Sustainable Finance Policy-Making: Why and How[16]

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Why should central banks and financial supervisors worry about climate change and decarbonisation? And how are they supposed to act upon them? These questions have been asked many times in recent years, but have yet to receive a definitive answer.

The main institutional answer given so far - at least in Europe and similar jurisdictions - has been based on the possibility that climate change or the low-carbon transition might affect the ability of central banks and supervisors to achieve their mandated primary objectives, such as price and financial stability (Schnabel, 2021; Semieniuk et al., 2021). If these climate-related risks were found to be material, stronger policy action would be justified.

But how are we supposed to find proof of the materiality of climate-related risks? At the moment, deep knowledge gaps remain in all the necessary ingredients: i) abundant and granular data; ii) methods to analyse and understand empirical evidence; and iii) reliable modelling methods to explore future scenarios. In the face of climate change and the urgency of decarbonising the global economy, obtaining incontrovertible results on risk materiality, if possible at all, might take too much time.

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Even without proof, there are a number of things policy-makers can do and, to some extent, are already doing. One is to put a price on carbon; governments should attend to that. Another is to expand the information set available to market participants, to allow them to price risks correctly. Central banks and supervisors can play a key role in this dimension, supporting the development of risk assessment methods and pushing financial institutions to disclose their exposure to climate-related risks. Both these policies have a theoretical backing in the idea of correcting specific 'market failures', i.e. the environmental externality and imperfect information.

Will this be enough? It's unlikely. There are several political obstacles to carbon pricing, and many additional failures affect the functioning of markets, especially financial ones. Two main alternative options can be considered. The first option is to lower the level of sophistication of mechanisms supporting the implementation of unconventional monetary/financial policies addressing climate risks. Empirical evidence shows that, in the face of radical uncertainty about the future, policy-making decisions based on 'fast and frugal' rules of thumb can outperform more sophisticated decision-making rules trying to capture the ineffably complex dynamics of the global economy. The second option is to explicitly modify the institutional structure to ensure more effective climate action, e.g., changing the mandates of central banks and supervisors, or creating additional delegations to independent institutions. Both options might require bending and adapting the current institutional boundaries, which comes with some risks to be accounted for.

In the remainder of the article, we discuss these points more in detail. We start by presenting the current conceptual and institutional justifications for existing sustainable finance policies. We then discuss their limitations in ensuring effective climate action and explore alternative strategies going beyond existing institutional frameworks. We conclude by inviting to a deeper analysis on the potential benefits and risks of these institutional options.

Sustainable finance policies: a recap

The pivotal role of finance in supporting an orderly and rapid decarbonisation process (and thus the mitigation of climate impacts) has been

increasingly recognized by the international community. First, the discovery, commercialization, deployment and diffusion of low-carbon technologies require adequate financial investments in the form of bank loans, debt and equity finance. Second, the financial risks materialising during the transition (e.g. an excessively rapid devaluation of carbon-intensive assets, or a 'green' bubble) need to be safely absorbed, minimising financial and economic instability.

Several 'market failures' might prevent financial market actors to autonomously align along a technological transition compatible with climate stability (e.g. maintaining temperatures below 1.5-2°C, as stipulated by the Paris Agreement). If this is the case, adequate policy guidance is needed. However, policy action is even harder than usual in this context, as financial policy-making and regulation functions are often in the hands of delegated authorities, i.e. independent or semi-independent institutions that have received a mandate to achieve specific and limited objectives. This is especially the case of central banks, which in many jurisdictions enjoy a high degree of independence in pursuing price stability (the quintessential central bank objective), macroprudential stability (especially after the 2007-08 global financial crisis), and whatever other goal governments have opted to delegate to them.

Nonetheless, we have experienced an increasingly strong presence of delegated authorities in the climate debate. Starting with the 'Tragedy of the horizon' speech of the Governor of the Bank of England (Carney, 2015), central banks and financial supervisors have played a key role in mainstreaming sustainable finance, e.g. with the creation of the Task-force on Climate-related Financial Disclosures (TCFD, 2017) and supporting the work of the European High-Level Expert Group on sustainable finance (EU HLEG, 2017). Further, the creation of the Network for Greening the Financial System (NGFS) in 2017 reflected the desire for an intensified international cooperation, in the attempt to strengthen the global response required to meet the goals of the Paris agreement.

