis based on data by McCollum *et al.* 2018)

In Graph 1, four models¹ show a rapid deep decarbonization and thus a larger amount of low-carbon investments flows. Meanwhile, two models² depict a future with stagnant or reduced investments, but show a more rapid acceleration in demand-side energy efficiency — less final energy demand — and conservation investments. Another reason why some models show less low-carbon investments is because they considered an earlier and higher deployment of carbon price starting from 2020. However, average estimates of energy system investments found that 1.5°C-consistent climate pathways would require a marked upscaling of energy system supply and demand side investments and an investment portfolio reallocation comparing even to 2°C and NDC scenarios.

In average, 1.5°C pathways would require additional 363 USD 2015 billions compared to 2°C scenarios and other extra 795 USD 2015 billions annually compared to NDC pathway. This upscale is remarkable in electricity by renewables where 1.5°C pathway requires an average of 730 USD 2015 billions annually, that is an extra 121 and 206 USD 2015 billions in comparison with 2°C and NDC pathways respectively. Furthermore, investments in demand-side energy efficiency are expected to be as high as 822 USD 2015 billions annually while in 2°C and NDC scenarios 636 and 352 USD 2015 billions correspondingly. Other investments such CCS and Bioenergy are considered to be greater in 1.5°C pathways than in other scenarios (Figure 4).

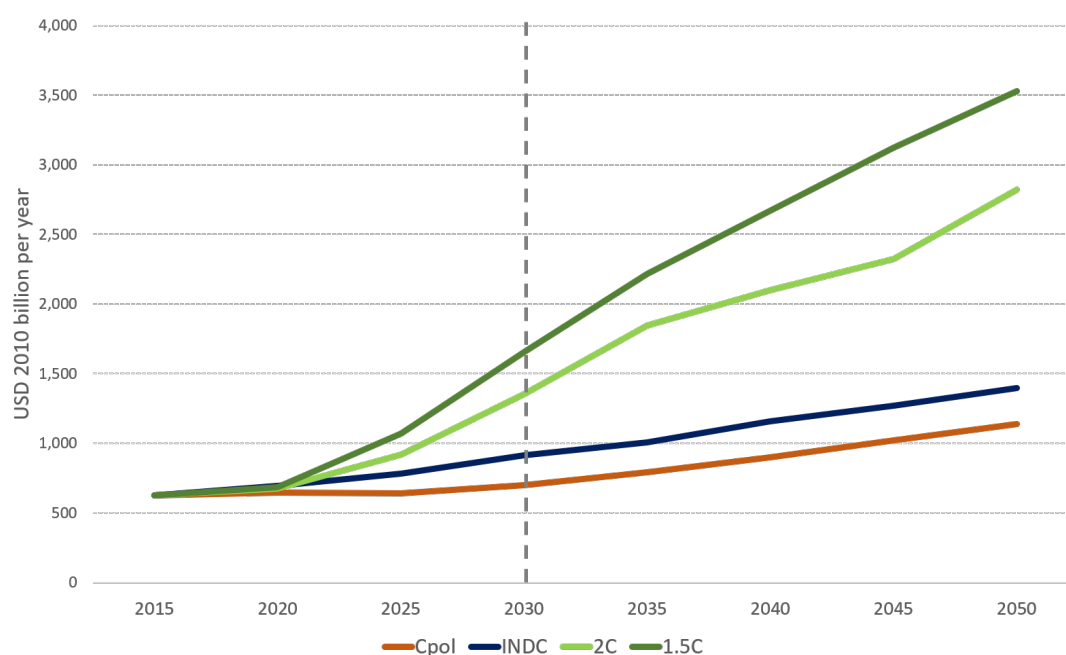


Figure 4 Low-Carbon Investments in energy supply and demand in four different scenarios (2015-2050, multi-model average) (own analysis based on data by McCollum et. al. 2018)

¹ AIM/CGE, MESSAGEix-GLOBIOM, POLES, REMINDMAgPIE

² IMAGE and WITCHGLOBIOM

2.2.2.2 Investment gap between current energy policies and 1.5°C

Investment gap in low-carbon energy supply and demand-side between 1.5°C and current policies scenario is in average 458 USD2010 billions worldwide for the period 2016-2030 and 1.5 USD2010 trillions annually on average for the period 2016-2050. If we look at a regional level the main economies (USA, China, Europe and India) accounts for 311 extra billion annually for 2030 and 886 USD2010 billions by 2050 (Figure 5).

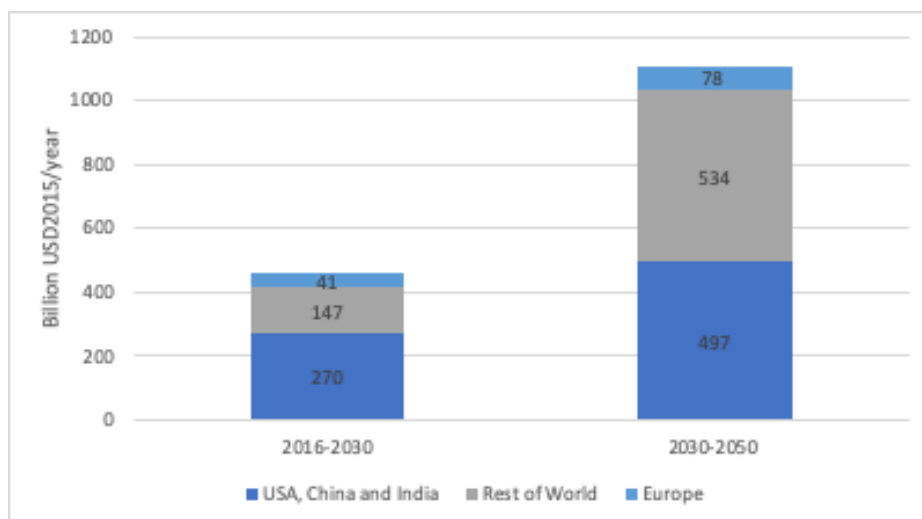


Figure 5 Average annual low-carbon energy and energy efficiency investment gaps (own analysis based on data by McCollum et. al. 2018)

2.2.2.3 Disinvestment needs in the financial sector in line with 1.5°C

For the period 2016 – 2030: Looking at the required disinvestment from fossil fuels, global average in annual fossil fuel supply investments will require a reduction (and subsequent redirection to green) of 25% in gas, 29% in oil and 55% in coal already by 2030 compared with the current policy scenario.

For the period 2016 - 2050: Investments in fossil fuel extraction, both globally and in the EU, have to be reduced by half. This means that the necessary disinvestments in fossil fuel extraction are in the magnitude of 551 USD2010 billions annually globally, from which the EU represents 33 USD2010 billions annually. For electricity generation in the power sector for the period 2016 to 2050, global disinvestment from fossil fuels is estimated at 144 USD2010 billions annually by 2050, representing a 70% decrease, and for the EU 23 USD2010 billions annually, representing 80% decrease.

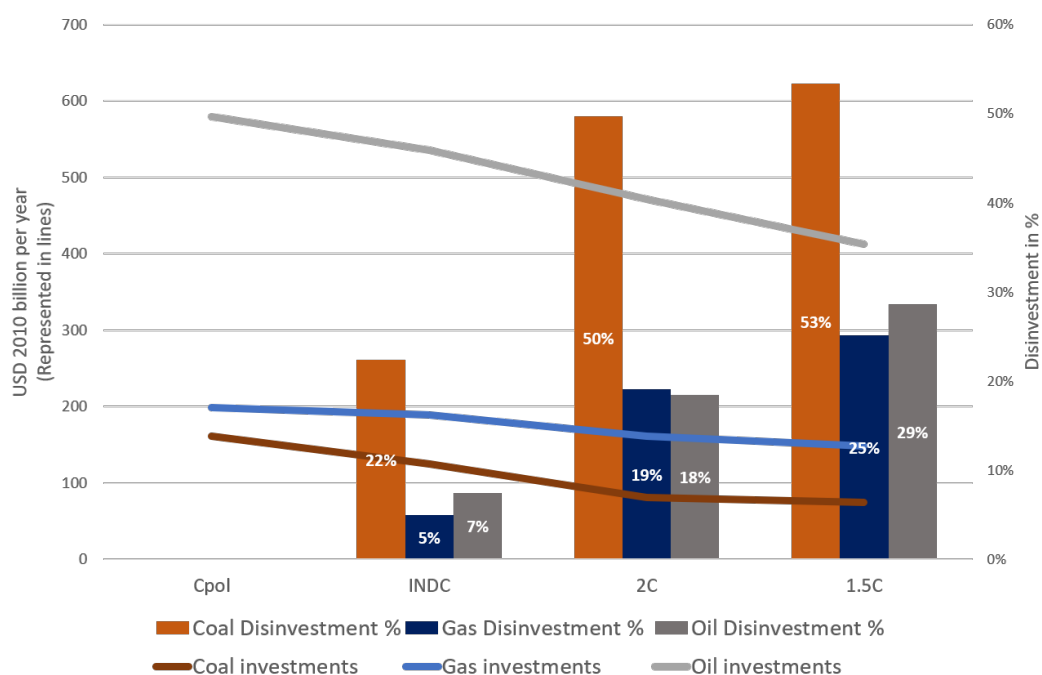


Figure 6 Global average annual fossil fuel supply investments dis-investment (2016-2030, multi-model average) (own analysis based on data by McCollum et. al. 2018)

Stranded assets in the transition to a 1.5°C compatible world are inevitable and will indeed signal that the world economy is bifurcating from fossil fuels at an appropriate pace. The more progressive the shift away from carbon-intensive technologies and assets, the less value will be destroyed and the more can be re-invested in low-carbon infrastructure (Baron and Fischer, 2015).

2.2.3 Linkages to COP21 RIPPLES Modelling Work Packages

Other work packages under the COP21 RIPPLES project have generated relevant findings to inform the financial transformation towards 1.5°C by modelling investments needs and the financial sector role into the transformation towards a low-carbon economy. In particular, work package 2 has performed an **Assessment of the adequacy of NDCs and available pathways to 2°C/1.5°**, with deliverable **D2.3: Report on implications of 1.5°C versus 2°C for global transformation pathways** providing information on how to enhance the level of ambition in selected EU countries, with a focus on the power and transport sectors. Work package 3 has developed the report on **Realising Green Growth: Economic and Security dimensions of NDCs and deeper mitigation pathways**, with deliverable D3.5 producing the **Report on quantitative and qualitative analysis of the financial system implications of decarbonisation pathways**, which has analysed how the financial sector interacts with certain policy shocks.

2.2.3.1 Work package 2: D2.3 Report on implications of 1.5°C versus 2°C for global transformation pathways

Global investments and dis-investment needs can be further downscaled and analysed at the regional and sectoral level. This is shown by COP21 RIPPLES' quantitative analysis on the power sector

across EU countries for the periods between 2014-2030 and 2030-2050 (Sferra and Schaeffer, 2019). COP21 RPPLES WP2 uses the SIAMESE model based on data and assumptions from the International Energy Agency (IEA) to calculate the necessary reductions in energy consumption and the related CO₂ emissions across three different scenarios: reference technology, 2C and beyond 2C as a proxy for PA goals. Investment needs are estimated for the power sector for EU 28 countries, where the shift to decarbonization has to happen faster than in other sectors and regions respectively - i.e. zero by around 2040-2050 and then go below zero in the second half of the century. To calculate investment needs in the power sector a different methodology was used other than McCollum et al. (2018). Investments are calculated *ex-post*, based on the model results related to the cost of capital of different power technologies and the retirement rate of power plants, taking into account different depreciation rates across technologies.

The following investment-related modelling results appear under the more ambitious “beyond 2°C scenario” compared to a 2°C or the reference technology scenario (see graphs 5 and 6 below):

- In all scenarios, 2025 would be the end date for investments in unabated coal plants in the EU. Results show that under a *beyond 2°C scenario* fossil fuel investments (both with and without CCS) will drop to (nearly) zero after 2030 in almost all European countries.
- The *beyond 2°C scenario* projects have substantially higher low carbon investments, reflecting a faster retirement of fossil fuel power plants in operation. This would require additional investments, especially in countries that are currently heavily reliant on coal plants. In Poland, for example, investments from 2014 up to 2030 would be twice as much as those required in a *Reference Technology* scenario. This transformation is challenging and requires clear policy signals to foster the development of renewables and other low or negative emission technologies.
- Projected annual investments from 2014 to 2030 are on average higher than in the period 2030 to 2050. This is also due to the declining capital cost of renewables, as cumulative capacity increases over time (assuming a 20% learning rate).

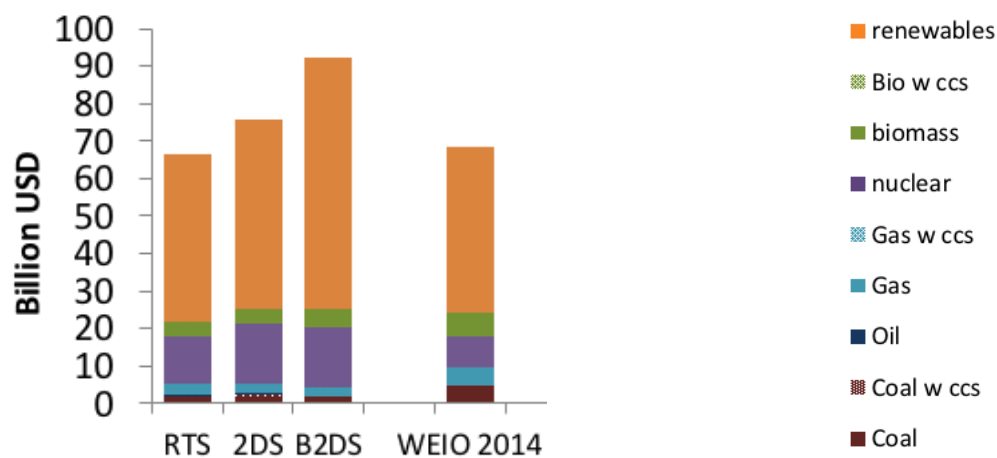


Figure 7 Average annual investments in the power sector of the EU28 from 2014 to 2030 across scenarios RTS, 2DS, B2DS and WEIO 2014 projections (Sferra and Schaeffer 2018, COP21 Ripples WP2)

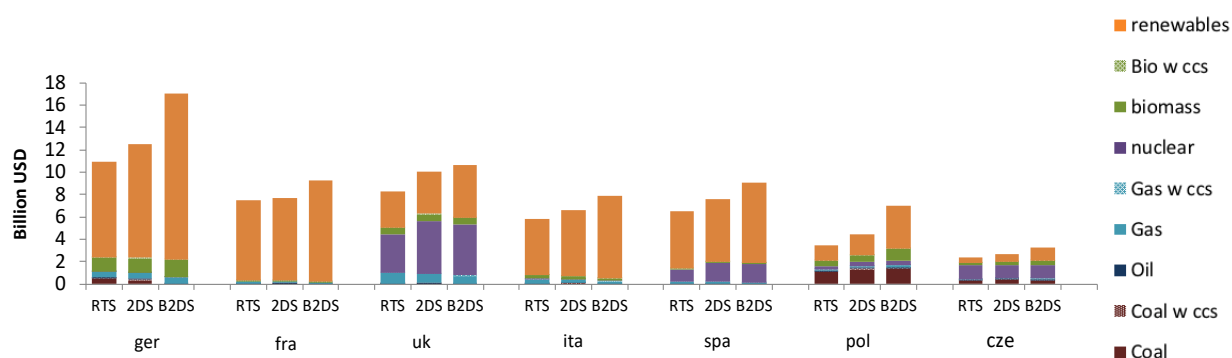


Figure 8 Average annual investments in the power sector of the EU28 (2014-2030, across RTS, 2DS, B2DS scenarios) (Sferra and Schaeffer 2018, COP21 Ripples WP2)

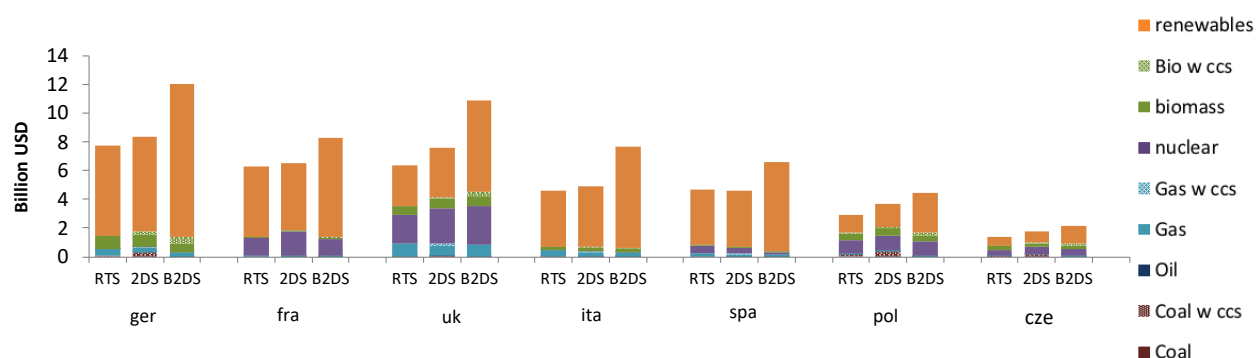


Figure 9 Average annual investments in the power sector of the EU28 (2030-2050, across RTS, 2DS, B2DS scenarios) (Sferra and Schaeffer 2018, COP21 Ripples WP2)

2.2.3.2 Work package 3: D3.5 Report on quantitative and qualitative analysis of the financial system implications of decarbonisation pathways

This deliverable is a type of novel effort to consider the financial system and its role in achieving 1.5°C scenarios. It intends to capture disparity and the effects of financing differences in developed/developing regions. It considers the impact of changes in interest rates on energy system costs and composition and, finally, assesses the best policy intervention to achieve finance goals. COP21 RIPPLES WP3 uses MEWA (Material Energy Waste and Agriculture) model to estimate climate policy as a large-scale expenditure program, used to mobilise resources due to increased investments in particular sectors and shifts in consumer or intermediary demand according to 2°C and 1.5°C scenarios. This modelling exercise is disaggregated into developed and developing regions that are interconnected by trade and capital flows. It makes it possible to capture disparity and effects of financing differences between the two regions that may impact the results of the simulations of 2°C and 1.5°C - i.e. the borrowing conditions such as leverage ratios and risk premium. Furthermore, since its approach focuses on the financial sector's role in meeting climate goals, the exercise considers interest rates on energy system costs beyond their composition, such as by assessing crowding out effects of other (competing) investments. It also covers operational expenditure (Opex) financed by the domestic commercial credit and capital expenditure (Capex) that can be co-financed on the international bond market. Finally, it can provide insights for policy interventions aimed at the achievement of sustainable goals, allowing for a broader scope in assessing the financial system. The main results derived from the MEWA model for 1.5°C scenarios are:

- Decrease in GDP is smaller than in the case of 2°C scenario – this is most likely due to the better time split of the intervention and the fact that agents anticipate its effects to be permanent.
- As larger mitigation is delivered earlier in the long run (second half of the century), the negative impact of climate policy on world's GDP is gradually eliminated.

At the moment, simulations are still ongoing and are planned to cover the impacts of certain finance policy interventions such as grants (direct transfers), concessional loans, inflation financing (Ex. Green new deal) and others.

2.2.4 Conclusions on the existing science

Based on the messages contained in IPCC SR15 (2018), the additional data by McCollum et al. (2018), and emerging results from the COP21 RIPPLES project, the following indication and evidence on the nature and scale of the financial transformation in line with Article 2.1(c) PA can be derived:

1. Literature on the implications of the 1.5°C goal for financial flows is scarce. More analysis and research are needed to translate the long-term goal in Article 2.1(c) into concrete guidance for financial decision-makers on what kind of investment can be considered Paris-consistent.

2. What is clear is that 1.5°C requires major reallocation of global investment portfolios. Current NDCs are currently failing to drive structural changes, which risks locking us in to Paris-inconsistent development pathways. The portfolio change might be of greater importance to investors than estimations of finance flows and investment needs. The main challenge is then not only one of mobilisation of incremental resources, but the redirection of investments away from misaligned activities and towards low-emission options.
3. Modelling results show that 1.5°C pathways require not only a rapid upscaling of low-GHG investment, but also a marked dis-investment from activities that undermine climate-objectives such as fossil fuel investments. This shift is much more pronounced under 1.5°C compared to 2°C pathways, implying greater urgency for the financial transformation.
4. In fact, annual low-carbon investment needs to overtake fossil investments globally already by around 2025 and have to reach a share of 80 per cent by around 2035. Investment in unabated coal halted by 2030 in most 1.5°C projections.
5. In some regions and sectors, this shift has to happen even faster. For example, for the power sector in the EU, 2025 would be the end date for investments in unabated coal plants and substantially higher low carbon investments in the medium-term until 2030, reflecting a faster retirement of fossil fuel power plants in operation.

2.2.5 Remaining gaps for understanding 1.5°C investment pathways in line with Article 2.1(c) PA

Despite the high agreement across modelling frameworks that limiting global temperature increase to 1.5°C would require a major reallocation of financial flows, there is an urgency to address remaining research gaps and information needs for deriving guidance for policy-makers and investors. Models and current developments in accounting and tracking the financial system have a short-term time span and present limitations in terms of sectoral coverage and financial system's understanding as an essential part of the economy. Challenges in linking models across different disciplines, spatial scales, time frameworks and thematic rules, as well as interactions between various societal subsystems, such as carbon cycles, economic decisions and energy systems still remain, clouding the scientific messages sent to financial decision-makers.

It's clear that the long-term financial goal of Article 2.1(c) PA implicitly calls for the transformation of global and national financial systems to enable the transition towards 1.5°C. Based on this evidence, the financial transformation can be defined as the required systemic transformation of financial flows and systems to achieve the climate transition towards 1.5°C compatible societies and economies, in line with Article 2.1(c) PA.

Since the aim of Article 2.1(c) PA is to reorient capital flows, it is not sufficient to track global levels of green and brown finance flows but also assess which actions and policy (dis-)incentives can trigger a shift in finance. This includes the tracking of the design and implementation of financial policies and regulations, fiscal policies and public budgets, public finance and information instruments targeted at aligning finance with the Paris goals (Whitley et al., 2018). Besides estimates of how much is invested

in which activities, it is important to assess who are the main underlying funders and whether existing public actions and privately-led initiatives are having the desired effects on finance compared to climate policy objectives and related investment needs. This is in turn critical to inform improved or new actions towards scaling and speeding up the necessary shift in financing patterns (Jachnik et al., 2019). The following sections of this report will explore a few different approaches, some of these underlying barriers and drivers for shifting financial flows in line with Article 2.1(c) PA.

3 The financial system after the Paris Agreement: Theoretical and governance elements/paradigms called upon by financial regulators and practitioners

The full transformation committed under article 2.1.c of the Paris Agreement requires a much deeper understanding of the financial system, rather than just considering it as “means of implementation”. Only then can the international climate governance identify *ad hoc* and structural opportunities, barriers and inconsistencies within the financial system that might enable, speed up, block or slow down a transformation towards net zero greenhouse gas emissions.