Several delegated authorities have nudged or required companies and financial intermediaries to 'stress-test' their portfolio against climate-related risks and disclose the results, or have run system-wide climate stress-tests of their banking and financial systems (Baudino and Svoronos, 2021; ECB, 2022; Vermeulen et al., 2018). Other delegated authorities, especially in emerging economies, have gone further, employing their policy toolkit to actively promote

green and low-carbon investments, such as differentiated reserve and capital requirements depending on the greenness of bank lending, favourable refinancing lines and green credit quotas (Campiglio et al., 2018; D'Orazio, 2022).

But why are central banks and supervisors acting on climate in the first place? And what determines their degree of engagement?

Climate-related risks might affect price and financial stability

A first argument for action builds on the possibility that climate-related risks could affect the ability of central banks and others' financial authorities to achieve their mandated objectives (price stability, financial stability, and others).

As emphasised by Schnabel (2021), there are three reasons for which climate-related risks might impair central banks' effectiveness at managing inflation. First, the transmission of central banks' monetary policy measures to the financing conditions faced by households and firms are likely to be affected by climate-induced losses. Losses from materialising physical risks or asset stranding (such as fossil reserves that will remain unextracted as the world decarbonises) could weigh on financial institutions' balance sheets, reducing the flow of credit to the real economy and impairing the credit channel (Lamperti et al., 2019). Second, climate-related risks (e.g., productivity losses induced by physical risks, or diversion of resources from more productive activities, such as R&D and education, to climate adaptation) might reduce the real equilibrium interest rate, pushing central banks closer to the boundaries of conventional monetary policy (Boneva et al., 2021). Third, both climate change and mitigation policies can have a direct impact on inflation dynamics by amplifying business cycles fluctuations and uncertainty, thereby requiring a greater interventionism through conventional channels.

Climate-related risks could also affect the stability of financial systems (Semieniuk et al., 2021). While the precise nature of risks and transmission channels is different between climate impacts and a low-carbon transition, they exhibit some key shared features. Non-financial firms could be affected by both a change in costs or revenues leading to a decline in profits (e.g. due to a carbon tax or climate-induced supply chain disruptions) and balance sheet losses (e.g.

destruction of physical assets due to extreme weather events). These costs could then propagate to financial institutions in two main ways: i) firms defaulting on their bank loans; ii) a drop in the valuation of firms' financial assets. Exacerbated by production and financial network effects (Cahen-Fourot et al., 2021), large enough initial shocks could eventually have systemic implications, causing a macro-financial crisis — what Bolton et al. (2020) call a 'Green Swan'. An overvaluation of green assets leading to the burst of a bubble is also a possible mechanism of transition-related financial disruption.

Can we 'prove' the materiality of climate-related risks?

So far, we have claimed that climate change and the low-carbon transition *might* affect price and financial stability. Policy-makers and academia have started developing theoretical conceptual frameworks describing what a 'disorderly transition' or a 'Climate Minsky moment' could look like (NGFS, 2019). However, we still don't know to what extent these scenarios are actual possibilities we should worry about, nor do we have a reliable assessment of the economic and financial implications of climate-related risks. In jurisdictions characterised by the presence of independent authorities with clear and limited objectives, the absence of reliable proof of the materiality of climate-related risks represents a crucial obstacle to policy action.

What would we need to reliably assess the materiality of climate-related risks and justify action? Three elements are key: i) abundant, harmonised and sufficiently granular data; ii) empirical methods to analyse and interpret the data; and iii) modelling methodologies to examine future scenarios in all their dynamic complexity. Unfortunately, several key knowledge gaps currently exist in all three dimensions.