This section will seek to kick-start this much broader and systemic approach to the financial system, bringing it to the centre of the responsibility to lock or unlock the transition in line with a low carbon pathway. They will cover what the authors have grouped as the most relevant couples of financial theories, policy types and governance approaches within finance. They’re based on the underlying idea that there is not a single understanding about finance and the financial system. Therefore, promoting one-size-fits-all solutions, normally created within/by/for specific groups of developed countries, might not produce the necessary transformation in terms of time and scale. As will be discussed in chapter 3.3, for example, central banking in developing countries already tends to have a policy-oriented mandate to promote development, which makes the integration of climate priorities much easier than in higher-income States where central banks have had a history of deeper independence and followed mandates more strictly limited to macroeconomic priorities such as price stability control.

The first two sub-sections will look at pull and push policies, developing those into the free market and regulation theories, which tend to be the most crucial discussion on how financial markets should be dealt with by governments and society at large. It will then expand on the recent history of the banking system to indicate the shift of governments’ priorities towards financial systems, and the recent evolution of micro and macro-prudentialism in central banking mandates. The next sub-section will present an innovation-based theory largely used to explain the role of finance in the transition to a low-carbon economy, proposing an inconsistency in the theory and an additional perspective to improve that theory. Finally, the chapter will cover two governance aspects, looking at how governance has functioned at different levels in the relationship between finance and global climate goals. It will also assess how governance modes have been used to trigger changes in finan-

cial markets, inspecting benefits and shortfalls to each mode. Based on these six initial considerations, the section will provide the basis for building a framework and a comparative exercise in the following Section 4.

3.1 A conceptual dichotomy: pushing vs. pulling the financial markets

The current effort of policy, business and civil society to mobilise finance against global warming, and in particular to mitigate climate change - rather than adaptation to climate change which is somehow left behind at financial sector level -, comes from a widely shared understanding of the two following points. First, neither the global economy nor finance flows are — as of today — aligned with a 1.5°C trajectory, and second, capital is not ‘naturally’ flowing to the right sectors of the economy (including those sectors and technologies that do not exist currently and need to be developed) nor in the good timing (not fast enough). Therefore, it is indeed necessary to take steps to put the financial system on track.

Two main logics then exist in order to mobilising finance for climate change mitigation. The first one is based on ‘price signals’ constituting the sole driving force to activate market players’ reactions to risk and opportunity. The second consists in direct action of policymakers willing to drive market players in a certain direction, through constraints or encouraging measures aimed for instance at limiting or prohibiting certain activities, or on the contrary to expand or to make them obligatory. Building on the academic literature on innovation (cf. for instance Rennings, 2000; Di Stefano *et al.*, 2012; Grubb *et al.*, 2014) we call the former a ‘pulling’ force, i.e. an attraction force, by opposition to the latter which consists in a ‘push’ from institutions. Whether finance should primarily be ‘pulled’ or ‘pushed’, or a mix of the two, in order to attain a specific goal basically depends on the understanding one may have on how the economy and finance work. It is out of scope of the present paper to discuss those broad questions in detail, therefore in the following we focus on the importance this framing has for climate change.

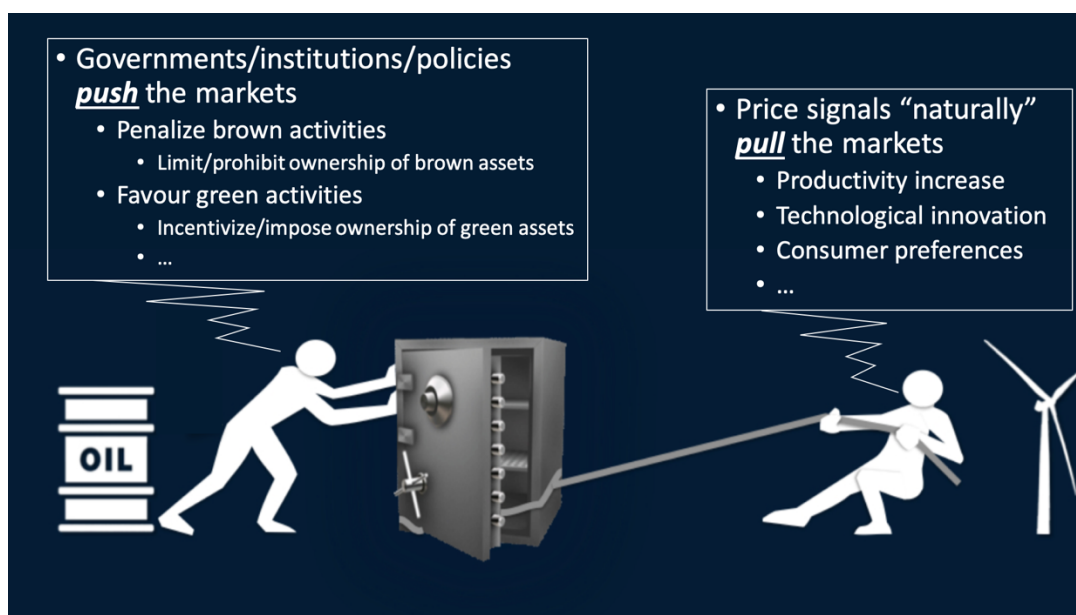


Figure 10 Illustration of the push and pull logics (modified from Dupré and Chenet, 2012)

The ‘pull vs push’ dichotomy we propose here is useful to depict the different options to mobilise the financial sector for climate change mitigation. Climate change mitigation for finance consists basically in two connected objectives, related to financing the net-zero carbon economy: stop financing brown, and reallocate in green — often considered as the two sides of the same coin. While stopping the financing of brown industries is justified to mitigate long-term climate change, which is a source of ‘physical risk’ for the financial system (DG Treasury, 2017; Regelink *et al.*, 2017; NGFS, 2018), real-locating in green is needed to meet the energy demand.³ But a sudden shift out of brown to green can produce an abrupt ‘transition risk’ that can result in financial instability (Carney, 2015; Battiston *et al.*, 2017). We see here that both notions of ‘objectives’ and ‘risks’ are intertwined. Clearly, the financial risk narrative, deeply rooted in the modern financial theory (Markowitz, 1952; Tobin, 1958; Sharpe, 1964), sounds more familiar to financial stakeholders than long-term economic, sectoral, environmental and social objectives, which market finance is not built to deal with (Bouleau, 2018a, 2018b; Lagoarde-Segot and Paraque, 2018).

Then, the ‘pull’ and ‘push’ logics come into play. The ‘pull’ logic, associated to the risk narrative, consists in the materialisation of a price signal that would reveal to market participants that it is not profitable anymore or too risky to stay invested in brown, or to continue to invest in brown, and re-

³ It is indeed important to address green and brown together as, for the reasons explained in previous sections, adding green technologies does not automatically come with retiring brown ones, and for energy typically it is easy to imagine a situation where more renewable capacity is installed while fossil fuels still continue to grow, and therefore eventually leads to a +6°C world with plenty of wind farms and solar panels. Alternatively, stopping the financing of brown energies can theoretically address climate change significantly, but does not address the energy demand. Besides, the issue of energy efficiency, which focuses on decreasing energy demand, whatever brown or green, is often overlooked.

spectively that it is more profitable to invest in green activities. Such a signal can come as a consequence of market efficiency, rendering long-term physical risk and short-term transition risk into current valuation differences, or from indirect policy action on underlying industries, such as bans on some brown technologies, carbon taxes, subsidies to green technologies or clear and ambitious long-term climate policies, which have effects on competitiveness and prices.⁴ From a financial market perspective, those policy options can be seen as compensating for the absence or weakness of ‘natural’ market signals, triggered by e.g. productivity increase, technological innovation and consumer preferences, which in an ideal market would be enough to render green more profitable than brown. The policy intervention in favour of market signal can also focus on risk disclosure, relying on the idea that companies are not transparent enough in the information they give to markets, and therefore markets cannot price those risks accordingly. Policy makers in this case try to help the pull logic to work well.

But policy makers can also trigger the ‘push’ logic in order to compensate an incapacity of price signal to operate. In other words, despite policy action at industrial level, financial market players may still consider brown as profitable, which may justify further policy action. ‘Push’ means here to explicitly put constraints on financial markets participants so that they make investment and financing decisions consistently with the climate target. Different schemes can be undertaken to penalise brown and symmetrically favour green activities for financial stakeholders, whether investors or credit institutions. Either by prohibiting or limiting ownership of financial assets in some brown economic activities (respectively constraining a minimum ownership of green assets) or by incentivising financial market players to hold less brown (respectively more green) assets, making it artificially more expensive (resp. cheaper) by measures such as increasing (respectively decreasing) related capital requirements.

All policy actions related to climate mitigation in the financial sector can be analysed in the frame of this pull and push dichotomy. The following section attempts to dig deeper in the underlying theories.

3.2 A theoretical dichotomy: Free markets vs. regulated markets

The conceptual dichotomy we presented in the previous section, ‘pull’ vs ‘push’ logics to mobilise the financial sector to allocating financial resources for climate change mitigation, can be seen under a related and more theoretical duality in economics, opposing free markets and regulation theories. The following summarises the main elements of those two theoretical frameworks that make up financial markets, with multiple possible mixes.

⁴ Those policy actions on non-financial sectors can be seen as ‘push’ actions in their own industries but constitute ‘pull’ market signals for finance.

“How we think about financial markets determines how we regulate them. It should therefore not be surprising that [...] different theories lead to different regulatory strategies.” (Pistor, 2012)

3.2.1 Free markets and efficiency: theoretical elements

Since Adam Smith (1776), and later Friedrich Hayek (1941) and Milton Friedman (1962), price mechanism in free markets constituted one of the most important economic concepts that served as a basis to structure modern finance. With the later development of financial markets in the second half of the 20th century, the Efficient Market Hypothesis (EMH) (Fama, 1970) then became the main paradigm of financial markets. It proposes that all relevant available information is instantaneously reflected in market prices. In an efficient financial market, the ‘fundamental’ value of a security, its ‘economic reality’, should thus be equalised by its market price. The investor is then able to take a robust decision to buy or sell a financial asset based on this sole price, which indeed is supposed to contain everything he needs to know about that asset.

“... under the assumption that security prices at any time «fully reflect» all available information. A market in which prices always «fully reflect» available information is called «efficient».” (Fama, 1970)

The EMH, formulated as a hypothesis, quickly became in the 1970s the central rule for financial markets, often forgetting the conditions to be met for the hypothesis to be verified: all the “relevant” information related to the security in question need to be “available”. Depending on the strength of the hypothesis formulated under three variants (weak/semi-strong/strong), the efficiency can relate to information reflected in past prices / all publicly available information about the market / all known information including privately available inside information.

The EMH can be considered as the financial market side of the theory of economic equilibrium (Mandelbrot, 1971; Walter, 2000), which, to put it simply,⁵ consists in defining a market by the balance between the supply and demand of a particular good or service (Debreu, 1959). The market price under such an equilibrium corresponds to the price fitting both the amount of goods required by buyers and produced by sellers. In the case of financial markets, the equilibrium is not between production and consumption of physical goods or services, but rather between supply and demand (‘bid and ask’) for a financial asset - e.g. a security, which does not necessarily implies the existence of an underlying physical asset (e.g. an interest rate derivative can be traded, and therefore has a market price). Note that such prices form on both primary (at the issuance of the financial asset) or secondary markets (each time the financial asset is sold, resold, re-resold and so on). The genuine form of market efficiency comes in theory with free markets - i.e. markets that are not regulated.

⁵ Beyond the simple concept, the theory of economic equilibrium is a complex issue having a long and intricate history (Tieben, 2009).

Prices thus reach their efficient level by the sole forces of supply and demand, without government intervention. Potential market failures - caused by e.g. information asymmetry, or externality - open the way to fixing the market, which can call for governmental or other institutional intervention, in the same way that creating and ruling a 'free' market actually requires some form of governmental involvement. The extent to which a market can be considered as genuinely 'free' is then a matter of nuance in the understanding of what a 'free market' is (Smith, 1776; Hayek, 1941; Polanyi, 1944; Popper, 1945; Galbraith, 2008).

Beyond just being a price formation process, the efficiency of markets implies a 'rational'⁶ allocation of capital, which 'optimises'⁷ the risks and benefits associated with financial assets. Therefore, the EMH is indeed a keystone of financial markets, allowing market participants to behave 'rationally' (cf. the Rational Expectation Hypothesis (REH) (Muth, 1961)) by following a simple indicator: prices.

"[The EMH] establishes a connection between the allocational role of capital markets, and the informational role of prices." [...] "This allocational efficiency of the capital markets represents the theoretical foundation for their existence. Without good allocation of risk and information, market agents will not be able to work in the financial markets, or not in the same way" (Walter, 2000).

Despite empirical and theoretical evidence tending to dispute the robustness of the EMH at the early stages of its dominance (Grossman and Stiglitz, 1980; Shiller, 1981; De Bondt and Thaler, 1985; Harnay and Scialom, 2016), it has become progressively accepted by the vast majority of market participants, including regulators. This explains the overarching role that has been given to markets in the allocation of financial resources since the 1970s, including when general interest and common goods are at stake, as long as an 'optimal' allocation of those resources is expected. This is particularly significant in the history of climate change economic policies, for which most major frameworks were based on such market mechanisms, in particular the Kyoto Protocol (e.g. Pottier, 2016). Beyond the question of relevance and applicability of the EMH related to usual financial parameters and information, the extent to which extra-financial concerns such as those related to environment, society and governance ('ESG') — in other words sustainability — can be integrated by markets in the same way that financial ones has indeed been highly debated since then (e.g. Revelli and Viviani, 2015; Bosch-Badia *et al.*, 2018; and references therein). The notion of market externality — such as GHG emissions —, by definition not priced by markets, tend to demonstrate for some authors (e.g. Aglietta, 2015) that markets are not efficient. The concept of 'complete market efficiency', or market efficiency in its strongest form, is sometimes called upon to extend standard EMH to ESG information, in order to describe a market where all the relevant information should be integrated in

⁶ Here 'rational' is used in the genuine economic sense of 'profit maximising', meaning that the agent (the "homo oeconomicus") responds fully to risk and price signals following his/her own interest, i.e. buying at low price, selling at high price.

⁷ Idem, 'optimal' is used in the same genuine economic sense.

prices, including the information that is available but not currently used by (all) market participants — such as ESG data — because they basically do not consider it. Such a market would thus not only be efficient relative to equilibrium of supply and demand, but also to reflect broader sustainability issues into prices. Including sustainability involves taking the component of time into account - i.e. the future. One can thus distinguish static and dynamic efficiency of markets, as quoted from Bosch-Badia et al. (Bosch-Badia, Montllor-Serrats and Tarrazon-Rodon, 2018): *“we can consider [financial market] statically efficient when its prices incorporate the information relevant for the welfare of current investors, while a dynamically efficient financial market should integrate the information relevant for future investors”*. This corresponds, following Aglietta (2015), to considering the efficient market hypothesis in its strongest form, which *“stipulates that financial markets reveal fundamental values of assets, i.e. the marginal contributions to social welfare of all types of capital. If it were true, the moving price system in financial markets over time would be the most relevant expression of what society values in pursuing its own perpetuation”*.

Despite the EMH becoming strongly distrusted after the 2007-08 financial crisis (e.g. Malkiel, 2011; Volker, 2011), the addition of sustainability considerations in finance (ESG/SDGs/SRI/...) ⁸ did not really suffice to circumvent the efficient market theory as one of the central dogma on financial markets (Aglietta and Espagne, 2016; Christophers, 2017).

3.2.2 Regulated markets: theoretical elements

Symmetrically to free markets, driven by efficient prices as explained above, another approach to drive financial markets is through regulation and governmental intervention, emphasising the role of institutions.

It is indeed interesting to look at financial markets from an institutional economics theory or regulation theory perspective. Here, the focus is on the institutions, as a social process, which are indispensable to make the capitalist economy work, rather than the usual *ad hoc* assumption of ‘natural’ market equilibrium. Then, the underlying core assumption is that, following Minsky (1986), future is uncertain and knowledge is imperfect, and as such market pricing cannot reflect the fundamental value of things, and as a consequence actors in financial markets tend to adopt strategies that destabilise the system (‘fundamental instability’). In opposition to the EMH and the REH, the Imperfect Knowledge Economics theory (Frydman, Duncan and Goldberg, 2007) stipulates that markets do not tend towards equilibrium, but rather generates volatility and instability, by reflecting the various and evolving moods and beliefs of market participants. In order to avoid dangerous and costly market-wide instability, the rationale is therefore to use government intervention, in order to regulate beyond the sole objective of information disclosure, and circumvent financial crises and economic losses. Moreover, as Minsky (Minsky, 1986) argues, such a regulatory reform impetus should not be lim-

⁸ This family of acronyms relates to the various key concepts that built a link between finance and sustainability. ESG: Environmental, Social and Governance. SDGs: Sustainable Development Goals. SRI: Socially Responsible Investing.

ited to the financial system, but rather target the entire economic system including government spending and taxation, employment policy, market power. This particularly makes sense for the challenge of climate change, where finance cannot be considered as an isolated tool in relation to the broader industrial and social policies.

More broadly, the regulation theory is opposing neoclassic approaches in that it poses that liberalisation of the financial system cannot guarantee *per se* a better allocation of capital. It articulates two levels: financial markets and micro/macro prudential regulations. On the one hand financial markets regulation defines rules and laws to guarantee a good market functioning, protecting savers and market actors (e.g. against fraud) and fixing market inefficiencies (e.g. on disclosure). On the other hand, prudential regulation monitors market participants especially on the basis of risks they take, in order to limit the occurrence of bankruptcies and avoid the development of whole financial system instability through propagation of systemic risks (cf. section 3.3).

For a century, financial markets have evolved between those two opposite options, namely free markets and regulated finance. According to Harnay and Scialom (2016), from the 1930s until the late 1960s, the public interest approach to banking regulation predominated, holding that “*regulation provides corrective measures against various market failures, including [...] externalities*”, further adding that “[t]his optimistic view of regulation motivated state intervention in a wide range of areas after the New Deal and World War II.” But this situation changed when regulation started to be seen, due notably to the influence of the Chicago school of economics, as “[preventing] *financial intermediaries from functioning at their full capacity, thereby generating inefficiencies and welfare losses*” (Harnay and Scialom, 2016). The efficient market hypothesis, as popularised by Fama (1970) (cf. above), then replaced somehow regulation theory as the predominant paradigm, and opened the way to a generalised deregulation of the financial sector during the 1970s and 1980s, reaching an ultimate point before the 2007-08 financial crisis.

While, from a practical point of view, regulation has progressively left space for a methodical deregulation of the financial system under the influence of the EMH and its corollary market self-discipline, the theoretical ground has seen in the meantime a renaissance, endeavouring to put regulation back to the policy agenda. Influenced by the work of Thorstein Veblen (e.g. Veblen, 1899) or Karl Polanyi (e.g. Polanyi, 1944), the ‘French regulation school’ in particular, led by authors such as Robert Boyer, André Orléan and Michel Aglietta (e.g. Aglietta, 1982; Orléan, 1999; Boyer and Saillard, 2005), contributed to prepare the tools and policy approaches that came back to regulators’ desks in the aftermath of the 2007-08 crisis, in particular through macroprudential regulation.

“Central banks and related public supervision agencies must act as social organisers of financial markets and frame markets through the visible hand of the public power in order to design financial regulation at the systemic and global level in coherence with the core characteristics of monetary capitalist economies.” (Ülgen, 2015).

3.3 A brief history of central banking priorities: systemic risks, climate change and the return of macro-prudential approaches

As seen in the section above, the understanding of financial markets from a free market or from a regulation perspective have shaped how and to which extent governments and regulators could or should intervene. In order to move away from any deterministic ideas about how markets “naturally” behave or have “always” operated, assigning intrinsic and immutable characteristics to that immaterial entity – the market –, this section will propose a brief historical approach to the financial system, showing how public priorities have shifted over time, thus altering the format and content of governments’ relationship with the financial system. We defend that this process is not one of linear evolution, but rather one of intermittency, with priorities alternating and fading away in face of new historical contexts, such as crises and credit expansion. In order to show this dynamism, the section will focus on the history of the banking system, inserting the new priority of fighting climate change to the later debates around regulatory approaches by central banks, in particular between micro and macro regulation.

Any history of the financial system ought to start with Bretton-Woods. The Bretton-Woods system resulted from the coordination effort led by United States and United Kingdom after World War II and reflected a governance structure with two newly created international organisations, the International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (IRBD). The system had an explicitly shared and “public” goal (Andonova, Hale and Roger, 2017) of stabilising currency fluctuation and aimed at the control of exchange rates against the US’ dollar-gold standard. With the breakdown of Bretton-Woods in 1971 no other actors became relevant in coordinating or steering efforts on the international financial system, while IMF and IRBD acquired different and new roles over time. The system that emerged from the 1970s no longer prioritised the public goal of stabilisation via the control of exchange rates, but rather focused on the development of credit markets by overall relaxing controls on capital movements (Silva, 2015). Global finance developed without a founding act or a cohesive effort for international cooperation, welcoming “activist monetary policies” as a replacement to automaticity, timeless principles and assumed beneficial relationships (Helleiner, Pagliari and Zimmermann, 2010). This activism and supra-national nature allowed non-state actors and transnational networks to overcome the sometimes lengthier political and legislative national processes, creating what some would later call a democratic deficit in global finance (Porter, 2001), which is included within a broader process of *financialisation* (Epstein, 2005; Deutschmann, 2011; Perez, 2012; Clark, Larsen and Hansen, 2015).

The international process of financial liberalisation after 1971 was mirrored domestically by an increasing push towards deregulation. Harnay and Scialom (2016) argue that in the United States this corresponded to a substitution of the predominating public interest view of regulation, which has been in place since Roosevelt’s New Deal in the 1930s. The theory was strongly connected with the priority of promoting public interest and increasing social welfare. This was, however, expected to be

carried by regulators strictly on efficiency terms, leaving other matters such as redistributive issues for politicians. In the 1960s, the connection between banking *regulation* and the idea of “financial repression” was boosted by new statistical techniques and studies that sought to show how regulations impacted negatively different industries, failed to achieve their welfare maximisation goal and hindered competition. Governance’s priority then shifted from social welfare maximisation to the pursuit of self-interest, with regulatory process being presented as a mere competitive process amongst pressure groups and lobbies to obtain favourable results from regulators. The role of central banking also shifted away from macro-prudential perspectives to micro-prudential ones, based on individual actors’ self-regulation, without a relevant role for the system’s oversight.

The relevance of US banks and financial institutions in the Eurodollar market also influenced European regulatory systems. Liberalisation of movement of capital was a cornerstone of Western European national systems, being dealt specifically under the broader Treaty of Nice (article 51), already under the auspices of the European Union (Stichele, 2008). The Treaty also expressly *allowed* prudential supervision (article 58), with a mandate to the European System of Central Banks to pursue the goal of price stability.

Following the failure of the West German Bankhaus Herstatt in 1974, a group of G10 central bank governors established within the Bank for International Settlements (BIS) a new Committee on Banking Regulations and Supervisory Practices – later simply referred as the Basel Committee. The first Basel Agreement from 1988 focused on the stability coordination of the international banking regime and on the key issue of capital adequacy, addressing credit risks by ensuring similar measurement and minimum capital requirements by individual banks (BIS, 2018). This discrepancy between banks’ interest in measuring and managing their own risks and the public interest in promoting a safe banking system ultimately ignored the existence of the systemic risks that arise from individual institutions’ potential of spillover effects (Morris and Shin, 2008). While Basel focused on the - “micro” - viability of individual institutions, it failed to capture ways in which these institutions are connected and interacting with the resilience of the system – “macro” - as a whole (Doyme Farmer *et al.*, 2012). As an example, Pillar I of Basel II (now Basel III), requires banking institutions to assess specific environmental risks on their credit and operational risk exposure, but this is limited to transaction-specific risks that affected the borrower’s ability to repay a loan, mainly as means to protect banks from environmental liabilities of their clients (Alexander *et al.*, 2014). While this might protect an individual institution in the short term, it does nothing to prevent it from acting in ways that create and amplify environmental systemic risks such as climate change.

With the global 2007-2008 crisis originating in the specific US subprime, it became clear that spillover effects and contagion had to be accounted for by financial system’s regulators. The high social costs of crises brought macro-prudential regulations – back – to the mandate of most central banks. Regulators started to be tasked specifically with the goal of financial stability, as it was the case with the Financial Policy Committee within the Bank of England, the Financial Oversight Council in the

United States and the European Systemic Risk Board in the European Union (Christophers, 2017). These are substantial developments, as “macro-prudentialism” requires a top-down approach to regulation that no longer looks at individual incentives for financial institutions, but rather at the safety and soundness of the whole system. Here it is important to note that by looking at the macro, regulators must go beyond the banking sector alone, but bring a wider awareness of how every node of the financial system can contribute to systemic risks, including institutional investors, insurance companies, and all the financial services and intermediation that contribute to the system, such as rating agencies, accountants, financial analysts, brokers etc.

In this context, we know that — inherently systemic and endogenous to the financial system — climate risks are among the largest risks humankind faces today and in the decades ahead. Climate change’s “systemic” nature is linked to the fact that the physical impacts of climate change will be felt across the entire economy and society, with feedbacks and interdependent effects in different sectors and regions, besides having deepening and cumulative effects over time. Moreover, risks from the *transition* towards a low-carbon economy, which also bear a significant systemic feature, are already starting to reverberate in the financial system. These effects are felt in the short to long term. That is potentially the case of entire carbon intensive sectors, such as the fossil fuel industry, which can progressively or abruptly become stranded due to a sharp transition with ambitious mitigation of greenhouse gas emissions (Caldecott, 2011), and/or because of individual firms’ assets having to be written off the balance sheets due to the loss of value in presence of climate impacts (Dietz *et al.*, 2016).

The financial system holds key processes that can create negative feedbacks and amplify the climate-related financial risks, thus also exacerbating financial systemic risks. This endogeneity is well exemplified with the purchase by central banks of large quantities of assets — a process known as quantitative easing — in order to reduce financing costs, encourage bank lending, stimulate private spending, achieve a stable rate of inflation and revive economic growth. The problem, evidenced in the cases of the European Central Bank and the Bank of England, is that even though claiming to be market neutral, these purchases have shown a tendency towards a disproportionately higher share of emission-intensive sectors, such as manufacturing and utilities (Matikainen, Campiglio and Zenghelis, 2017; Jourdan and Kalinowski, 2019). In practice, because of the failure to take climate change as a system’s priority, central banks are effectively aggravating environmental risks by favouring carbon-intensity, including by sending a contradictory signal to the rest of the economy. Another example of mismatched feedbacks due to lack of a systemic perspective is the credit rating system in place, which might downgrade the sovereign investment grade of developing and most vulnerable countries due to climate vulnerability. Access to the necessary funding to adapt to climate change and to finance reconstruction efforts becomes harder (Buhr *et al.*, 2018; Zamarioli and Thomas, 2018), making the local effects even harsher and also maximising the potential of contagion to the global system. In advanced societies, climate risks might also affect the credit of cities, affecting their ability to

access debt mechanisms as the municipal bonds in the United States (Moody's, 2017), with potential risk feedbacks to the financial system.

The management of those risks requires macro-prudential oversight. The Paris Agreement's objective to bring all financial flows to alignment with climate objectives (article 2.1.c) also creates an additional responsibility for governments to ensure that such alignment happens in a timely manner, in line with decarbonisation pathways. Different financial theories can create both complementary and conflicting narratives, each with its own framework on how to tackle climate change. However, while there is still debate on the most efficient, timely and effective ways to support limiting global average warming to 1.5°C, the climate priority is now clear and the goal has been commonly agreed by nations around the globe. This climate goal starts therefore to become explicit on the whole fabric of the financial regulation. It starts from central banking and potential macro-prudential regulation of climate-related systemic risks, but goes beyond and encompasses all types of financial actors while taking into consideration not only the risks that climate change might pose to their operations, but also their own individual role and responsibility on global warming. Given the risks and responsibilities at hand, price stability and financial stability start to be understood in light of the necessity of coupling with a new priority for the long-term maintenance of the financial system's governance: climate and environmental sustainability.

3.4 A broader financial paradigm shift for fighting climate change: from thinking a niche to thinking a system

The awareness of the role of the economy in both exacerbating and addressing climate change, framed as "the greatest market failure ever seen" (Stern, 2008), led to the development of diverse narratives and approaches calling for the financial system and financial institutions to tackle the problem of the related costs. Consensus was early formed around the need of investments to develop a green economy, or the development of a green sector that would lead a chain reaction towards a *green industrial revolution* (UNEP, 2008). The inherently disruptive element of the term *revolution*⁹ is essential for the theoretical underpinnings and expected goals from what became the area of green finance. With a variety of definitions, green finance can be understood as the financing of investments that can provide environmental benefits (G20, 2016). It's based on the idea of additionality, since benefits to the environment might be accounted for as long as they help to fund the development of a green *niche*. Neither the green economy nor its counterpart the green finance contain the aspiration of greening the whole economy, but are rather focused in strengthening a sector that will eventually lead a revolution.

The theoretical basis for growing a green cluster or niche, with a specific role for green finance, can be traced back to the theory of *creative destruction* (Schumpeter, 1934). From lessons of evolution-

⁹ Defined by the Oxford Dictionary of British & World English as *a dramatic and wide-reaching change in conditions, attitudes, or operation*

ary biology, Schumpeter posited that the economy goes through cycles, with innovation playing a central role in the breaking with old socio-technical regimes and the creation and establishment of new ones. As a simplification of his broader theory, entrepreneurial activity would attract massive amounts of investments into new promising — clusters of — technologies, or a niche, which generate speculation and excess funds by optimistic investors, creating a bubble that occasionally bursts into a crisis. Old and not competitive technologies die out during the crisis and by the end of the recession period a new business as usual emerges, dominated by the victorious technologies (Perez, 2012). That has been the case of, for example, the rise of combustion engine for transportation in the 20th century, or the burst of the information and communications technologies (ICT)’s bubble at the turn of the 21st century. The technological lock-in takes place once the crisis is over and the newly coal/oil powered vehicles, or computerised society do not go back to horse power or fax machines, even if prices for the later technologies fall enormously.

This same evolutionary and niche approach has been used as the theoretical justification for the technology substitution needed to decarbonise the economy (cf. e.g. Grubb, 2018). Investments in renewables decrease their price over time, up to a tipping point when carbon-intensive technologies lose competitiveness and are no longer deployed, signalling a new *status quo* in the energy sector. Credit finance is essential under this approach, since it works as the fuel for boosting niche-related technologies that are necessary for the transition. In turn, the term “transformational climate finance” can be understood economically to be based on this broader evolutionary approach, with comparable tipping points caused either by external shocks, as the oil crisis in the 1970s, or by incremental changes, as the shale gas development in the US¹⁰ (Westphal and Thwaites, 2016, p. 7).

Even within approaching the niche, governance might follow market-fixing or market-shaping approaches (Ryan-Collins, 2019). For example, the call for carbon-risk disclosures, as well as the definition of climate-aligned standards, criteria and metrics follow the understanding of a market failure, which can be *fixed* via regulation. With corrections for better information and clearer tools, the market can freely grow the green niche, thus providing sufficient funding for the transformation. On the other hand, the understanding that public and private actors have historically acted in different roles across the timeline of technological transitions (Mazzucato, Semieniuk and Watson, 2018) can prompt different types of shaping-type regulations, adapted for different players and points in time. According to this line of thought, simply attracting more capital is not sufficient for creating and growing a green market, since quantities might be misplaced for the needs involved in making innovations viable and mainstream. Specifically, public actors tend to be the main investors in high-risk finance, such as earlier stage technologies and uncertain markets that nonetheless serve to wider

public purposes or “missions” (Mazzucato, 2015). An example of this type of market-shaping approach can be found in the recent evolution of blended finance instruments and mechanisms, such as green bonds, which have the potential to channel private capital towards specific activities and technologies that are necessary for the zero-carbon transition and broader fight against climate change.

From a broader economic and financial perspective, it makes sense to grow the green niche either by fixing a market failure, through e.g. transparency measures, or by giving a direction to the economy by accelerating specific types of green innovations, since both approaches tend to work well for accelerating growth. A strong green market with viable new technologies can become a comparative advantage to whichever economies hold those assets, which create an additional and climate-unrelated incentive for governments to opt for growing a green niche in lieu of other types of interventions, even when benefits for climate cannot be substantiated – e.g. the case of loose definitions for green that prioritise market buy-in in detriment of coherent climate and environmental outcomes. Politically, selecting winners to join or boost a green niche also tend to be easier than picking misaligned - brown - losers, which would have to either adapt and reduce their carbon footprint over time or leave the market altogether. In practice, among the potential losers we have solid and established industries, such as fossil fuel-related ones, which also happen to be among the largest firms in the world. Shifting investments abruptly away from these activities could also risk bursting what became known as the “carbon bubble”, sending shocks with systemic implications to the entire global economy (Caldecott, 2011). Moreover, those large firms are currently the best equipped, trained, resourced (human) and capitalised to turn to green activities — e.g. TOTAL is the fourth largest oil & gas company in the world, but has also ranked as fourth largest utility-scale solar photovoltaics developer in the world (Roselund, 2018). Although in consonance with economic and political perspectives, our argument is that the theory behind the push to grow a green niche is not sufficient for a timely transition that will keep the world below the goal of 1.5°C of warming. That does not mean that the niche perspective is wrong or undesirable, as it makes the direction of the transition viable. Instead, we defend that the theory must be coupled with a systems approach that takes into account the entire economy, including already deployed assets or stocks, thus going beyond the limited consideration of only flows.

The Schumpeterian argument of creative destruction was intended to explain the endogenous role of innovation for economic development. New investment flows into the economy for and because of viable new socio-techno regimes are expected to result in economic growth. Nowadays growth is calculated with the expansion of gross domestic product (GDP), which is indeed a measurement entirely based on flows and that does not take into account stocks (van den Bergh, 2009). The issue here is that stocks matter a lot for climate change, because already deployed technology and infrastructure can continue to emit greenhouse gas way beyond the IPCC’s deadline for ‘net zero’ emissions of 2050, even if no more of those technologies are deployed. That remains true even if no more

of those carbon-intensive technologies are deployed. It would be similar to keeping fax machines in the 2010s to exchange files among a group of friends who happen to like fax machines. The activity has little to no economic impact because it does not spur new investments, or financial flows, since no more fax machines are purchased. Already deployed machines are mostly irrelevant for GDP. The problem is that in the case of climate change, the ongoing use of carbon-intensive stocks and infrastructure, even when influencing little on flows and growth, can matter enormously for the overshooting of our global carbon budget. Even if no more inefficient buildings or coal power plants are built, the ones still in operation will continue to emit for years and decades to come.

The evolutionary development of socio-technical regimes are mathematically assessed on the grounds of logistic substitutions (Grubb, Hourcade and Neuhoﬀ, 2014). These substitutions measure the deployment of new technologies, which means that they consider only the new additions to the system, or the flows. From this perspective, focusing only on flows could help reducing future emissions, but would fail to achieve the absolute limitation on global average temperature rise (Kessler *et al.*, 2018). Kessler *et al* (ibid) use the analogy of a “bathtub” to exemplify this financial claim. A bathtub full of “dirty water”, or an economy full of carbon-intensive stocks, gradually receives both dirty and “clean water” – the later representing investments that are aligned with Paris Agreement objectives. The niche-based transition posits that by growing enough a green market, at some point the dirty water’s faucet will be closed. Dirty water stops to flow, because carbon-intensive technologies are no longer competitive in this scenario, with only clean water flowing into the bathtub afterwards. The theory limitation lies on its disregard of the dirty water already in the bathtub and on the fact that the bathtub doesn’t have a lid or ceiling to limit how much water can go into it. Boosting green investments doesn’t substitute or automatically displace climate-misaligned stocks already in the system, even when it’s no longer viable to grow or invest in such a misaligned technology and market.

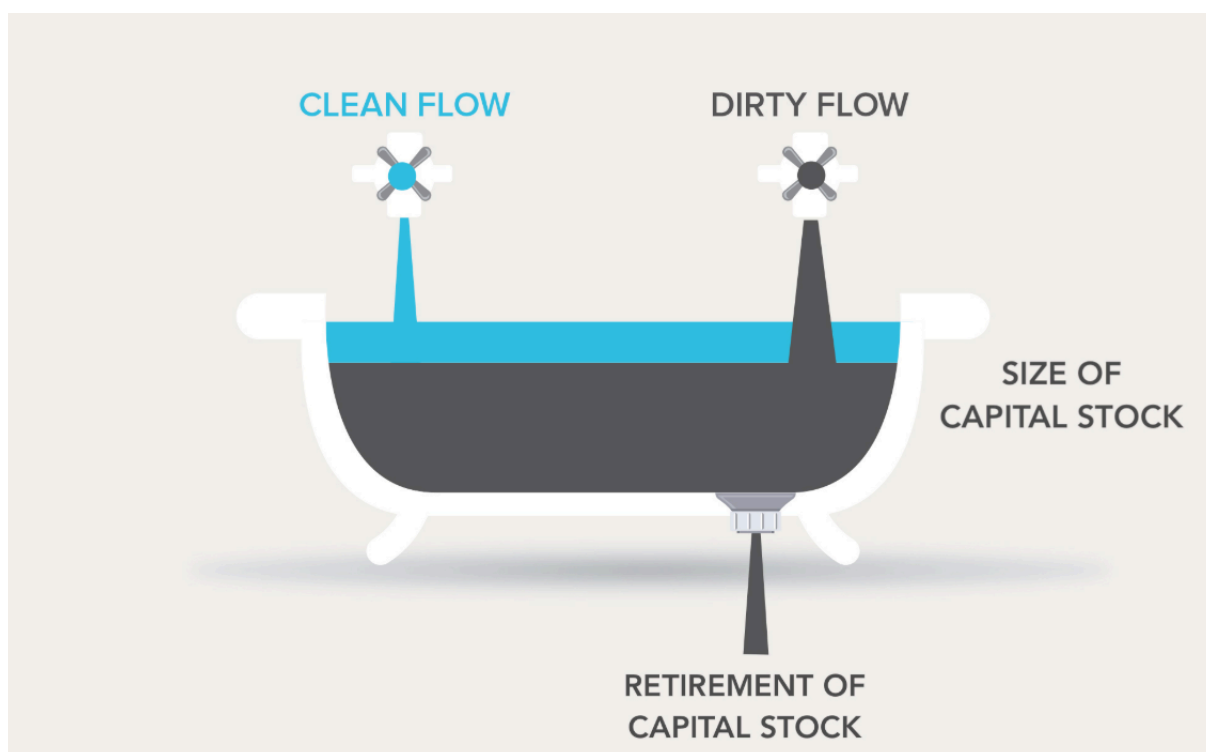


Figure 11 Dirty and clean waters representing brown and green flows and stocks (Kessler et al., 2018)

The green niche approach remains essential for transforming the financial system, as it can drive the economy to a new climate-aligned business as usual. But in order to remain below 1.5°C of average global warming, the economic understanding of the climate challenge cannot ignore the role of existing stocks. Even when void of relevance for growth, these stocks are essential in the case of continued emissions, in the form of carbon-intensive assets, or for capturing GHG via natural sinks, as the agriculture, forestry and other land use (AFOLU) sector. Governance as a whole must advance on the economic dimensions of substituting, adapting or retiring the brown, or boosting the green stocks. Socio-economic climatic models already try to include such considerations in the form of retirement rates or capital depreciation ratios. This might work as statistical dummies but cannot fully complement or justify the use of a theory that fails to reflect reality. A systems-based type of governance might provide solutions to account and speed up the retirement of carbon-intensive stocks.

3.5 Polycentric governance for a climate transformation of the financial system: levels and modes

Assessing the governance is another approach that goes beyond the theories behind the understanding of the financial system and the types of policies used to fix or shape the market. By doing so, we can understand not only the why, but also the how and by whom. In this context, governance can be defined as the adherence to common rules aimed at steering behaviour towards shared public goals (Roger, Hale and Andonova, 2017). Particularly relevant for this conceptualisation are the notions of “steering” action and the goal’s “publicness”. In the financial system’s case, both elements have been

weakened since the end of Bretton-Woods and substituted with a private-centred model based on the pursuit of self-interest. As seen in sections 3.2 and 3.3, this can be seen in the fading coordination role of international financial institutions, on national and transnational deregulation efforts aiming at freedom of capital and on central banks' focus on self-regulation by financial institutions and micro-prudentialism. Lack of strong international institutions or a clear institutional complex (Oberthür *et al.*, 2017) indicate that the resulting financial arrangement perform weakly as a formal governance regime. That is especially true if we consider that the financial system's non-state governance is focused on the avoidance of a strong orchestration, since any such coordination could result in additional restrictions to non-state and private agents' activities (Silva, 2015). As an example, Goldin and Vogel (2010) argue that since Basel II banks have engaged in a series of innovations particularly aimed at taking advantage and circumventing the established rules, such as by transferring liabilities and making a secondary market out of their counterparty risks. However, the financial system's weak or lack of regulation does not imply a lack of governance, since we can still identify a general commitment to a specific set of policy priorities (Tucker, 2016). In this deregulated context, how can we make sense of an international financial governance that works towards climate goals?

Built upon the idea that redundancies are not necessarily negative for managing systems (Low *et al.*, 2003) and the fact that the solution for global problems such as climate change might not lay on a uniform worldwide approach (Ostrom, 2010), the concept of *polycentricity* might provide an interesting avenue for assessing the role of the financial system for decarbonisation. Polycentric climate governance can be roughly defined as an interdependent system of formally independent decision-making centres that build incremental additions towards a similar goal (*ibidem*). The concept enables the consideration of institutional arrangements situated below the thresholds of formal regimes and organisations, thus including partnerships and international cooperative initiatives (Ostrom, 2010; Jordan *et al.*, 2015; Oberthür *et al.*, 2017). Such inclusion of informal arrangements makes the concept of polycentricism ideal for understanding the largely deregulated and private-centred financial system.

Based on polycentricity, the following sub-sections will focus on the understanding of how different parts of the financial system's governance can be recalibrated towards alignment with climate goals. Even if resulting in some redundancy, we defend that it is the overlapping of fragmentary and multi-level efforts by different types of actors and through different modes that can build a strong and interdependent climate-gearred structure that can transform the governance of the financial system.

3.5.1 Governance levels: subnational, national and international

Polycentricity frames our investigation of how climate objectives might be integrated as a policy priority in the different levels of the financial system's governance. Climate change has been described as a 'glocal' problem, since caused locally and cumulated into a global problem, with global impacts that are experienced locally (Gupta, van der Leeuw and de Moel, 2007). Its complexity requires a multilevel approach that looks not only into the specificities of individual levels, but also at how dif-

ferent levels interact, each producing particular types of financial demands and impacts. These demands and impacts are supplied via governance responses by the financial system, which reflects the ability and the willingness by financial actors to decarbonise, as well as structural knots that might block or delay a fully integration of climate objectives into their financial business as usual.

While greenhouse gases in the atmosphere may be uniformly distributed at mega-scale, mitigation actions and impacts are unevenly distributed across different localities and regions, according to location, socio-ecological conditions, prior preparation for extreme events and past investments (Ostrom, 2010). Behaviour of individuals, firms, communities and local governments generate local knowledge and trial-and-error learning processes. The responsibility over infrastructure assets and associated services, many of them essential for climate alignment or for creating climate misaligned stocks in the economy, are often shared or held alone by subnational levels of governance (OECD, 2018b).

Within the local and subnational levels, activities in cities towards climate objectives are particularly relevant for creating specific demands for financing. In order to keep our chances of curbing global warming to 1.5°C, emissions in 2050 from buildings stock must be 80-90% lower than present day, energy use from transport must be reduced by at least 30% and the renewables supply will have to make 70-85% of electricity (IPCC, 2018). To address those needs, a range of sub-sovereign and international transfer and financing mechanisms, innovative policy packages incentives, and guarantees need to be structured, successfully tested, institutionalised, and scaled up (*ibidem*). Networks and coalitions have been created to address this connection between local demands and international supply, such as the Cities Climate Finance Leadership Alliance (CCFLA), which brings public and private finance institutions, governments, United Nations and civil society and other members to increase visibility, capacity and supply of investments into low-carbon and climate resilient urban infrastructure (CCFLA, 2014). Other examples of local and regional finance-focused partnerships and co-operative initiatives are the C40 Cities Finance Facility, the Carbon Neutral Cities Alliance, the City Creditworthiness Partnership, the Joint Work Programme on Resilient Cities (JWP), the MobiliseYourCity Partnership, the R20, the Transformative Actions Program and the Transformative Urban Mobility Initiative (TUMI).

Given the limited reach of climatic local demands against the globalised nature of the financial system, the relationship between climate and finance at the local level tends to be one based on simple financing between local clients and suppliers of finance. This relationship might sometimes follow a subservience of local activities to financial biases from higher levels, which can be detrimental to the localised environmental benefits they purport to address, as a facet of what is commonly called *financialization* (cf. e.g. Clark, Larsen and Hansen, 2015; Zeitoun *et al.*, 2016). It's the case for example of complex infrastructure projects justified on climate grounds that fail to prove a strong climate additionality but are nonetheless preferred by upper level financial decision-makers over alternative and more climate-effective projects without similar commercial attractiveness. In another direction,

the governance of climate financing can benefit from a bottom-up approach as it can bring proximity between climate demands and financing sources, it can increase knowledge about projects thus potentially reducing risks, and it can bring into consideration the interests of local communities and the role of entrepreneurship, innovation funding and related issues such as cluster formation and local development. That is the case of municipal governance structures built for harnessing capital from debt markets through the issuance of green bonds, with proceeds particularly used in climate-aligned and climate transformational projects (Brand and Steinbrecher, 2019). It is also the case of green microfinance, focused on the provision of tailored credit for local clients carrying climate projects such as clean energy products, forestation and avoided deforestation, low-carbon agriculture, community-level projects etc (Rippey, 2012; Moser and Gonzalez, 2016).