First, data is often absent, scattered or not harmonised. Several projects have been set up to collect and analyse asset- and firm-level information, e.g. for coal/gas plants, housing properties, and infrastructure (see for instance the GeoAsset project). However, more work is needed to provide an integrated perspective across countries and sectors. In addition, clear large-scale data maps of real-financial linkages are often absent and, when available, they typically do not encompass sufficient spatial detail to quantify physical risks.

Second, the empirical analysis of the data is also in its infancy. The analysis of exposures is becoming common, both for what concerns physical assets (Tong et al., 2019) and financial assets (Giuzio et al., 2019). However, the analytical and quantitative power of such tests is likely to remain limited, given their static nature. It is also hard to link exposure data to the probabilities of individual counterparties defaulting due to climate-related drivers that have no historical precedents. In addition to exposure data, it would be key to have a better understanding of climate-related expectations and beliefs of economic agents, as these would contribute to defining the response of the system to shocks. Asset pricing methods can be used to study the extent to which climate-related risks are already internalised by investors. Bolton and Kacperczyk (2021), for instance, find evidence of positive carbon risk premia in recent years, suggesting that investors increasingly request compensation for the potential costs that mitigation efforts would create for carbon-intensive firms. Alternative approaches to capturing climate-related 'sentiments' include using text analysis methods to study communications — such as social media posts, speeches, newspaper articles (see for instance Engle et al., 2020) — and running surveys of investors to elicit their opinions and beliefs (e.g. Krueger et al., 2020). However, much more work is still needed in this direction.

Third, one should feed the data and estimated parameters to adequate models enabling a dynamic exploration of possible futures. Several features would need to be present for a model to be able to fully grasp the complexity of possible macro-financial and transition patterns, including: (i) a multi-sectoral perspective, including inter-industry exchange of intermediate inputs and supply chains; (ii) multiple technologies with different physical, financial and sustainability characteristics; iii) clear links between the real and financial parts of the model, including mechanisms of portfolio choice and credit provision; iv) mechanisms to incorporate propagation of shocks across both production and financial networks; v) a realistic representation of dynamic human behaviour, including its irrational and socially-determined dimensions; vi) a way to incorporate uncertainty and its impacts on decision-making. Unfortunately, although not surprisingly, the assessment of climate-related risks is currently being carried out employing models that generally do not exhibit all of the dimensions above (Baudino and Svoronos, 2021; ECB, 2022),

though some alternatives are gradually emerging (see for instance Lamperti et al., 2021, 2018). More in general, models are by definition aimed at reducing real-world complexity in order to understand its key mechanisms. This requires making a number of limiting assumptions on human behaviour and the functioning of economic systems, which in turn makes all models susceptible to criticism and non-acceptance. In other words, the perfect model, accepted by everyone, might never come.

Considering all of the above, a question ensues: what happens if a solid and incontrovertible proof of the materiality of climate-related financial risks never materialises? We discuss two main strategies in the coming sections: (i) find ways to act within the existing institutional framework; (ii) adopt policy choices that bend or modify the institutional framework.

Strategy 1: act within the existing institutional framework

A first strategy is to accept the limitations imposed by the current institutional framework and do whatever is already allowable within it. Luckily, there are plenty of options available and, to some extent, already pursued.

The most prominent policy option is of course to put a price on carbon, either via taxes or the introduction of a market of carbon allowances (Baranzini et al., 2017). In simple economic terms, this is directed at addressing a market failure, i.e. the environmental externality. Since many environmental goods and services (including climate stability) do not have a market price, private economic agents are able to keep the benefits of polluting (i.e. production and associated profits) for themselves, while socialising its costs. This constitutes a strong disincentive to shift towards cleaner production technologies. If, however, the externality was to be internalised via policy (e.g. a carbon tax), consumers would have the incentive to move towards green products and firms would be more inclined to innovate their technologies and substitute high-carbon for low-carbon intermediate inputs. In absence of additional market failures, this should also convince financial institutions to support low-carbon activities.