The governance of the climate financing of local activities can be analysed individually, in connection with other localities and regions via cooperative initiatives (horizontally) or in its relationship with higher levels (vertically). The polycentric approach to the financial system's embedding of climate objectives can benefit from this bottom-up process of building and sharing knowledge with higher levels of governance. It can contribute to issues such as the green definition for green bond issuance, the translation of national "fair share" carbon budget down to project level (SBTi, 2018), climate impact maximisation and impact measuring, monitoring, sanctions and tools for bringing projects back to compliance. National and international levels of climate and financial governance can also send top-down signals and define legal boundaries for local action. As an example, the credit rating agency Moody's announced in 2017 that US climate vulnerable cities failing to demonstrate a plan to avert climate credit risks and build resilience to climate change would have their credit downgraded (Moody's, 2017). This has created a big push for local action, with a new figure indicating that 82% of surveyed US cities reported they will have a climate risk action plan in place by the end of 2019 (Moody's, 2019). Out of those cities, 54% plan to issue climate-driven bonds to finance adaptation and mitigation measures.

The national level plays a key role for defining the degree of empowerment and corresponding sources and availability of financing to subnational levels. This creates an uneven distribution of responsibilities for climate objectives across different countries, which is in turn reflected in the different financing needs from the subnational level (Figure 1). Even with such variations, as well as the globalised nature of the financial system, national states tend to remain relevant since they hold the prerogatives of financial regulation and the means for enforcement mechanisms, thereby affecting directly national and subnational levels of governance. Indeed, Ostrom (Ostrom, 2010) argues that global solutions negotiated on the international level are not guaranteed to work well if not backed by national and subnational levels of governance. The national state also holds the role of mobilisation of non-state actors, with some authors arguing that such *governing* cannot be seen as opposed to *governance* (Setzer and Nachmany, 2018). In the sphere of climate governance, this mobilisation and coordination role was recognised at different parts of the Paris Agreement, but is particularly

relevant in the definition of the national state as the central figure responsible for formulating, reporting and updating the nationally determined contributions (NDCs) and national adaptation plans (NAPs).

Environmental and climate-related investment by level of government, 2000-2016

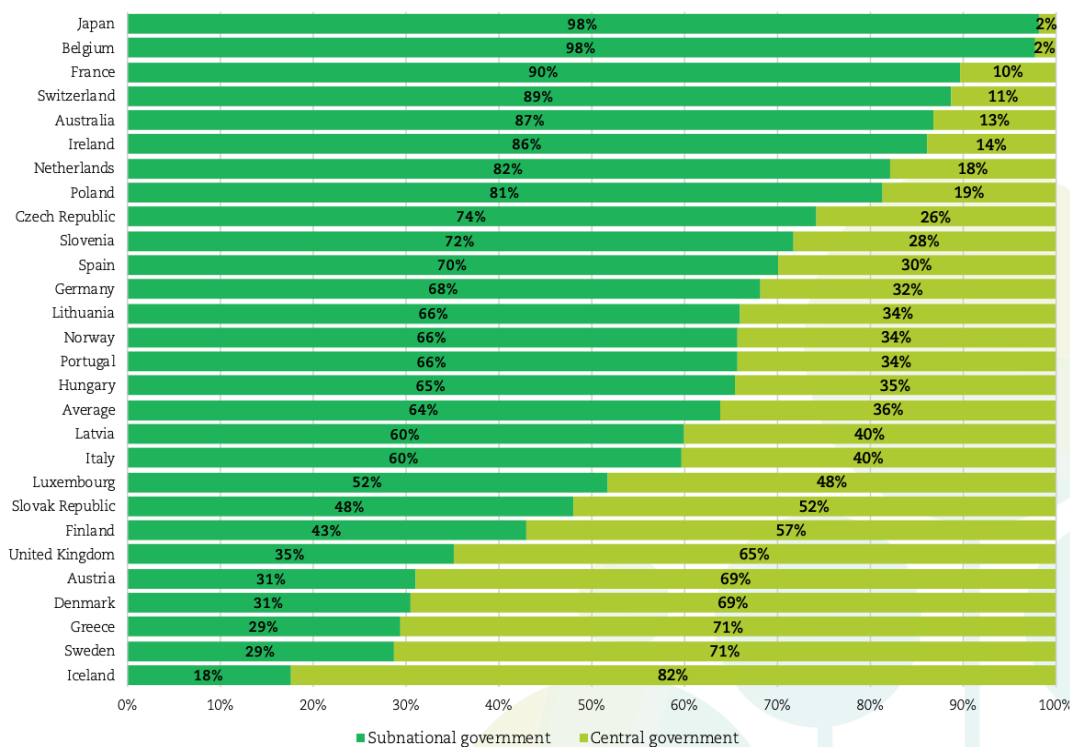


Figure 12 Environmental and climate-related investments by level of government in OECD countries, 2000-2016 (<http://www.oecd.org/cfe/Financing-Climate-Flyer.pdf>)

Both NDCs and NAPs are extremely important climate governance instruments that can set medium to long term directions for the financial system at subnational and national levels. The definition of the portfolio of priority measures can generate cost estimates for composing a financing and financial strategy. This strategy can in turn shape economic and institutional components that may or may not support the creation of enabling environments for the attraction of capital to viable projects. Beyond simple project financing, which considers finance as an external component, national action can go a step closer in terms of compliance with Paris Agreement's article 2.1.c and establish strategies for aligning the national financial system with low-carbon and resilient pathways. As seen in section 3.4, simply matching investments to the needs to develop a green niche will not be sufficient for achieving the maximum global warming goal. While international governance is moving towards a growing awareness of the relevance of misaligned flows and stocks, this is yet to be reflected in future updates of NDCs and NAPs, with great impact on the effectiveness of activities' implementation. National efforts for financial alignment could potentially include areas such as macro-prudential and central banking regulation, which can assume a transnational character in the co-production and coordination of the process of mainstreaming climate change considerations into the financial sys-

tem. That is the case of the Central Banks and Supervisors Network for Greening the Financial System (NGFS), a group formed in 2017 and composed by central banks and supervisors from 16 countries, with a total of 34 members and 5 observers and focus on the integration of climate change with supervision, macro-financial and mainstreaming of green finance (NGFS, 2019a). Other areas for national action might include the relationship between firms and investors in matters of GHG past disclosures, decarbonisation planning, valuation and integration of green assets and green financing. Finally, it's essential to establish means for mobilising non-state actors, both financial and non-financial, for co-develop solutions for a climate-integrated market, with the just transition and phasing out of climate-misaligned activities.

National governance generates demand and supply needs that are both shaped and help to build up a general direction at the international level, in a process with feedbacks and interdependence. As an example, some national states are responsible under the Paris Agreement for the *climate finance* aimed to aid developing and most vulnerable countries to mitigate emissions and build resilience against climate change (article 9, Paris Agreement). Funding to support developing countries can either be carried bilaterally or through key regional and international institutions, such as Multilateral Development Banks (MDBs) or the Green Climate Fund (GCF). It can also acquire a myriad of forms, such as purely public or private, or a mix of both in public-private partnerships and blended finance. The later are aimed at bringing private actors and private capital to the co-generation of climate public value, as the case of guarantees and de-risking instruments, green bonds, direct investments, credit lines, political risk insurance, grant and technical assistance (OECD, 2018a). The bilateral and multinational engagement that follows from action by national actors build a polycentric system of knowledge-building and knowledge-sharing on how to increase the transformational role of finance. It also advances important issues for triggering the wider transformation of finance, while in practice providing part of the capital means for implementing national and transnational climate objectives.

On the international level, the process of deregulation and the push for financial openness have resulted in the big globalisation of the financial system in the past decades. National regulations and enforcement mechanisms could no longer reach global firms appropriately, and the international regime lacked the tools to maintain a direction by timely catching up to financial practices. Three international institutions were tasked with the common goal of maintaining global financial stability, namely the International Monetary Fund (IMF), the Bank for International Settlements (BIS) and since 1997 the Financial Stability Forum (FSF), but no binding international standards have been codified to establish a mutual understanding of financial transparency and accountability (Abdelal, 2009). Global rules for capital freedom were debated within the IMF in the mid-1990s, but the proposals were defeated primarily by the US Congress after the Asian crises in 1997-98 (Abdelal, 2006). Meanwhile French and European policymakers codified and mainstreamed the globally adopted rules of capital freedom, with big support of the OECD, largely turning capital control into an illegitimate poli-

cy tool (ibid). The interplay between US bilateral and *ad hoc* practices and EU liberal codification can be considered as the cornerstones of the global financial system up until the 2007-08 crisis. In that context, the role of the financial system for climate objectives would be limited to altruism and to the pursuit of financial actors' own interest, with a financial shift taking place only to the extent and as a result of a deeper change in the so-called real economy.

The emergence of developing economies as regional and global financial players has pressed for an enlargement of the otherwise small decision-making structure of global financial governance. The G20 was formed after the Asian Currency crisis and the 2007/2008 crisis saw the strengthening of mandates to IMF and BIS, as well as the creation of new institutions such as the Financial Stability Board (FSB) (Moshirian, 2015). Global regulatory reforms discussed by the G20 were also advanced by organisations such as the OECD and the International Organisation of Securities Commissions (IOSCO). Climate governance has been succeeding to find synergies with these new global financial priorities, as it has been the case with the creation of the Task Force on Climate-related Financial Disclosures (TCFD) under the FSB, the Green Finance Study Group under Chinese presidency of the G20 in 2015, OECD's work on climate transparency, green finance and Rio markers for international development, IMF's support in the design of fiscal policy for mitigating climate change, UNEP Finance's work on sustainable insurance, UN Principles for Responsible Investment (PRI) targeted at investors etc. Beyond the knowledge-building and top-down work led by international institutions, other partnerships and international cooperative initiatives have helped to strengthen the polycentric regime, such as the banking-based Climate Action in Financial Institutions (CAFI), the Global Investor Coalition on Climate Change (GIC), the Portfolio Decarbonization Coalition, the Fossil Free Movement etc. These dynamic initiatives constitute normative systems and decision-making processes, deriving governance functions such as the definition of guidance and signalling, the setting of rules to facilitate collective action, transparency and accountability, capacity building and technology as means of implementation, and knowledge and learning (Oberthür *et al.*, 2017).

3.5.2 Governance modes: between binding norms, soft-law voluntarism and self-regulation

In the context of internal and external challenges to the state, Pierre (2000) defines governance as the 'steering' and sustaining of societal co-ordination and coherence among a wide variety of actors with different purposes and objectives. The financial system's deregulation in the 70s and 80s played a crucial role in this new understanding of governance as not necessarily associated with governments, since representing a powerful example of contestation to the traditional role of the state in society. The different "modes" of governance indicate ways in which such 'steering' can be achieved, broadly located somewhere between the dichotomy of state intervention and societal autonomy (Treib, Bähr and Falkner, 2007). Alternative modes started to gain relevance outside the realm of state regulation, in what was called "reflexive law" (Gaines and Kimber, 2001), or similarly "mutual regulation", "self-regulation", "responsive regulation", "reflexive adaptation", "smart regulation", "post-regulatory governance" (Richardson, 2008, p. 289) or "soft law" more broadly.

The *reflexivity* characteristic developed from the idea that such new modes created autonomous and autopoietic subsystems that could process their own internal reflexion, learning and behavioural changes. They thus prescribed a limitation to policymakers, who should use less ambitious and market-compatible tools to influence, rather than regulate through prescriptive controls the behaviour of economic actors. This autopoietic perspective acquired by reflexive law and taken up by the financial liberalisation agenda at the end of the 1980s opposed its earlier Habermas-based discursiveness, which saw the creation of these subsystems as a means to promote internal reflexion and develop their social identity with democratisation goals (Gaines and Kimber, 2001). Within the financial system, environmental and ethical concerns were re-characterised as pertaining to these autopoietic sub-systems, shifting the understanding of potential conflicts from an ethical or a systemic perspective to a financial quantification of material risk (Richardson, 2008). The concept of a reflexive law grounded the extrinsic idea that a self-regulating financial system could adjust itself more quickly and flexibly to financial innovations. Intrinsically however, a criticism to this autopoiesis is that coupled with the *de facto* restriction of information disclosure through secrecy and confidentiality clauses, which are commonly present in financial system's transactions, such claims of self-improvement became hardly possible to be assessed on comparative and scientific grounds, particularly in their generation of public values.

This mode of self-regulation, largely based on market's voluntarism, resulted from the erosion of the national state's authority and enabled the harvesting of the exceeding powers created by the borderless nature of financial activities (Padoa-Schioppa, 2004), or simply filled the gap of state sovereignty's retreat (Dunning and Lundan, 2011). Environmental concerns within the financial system grew with basis on this voluntary assignment to broader ethical rules, or what became known as socially responsible investing (SRI). SRI was originally based on religious and mission-based investors and, from the 1990s, it started to become increasingly mainstreamed as a do-good type of market altruism (Richardson, 2013). In the subsystem's quest for fixing its own autopoietic goals, such as avoiding future crisis with self-regulatory and micro-prudentialist coordination under the Basel Accords, the financial system was able to keep social pressure and state regulation in check. In a world dominated by governments competing for their preferred type of investments, this created a spiralling process of 'race to the bottom' in regulatory standards and a 'race to the top' in incentives for the financial sector (UNCTAD, 2012), finding the stability and predictability of the system in the crossing point between these two tendencies.

Some authors have criticised the usefulness of voluntary governance modes described under the "soft" law typology, by indicating their incapability to generate even "soft" responsibility, since dispossessed of sanctions (Klabbers, 1996). The main problem would be that soft law relies on political and moral commitments on their own terms, or rather on their interpreter's terms, bearing no legal validity. However, this legal positivist approach can easily lose sight of the important social function exerted by such voluntary modes, with relevant coordination and signalling effects that matter

enormously for governance. These soft instruments, for example, can work to adjust and complement hard regulation, clarifying established codes and working as a precursor to the establishment of new regulation (Bjorklund and Reinisch, 2012). The later function can be extremely useful at the financial system's quick rate of innovation. Clearly though, this role of precursor can easily constitute a rhetorical argument for establishing and maintaining weaker forms of regulation, feeding on the premise that at some point such harder forms will be installed. Soft instruments can also help to steer behaviour beyond national boundaries where no single jurisdiction has a clear authority over activities. Voluntary and soft law modes can also work to define future behaviour and attitudes, contributing to stability and predictability in a type of system that evolves with in-built flexibility. These practices, standards and enforcement cooperation types of soft law can be 'harder' than their quality suggests, including in Central Banks and International Financial Institutions' policies (Brummer, 2011).

The historical evolution and theoretical justifications of the financial system in terms of deregulation and self-regulation helps to explain the voluntarist nature of most ongoing efforts to incorporate climate objectives onto the financial system. In defining 'informal international law-making', Pauwelyn (2011) argues that financial system's voluntary guidelines and standards have nothing of 'soft', since they can hardly be considered as vague, aspirational or deeply contested. Such informality should also benefit a transition away from a one-size-fits-all model of accountability, which according to the author no longer works. The international financial system has seen the opposition between two views of the world, a US-led voluntary perspective and a European effort to create binding codifications (Abdelal, 2009). These different approaches have also produced different modes of governance in the policy dimension (Treib, Bähr and Falkner, 2007), which have been applicable to climate-led transformations of national financial systems. On the international level however, voluntarism remains the main rule.

Voluntary and soft law instruments are not perfect because of their particular failure to generate a 'compliance pull'. Their underlying paradox in terms of compliance lies on the fact that standards have been often concluded in non-binding settings precisely and deliberately to avoid any obligation to comply (Chinkin, 2003, p. 4). This voluntarism would act to lessen the pressure on public actors to enact binding agreements, at the same time of averting further limitations to financial actors' self-interested action. Self-regulation can also suffer from a problem of legitimacy, since the mode is built within exclusive and closed standard-setting clubs. The specific understanding of financial legitimacy within this private-centred autopoietic system is essential because with the necessity to add a new green component – i.e. climate objectives –, the otherwise closed group must open up to a foreign subsystem it might no longer control endogenously. This new subsystem speaks with its specific language, subscribes to its own objectives and metrics, and answers to its own legitimacy processes. The inclusion of these new green and climate objectives within the financial system tends to reposition the financial legitimization's centre of gravity. It means to say that while financial actors can easily

create, justify and legitimise a new financial innovation or action with grounds on financial theory, they cannot define alone what is green or climate aligned, simply because they do not hold the legitimacy to do so. The latter requires a stamp by climate science and the sustainability community and potential contestations to the validity of such seal, in form of greenwashing claims, can generate costly reputational risks for the financial system. Under the pressure to incorporate climate objectives, and willing to avoid any binding regulation, the financial system has two options to avert such risks. The first is to flexibilise its own subsystem's legitimation autopoiesis, allowing for new metrics and rationale from the green subsystem to be integrated and share a role in its decision-making. This would be the case, for example, of seeking external and unbiased scientists to validate claims of climate alignment to financial instruments and activities, a plan that can also suffer from oppositional claims of potential capture and conflict of interests by such scientists. The second is to share or outsource these risks with willing public actors, such as national legislators, who can confer legitimacy by absorbing risks into the political process.

The issue of legitimacy can be central for soft laws with a climate component. It changes, for example, how even voluntary-based modes are perceived according to the different types of actors that produce them. Scharpf (1999) established democratic legitimacy as a two-dimensional concept, distinguishing between input-oriented and output-oriented. The input side is related to the mechanisms or procedures linking political decisions to democratic preferences, while the output is linked to the outcomes or effectiveness produced by certain activities with a narrative of public value's generation. It is to say that it matters to know how a mode was defined, including by whom, and what it has finally produced as output. When a non-environmental financial innovation occurs, that must be legitimised within the financial system in a promotional effort to reassure market participants about its potential, thus guaranteeing its buy-in and market development (Huault and Richard, 2012). This has been the case with exchange-traded funds (ETFs) and credit derivatives. Here, the perception of society at large about the new innovation plays next to no part, since validation occurs within the system and can be measured internally in terms of market uptake, which then becomes the metrics for an output-oriented legitimation. In this logic of a closed system, if the instrument delivers the promised financial benefits, it is legitimate. That is the case even when instruments run in the shadow of regulations such as the Basel Accords, as with the growth of the securitisation market and its practice of masking "junk" securities via pooling, leading to the 2007/2008 financial crisis.

In the case of climate-centred financial solutions, the climate element cannot be simply justified in autopoietic financial terms. A company issuing a green bond based on its own self-regulatory concept of green might face a societal backlash out of greenwashing contestations. An example was the issuance of over US\$500 million in green bonds by the Spanish oil company Repsol in 2016, which got excluded from green bond indexes after claims of greenwashing (Viegas, 2016), and the similar case of the non-issuance of green bonds by the Russian aluminium company Rusal (Hale, 2018). The uncertainty generated can be framed in terms of reputational risks. In order to push away those risks,

the definition of green can be outsourced to external private verifiers. But the questions regarding legitimacy remain: how to guarantee, in a competitive environment, that verifiers will not engage in a *race-to-the-bottom*? After all, easier and more lenient definitions of green are cheaper to be implemented and more easily used by different types of operations, so lower requirements might become an effective way to attract more clients to these private verifiers. Also, by making entry to green issuances easier, market share can grow and benefit these same verifiers. All in all, the construction of green definitions solely based on the involvement of financial system's participants tend to lack *input* legitimacy. How much does a financial actor know about climate pathways and climate alignment, and how can society trust that a scientist working for an investor is in pursuit of climate interests, rather than profit-maximisation or advancements in its own career?

Legitimacy about governance modes in relation to green criteria and standards could be improved by providing evidence about these instruments' results towards climate objectives, building links with effectiveness and *output* legitimacy. The problem is that financial transactions tend to lack proper sustainability disclosure, often argued on the basis of proprietary and competition sensitivity of information. This takes us back to the problem of reflexive law being assessed scientifically, maintaining output legitimacy grounded on a type of financial dogmatic ecumenism, or based on faith. Without sufficient information and a proper way to assess output legitimacy, avenues have been tried to improve or to shift the risks involved with the input legitimacy. For example, it is the case of certification of existing green classification systems by public actors, or creation of new ones by public institutions. While the political process normally seeks to increase input legitimacy by broadening participation, in practice we also have a state absorption of these reputational risks and their consequent risk-sharing with society. Even when classification standards, criteria and metrics developed by governments remain voluntary, they receive a public legitimisation stamp that make it safer for the financial system to use such classification. If governments accept to absorb these risks from private actors, what are the commitments' counterpart by private actors? What more, by justifying this risk-sharing to society on climate grounds, how to ensure accountability that such climate effectiveness — output — is verified in the promotion of specific financial instruments? These are valid questions for most debates related to the governance modes of green instruments. As thus argued, the financial system will require a much deeper transformation to bring climate objectives as a permanent component of its own system, in way of allowing a type of output legitimation that is closely linked with the latest science. Meanwhile, the public sector must ensure that its intervention is also closely linked to commitments on the outcomes and not only geared at fixing the input side of legitimacy. Otherwise governments can risk institutionalising greenwashing, with the only visible outcome being the absorption of risks from private actors and their sharing with society at large. In other words, financial governance must in-built climate considerations in ways that deliver emission reductions in line with the 1.5°C maximum average warming goal, while governments must ensure the same focus on outcome when designing and sponsoring any type of green financial intervention, voluntary or not.

4 Description and decryption of current narratives

4.1 The main current narrative families

As described in section 2 and 0, different policy narratives and approaches are used to mobilize the financial sector against climate change. We propose here a brief summary of the three main axes at stake.

The issue of the cost of climate mitigation and adaptation was initially approached through mainly public and governmental funding, through institutions such as national and multilateral development banks and instruments such as the GCF. The main idea here was that from an economic point of view climate change was primarily the result of a global market failure (Stern, 2007) and that such long-term, uncertain and common-good issues could not be solved by private financial institutions, mostly blind to the climate problem without at least a substantial and generalized carbon price.

Then, as the extent of the financial challenge became clearer in the face of a requisite full decarbonization of the global economy, the necessity to call on capital markets as a major funding force progressively prevailed. This expectation that financial institutions could be involved and take their part of the climate challenge was supported by the green growth narrative, highlighting the opportunity to finance and invest in low-carbon and renewable technologies. This move has accompanied the build-up phase of the COP21 / Paris Agreement, and benefited from the sudden engagement of many 'responsible investors' (cf. section 3.5.2 about SRI) to commit to climate mitigation and to decarbonizing their portfolios (cf. end of section 3.5.1).

Finally, the most recent major move that came into play can be seen as a less upbeat narrative, anchored on the risk that climate change is posing — and especially will pose — to financial markets and global financial stability. Popularised by the Governor of Bank of England (Carney, 2015), this view emphasises that the financial system is currently not functioning well to capture and manage climate-related financial risks and is even threatened by either abrupt transition to a low-carbon economy or longer-term catastrophic global impacts from climate change. But while questioning the very structure of the financial system and its capacity to anticipate unprecedented events in the long-term, the quite surprising outcome of this awakening of consciousness initiated by financial supervisors and regulators is that the focus is basically only on risk disclosure as the main solution, and not genuine regulation (Christophers, 2017). Nevertheless, that primary phase led up to a new one that eventually opens deeper regulatory options such as new rules governing financial products and prudential regulation. The launch of the European Commission (EC) action plan on sustainable finance (EC, 2018) and the creation of the Central Banks and Supervisors Network for Greening the Financial System (NGFS, 2018) clearly illustrate this potential shift in regulators' mindset.

4.2 Analysis of climate-related finance policies through our theoretical and governance framework

We use the exploratory framework developed in section 0 to build a typology of theories and governance modes that can be applied to climate-related finance policies. We can thus characterise a policy on the basis of the different features we defined above among three categories. Those categories are the following:

- Theories
 - Free market or Regulation
 - Green niche or System
- Types of policies
 - Pull or Push
 - Micro or Macro
- Governance modes
 - Government compulsory or Government Voluntary or Self-regulation

Our objective is to identify the theoretical and conceptual features underpinning a specific set of financial policies regarding climate change and broader sustainability issues, in order to determine their main explicit or implicit characteristics. This approach should then allow to draw some inferences on the potential contradictions, complementarities, gaps, dead-ends, opportunities or levers that potentially arise among the multiple regulatory options on the table, and to compare the fundamental features of policies between different countries. Initially, what are the factors driving countries' interactions with the financial system and, later on, how do these different approaches to finance rank in terms of climate effectiveness?

The present work is a first development and exploration of the proposed framework. The following constitutes a first attempt to testing it with concrete examples, to either validate or challenge our initial framing, depending on the results we draw from our analysis. A similar framework might be developed with a countless number of different opposing theories, policy types or governance approaches. The authors' choices have been on a selected number of key topics which in turn can serve as good indicators for how different countries can integrate the new goal brought by the PA's article 2.1.c into their own financial traditions. Building on this initial framework, further research might seek to answer, for example, what are the factors influencing countries' interactions with the financial system, how does the level of development influence these interactions, and how do these different approaches to finance rank in terms of effectiveness in the country's emission reductions?

In the following, we propose to apply this framework to both the current EC action plan on sustainable finance and the recent "Guidelines for Establishing the Green Financial System" established by the Chinese government. We will then address the main points identified with some governance and policy recommendations in section 5.1, as well as indicating areas for further research in section 5.2.

4.3 Analysis of the European sustainable finance action plan

The European Commission released in March 2018 an ambitious action plan on sustainable finance, entitled “*Financing Sustainable Growth*”¹¹ (EC, 2018). This followed a set of recommendations made by an expert group¹² (HLEG, 2018) formed by the European Commission in October 2016 in the context of the Capital Markets Union. The Action Plan is composed of ten actions that are developed under three main objectives: i) Reorient capital flows towards sustainable investment; ii) Mainstream sustainability into risk management and iii) Foster transparency and long-termism in financial and economic activity. A short summary of those actions can be found in Annex 1 of the report.

The ten different actions and sub-actions of the European sustainable finance action plan are detailed in the initial EC communication (EC, 2018) and the multiple legislative documents and reports published since then, notably by the Technical Expert Group (TEG). In the following we only indicate the title of the action as mentioned in the initial communication, and when necessary use a short appellation to designate sub-actions that we identify in the EC communication. Those sub-actions do not necessarily correspond to the list of initiatives described in the EC communication (EC, 2018): we distinguish sub-actions that show different characteristics while being grouped in the same broader action. Actions that contain a legislative proposal or level 2 measures¹³ are indicated with a [L].

Nota bene: our analysis is based on all the available literature and discussions we had access to. The authors constructed the typological framework in order to be as much as possible objective in the analysis of policies, but due to some to unclarities in the provisions — relating to the fact that the definition and implementation of the action plan are still a work in progress — our process of classification and analysis cannot be exempt of some subjectivity. The analysis below is summarised in Table 3 and 4 of the Annex 3 and is represented graphically in Figure 13.

¹¹ The usual denomination of the action plan is “action plan on sustainable finance”, despite the formal communication was “Financing Sustainable Growth”.

¹² The High-Level Expert Group on Sustainable Finance (HLEG).

¹³ Legislative proposals are proposed by the Commission for adoption by the European Parliament and Council. Level 2 measures are technical implementation measures, adopted, adapted and updated by the Commission with the help of consultative bodies. More details here: https://ec.europa.eu/info/business-economy-euro/banking-and-finance/financial-reforms-and-their-progress/regulatory-process-financial-services/regulatory-process-financial-services_en

Table 1 EU Sustainable Finance Action Plan

EU SUSTAINABLE FINANCE ACTION PLAN		
Actions		Sub-Actions
1	Establishing an EU classification system for sustainable activities	-
2	Creating standards and labels for green financial products	Green bond standard and prospectus for GB issuances (2.1) (exploration of) EU Ecolabel for certain financial products (2.2)
3	Fostering investment in sustainable projects	-
4	Incorporating sustainability when providing financial advice	-
5	Developing sustainability benchmarks	Transparency of the methodologies and features of benchmarks (5.1) Harmonising benchmarks comprising low-carbon issuers (5.2)
6	Better integrating sustainability in ratings and market research	(exploration of) mandatory credit rating integration of sustainability factors (6.1) (exploration of) encouraging sustainability ratings and market research (6.2)
7	Clarifying institutional investors' and asset managers' duties	Clarify II and AM' duties in relation to sustainability considerations (7.1) Increase transparency towards end-investors on how they integrate such sustainability factors/risk (7.2)
8	Incorporating sustainability in prudential requirements	(explore the) feasibility of inclusion of climate-related risks in institutions' risk management policies (8.1) (explore the) potential calibration of capital requirements of banks as part of the CRRD (8.2) EIOPA invited to provide an opinion on the impact of prudential rules for insurance companies on sustainable investments (8.3)
9	Strengthening sustainability disclosure and accounting rule-making	Revision of the guidelines on non-financial information (9.1) Proposal requiring AM and II to disclose how they consider sustainability factors in their investment decision making process (9.2) [L] Promote innovation and development of best practices in corporate reporting, such as environmental accounting (9.3) Explore alternative accounting treatments to fair value measurement for long-term investment portfolios (in relation with IFRS) (9.4)
10	Fostering sustainable corporate governance and attenuating short-termism in capital markets	Assess the possible need to require corporate boards to develop and disclose a sustainability strategy and measurable targets (10.1) Assess the possible need to clarify the rules according to which directors are expected to act in the company's long-term interest (10.2) Invite the ESAs to collect evidence of undue short-term pressure from capital markets on corporations and consider, if necessary, further steps (10.3)

Action 1: Establishing an EU classification system for sustainable activities [L]

This is the emblematic ‘taxonomy’ of sustainable activities (EU TEG SF, 2018, 2019b) put forward by the EC as the core element of its action plan (cf. Fig. A1). As such, the taxonomy is not a policy, but it constitutes a backbone for most of the other actions decided or envisioned by the EC, therefore illustrating the main underlying idea of the policy maker: promoting at all possible levels of the financial system the economic activities considered as ‘sustainable’, to attract capital.

Therefore, the EC taxonomy provision as it stands today can be considered as a tool relying more on **free-market** theory than on regulation theory, as the idea of the EC here is to let markets decide what they want to invest in and finance, after helping them in the characterisation of what is sustainable. The mechanism is therefore a **pull** that builds on traditional market forces, without much governmental pressure.¹⁴ Oppositely, a pure regulatory and push move could have led to directly prohibit some undesirable activities. Of course, there is a nuance of ‘regulationism’ and push here, which can actually become stronger with time if the taxonomy and attached provisions become broader — especially on undesirable activities —, more binding and less voluntary in the future.

Moreover, the taxonomy being only a characterisation of ‘positive’ / sustainable activities, it clearly constitutes what we define as a **green niche** tool — that is expected to grow —, rather than one tar-

¹⁴ The taxonomy could be considered more of a push if it would contain items such as a blacklist of activities, or even a ‘brown/unsustainable’ taxonomy (ACPR, 2019) which would not *per se* prohibit investing in those activities but provide a more stringent direction to market participants (government encouraging positive or discouraging negative does not have the same effect, even if nothing is compulsory/illegal).

getting from now on the whole system altogether. Similarly, while having a broad perimeter of application, the approach targets the individual transaction, defining whether the underlying activity is sustainable or not. Especially if the taxonomy takes a “transition” perspective — i.e. defines as ‘sustainable’ the activities that are not perfectly aligned with the target but considered as acceptable for a limited time enabling the transition — it is a typical **micro** approach, as indeed such activity can appear sustainable at the individual level but there is no oversight on the overall quantity at the macro level (e.g. if everyone decides to invest in that particular activity, the sustainability threshold will be clearly exceeded).

Finally, the governance mode is not easily characterised here as the use of the taxonomy itself will depend of which framework it is applied in (e.g. to define either a green bond standard, a benchmark methodology or a capital requirement adjustment). But the general approach of the EC on this is not to force nor constrain financial institutions in their decision, but rather to simplify their job and choices, therefore, while the taxonomy will be key to several legal compulsory frameworks, a significant part of them will still rely on a certain **voluntarism** of market actors.

Action 2: Creating standards and labels for green financial products

Sub-action 2.1: Green bond standard and prospectus for EU green bond issuances [L]

Green bonds are the principal financial product being supported and promoted by governments in general, and in Europe in particular, in the frame of the fight against climate change. The green bond standardisation envisaged by the EC aims to attract (**pull**) investors and stimulate issuers so that the **niche** grows (green bonds correspond actually to <0.5% of the global bond market outstanding)¹⁵ and eventually becomes big enough to significantly contribute to finance climate needs. This provision, despite contributing to significantly structure the market by regulatory means, is still more influenced by **free market** theory than by regulation theory, as its main objective is to “encourage” investors in their **voluntary** decisions, in a market that is considered as an object to motivate, rather than to frame or restrain. Focusing on the transaction/product level, and not even the company level (a green bond can be issued by a company whatever the ‘greenness’ of the rest of its activities) it activates a type of **micro** mechanism, as explained above.

Sub-action 2.2: EU Ecolabel for certain financial products

Similarly to green bond standard, the EU Ecolabel project is a **voluntary** mechanism that expects to attract (**pull**) investors eager to invest in financial products exposed to green activities, by simplifying the market and showcasing specific products. Therefore, this **micro** provision is a relying on **free market** approaches, looking at existing products and motivating the creation of new ones. As such, a

¹⁵ Using USD489bn outstanding climate-aligned bonds (CBI, 2019) in a USD100 trillion global bond market (Tissot, 2018).

labelling scheme can target system changes, especially if it evaluates different scales of ‘green’ and highlights what is not, but in this specific case, it focuses on a specific level/threshold of green, and tends to exclude underlying companies and activities that are in the transformation from ‘brown’ to ‘green’, therefore constituting a pure **green niche** tool.

Action 3: Fostering investment in sustainable projects

We do not assess this action through our framework, as the EC did not provide so far a clear provision beyond broad ideas concerning the advisory capacity and the financing instruments managed by the EU (e.g. European Investment Bank, European Fund for Strategic Investment, European Fund for Sustainable Development, EU External Investment Plan).

Action 4: Incorporating sustainability when providing financial advice [L]

This fourth provision is significantly different than the first three in that it does not focus on growing the green niche but is rather explicitly about “*reorienting the financial **system** towards sustainability*”. Indeed, if properly fit, such a scheme should apply to any type of investment and cut across all economic sectors and activities investors can have an impact on. While still relying on market forces and investors’ decisions (especially individual savers/investors) to **pull** capital, it contains a significant **regulation** feature, as it adds **compulsory** rules and configuration to market functioning, and asks advisor to go beyond asset prices and risk/returns mechanisms. But since it only touches upon the level of individual transaction, the provision constitutes a **micro** type of policy.

Action 5: Developing sustainability benchmarks

Sub-action 5.1: Transparency of the methodologies and features of benchmarks [L]

The logic of this action 5 is to help investors better understand the quality of ‘sustainability benchmarks’. By promoting transparency, this provision builds on **free market** approaches, and relies on investors’ choices to **pull** investments towards sustainable activities. Depending on which underlying indicators are selected to define how sustainable a benchmark is, a system impact can be achieved if its perimeter is the whole investable universe, but so far most available sustainability benchmarks consist in emphasising the companies and activities that are green/sustainable; moreover, the vast majority of those benchmarks are genuinely conceived as additional **niche** ones, whereas an alternative approach would be to impose a real sustainability criterion to current traditional mainstream benchmarks so that they can drive a major macro shift of the overall market. While transparency will certainly be imposed by the regulation (**compulsory**), it will not contribute per se to structure the market.

Sub-action 5.2: Harmonising benchmarks comprising low-carbon issuers [L]

Beyond transparency promoted above, the fact of harmonising benchmarks for certain objectives constitutes a more consistent **regulatory** move to construct a market for a certain purpose. Indeed, if

the EC constrains the definition of “EU Climate Transition Benchmark” and “EU Paris-aligned Benchmark”, as the TEG proposes in its June 2019 interim report (EU TEG SF, 2019a), it will contribute to significantly shape the market. Nevertheless, this does not prevent anyone to build a benchmark with close objectives but using another appellation than those ones, and therefore escaping the type of standardisation proposed here.

Action 6: Better integrating sustainability in ratings and market research

Sub-action 6.1: mandatory credit rating integration of sustainability factors

This exploration of **compulsory** integration of sustainability factors in credit ratings for all companies would constitute a significant **regulatory** move towards structuring a **system** approach of sustainability in that credit ratings so far do not significantly consider sustainability factors, while it is clear that environmental and other “mega-trends”¹⁶ do and will increasingly affect companies business world-wide.¹⁷ Nevertheless, it would still be a **pull** and **micro** type of action from regulation, as credit ratings are made to help financiers in their individual loan agreement decisions, without any government intervention in a particular direction.

Sub-action 6.2: encouraging sustainability ratings and market research

While standing in the same broad action, this exploratory provision is much more relying on a **free market** approach as the EC does not plan here to resort to the law but rather encourage **voluntary** sustainability ratings and market research. Moreover, currently those sustainability tools are shaped and used as complementary **niches** to the main financial assessment toolbox and cannot as such bear a broad power of change.

Action 7: Clarifying institutional investors' and asset managers' duties [L]

Sub-Action 7.1: Clarify institutional investors' and asset managers' duties in relation to sustainability considerations

Fiduciary duty is one of the key principles of investment. In clarifying and potentially increasing the responsibility of investors towards sustainability on behalf of their clients (end-investors) beyond the sole influence of risk/return mechanisms, the EC is here touching upon a core question and opens the door to fundamental **system** change, as it has the potential to cover all types of assets and economic activities in all the possible dimensions of sustainability. Such a significant **regulatory** move would certainly constrain professional investors in a **compulsory** way at a major scale, but would still rely on a micro approach in that it would only concern the individual relationship between the investor and its client. Depending on how much the definitions and criteria are directive on a specific sustainability direction, the provision can be considered to a certain extent as a policy push, but it will

¹⁶ Cf. PRI and Willis Towers Watson, 2017

¹⁷ Cf. WEF, 2019

very undoubtedly let a major degree of freedom to the (end-)investor in the precise investment choice, and therefore will let usual market forces **pull** capital as they see fit.

Sub-Action 7.2: Increase transparency towards end-investors on how they integrate such sustainability factors/risks

Complementary to the above, this provision seeks to enhance the methodological and strategical transparency of investors' sustainability approaches, relying on the principle that transparency between professional investors and their clients will be enough to let the market go in the right direction without having to define more precise rules, therefore implicitly building on the expected genuine ascendancy of **free market**.

Action 8: Incorporating sustainability in prudential requirements

These exploratory provisions mark the ambition of the EC to mobilise the prudential framework, which is the core financial regulation tool, to approach climate change. It constitutes in itself a significant **regulatory** move, somehow inspired by — and potentially conflicting with the initial objectives of — the post-crisis call for financial regulation and supervision in the purpose of markets stability.

Sub-action 8.1: feasibility of inclusion of climate-related risks in institutions' risk management policies [L?]

Limited to the individual institution / **micro** scale, climate-related risk management cannot address the issue of systemic risk but avoids the green niche trap in that it should necessarily cover risk factors coming from the broad diversity of activities and industries in the global economy (i.e. **system** level). Nevertheless, being focused exclusively on internal risk management (and not risk for the overall society), it composes by definition a strong **pull** approach.

Sub-action 8.2: potential calibration of capital requirements of banks as part of the Capital Requirement Regulation and Directive (CRRD) [L?]

This item is one of the most commented and debated among the 10 actions. It is indeed one of the rare provisions for which policy-makers have to take decision on the precise direction of the transition, i.e. **push** what types of products and activities are to be favoured/penalised via the capital requirement framework. Compared to 8.1 above, the exact feature of capital requirement adjustment will determine whether it is building on a **green niche** approach (e.g. green supporting factor) or a more **system** shift (e.g. brown penalising factor). Similarly, it can rely on both a micro and macro approach.

Sub-action 8.3: EIOPA invited to provide an opinion on the impact of prudential rules for insurance companies on sustainable investments

This provision is similar to previous one, for the insurance industry.

Action 9: Strengthening sustainability disclosure and accounting rule-making

The provisions of this action are strongly relying on a market **pull** to guide capital towards sustainability, implicitly calling upon the efficient market hypothesis.

Sub-action 9.1: Revision of the guidelines on non-financial information

The Non-Financial Information (NFI) Directive allows companies to report sustainability in a flexible way. This revision is expected to give a clearer framework for disclosure, without *per se* providing a strict standard. The EC is thus relying quite strongly on **free market** forces, leaving market players without stringent rules. Being not restricted to certain types of activities, this provision covers a broad perimeter and as such has a capacity to encompass a **system**-wide variety of issues.

Sub-action 9.2: Proposal requiring asset managers and institutional investors to disclose how they consider sustainability factors in their investment decision making process [L]

This legislative proposal is a significant **regulatory** move, in that it asks more methodological transparency from investment firms — in relation to action 7 above. But while being compulsory, it is not prescriptive on how investors should disclose, nor on the types of sustainability integration methodologies that can be used, being therefore an indirect **pull to free markets** that leaves some space for interpretation in its application.

Sub-action 9.3: Promote innovation and development of best practices in corporate reporting, such as environmental accounting

The ambition of just “promoting” innovation and development of best practices is really a call for **free market** and **voluntarism**, and even **self-regulation**. However, despite being apparently beyond the scope of this action plan, “environmental accounting” mentioned as an example has a great potential to drive change through a new policy-led construction of the assessment of value. In other words, if the accounting framework would eventually include environmental accounting in such a way that sustainability at **system** level is really considered, it would have strong impact on the way companies and governments (if applied at macro scale) take decisions related to non-financial capital.¹⁸ But it should be noted that the policy as currently framed does not seem to have such an ambition.

Sub-action 9.4: Explore alternative accounting treatments to fair value measurement for long-term investment portfolios (in relation with IFRS)

Such an exploration can also have a very significant **system** impact, in covering all types of **micro**-scale valuation related to long time horizons in mainstream accounting frameworks. In acting directly

¹⁸ For a discussion on non-financial capital, cf. Rambaud (2019).

in the accounting standards and associated **compulsory** rules, it would constitute a significant **regulatory** move.

Action 10: Fostering sustainable corporate governance and attenuating short-termism in capital markets

The different items proposed in this last action are still quite vague at the moment and correspond rather to a diagnosis phase. All of them represent a quite strong **regulatory** approach to markets in that they seek to structure and adjust markets for the sake of long-termism (or at least less short-termism). As they address the issue of long term, they have a substantial capacity to address **system** changes rather than just green-niches, but it is quite unclear at the moment.

Sub-action 10.1: Assess the possible need to require corporate boards to develop and disclose a sustainability strategy and measurable targets

Focusing of companies, such a **compulsory** provision would represent quite a strong regulatory move; but the EC approach to such issues usually involves **voluntary** appreciation from companies to adjust to their will and capacity. It is difficult to distinguish at this stage whether this could translate a policy push for certain technologies or activities, as made possible with the mention of “measurable targets”.

Sub-action 10.2: Assess the possible need to clarify the rules according to which directors are expected to act in the company's long-term interest

Compared to previous item, this one sounds more enforcing (**regulatory**) in relation to long-term, but actually leaves more freedom as to how to define what is the company's interest, therefore certainly relying on usual market **pulling** forces such as market prices and risks.

Sub-action 10.3: Invite the ESAs to collect evidence of undue short-term pressure from capital markets on corporations and consider, if necessary, further steps

The most important keywords here are certainly for the ESAs to “consider [...] further steps” in case of proven short-termism from capital market to companies. If so, the **regulatory** approach would be strong, opening the door to **macro** rules to govern the financial system as a whole in its relationship with companies, therefore **pushing** for explicit long-term consideration.

4.4 Analysis of the Chinese Guidelines for Establishing the Green Financial System

Approved by the Chinese State Council on 31 August 2016, the *Guidelines for Establishing the Green Financial System* – the “Guidelines” (excerpt in Annex 2) - were released in parallel with the Chinese Presidency of the G20, which included for the first time the topic of “green finance” in the G20's agenda. The Guidelines were jointly produced by the People's Bank of China, the Ministry of Finance, the National Development and Reform Commission, the Ministry of Environmental Protection, the

China Banking Regulatory Commission, the China Securities Regulatory Commission and the China Insurance Regulatory Commission.

Similarly to the EU Action Plan on Sustainable Finance, the Guidelines brought as their main purpose the need to mobilise and incentivise investments in green industries. Unlike its European counterpart, however, the Chinese plans have gone beyond and also included as an equally relevant objective the necessity to effectively control investments in polluting projects, thus also considering the relevance to address “brown” and climate-misaligned investments (The People’s Bank of China *et al.*, 2016). The Guidelines have been split into 9 sections, containing a preambular one (Section 1), with the justifications, followed by 8 topical sections, with a total of 31 actions. Each part of the Guidelines possesses a different mix of theories, policies and governance approaches, indicating a country-specific tradition not only on the way of building the national financial system but also on the way of interacting with the international one.