Of course, fiscal policy is not really a function under the control of central banks or financial supervisors, but rather of governments and finance

ministries. So, unless there is a modification of the current institutional framework (e.g. via a carbon central bank, see last section), delegated authorities' only role in this regard is to remind that carbon pricing is necessary and urgent, via both research and institutional pressure (e.g. speeches). However, this does not make central banks powerless. Indeed, there are a variety of possible climate finance policies, whose scope will depend on the underlying institutional framework. In high-income western economies like the European Union, where delegated objectives are narrow, at least two categories of initiatives can be launched.

First, central banks and financial institutions have a central role to play in supporting the scientific community in the assessment of climate-related risks. Not only they hold the largest and most detailed data sources about financial and non-financial firms' transactions; they also have a long tradition in developing macroeconomic models. These can offer insights on how business cycles are affected by both credit and asset market dynamics, including cases where assets' values go burst (e.g. housing market models) and financial flows need moving from the banking sector to the real economy. In addition, thanks to their supervision activities, they can retrieve the sectoral and geographical exposure of banks and institutional investors. The expertise and data held by statistical and research departments within central banks are highly complementary to the knowledge stock on the effects of emission mitigation pathways and physical hazards. The question is how this information can be used effectively.

Second, central banks and financial regulators can increase information available to markets. This would reduce the existence of an information asymmetry failure. Banks and financial institutions face difficulties in inferring the exposure of a counterpart to transition risks and physical events. Central banks can develop forward-looking models of risk evaluation to account for climate and transition futures. If all information was available, in principle, financial firms would allocate credit more efficiently and effectively pricing climate-related risks. However, if this is not possible, distortions will emerge. The presence of deep uncertainties, as discussed above, is likely to make this process exceptionally hard or long, while evidence suggests that climate change is accelerating and carbon budgets to meet ambitious mitigation are rapidly depleting.

Will this be enough?

It is hard to know whether the initiatives outlined above, if implemented in a strong and credible manner, could provide a sufficient push to rapidly decarbonise the economic system. What we can certainly notice is that, at the moment, they are not fully implemented.

Carbon pricing initiatives have been multiplying and strengthening in recent years (World Bank, 2021). The EU Emission Trading Scheme, after long years of disappointment, has started to deliver strong carbon price signals, and the launch of Chinese national market of permits promises to be a further important step in the right direction. However, in general, recent evidence signals that carbon pricing is far more discussed in the academic debate than it is used in practice (Peñasco et al., 2021). This is due, at least partially, to its relatively low political acceptability and the dependence of policy action to the electoral cycle. Further, carbon pricing is complicated by three factors. First, the transition will come at some cost, at least for certain countries, sectors and firms; and the cost will be itself an outcome of how well is the policy effort carried out (i.e. an abrupt climate policy might trigger macro-financial disruptions). Second, fundamental uncertainty renders any calculation of the desirable carbon price questionable, which makes it difficult to credibly commit to a specific price path. Third, carbon pricing can be successful in reshaping economic decisions and financial flows only if markets work well. Unfortunately, this is hardly the case (Stern et al., 2021). Indeed, markets are prone to frictions, multiple equilibria, volatility and excessive market power, suggesting that price signals will hardly be sufficient to manage climate-related risks, and that carbon pricing should be considered as part of a much wider policy spectrum.

The informational policies mentioned in the previous section, aimed at assessing and disclosing climate-related financial risks, also have important limitations. First and foremost, the result that novel information is adequately reflected in financial prices follows from the demanding "efficient market hypothesis". Beyond a number of historical failures of such hypothesis, recent evidence from a survey of institutional investors, whose portfolio is characterized by long maturities compatible with the scales of climate risks, rejects the view that additional and more precise information of climate-

related risks can suffice to align their investment strategies (Ameli et al., 2021, 2020). Further, collecting information about climate risks and exposure of individual counterparts, as well as formalizing harmonized disclosure procedures aimed at generating reliable taxonomies and benchmarks may require time that would further delay markets' reaction.

Considering these limitations and obstacles to implementation, it appears wise to explore additional and alternative policy options, even if these require some modification to the existing distribution of institutional responsibilities and functions.