Table 2 Chinese Guidelines for Establishing the Green Financial System

Chinese Guidelines for Establishing the Green Financial System	
Section 2. Vigorously Develop Green Lending	Section 6. Improve Environmental Rights Trading Market and Develop Related Financing Instruments
Section 3. Enhance the Role of the Securities Market in Supporting Green Investment	Section 7. Support Local Government Initiatives to Develop Green Finance
Section 4. Launch Green Development Funds and Mobilize Social Capital through Public and Private Partnerships (PPP)	Section 8. Promote International Cooperation in Green Finance
Section 5. Develop Green Insurance	Section 9. Prevent Financial Risks and Strengthen Implementation

Section 2. Vigorously Develop Green Lending

Section 2 of the Guidelines focuses on lending activities, which are normally performed by banks and financial institutions against the expectation of repayment with interest. These institutions do not participate in the businesses receiving the money, like shareholders often do, because they do not hold ownership of companies.

In this context, the seven actions proposed by this section indicate the need for some form of regulation, drawing a few limits to the market, but also indicate the formulation of practices to improve the very functioning of the free market. It’s important to stress that regulation can be often applied specifically to boost and guarantee the good functioning of free markets, which is the case of traditions such as the German ordoliberalism (Sally, 1996). That’s a clear case with the promotion of securitisation of green loans, in which regulation is used to level up and increase the overall capacity of the **free market** to grow and boost its own efficiency. However, the remaining actions under Part 2 tend to have a stronger departing point from **regulation** theory, approaching the market from a perspec-

tive of improved system for green credit statistics and monitoring and evaluation, but also indicating the inclusion of environmental liability and penalties for violating companies. In the section, we found that three actions have a very clear objective of growing a **green niche**, namely the policy framework to support green lending, the securitisation of green loans and the implementation of a credit management system that controls risks and cuts costs of green loans and boosts support for green enterprises. At the same time, the **systems'** approach can be verified in the planned creation of disincentives for loans to industries of high pollution, high energy intensity and high capacity, as well as the introduction of lenders' environmental legal liability, evaluation of financial institutions' risk exposures to loans and assets in areas of high environmental risks and the mechanisms for sharing enterprise environmental information to be used as a basis for loan and investments decision-making.

In terms of types, most of the actions under Section 2 can be considered as **push** policies, since they all seek to define clear limitations to the financial system. Exceptions to this are the policy framework for green lending and the promotion of securitisation loans, which try to reduce risks and improve pricing mechanisms by providing a **pull** to a few selected green instruments. In terms of the consideration of environmental risks, there is a certain balance between individual and systemic. The promotion of a self-regulatory organisation in the banking industry for establishing a green banking evaluation mechanism, the securitisation of green loans and the credit management system for boosting green enterprises are clearly **micro**-based solutions, focusing on the individual risks, while the introduction of an environmental legal liability and the environmental information inclusion to a financial credit database constitute clear **macro**-focused strategies, allowing for the management of systemic risks. The support to green lending contains a bit of both, looking into the improvement of individual risks of green companies, but also indicating the use of the central bank for re-lending operations and the inclusion of such green credit information into macro-prudential assessments. The same happens with the inclusion of environmental and social risks into stress tests for credit risks, which should lead to the quantification of both credit and market risks to financial institutions, improving **micro** perspectives more strongly, but also with an element of **macro**.

On the governance front, the Chinese model mostly opts for **compulsory** modes, sometimes coupled with wording that indicates some level of **voluntarism**, such as in the case of green securitisation, and **self-regulation** with the green evaluation system.

Section 3. Enhance the role of the securities market in supporting green investment

The increased support to green investments has a dual nature, with most activities carrying both an element of regulation theory but also an underlying focus on free-market. Improved standards for third party verification, support to qualified green enterprises to obtain financing via initial public offerings (IPOs), support in the development of green bond and green equity indices and guidance to institutional investors to invest in green products strongly rate as **free market** focused types of regulations. Inversely, actions such as the improvement of rules and regulations for green bonds,

measures to reduce the cost of green bonds and the gradual implementation of mandatory environmental information disclosure rank more strongly as a **regulation** theory, even when bringing an additional benefit for the free market. In terms of the focus, the big majority of actions under Section 3 are particularly interested in growing a **green niche**, with the single exception of the mandatory environmental information disclosure system, which is planned for all listed enterprises and bond issuers, hence nudging towards a more **system's** change in the market.

As the types of implemented policies, the support to green investments is ranked as mostly as strong **pull** initiatives, since they try to address the risk and fix prices of specific instruments. The single exceptions that rank more strongly as **push** policies, even though containing a weaker element of pull ones, are the active support to green IPOs and the mandatory disclosure, since building on a black list of major emitters and planning penalties for wrongdoing by enterprises and bonds issuers, effectively forcing their shift towards more transparent disclosing practices. In relation to risk, all actions under the section were deemed as mostly focusing on the **micro**, since not particularly interested in systemic risks. However, even if still mostly targeting the micro, mandatory disclosure and guidance of institutional investors to invest in green assets can be also considered to spurr some lower levels of **macro**, because disclosure requirements, responsibility reports, penalties and stress tests might also include components to measure and avert the propagation of systemic risks.

On the governance, most initiatives point to a **compulsory** nature, with exception of the promotion of green instruments and incentives to invest in green assets, mixed with textual formulas that indicate some level of **voluntarism**, with exception of information disclosure, and even some room for **self-regulation** as the rules and regulations for green bonds, standards for third party verification and green credit rating, and guidance to incentivise investment in green assets. On the governance level, the Guideline brings for the first time an express participation by **sub-national** actors, indicating the possibility of local governments to support green bond issuance through specialised guarantees and credit enhancement mechanisms.

Section 4. Launch Green Development Funds and Mobilise Social Capital Through Public Private Partnerships (PPP)

All three initiatives rank strongly as **regulation** theory. However, the support of green fund development, support to investment in green industries as a policy signal and the support to PPPs also produce some **free market** benefits. The three initiatives are geared towards growing the **green niche**, without setting economy-wide shifts.

While all three initiatives possess a **push** characteristic, since defining the means to boost the green sector from its strategic understanding, support for the establishment of green development funds and their market-based operations and the support to green PPP can be equally considered as **pull** types of policies. The actions focus on reducing individual risks, deeming all of them **micro**, with a bit of **macro** consideration.

Governance-wise, all three types are developed by the government while remaining a **voluntary** characteristic, with the possibility of green funds to take the shape of **compulsory** regulations of **self-regulation**, depending on how the guidelines are advanced. In terms of levels, there is a strong focus on **local** governments for the use of green funds, including by indicating policies alternatives for their implementation, along with considerations about their national and international aspects.

Section 5. Develop green insurance

The Guidelines indicate the intention to create of a nation-wide and compulsory insurance scheme for environmental risks, which should work to improve the assessment, prevent and inform environmental protection departments in the government about such environmental risks. The initiatives are heavily **regulatory**, with some smaller benefits to **free markets** deriving from incentives for the insurance sector to innovate in terms of environmental protection. All three are entirely focused on the **systems**, since such compulsory and voluntary approaches should be applied to the entire market.

They also carry a strong characteristic of a **pull** policy, with incentives and support to insurance to participate in the development of the environmental risk control system indicating some type of **push** mechanism, since establishing the basis for a command-and-control type of regulation later on. The three types of initiatives present at least one aspect of **micro** measures, since focusing on the viability of the firm. However, by encouraging and supporting the development of an environmental risk control that is applicable to the whole economy, the initiative provides the possibility of **macro** oversight. Also, innovation in green insurance could be considered a weaker element of macro since bringing together several areas under the same coordination.

Relating to governance modes, all three insurance initiatives might be considered as **compulsory**, with the possibility of having **voluntary** elements, according to the implementation to be defined by the government.

Section 6. Improve Environmental Rights Trading Market and Develop Related Financing Instruments

The Chinese Guidelines seek to integrate its financial system into carbon markets, intending to create instruments such as carbon swaps, carbon options, carbon leases, carbon bonds, carbon backed securities, carbon funds, carbon futures, among others. This trading structure should extend to other types of pollution rights, all of them rank strongly as **free market** focused interventions. However, the trading of pollution rights for carbon, water and energy use can be manipulated to effectively regulate the economic activity via procedural rules and control of available emission rights, also corresponding to a level of **regulation** approach. Regarding focus, the creation of financial carbon instruments focuses on the strengthening of green evaluation, benefitting and boosting a green niche. Meanwhile, all the initiatives aim at reforming the structures in order to obtain strategic, economy-wide and **system's** change.

Characterised by a efforts to correct the market failure represented by different types of pollution, thus reforming and improving the price system, the policies can be considered as **pull** ones. The specific case of carbon emission rights' trade also hold a strong element of **push** policies, since imposing a clear limitation to the possible action of market participants. In terms of risks, we have that all initiatives can have important effects both in terms of reducing and improving management of individual and systemic risks. The earlier can be verified in the incorporation of pollution prices into polluting companies' activities, exteriorising and assigning a price to those risks. Macro-prudentialism also becomes strengthened because of the possibility of government oversight and control through release and retake of emission rights, which can be made useful to reduce systemic risks.

The modes of implementation are a mix between **compulsory** enforcement in the case of trading of emission rights and carbon-based financing instruments as means to boost financing for green companies, and **voluntary** approaches, with the development of carbon finance products, which may or may not be bought in by financial actors. All policies are explicitly designed for the **national** level.

Section 7. Support Local Government Initiatives to Develop Green Finance

Section 7 contains a single action, which follows a regulation approach, geared mostly to the development of a **green niche**, with establishment of green guarantees, green development funds, green bonds and means to attract international investment to green sectors.

The strategy mostly follows a **push** characteristic, with central government sending a clear instruction to sub-nationals, coupled with the untangling of means for direct financing to green projects. It also carries a weaker element of **pull** policy when it tries to add new instruments to correct for risk and price failures, such as the provision of guarantees. It ranks strongly as both **micro**, since targeting the risks of individual companies and projects, but also **macro**, since textually and expressly indicating the need of both central banking re-lending and action upon macro-prudential assessments.

Policies are expected to be **compulsory** and are clearly and distinctively geared at the **sub-national** level.

Section 8. Promote International Cooperation in Green Finance

While Section 7 focuses on the sub-national action, Section 8 focuses on the Chinese action **internationally**. This action covers cooperation for green finance, opening of Chinese green securities market and "greenness" of Chinese outward investment. When talking about international *consensus*, the use of international bodies to directly leverage and invest in green, and rules to improve the green credentials of Chinese outwards investment, we understand that the Guidelines bring an element of **regulation**, by seeking to strengthen rules, Chinese regulatory approaches and values elsewhere in the globe. Inversely, the opening of securities' markets on its own can be mostly considered as a **free market** initiative. Theoretically, all three initiatives possess some interest in strengthening the **green niche**, particularly the opening of green securities market that ranks more strongly in this

criterion. The expanded cooperation in green finance has a weak degree of system's approach, since capacity building and international networks for green finance can directly influence and strengthen awareness about Chinese approaches towards pollution liability and brown risks and investments. The greening of Chinese outward investment ranks however as a strong **system's** type of action, since it approaches all investments in terms of reducing pollution with greenhouse gases and other stresses to the environment.

The three international activities hold a **pull** characteristic, since aimed at influencing markets by providing. The greening of Chinese outward investments brings a strong **push** element as well, by linking with the need of liability insurances and pointing to a more coercive path for the shift. In terms of risks, both the international cooperation and the greening of outward investments offer the potential for including **macro** considerations, particularly if reflecting the remaining of the Chinese strategy. The opening of green securities market represents a more **micro** type of policy, since such securities tend to influence and take into account individual risks alone, without any explicit mention to systemic risks.

All the three activities possess both **compulsory** and **voluntary** potentials, as well as **national** configurations aimed at connecting – and improving the green credentials of the connection of - China with the rest of the **international** system.

Section 9. Prevent Financial Risks and Strengthen Implementation

The last section of the Guidelines focus on strengthening the institutional capacity and indicating a few minimum tasks to be performed by the administration. The improvement of the supervision mechanism to prevent risks related to green finance, together with the promotion of green finance by national agencies and local governments assume a clear characteristic of **regulation**, with some lower effect on free markets by the last two – national and local action. Public communications on green bonds, since not defining any specific law while at the same time targeting improved information and awareness, seeks to create a political support for the sector and helps to adjust prices to such information, thus improving the **free functioning of markets**. All plans are mostly focused on improving the **green niche**, however all of them promote some weaker co-benefits to the entire **system**.

The four actions indicate a strong characteristic of **pull** policies, since setting the necessary institutional structures to allow for a better functioning, at the same time of sending clear signals to influence the market. We've rated the supervision mechanism to prevent risks from green finance as an equally relevant **push** characteristic, as it points out to certain strict and more command-and-control types of activities such as the supervision of standards, control of default risks, develop equity finance with a view to preventing excessive leverage by green projects, avoid unhealthy arbitrage etc. It's also the authors' view that all actions are based on a strong **macro** approach, creating institutional forms to address, avert and manage systemic risks, while at the same time producing weaker but

relevant **micro** benefits for individual risks. The micro component is particularly relevant in the case of the supervision mechanism, where micro and macro-prudentialism are both mentioned explicitly as specific goals.

The whole section possesses a tendency towards **compulsory** regulations, focusing mostly on the **national** level, but also with some references to **sub-national** engagement and action in the cases of government agencies' coordination and the nudge to regional and local governments towards the promotion of green finance plans.

4.5 Comparison between the key policy strategies for EU and China

We can compare our EU and China analyses for the 8 different characteristics we introduced (cf. the 4 dichotomies explained in section 0): Free market vs Regulation, Green niche vs System, Pull vs Push, Micro vs Macro, in order to identify which features dominate. Below we provide a brief explanation of the overall plans of EU and China and follow with a comparison between the two. The Figure 6 below visualises the result of the ranking exercise carried out to build the framework, with corresponding tables available in Annex 3.

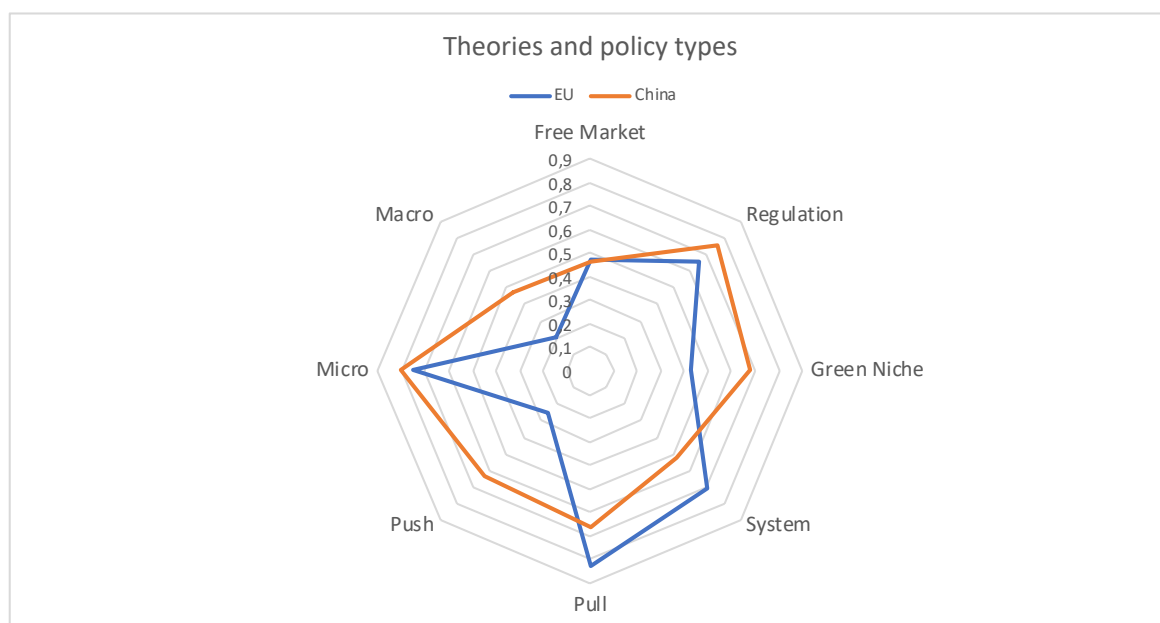


Figure 13 Comparison of EU and China's key policy strategies in our theoretical and governance framework

This graph represents the shares of the entire sustainable finance policy portfolio of the EU and China in each of the categories as analysed in sections 4.3 and 4.4. Each provision of the "EU Sustainable Finance Action Plan" and the "Chinese Guidelines for Establishing the Green Financial System" was assessed with means to defining how each action of the strategies rank in the chosen categories. One table for each official document was created, with values given as 1, 0.5 or 0 respectively to fitting the category, partially fitting and not fitting it at all. Then the aggregation was compared to the entire policy portfolio to assign percentages in each of the category analysed, resulting in the graph above, which answers the question "how much of the actions within the EU/China strategy rank as

free market/green niche/pull/push/etc?”. The comparative aspect allows us to see which approaches were focused or avoided by the European and the Chinese strategies. A similar exercise can be done with new theories, types of policies and governance approaches, and to be expanded to other countries, enabling a wider comparison and potential grouping to illustrate global, regional, national and local interactions with finance to fight climate change.

4.5.1 Overview of results for the EU

In average for the EU sustainable finance action plan (EUSFAP), we do not see a strong difference between the occurrence of **free markets versus regulation** characteristics, despite regulation being slightly higher than free market. It seems to mean that both theories, while quite opposite, have a similar type of influence on the EUSFAP framework. Indeed, there is in the EC Communication text (EC, 2018) a strong appeal to regulation in order to drastically mobilise the financial system for climate, which equals to admit that markets are not currently structured to do the job. At the time of writing, the EU action plan is still not completely defined nor implemented, therefore our current interpretation should be taken cautiously, but we can distinguish regulatory provisions that seem already quite mature, for which the Technical Expert Group (TEG) has released documents and technical guidance, from those relying on European Supervisory Authorities (ESAs) or other EU administration bodies for which the important features are still not available. The former are mainly framed on helping markets functioning better (or ‘fixing the markets’) while the latter are more about structuring them in an alternative way so that they work better (‘shaping the markets’). But it is interesting to note that most of the advanced and publicly discussed provisions (taxonomy, green bond standards, ecolabel, benchmarks, disclosure) are those based on activating free markets mechanisms. This can probably explain why an overall impression that free-market ideology dominates (Aglietta and Espagne, 2016; Christophers, 2017), as the more ‘regulation theory’ ones have been less discussed (with the notable exception of prudential capital requirements adjustment (e.g. Dafermos, Nikolaidi and Galanis, 2018; Thomä and Hilke, 2018)) and not been released yet. It will be interesting to analyse at a later stage of the policy process with the concrete provision details if the domination of regulation over free-markets is still there.

Along the way of the previous, the distinction that can be seen in the **pull vs push** category is very interesting. Indeed here, the EUSFAP actions rely much more on pull rather than on push mechanisms. It means that those provisions expect to attract market players towards green and sustainable activities, rather than directly constrain them in a certain direction or explicitly ask financial institutions to finance/invest in specific sectors while avoiding others. This signal is quite strong, and the difference with the previous one (free market vs regulation) can be explained in that the EUSFAP regulation framework is not seen by the regulator as a hard constraint put on financial markets but rather a means to help them function better. That can also help to interpret the voluntarism from private financial institutions to broadly support such regulatory move, in that it does not constitute a

profound comeback to regulated markets (cf. section 3.3) but rather a smooth regulation pathway to facilitate business without adding too many hard constraints.

Next, there are overall more actions considered as having a **system** approach rather than a **green niche** approach. This can sound counter intuitive as the Action Plan is strongly relying on the taxonomy, which itself is a green niche concept. But actually the taxonomy, while focusing as of today on climate mitigation compatible activities (i.e. green), is supposed to be developed at next stages for broader perimeters related to overall sustainability, and many of the provisions that we analysed do explicitly refer to sustainable factors, which *per se* can be more related to system change rather than ‘growing the green niche’ narrative. Moreover, the current debate is whether such taxonomy approaches should explicitly cover brown activities (i.e. those to be avoided, and as such blacklists). This does not appear to be the most favourite EC option at the moment but cannot be excluded on the basis of the wording of the current texts.

Finally, most of those actions are primarily of the **micro** type (macro being the least recurring element of all), focusing on the individual transactions or institutions, without having a perspective on the whole system dynamics and interactions. This very point can also be seen inside the specific discussion of prudential rules: regulators tend to focus on microprudential actions rather than macroprudential ones, whereas climate change is clearly as macro issue.

4.5.2 Overview of results for China

China’s “Guidelines for Establishing the Green Financial System” (hereafter Chinese framework) appears to be more influenced by **regulation theory** than by **free market theory**, which sounds consistent with the centralized functioning of the Chinese system where private companies and markets are much more strictly regulated than in Western standards. Nevertheless, the planification feature of the Chinese economy is much less present than a couple of decades ago, which explains why the free market characterisation is though quite important.

The different provisions of the Chinese framework show more **green niche** characteristics than **system** ones, corresponding to the importance of the promotion of renewables in the national agenda. But while undoubtedly lower, characteristics of a system change objective is quite high too.

There is no significant difference between **push and pull** mechanisms. This means that China relies as much on one logic as on the other. We see this result as a good illustration of the dual approach followed by China when it comes to use market on purpose, an economic system often described as state capitalism (Bremmer, 2010).

The overall provisions very clearly exhibit a **micro** feature, in that almost all do have a focus at firm (whether financial or non-financial) level. But this does not mean that the Chinese framework is exempt of macro considerations, as a significant number of guidelines indeed consider the broader system, including via the role of the central state and local governments, but also with specific tools

such as dedicated markets for pollutant emission rights that aim to control and oversee environmental issues at large level (national and even international).

4.5.3 Comparison between the EU and China

Altogether, the main difference between the EU and Chinese frameworks (cf. Fig. 6) is that China displays much more homogeneity among the different characteristics compared to the EU. Indeed, being quite low on both macro, push and green niche items, the EU appears more polarized. A first interpretation of this would be that China uses a more diverse set of policies, but it would also mean that those policies rely on a quite heterogeneous theoretical framework. As those theories may appear inconsistent with each other, it may illustrate either an explicit will to mix the best of each approach, or oppositely a kind of contradiction among the entire policy choices that may hinder the overall impact and efficiency of the framework. But as mentioned above, this certainly provides a good illustration of the mixed policy approach of China, conceptualised in the state capitalism idea.

Nota bene: the number of items analysed is not the same for China and the EU, nor the cut between provisions is rigorous enough for individual provisions to be considered as independent. Consequently, the quantitative approach we use here is clearly limited. That is why we do not go very deep in the interpretation of the numbers but rather try to understand the meaning of the main trends displayed by our results.

If we go more in the details, we see the following main features:

- Regulation appears stronger for China than for the EU. It may reflect the centralisation of the decision-making process and the power of regulation, which are both very strong in China in general, not in particular for sustainable finance policies. Still, China and the EU display the same level of free-market influence. This certainly reflects a deeply rooted approach of the EU on the one hand, and the more recent turn towards markets decided by the Chinese authorities.
- Green niche appears stronger for China than for the EU, while displays the opposite characteristic for system. Unlike for Europe, the Chinese decision system could have intuitively led to a broader system thinking, but here it is clear that the promotion of renewables is quite high in the agenda. Also, for Europe, the goal of the EUSFAP is supposed to be to treat the overall sustainability challenge, which is translated in the wording it uses.
- The Chinese framework is much more balanced between pull and push than the EU one. Despite what stated above, we can see here the underlying power and primary logic called upon. Europe is still very liberal while China is administrated centrally.
- There is no big difference between Chinese and EU frameworks for the micro/macro feature. In both cases micro clearly dominates. Macro is quite high too for China, but much lower for the EU, where the recent effort of the EC to bring this climate and finance conversation to regulators and supervisors is still not at the same level than what occurs in China where the

central government has much more control over the whole national financial system, hence some oversight on what it delivers globally. It is worth noting that beyond sustainable finance, which is quite a new topic for the EU, a significant ‘macro’ effort of the EU on climate takes place at genuine climate policy level.

5 Recommendations

5.1 Policy

We saw that a variety of theories and governance paradigms can be called upon for designing climate-related financial policies. This wide set of approaches can derive from various country financial traditions, different development stages, specific long-term strategies or even operator-level divergences about the theoretical underpinnings of finance. Such policies can often become inconsistent with each other on the national level, or represent an international promotion of certain values and specific financial traditions behind a façade of climate change. Because the field is new, being far too early to judge those policies in terms of results, it is difficult to distinguish whether such versatility — polycentricity — is indeed positive. They might show a will from policy-makers to diversify their policy toolbox and open their mind to new approaches, or illustrate a lack of consistency and rigor in mobilising the right tools. Internationally, they could represent a move away from one-size-fits-all approaches and towards more tailored solutions to different countries’ realities, or reflect conflicting and counterproductive trends as the result from the lack of global coordination and steering of finance away from carbon intensity.

As demonstrated along the paper, the component of ‘time’ is missing when approaching finance’s essential role in averting climate change. The real issue at stake is to ensure that finance can indisputably take its role and assume its responsibility in the fight against climate change. Moreover, the paper insisted on the fact that (a) the financial system as it works today has not been created to solve climate change, and (b) the financial system as it works today appears not to be able to solve climate change. Therefore, our policy recommendations focus on a few overarching principles to address those two points, with the primary objective to give finance most chances to deliver relative to PA Art. 2.1.c, rather than merely optimising what finance can do at the margins without changing its core structure and operations to the goal of full decarbonisation of national, regional and global economies. These policies are:

- Accounting for ‘time’ is essential and climate-focused financial policies must be essentially thought in the long-term. That includes planning ahead and making transparent how *ad hoc*, short-term and/or phased initiatives will feed into long-term climate strategies and ultimately work to achieve our agreed climate goals, such as zero net emissions before and around 2050. In light of the climate emergency, there is no more space for *wishful thinking* and *hoping*. Climate-aware financial policies must be pragmatic and transparent in terms of emissions reductions.

- From the market operations' perspective, policies must tackle short-termism, ensuring that time horizons are extended as much as possible to avoid biases and counter-productive effects. By avoiding short-termism, finance can also overcome the hurdles involved in infrastructure financing, necessary for the achievement of medium to long-term climate strategies and forming the basis for implementation of a variety of other Sustainable Development Goals (SDGs).
- If *all* finance flows must become aligned with a low-carbon pathway and climate-resilient development, then climate considerations can no longer be considered only as part of climate policy. While in the past researchers defended that climate change had to be mainstreamed, we can say that in terms of science and economic theory this has already started to happen – at a very fast pace. Now economic policy must follow suit. Sub-national, national and international governance can no longer continue to replicate traditional economic assumptions, theories and narratives that fail to account for the urgency and essentiality of climate change. No economic policy or financial strategy can be deemed fact-based if it will ultimately fail to keep our globe below a 1.5°C warming threshold.
- Governments must take a step back and account for how their financial policies sum up in face of climate goals. This oversight involves the consideration whether financial policies on different levels and through various modes might conflict or slow down other climate efforts.
- Governments must produce and bound financial actors to provide comparable data not only on flows, but also on risks, portfolio carbon-intensity and decarbonisation strategies that can be translated into a comprehensive systemic perspective. This includes questioning and finding ways to improve irrelevant and non-comparable data from self-reporting, as well as inquiring to which degree corporate secrecy can be argued to justify insufficient and incomplete information.
- Policies must be pursued to build civil service and market participants' capacity for facing the climate challenge. This should involve the creation of participative networks with the climate science community, looking for ways to foster climate-focused interdisciplinarity within the financial system.
- Governments must also ensure that financial regulators and central banks are expressly tasked to deliver through the financial system the maximum they theoretically can against climate change. It is key that that their respective mandates are adjusted to allow them to do so.
- Developed and developing countries alike must discuss and account for striking problems such as ongoing public and private flows to carbon-intensive assets, as well as start to draft retirement strategies for already deployed stocks that will continue to pollute and quickly eat up our collective carbon budget over time. If emissions must go down to net zero before and around 2050, then the carbon intensity of new investments must decline much earlier, in particular for building long-lived infrastructure.

- Sub-national, national and international actors must strive to cooperate, co-build and share knowledge for the steering of the financial system towards full decarbonisation and appropriate measures for climate resilience. The lack of a strong financial governance on the international level should not hinder climate action's effectiveness, but rather be used as a source for innovative and country-based tailored approaches that fit various economic traditions, as long as maintaining a clear and effective delivery of the necessary targets in terms of mitigation and adaptation. In this sense, international climate-focused financial governance cannot allow itself to become the bearer of specific economic traditions under the flag of climate change, risking to weaken the underlying climate objective.

5.2 Research

The report has demonstrated a significant number of research gaps, that ongoing and future academic research should address for the sake of a better contribution of scholar work to the overwhelmingly important issue of climate change related to the financial sector.

We articulate the different research needs based on a recent article by Linnenlueck et al. (Linnenluecke, Smith and McKnight, 2016), entitled *“Environmental finance: A research agenda for interdisciplinary finance research”*, which proposes a summary view of what “environmental finance” is, and what academic research can undertake to help the academic field to grow, and from it to contribute to a positive societal outcome via concrete impacts beyond just theoretical inputs.

We deepen the analysis of Linnenlueck et al. on the basis of our findings, and focus more explicitly on the climate change issue — which actually accounts for most of the “environmental finance” challenge highlighted by that paper —, starting from the market failure assertion (Thomä and Chenet, 2017) as the core element when it takes to discuss the finance sector role in the fight against climate change (cf. sections **Fehler! Verweisquelle konnte nicht gefunden werden., Fehler! Verweisquelle konnte nicht gefunden werden., 3.4 and Fehler! Verweisquelle konnte nicht gefunden werden.**), and more explicitly the question of alignment of financial flows with the Paris Agreement target, specified under its Article 2.1(c) (cf. section **Fehler! Verweisquelle konnte nicht gefunden werden.**). The major research items we propose to consider in such a research agenda are grouped under 5 key topics, following the 5-fold structure proposed by the authors we are building on. The relevance of this categorisation is quickly discussed in the following, but we do not fundamentally challenge it at this stage, noting for future work that it may be necessary to broaden, regroup and these categories:

1. Regulation
2. Asset impairment (should be broadened to cover climate-related financial risks in general)
3. Adaptation (should be taken in the double sense of the necessity of climate change adaptation finance and the reciprocal imperative adaptation of the financial system to the climate change emergency and new economic conditions that the financial system will face)
4. Managing increased volatility (can be seen as sitting in both categories 2 and 3 above)

5. Valuing opportunities (can be seen as the reciprocal side of risk above, and attached to the general green growth narrative)

(1) “Regulation”

Until recently, carbon pricing has been considered as one of the main economic tools to approach climate change from a finance perspective. And as such, most finance-related academic work has focused on carbon pricing. We think it is indispensable to go far beyond carbon pricing as the sole regulatory tool to be activated, when financial regulation is today at the heart of the discussion of mobilizing finance for climate. A comprehensive catalogue of financial regulatory tools shall be built based on the finance literature (e.g. prudential rules, tax incentives, financial reporting, collateralisation, quantitative easing, accounting), completed by the respective theoretical and practical challenges they face. The emerging research field on prudential regulation relative to climate change is particularly inspiring in this respect (e.g. Campiglio *et al.*, 2018; Dafermos and Nikolaidi, 2018; D’Orazio and Popoyan, 2019), and very well articulated with the ongoing questions open by regulators and supervisors (e.g. Batten, Sowerbutts and Tanaka, 2016; ACPR, 2019; NGFS, 2019b).

More specifically, we saw that the theoretical underpinnings of the policy decision in terms of financial regulation are not very clear nor readable. We therefore encourage more theoretical research at the intersect of the fields of political economy, financial economy and financial regulation, to really take into consideration both the economic challenge and societal threat at stake, in the face of the radical uncertainty that seem to impede policy decision (e.g. Aglietta and Espagne, 2016; Christophers, 2017; Ryan-Collins, 2019).

On less theoretical grounds, we saw from section 2 that a lot of expectations for the operationalisation of PA Art.2.1.c are relying on data and scenarios. In this respect, it appears indispensable that much more academic efforts are employed on developing methodologies for tracking the consistency of the different types of public and private finance and investment flows with the PA, with specific attention devoted to long time horizons and uncertainty, sector coverage. Consequently, academic research should also pay more attention to the question of data and disclosure, in the wake of the recent policy wave introducing climate disclosure in companies’ and financial institutions’ reporting. The specific question of how to identify and gather ownership, in order to facilitate the identification of who are the underlying funders and owners of economic activities at financial system scale, would be of great use for all the work related to responsibility of financing green vs brown, identification of key decision makers for triggering change, and all the new questions that currently arise in the legal field in relation to the massive litigations coming to court.

Similarly, it is very much needed to get a detailed understanding of the interaction between the different policy frameworks, at local and international scales, which can constitute strong dis/incentives without always being controlled by policy-makers (e.g. inconsistency between the fiscal support to fossil fuels and the objective to shift financial markets towards renewable energies).

In relation with regulation, research on the questions of fundamental/financial value and accounting related to climate change could be very useful, when it comes to the integration of climate change in the financial decision.

Lastly, and quite broader than pure regulation perspective, the understanding of the financial system's role in the economy, and the related challenge in integrating finance in all its importance and complexity into macroeconomic / climate models, is key for the definition of upcoming financial regulatory measures, and therefore this topic needs to be addressed earnestly in order to tackle the current drawbacks of many macro modelling approaches.

(2) "Asset impairment"

The question of asset impairment risk (asset stranding) in the face of the energy transition has been a key feature of the recent rise of the finance sector and climate change discussion (e.g. The Guardian, 2014; Carbon Tracker, 2018), and it has somehow monopolised the academic research attention until recently (e.g. Griffin *et al.*, 2015; McGlade and Ekins, 2015; Caldecott, 2018; Pfeiffer *et al.*, 2018). Nevertheless, multiple other issues linked to financial valuation of assets need to be addressed, particularly when it comes to the question of time horizon in traditional financial analysis. This opens the way to further climate-related risk analysis coming either from the physical effects of climate change or from the transition put in place to mitigate it (e.g. TCFD, 2017). This is all the sense of the workstreams launched by the NGFS (NGFS, 2018) and the ongoing research projects accompanying them. Specifically, the NGFS and related bodies call for intense research to be conducted on climate-related scenarios and their applicability in the form of stress-tests, which appear to be the main operable tool so far in the hands of prudential regulators. But stress-tests currently suffer from many methodological questions, related to e.g. the diversity of assets, the multiplicity of possible scenarios, the high inter-linkage of the economy and financial system, the unprecedented features and possible events to take into account, or the radical uncertainty attached to most of the processes at stake.

Beyond the sole question of exposition to climate risk parameters, specific questions of particular importance relate to the topic of asset valuation, methodologies for credit and sovereign ratings, network propagation and cascade effects.

Moreover, the topic of stranded assets should be addressed with a broader perspective and not be limited to fossil fuel production assets. For instance, infrastructures and all long-lived assets in general (e.g. airports, highways, pipelines, extended cities) are potentially exposed to stranding in abrupt transitions. Such approach would help stress-testing and other related approaches to be more reliable on a systemic way.

(3) "Adaptation"

The adaptation field highlighted in the reference paper should not be limited to the question of adaptation finance (costs, benefits, financing schemes and governance) but also include the broader

question of how to adapt to a new global economic environment where economic growth is no longer necessarily a default regime (because of, or contingently to climate change, but also in relation with other main sustainability issues such as biodiversity loss or water and natural resource depletion), but is fundamentally questioned. This, either because such capital regimes are incompatible (not desirable) with the ecological constraints accepted and desired elsewhere, or because even if it is a consensual objective, growth as we know it may not come back (exhaustion of the growth pump).

More specifically to adaptation finance, which is still left behind compared to mitigation finance but reminded in the Paris Agreement as a key issue, some new research should be undertaken to identify new approaches to mobilise private capital to finance adaptation at a large scale, which suffers from a lack of reproducibility (conceptually, financing adaptation is not as 'simple' and global scale as e.g. financing a new energy system; indeed adaptation is very local and scenario dependent, and additionally is usually seen as a burden-only in the short term).

(4) “Managing increased volatility”

Linnenlueck et al. (2016) emphasise the volatility challenge, as a question of insurance risk and stock market hedging. While being important, it is necessary to link this question with the broader transition risk issue and the fact that with or without climate change the future of economic fundamentals is probably not steady state. Moreover, the issue of the financial system alignment with the goals of the Paris Agreement should be considered as a priority objective, and as such should open new research on the role of financial markets and markets participants related to that objective. To what extent the usual principle underlying financial markets functioning (the quest for financial return) can still be the major driving force to orient capital against climate change and to what extent the financial system needs to be redesigned and reorganised for that purpose?

(5) “Valuing opportunities”

Based on the theoretical debate we discussed above (cf. section 3.4), it seems necessary to challenge the somehow blindly positive discourse on clean tech financial opportunities ('grow the green niche') to highlight the fact that the interaction between the supply and demand sides is not that simple, and more broadly question the green growth narrative in both its feasibility and acceptability. For example, it will be interesting to identify challenges such as the possible occurrence of green financial bubbles, and potential green/clean tech oversupply that would have other consequences on e.g. natural or mineral resources. In relation to the above on asset impairments, more research would be needed on the decommissioning of brown assets and the role of public governance in accompanying this change to avoid major losses and unacceptable levels of socialisation of costs.

In addition to the above, we propose below a list of research questions that we think should be addressed thoroughly by the research community, building as much as possible on transdisciplinarity.

Theoretical economics

- How do different economic theories can respond on their own to the urgency of climate change? Which of their underlying assumptions pose limitations to the need to decarbonise the economy? Does questioning these specific assumptions undermine the whole theory or is there room for adjustment with the maintenance of some level of theoretical coherence?
- If a tax on carbon is deemed as either unfeasible or insufficient for a low-carbon and resilient shift of the whole global economy, what other economic and non-economic solutions could be considered for a systemic change? What solutions could be sectoral based?
- What sectors/activities may be considered to produce co-benefits, what are neutral and what can be detrimental to climate mitigation?
- How to better build a capital formation theory that takes into consideration the climate challenge? Can capital carry an inherent carbon weight?
- How to integrate company-level climate information and financial decision-making?

Empirical economics

- What are the appropriate metrics for measuring portfolio carbon intensity and for building medium to long-term decarbonisation strategies? What specific data is necessary?
- What has been the effectiveness of different governance modes when applied to the financial system? What economic effects have these policies created in terms of verifiable indicators, beyond simple efficiency? What effects do we have with the inclusion of climate considerations?
- How can we model different systemic and sectoral decarbonisation choices outside of equilibrium, perfect market and rational behaviour assumptions?
- When should investments in carbon-intensive sectors/activities be entirely phased-out in order to remain in line with latest IPCC-based low-carbon pathways? (this should go way beyond coal)
- How to assess systemic risks? What data is necessary and what best methodologies can produce most credible results? How can macro-prudentialism boost a climate-focused transition?

Public policy

- What specific roles can sub-national and regional governance have in economic policy and the full shift of the financial system towards net zero carbon and appropriate climate resilience?
- How can climate governance work effectively in a context of financial deregulation?
- What policy innovations, market and non-market based, might help sector A, sector B and sector C to achieve full decarbonisation?
- What policy interventions – market and non-market based - have delivered the largest climate outcomes in terms of mitigation and adaptation?

- How to build a system of real-time climate information that does not conflict or undermine company and investor-level private information and hinder competitiveness?

IT/data

- What could be the ways to measure carbon intensity on the company level that go beyond estimation-based self-reporting?

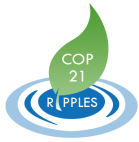
To conclude in a few words, there is a strong need for transdisciplinary approaches that have to transcend the usual limits between the academic fields of macroeconomic modelling, political economics, energy modelling, climate policy, climate modelling, financial regulation, financial mathematics and more. This needs to be undertaken in collaboration with practitioners in order for research to concretely help decision makers in a time of history when science is both needed and feared.

6 Conclusion

Climate-related financial policies are new, and quickly rising. As such, this statement can be seen on its own as positive and encouraging. Nevertheless, the extent and pace of the climate threat demonstrated by science must be forcefully highlighted again and again to challenge the current approach to policy-making, regardless of recent successes, to live up to the challenge.

In previous sections, we emphasised the fact that the current financial system is not aligned with the Paris Agreement nor — and this may be even more important — is it fit to deliver such alignment, despite one often considering that a simple operational shift or a fix might change the way it works for climate. We saw that after about a decade of slow progress, while an everyday stronger view on regulation emerges to both redefine some of the basic features of the financial system and restructure its organisation and governance, a parallel move relying on the self-regulation and market efficiency dogma is still high on the agenda. However, this reliance on free market is one of the core explanations for the failure of markets to solve the climate tragedy or even, to some authors, its main cause. Indeed, as postulated by mainstream conservative central bankers themselves, the genuine short termism of current financial markets makes them blind to climate change, and the reliance on usual toolboxes that do not fit the characteristic of climate change makes the threat negligible or a priori manageable without requiring upheavals.

We think that policies in general, and climate-related financial policies in particular, must go far beyond what is currently happening. The threat from climate change and the challenge to fully decarbonise our economy in only a few decades require the full power capacity of financial markets, and they need to be deeply governed, rather than smoothly guided, towards the goal. Indeed, the wrong incentives are still too much present to ensure that the financial system will deliver. Even if many rules and behavioural patterns changed since the 2007-08 crisis, the main ‘physical laws’ governing financial markets are still grossly the same and are predominantly incentivising short-term returns on



investments. A fast decarbonisation of the global economy and parallel adaptation of our societies cannot be a smooth process only driven by positive incentives; actually, relying on such mechanisms — as is currently happening — can indeed grow the green niche and bring some hope for a more climate-friendly economy in the long run, but the target of limiting global warming to 1.5°C requires a far higher level of efforts now and cannot rely only on win-win changes. As exemplified with the energy industry, not only is it essential to no longer build new coal-fired (and other) power plants, but beyond that, it is just as essential to decommission the ones that currently operate. Consequently, climate-related financial policies should not be only focusing on the positive/green side of the story but have a serious approach on the negative/brown part.

The recent apparent mobilisation of financial institutions for climate has essentially been initiated thanks to the risk narrative, highlighting the potential losses from an abrupt energy transition in the short term, and from catastrophic climate change in the long term. But educating and incentivising financial institutions and reforming the financial system to avoid risks is not the same as structuring the system so that it contributes to shape a better future. Thinking only about financial risk (at micro or even macro/stability scale) is not enough to guarantee good and timely financing and investing decisions against climate change. Indeed, a perfectly efficient market would have already integrated the knowledge and information we have about the level of threat from uncontrolled climate change. But as explained above, the very characteristics of climate change prevent the financial system to duly embed this information into relevant prices and risk signals. Therefore, it is time for policies to be proactive and mobilise the power of the financial system for the purpose of the climate emergency, and not just against what can be seen from here and now as a potential financial risk.

Based on the deep analysis of both the climate science prerequisite on the one hand and the functioning of the financial system on the other hand, we strongly believe that the disconnection between the two in terms of necessary changes is currently too large and must be fixed. Climate science cannot be changed. The financial system can, for the good of all.

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ANNEXES

ANNEX 1. The European Commission sustainable finance action plan.

Extract from the report *“Synthesis: Governance and instruments for integration of climate and sustainable development finance”*, EU H2020 ‘Green-Win’ 642018 RIA project (2018).
<https://green-win-cloud.org/index.php/s/2k5eg5pZktX9tF2#pdfviewer>

From an expert group recommendation to a European Commission action plan

The HLEG published its recommendations in January 2018, rapidly followed by the adoption by the Commission in March 2018 of an action plan on sustainable finance. Some of these actions have been further detailed in May 2018, as part of a package of first measures adopted by the EC.

The 10 actions are organized under three main objectives aiming to i) Reorient capital flows towards sustainable investment; ii) Mainstream sustainability into risk management and iii) Foster transparency and long-termism in financial and economic activity. The level of ambition of the action plan is high, partly explained by the proximity of the next elections, in a sort of last chance for a publicity stunt on the issues of finance and environment that were among the highlights of the current European mandate.

The following summarizes each of the actions (EC, 2018):

1. Establishing an EU classification system for sustainability activities

The taxonomy is the core piece of the Action Plan, planning to define what can be considered an “environmentally sustainable economic activity”. The taxonomy will be designed to serve as a backbone of several of the other actions, such as the creation of standards, labels, benchmarks and potential capital ratio changes (cf. Fig.A1). The taxonomy as such does not define what is “brown” and therefore does not help to identify what activities should not be invested in from a sustainability perspective.

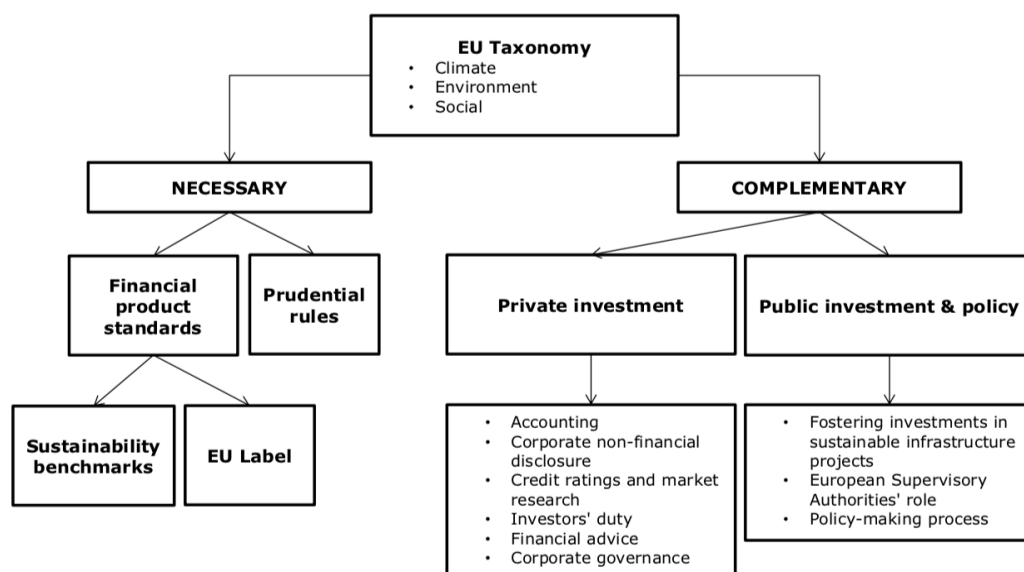


Figure A1 Central Role of the EU taxonomy in the Action Plan (EC 2018b)

2. Creating standards and labels for green financial products

Green standards and labels aim to help guide investors to the financial products they are looking for. But it does not directly cover the mainstream products market and only endeavours to grow the green market, which is so far still a niche.