Strategy 2: go beyond existing institutional framework

Going beyond what the current institutional framework allows is, of course, possible. Institutions are social constructs and they change as societies change. Indeed, current institutional frameworks are different from the ones of the past and evolved following changing societal needs. For what concerns central banks, the most recent paradigmatic shift has been the movement to central bank independence in a large number of countries during the 1990s, often accompanied by a focus on inflation targeting via interest rate manipulation (Vonessen et al., 2020). This constituted a significant change with respect to the traditional role central banks used to play throughout history.

To modify the existing institutional framework in an orderly and effective manner, three main ingredients are necessary. First, we need a theoretical justification for institutional change. This can be provided either by employing a conceptual framework centred around the concept of market failures or by invoking a precautionary approach in the face of deep uncertainty (Chenet et al., 2021). In either case, a theoretical justification for action is possible, even if not entirely present at the moment. Concerning failures, markets (including financial ones) are ripe with them, including the inability of individuals to understand complexity and their myopic and irrational behaviour. Credit markets may not be willing to provide the necessary liquidity to low-carbon firms, even in the presence of the 'right' prices (Campiglio, 2016). Alternatively, another argument supporting the use of financial regulation comes from recognizing the deep uncertainty that surrounds our current

ability of monitoring and quantifying these risks. In a context where losses induced by physical events and transition frictions are hard to quantify and uncertainty about their unfolding in complex economic systems is pervasive, a precautionary approach centred around simple regulation aimed at avoiding worst-case scenarios (e.g. temperatures above 2 or 3 degrees) might be not just the only viable option from a practical perspective, but one that outperform alternative solutions (Aikman et al., 2021; Chenet et al., 2021). Indeed, markets tend to perform poorly in delivering rapid, desirable, and efficient allocations of funding sources in presence of asymmetric information and uncertainty about future states of the world. Similarly, policy makers face difficulties in designing monetary-based instruments (e.g. carbon taxation) that are politically acceptable and effective when externalities are hard to quantify and markets may not work as perfectly as theory would prescribe.

Second, we need a good understanding of the risks of institutional change, so to put in place forward-looking risk mitigation strategies. Two main risks appear to be present in this case (Baer et al., 2021). First, transferring additional policy functions to an unelected technocratic institution without a proper mandate would mean moving this function away from democratic control. Second, an excessive diversification of policy functions would make central banks more prone to failure, especially if there are possible conflicts between them, and potentially less credible in their commitments. This could in turn have negative impacts on their capacity to maintain price and inflation stability. If brought to the extreme, this scenario could lead to a transfer of policy functions back to the governments and the loss of central banks independence.

Third, we need to identify a strategy to reach the institutional framework we believe is the most appropriate to deal with societal challenges. We identify two main possible avenues to achieve this, on which we expand in the next section.

Ideas for the future

A first avenue to ensure more effective climate action is to accept the limitations of risk assessment methods and start acting with whatever indication we can extract using existing datasets and methodologies. In

situations where risks are easily computable, there is no cost to complexity: more information is always perceived to be better than less; and decisions should optimally weight all relevant factors. Contrarily, taking uncertainty seriously may imply that financial regulation built on simple indicators, available data and shared estimates outperform more complex assessments. This matches what Stern et al. define a "guardrail approach" (Stern et al., 2021): if there are actions that are likely to limit the chances of disastrous events and have moderate costs, they should be undertaken. For example, if capital requirements are used to limit banks' risk-taking, one should ideally define them in a way to perfectly mirror the probability of default of each asset in their portfolio, possibly taking into account cross-exposures and interconnectedness. However, this entails an extremely complex use of data and modelling. Aikman et al. (2021) have shown that capital requirement rules based on Basel II criteria employing fixed rating agency outlooks outperformed approaches allowing internal estimation of counterparty-specific probability of defaults, especially in environments with changing regimes. The key question is whether and how a "fast and frugal" approach can be designed to address climate physical and transition risks.

Several initiatives that have been already undertaken in some countries aim at enriching the current regulatory framework, encompassing stress testing procedures, mandatory disclosure of climate-related risks, differentiated capital requirements for low- and high-carbon assets, and more. We argue that the success of these initiatives is largely dependent on their implementation strategy, which need to be (i) forward-looking; and (ii) immediately feasible. Forward-lookingness, in this context, indicates anticipation of conditions that have been hardly or not experienced. One simple way of doing this is through narratives and statistical analysis with higher weights on rare past events. This would reflect the intuition that a way to be prepared for unknown conditions is via fictitious scenario construction informed by the analysis of historically infrequent events. On a different ground, immediate feasibility refers to the fact that available or easy to retrieve information should be used to define regulations that are rapid to adopt, simple to monitor and flexibly adjustable as experience becomes available.

An example can be offered with respect to capital requirement regulation. While exact exposure of assets to weather events and climate policy is difficult

to measure (as mentioned above), we have some systematised sources of information about susceptibility to both. In the same way rating agencies scores provide an imprecise yet easily accessible advice on credit risk, long term weather forecasts offer well-organised and public information about the likelihood of experiencing weather conditions significantly different than in the past, under scenarios of possible futures. Further, input-output data tracking flows of value added across sectors of economic activities are available to determine industries' average emission intensity as well as reliance on high-emission intermediate products. It would be relatively easy to indicate whether locations are likely to experience more extreme weather with respect to the past and industries are likely to shrink production if carbon prices rise as much as in some rare historical event. At this point, Monte Carlo analysis can be used to analyse the minimum capital cushions that would be needed to absorb an extreme case where all assets within sectors and locations are "at risk" of default. Such an exercise could help the construction of a long run, dynamically-evolving and forward-looking target for the bank, and the key advantage of such an approach is that it just relies on information on sector and location, in addition to publicly available data about weather projections and value chain structure.

A second avenue for stronger climate action is to adopt bolder strategies of institutional change, in place of, or in addition to, adopting a different rule-making routing. Several alternatives exist. For instance, the mandate of delegated authorities can be modified so to include climate-related objectives. This was the path chosen by the United Kingdom, whose government in 2021 has updated the remit of both the Monetary Policy Committee and the Financial Policy Committee of the Bank of England to reflect the government's strategy to achieve and economic system which is "environmentally sustainable and consistent with the transition to a net zero economy" (Sunak, 2021). Alternatively, new delegations can be imagined, so to transfer policy functions linked to the achievement of a clear forward-looking schedule of carbon prices to an independent institution capable of abstracting from electoral cycles, i.e. a 'carbon central bank' or a 'carbon council' (G30, 2020). This could reduce uncertainty around climate-related risks, acting not on the basis of quantified climate-related risks, but rather on the necessity of reaching politically-determined net-zero targets.

Conclusions

In this article we have discussed the evolving academic and policy debate on sustainable finance policy-making. While much can be done within current institutional arrangements — e.g. put a price on carbon or expand the information set available to markets via improved risk assessment methods and disclosure — this is unlikely to trigger a rapid and orderly decarbonisation process, due to multiple market failures and political obstacles.

In the face of the complex climate change challenge, simpler and more direct guidance should be offered to financial markets. While the dominant paradigm for studying decision-making in finance is based on rational management of known and (presumably) calculable risks, the presence of uncertainty can overturn the picture. Decision rules that attempt to achieve ever greater precision can become increasingly imprecise moving from theory to practice. Rules that attempt to weight optimally all the relevant information can sometimes generate poorer results than simple, 'fast and frugal' rules of thumb.

Unconventional thinking and policy-making, going beyond current practices and institutional boundaries, might thus be recommended. However, institutional changes may not be trivial, and could come at a cost. Reforming the mandate of the European Central Bank, for instance, is a particularly difficult task. The recent experiences of the Global Financial Crisis and the Covid-19 pandemics have also shown that some of the interventions carried out to face large downturns can encounter legal issues. It is thus crucial to explore all the possible ramifications of changing institutional practices and identify sustainable ways to ensure institutional coordination towards the decarbonisation objective.

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