3. Fostering investment in sustainable projects

The EC is planned to take “further measures” to improve the efficiency and impact of instruments aimed at sustainable investment in the EU, through both its direct investor role (e.g. European Fund for Strategic Investments) and its facilitator role, through technical and project development assistance.

4. Incorporating sustainability when providing investment advice

This action opens a potential large window of change, amending the Markets in Financial Instruments Directive (MiFID II) and Insurance Distribution Directive (IDD) delegated acts to ensure that sustainability preferences are taken into account in the suitability assessments undertaken by regulated entities. Hence, ESG preferences will be reflected in the advice investment firms and insurance distributors give to retail clients, and thus has the potential to unlock massive amounts of savings for the ecological transition, as many individual savers claim to be willing to invest “green”.¹⁹

5. Developing sustainability benchmarks

The EC intends to adjust the Benchmark Regulation, on the transparency of the methodologies and features of benchmarks and will create a new category of low-carbon and positive carbon impact

¹⁹ See chapters 3 and 4 of the HLEG report, which document these arguments thoroughly.

benchmarks. But this action falls short by not addressing mainstream indices, which largely dominate the market.

6. Better integrating sustainability in ratings and research

This action consists mainly in exploring the merits of amending the regulation in order to mandate credit rating agencies to explicitly integrate sustainability factors into their assessments, which could be a major change given their prominent role.

7. Clarifying institutional investors and asset managers' duties

This legislative proposal will aim to explicitly require institutional investors and asset managers to integrate sustainability considerations in the investment decision-making process, and to increase transparency towards end-investors. It notably intends to enlighten the possible “breaches of fiduciary duty” raised about fossil fuel divestment.

8. Incorporating sustainability in prudential requirements

With this action, the EC opens a controversial and core issue of how to mobilize central regulation for sustainability, by exploring the feasibility of including risks associated with climate and other environmental factors in institutions' risk management policies, and the potential calibration of capital requirements of banks. The aim would be to take into account such factors, when relevant, to safeguard the coherence and effectiveness of the prudential framework and financial stability (e.g. 2°ii, 2018). The Action Plan does not mention explicitly whether it favours a “green supporting factor” or/and a “brown penalizing factor”, which would operate in a symmetric way for activities that should not be invested in anymore. While a “brown penalizing factor” is mainly backed by environmental NGOs, its green counterpart has been publicly supported by some banks (e.g. FBF, 2018) and by Vice-President Dombrovskis himself (EC, 2017).

9. Strengthening sustainability disclosure and accounting rule-making

Related to action #7 and influenced by Article 173 and TCFD, this action opens a broad list of items that can affect usual disclosure and accounting rules across the investment chain. The EC will both revise the different guidelines on non-financial information and assess whether current regulations are fit for purpose.

10. Fostering sustainable corporate governance and attenuating short-termism in capital markets

This last action targets the core functioning of capital markets, with a special emphasis on the fundamental issue of time horizons in the investment chain, both from a processes and strategies perspective, and the issue of personal responsibility of directors. The European Supervisory Agencies (ESAs) and the European Securities and Markets Authority (ESMA) will be mobilised to collect information on undue short-termism, e.g. from portfolio turnover and equity holding periods by asset managers, or from remuneration schemes.

ANNEX 2. Chinese Guidelines for Establishing the Green Financial System

Chinese Guidelines for Establishing the Green Financial System		
Section 2. Vigorously Develop Green Lending	1	Establish a policy framework to support green lending. Further improve the green credit policy system. Improve the green credit statistics system and strengthen the monitoring and evaluation of the implementation of green loans. Support green credit by central bank re-lending operations, specialized guarantee mechanisms and other measures. Allow projects supported by green loans to apply for fiscal subsidies on interest payments. Explore ways to incorporate green credit into the central bank's macro-prudential assessment framework. Use key indicators of green credit performance and green banking evaluation results as important references to develop incentives for green finance business and disincentives for curbing loans to industries of high pollution, high energy intensity and overcapacity.
	2	Promote self-regulatory organizations in banking industry to gradually establish a green banking evaluation mechanism. Clarify the evaluation indicators, the organization process of evaluation work, and utilization of the evaluation results, and guide financial institutions to actively carry out green finance business and better manage environmental risks. Apply green banking evaluations to major banks first, and based on experiences gained, gradually expand the scope of evaluation to small- and medium-sized commercial banks.
	3	Promote securitization of green loans. Based on the experience from pilot programs of loan securitization, expand the range of participating financial institutions, standardize the selection process of underlying assets, explore efficient and low-cost approaches to collateral registration, improve the market liquidity of securitized assets, enhance information disclosure, with a view to promoting normalized development of green loan securitization.
	4	Explore ways to introduce lenders' environmental legal liability. Based on China's legal framework and domestic conditions as well as lessons from relevant international experiences, explore ways to clarify the due diligence requirements, conditions for immunities from legal prosecution, and environmental legal liabilities for lenders, and to propose relevant legislative suggestions.
	5	Support and guide banks and other financial institutions to establish a credit management system that conforms to the characteristics of green enterprises and projects. Optimize the credit approval process, boost support for green enterprises and projects while controlling risks, and resolutely cancel unreasonable charges to reduce the cost of green loans.
	6	Support banks and other financial institutions to treat environmental and social risks as important drivers in their stress tests for credit risks, and incorporate these test results into asset allocation and internal pricing. Encourage banks and other financial institutions to evaluate their risk exposures to loans and assets in areas of high environmental risks. Quantify the potential credit and market risks to financial institutions due to such exposure under different scenarios.
	7	Incorporate the enterprise environmental information including environmental violations into the financial credit information database. Establish a mechanism to share enterprise environmental information, which should provide a basis for loan and investment decisions of the financial institutions.



Section 3. Enhance the Role of the Securities Market in Supporting Green Investment	8	Improve the rules and regulations for green bonds and unify the green bond definitions. Research and improve the relevant regulations and self-discipline rules for issuance of green bonds. Clarify that funds raised by the issuance of green bonds must be fully (or mainly) used for green projects. Strengthen inter-departmental coordination and unify the definitions of green bonds. Clarify the requirements of information disclosure and other regulatory arrangements or green bond issuance. Support qualified institutions to issue green bonds and related products, and enhance the efficiency for approval or registration for green bond issuance.
	9	Take measures to reduce the financing cost of green bonds. Local governments can support green bond issuance through specialized guarantees and credit enhancement mechanisms. Study and formulate other measures to reduce the financing costs of green bonds.
	10	Explore ways to formulate standards for third party verification of green bonds and green credit rating. Standardize the quality requirements for third party verification of green bonds. Encourage institutional investors to make use of green verification reports in investment decision-making. Encourage rating agencies to evaluate, in their rating exercises, the green performance of the issuers, the “greenness” of the projects, as well as the impact of environmental costs on creditworthiness, and to disclose such information separately in credit rating reports.
	11	Actively support the qualified green enterprises to obtain financing via initial public offerings and secondary offerings. Actively assist qualified green enterprises in their efforts for IPOs, and help listed green enterprises to issue additional shares via secondary offerings according to legal procedures.
	12	Support the development of green bond indices, green equity indices and related products. Encourage financial institutions to develop green index based financial products, such as mutual fund products or private equity fund products, to meet the diverse needs of investors.
	13	Gradually establish and improve the mandatory environmental information disclosure system for listed enterprises and bond issuers. For listed companies that are on the black list of major polluters compiled by the Ministry of Environmental Protection, formulate and strictly implement the disclosure requirements for information on emission of major pollutants, construction and operation of environmental protection facilities, and major environmental incidents. Increase the penalties on listed enterprises and bond issuers that forge environmental information. Cultivate the ability of third party professional organizations to provide environmental information disclosure services for listed enterprises and bond issuers. Encourage third party professional organizations to participate in the collection, research and release of corporate environmental information and analytical reports.
	14	Guide institutional investors to invest in green assets. Encourage long-term funds such as pension funds and insurance funds to carry out green investment and encourage investors to release green investment responsibility reports. Enhance the analytical capacities of institutional investors on environmental risks and carbon intensity of their investments, and conduct stress tests of the impact of environmental and climate factors on institutional investors (especially insurance companies).
Section 4. Launch Green Development Funds and Mobilize Social Capital through	15	Support the establishment of all kinds of green development funds and their market-based operations. The central fiscal authorities will set up a national-level green development fund by integrating existing special funds, such as energy saving and environment protection funds, and invest in green industries to demonstrate the government’s strategic guidance and policy signals for green investment. Encourage local governments and social (private) capital to launch regional green development funds to support the development of local green industries. Encourage social (private) capital and foreign capital to set up all kinds of private green investment funds. Ensure that the investment and management of governmental green development funds are in accordance with the market approach, under the premise of executing national strategies and policies.



Public and Private Partnerships (PPP)	16	Local governments could support the projects invested by green development funds through measures such as relaxing market access restrictions, improving pricing of public services, granting franchises, implementing favorable fiscal and land policies, and improving benefit- and risk-sharing mechanisms.
	17	Support the introduction of the PPP model in the green industry, encourage the bundling of energy saving and emission reduction projects, environment protection projects and other green projects with related higher-return projects, and establish a green service charge mechanism for projects with a “public goods” nature. Improve relevant rules and regulations on green PPP projects, and encourage local governments to release operational rules based on experience of past PPP projects. Encourage all kinds of green development funds to support green PPP projects.
Section 5. Develop Green Insurance	18	Establish a compulsory environmental pollution liability insurance system in areas of high environmental risks. Formulate and revise relevant laws and regulations of compulsory environmental pollution liability insurance according to procedure. The environmental protection agency, in collaboration with the insurance regulatory agency, should publish implementation rules. Include enterprises under the coverage of compulsory environmental pollution liability insurance in areas in which there are higher environmental risks and concentrated environmental pollution incidents. Encourage insurance institutions to play an active role in prevention of environmental risks, to carry out “environmental examination” for enterprises, to inform the environmental protection departments of the environmental risks discovered, and to support environmental risk supervision. Improve the environmental damage evaluation procedure and technical standards, guide insurance companies to expedite damage assessment and settlement of claims, compensate pollution victims on a timely basis, and control damages to the environment.
	19	Encourage and support insurance institutions to innovate green insurance products and services. Establish and improve the catastrophe insurance system related to climate changes. Encourage insurance institutions to develop insurance products for environmental protection technologies and equipment, liability insurance for product quality and safety for low-carbon and environmental friendly products, liability insurance for vessel pollution damage, forest insurance and insurance for agriculture and husbandry disasters. Actively encourage insurance institutions to participate in the environmental pollution risk management of the breeding industry. Establish the coordination mechanism between agriculture insurance compensation and safe disposal of ill livestock.
	20	Encourage and support insurance institutions to participate in the development of the environmental risk control system. Encourage insurance institutions to perform the function of disaster prevention. Actively make use of Internet technologies and other advanced tools to establish monitoring and early warning mechanisms for applicants of pollution liability insurance policies. Conduct real-time risk monitoring and regular risk evaluation, alert hidden dangers in time, and efficiently process insurance claims. Encourage insurance institutions to make full use of their specialties on risk management, and provide education on environmental risk management to enterprises and the public.
Section 6. Improve Environmental Rights Trading Market and Develop Related Financing Instruments	21	Develop different kinds of carbon finance products. Promote the development of a unified national carbon trading market and carbon pricing center with global impact. Progressively develop carbon forwards, carbon swaps, carbon options, carbon leases, carbon bonds, carbon asset backed securities, carbon funds and other carbon finance products and derivatives. Explore and develop a trading system for carbon futures.
	22	Promote the establishment of markets for pollutant emission rights, energy use rights, water rights and other environmental rights. In key basins and key areas of air pollution, jointly promote inter-regional trading of pollutant emission rights and expand pilot projects on compensated use and trading of pollutant emission rights. Improve and innovate the systems for pollution emission rights trading. Establish and improve the certification process for pollutant emission rights and the market-based price formation system. Establish regional and national trading markets of pollutant emission rights.



		Establish and improve trading markets of energy use rights and water rights.
	23	Develop financing instruments based on carbon emission rights, pollutant emission rights, energy use rights, water rights and other environmental rights, with a view to expanding the green financing channels for enterprises. Based on the pilot experience of banks that provided financing with environmental rights as collaterals, develop methodologies for evaluating collateral values and their reference ranges. Improve the market-based pricing for environmental rights. Establish an efficient registration and disclosure system for collaterals. Explore methods for re-purchasing environmental rights and other approaches to the disposal of collaterals. Explore ways to include environmental rights and their future cash flows as qualified collaterals, and reduce compliance risk of transactions involving pledges by environmental rights as collaterals. Develop financial products such as repos, factoring, and custodian services for environmental rights.
Section 7. Support Local Government Initiatives to Develop Green Finance	24	Explore supportive measures, such as central bank re-lending, macro- prudential assessment, and capital market instruments to promote green finance at the local level. Encourage and support local governments to crowd-in social (private) capital to invest in green industries, by measures such as setting up specialized green guarantee programs and establishing green development funds. Support local governments to make full use of the green bond market to finance medium- and long-term green projects with stable cash flows. Encourage local governments to include projects with significant environmental benefits into the green project database, and expand the financing channels for these projects by listing them on national financial asset trading centers. Encourage international financial institutions and foreign corporations to cooperate with local governments to make green investments.
Section 8. Promote International Cooperation in Green Finance	25	Expand the scope of international cooperation in green finance. Continue to promote the global consensus on developing green finance under the framework of the G20, promote the application of voluntary principles for green banking and green investment, as well as other best practices on green finance, and improve related capacity building. Promote regional cooperation on green finance and support green investment of relevant countries through implementing ‘the One Belt One Road’ strategy and regional cooperation mechanisms such as Shanghai Cooperation Organization, China-ASEAN Cooperation, and South-South Cooperation, and the role of the Asian Infrastructure Investment Bank and BRICs New Development Bank in leveraging private green investment.
	26	Promote the progressive, two-way opening of the green securities market. Support domestic financial institutions and enterprises to issue green bonds overseas. Make full use of bilateral and multilateral cooperation mechanisms and guide foreign capital to invest in China’s domestic green bonds, green equities and other green financial products. Encourage the establishment of joint venture green development funds. Support international financial organizations and multinational corporations to issue green bonds in the Chinese market and make green investments in China.
	27	Enhance the “greenness” of China’s outward investment. Support and encourage domestic financial institutions, non-financial enterprises and multilateral development banks with China’s active participation to strengthen environmental risk management, improve environmental information disclosure, adopt green financing instruments such as green bonds, develop green supply chain management, and explore the use of instruments such as environment pollution liability insurance to manage environmental risks, in implementing “One Belt One Road” and other overseas investment projects.



Section 9. Prevent Financial Risks and Strengthen Implementation	28	Improve the supervision mechanism to prevent risks related to green finance. Improve coordination among supervisory agencies on green finance businesses and products, make comprehensive use of macro-prudential and micro-prudential management tools, unify and improve relevant supervision rules and standards, enhance information disclosure, effectively control the default risks of green loans and green bonds, and fully develop equity finance, with a view to preventing excessive leverage by green projects, unhealthy financial arbitrage, “green washing” and other problems, and preventing systematic financial risks.
	29	Government agencies should coordinate and join force in promoting the development of green finance. The People’s Bank of China, the Ministry of Finance, National Development and Reform Commission, the Ministry of Environment Protection, China Banking Regulatory Commission, China Securities Regulatory Commission, China Insurance Regulatory Commission and other relative departments should pay close attention to the business development of, and the risks associated with, green finance, monitor and evaluate policy incentives and supervisory rules, and make appropriate policy adjustments in time. Strengthen the development of financial information infrastructure, and promote the sharing of information and statistics. Establish and improve the early warning systems, and intensify the supervision and evaluation of use of funds for green projects.
	30	Each region should, taking into account local circumstances and priorities, actively promote the development of green finance. Local governments should develop their plans for promoting green finance, clarify the division of labor, and incorporate the development of green finance into their annual performance targets. Strengthen the capacity building of green finance, and accelerate talent development and acquisition.
	31	Intensify public communications on green finance. Actively promote best practices of green finance and financial institutions and enterprises with outstanding green performance, and seek to build a greater public consensus of green finance development. Further increase environmental awareness, promote green consumption, and develop a better social atmosphere for ecological civilization and green finance.

ANNEX 3. Framework

The tables below constitute part of the framework created to assess and compare different financial strategies for fighting climate change. Based on the various theories, types of policies and governance approaches discussed under Section 3, each point action (lines) was individually graded by two researchers according to their characteristics as free market vs. regulation, green niche vs. system (columns) etc. These independent grading exercises were then brought together in extensive discussions that sought to find an agreement for each graded cell. The choice of method does not exclude a large level of subjectivity, which might be better addressed in the future through an exercise with a larger number of specialists on board. The selected indicators might also be expanded to include other theories, types of policies and governance. Even if only exploratory at this stage, the framework can be considered as a first step to unveil the huge granularity across climate-related approaches to the financial system, opening the way for more tailored solutions that take into account countries' traditions and existing financial structures. From the understanding of how countries differentiate, further analyses might also assess how effective their actions are proving to be in terms of GHG emissions' reductions.

**Table 3** Framework for the EU Action Plan[illegible]

No	Policies	Theories				Types of policies				Governance		
		Free Market	Regulation	Green Niche	System	Pull	Push	Micro	Macro	Modes		
										Gov Compulsory	Gov Voluntary	Self-regulation
	(Explore the) feasibility of inclusion of climate-related risks in institutions' risk management policies (8.1) [L?]											
	(Explore the) potential calibration of capital requirements of banks as part of the CRRD (8.2) [L?]											
	EIOPA invited to provide an opinion on the impact of prudential rules for insurance companies on sustainable investments (8.3)											
9	Strengthening sustainability disclosure and accounting rule-making											
	Revision of the guidelines on non-financial information (9.1)											
	Proposal requiring AM and II to disclose how they consider sustainability factors in their investment decision making process (9.2) [L]											
	Promote innovation and development of best practices in corporate reporting, such as environmental accounting (9.3)											
	Explore alternative accounting treatments to fair value measurement for long-term investment portfolios (in relation with IFRS) (9.4)											
10	Fostering sustainable corporate governance and attenuating short-termism in capital markets											
	Assess the possible need to require corporate boards to develop and disclose a sustainability strategy and measurable targets (10.1)											
	Assess the possible need to clarify the rules according to which directors are expected to act in the company's long-term interest (10.2)											
	Invite the ESAs to collect evidence of undue short-term pressure from capital markets on corporations and consider, if necessary, further steps (10.3)											

Table 4 Framework for the Chinese Guidelines for Establishing the Green Financial System

No	Policies	Theories				Types of policies				Governance		
		Free Market	Regulation	Green Niche	System	Pull	Push	Micro	Macro	Modes		
										Gov Compulsory	Gov Voluntary	Self-regulation
	Chinese Guidelines for Establishing the Green Financial System											
1	Establish a policy framework to support green lending.											
2	Promote self-regulatory organizations in banking industry to gradually establish a green banking evaluation mechanism.											
3	Promote securitization of green loans.											
4	Explore ways to introduce lenders' environmental legal liability.											
5	Support and guide banks and other financial institutions to establish a credit management system that conforms to the characteristics of green enterprises and projects.											
6	Support banks and other financial institutions to treat environmental and social risks as important drivers in their stress tests for credit risks, and incorporate these test results into asset allocation and internal pricing.											
7	Incorporate the enterprise environmental information including environmental violations into the financial credit information database.											
8	Improve the rules and regulations for green bonds and unify the green bond definitions.											
9	Take measures to reduce the financing cost of green bonds.											
10	Explore ways to formulate standards for third party verification of green bonds and green credit rating.											
11	Actively support the qualified green enterprises to obtain financing via initial public offerings and secondary offerings.											
12	Support the development of green bond indices, green equity indices and related products.											

No	Policies	Theories				Types of policies				Governance		
		Free Market	Regulation	Green Niche	System	Pull	Push	Micro	Macro	Modes		
										Gov Compulsory	Gov Voluntary	Self-regulation
13	Gradually establish and improve the mandatory environmental information disclosure system for listed enterprises and bond issuers.											
14	Guide institutional investors to invest in green assets.											
15	Support the establishment of all kinds of green development funds and their market-based operations.											
16	Local governments could support the projects invested by green development funds through measures such as relaxing market access restrictions, improving pricing of public services, granting franchises, implementing favorable fiscal and land policies, and improving benefit- and risk-sharing mechanisms.											
17	Support the introduction of the PPP model in the green industry, encourage the bundling of energy saving and emission reduction projects, environment protection projects and other green projects with related higher-return projects, and establish a green service charge mechanism for projects with a “public goods” nature.											
18	Establish a compulsory environmental pollution liability insurance system in areas of high environmental risks.											
19	Encourage and support insurance institutions to innovate green insurance products and services.											
20	Encourage and support insurance institutions to participate in the development of the environmental risk control system.											
21	Develop different kinds of carbon finance products.											
22	Promote the establishment of markets for pollutant emission rights, energy use rights, water rights and other environmental rights.											
23	Develop financing instruments based on carbon emission rights, pollutant emission rights, energy use rights, water rights and other environmental rights, with a view to expanding the green financing channels for enterprises.											
24	Explore supportive measures, such as central bank re-lending, macro- prudential assessment, and capital market instruments to promote green finance at the local level.											

No	Policies	Theories				Types of policies				Governance		
		Free Market	Regulation	Green Niche	System	Pull	Push	Micro	Macro	Modes		
										Gov Compulsory	Gov Voluntary	Self-regulation
25	Expand the scope of international cooperation in green finance.											
26	Promote the progressive, two-way opening of the green securities market.											
27	Enhance the “greenness” of China’s outward investment.											
28	Improve the supervision mechanism to prevent risks related to green finance.											
29	Government agencies should coordinate and join force in promoting the development of green finance.											
30	Each region should, taking into account local circumstances and priorities, actively promote the development of green finance.											
31	Intensify public communications on green finance.											