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Risks and Challenges of Ecological Transition for the Financial System: What Role for Central Banks?

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Abstract

The ecological transition poses the most impelling challenges for central banks, regulators and supervisory authorities. This paper explores the different types of risks associated with ecological transition. It deplores their absence in the instruments of control and regulation at a time when climate change threatens financial stability and can be at the root of a systemic crisis. Risk management is particularly sensitive given its uncertain nature. Nowadays, many actors, including governments, the private and public sectors, as well as part of the international community, are intervening to support the ecological transition. Nevertheless, it would appear that central banks are best able to meet these challenges.

Keywords: ecological transition, climate, central banks, monetary policy
JEL: F52, F58, Q54

Introduction[3]

The global financial crisis (2008), the sluggish growth that followed and the Covid-19 pandemic of March 2020 have revealed that economies have reached their limits in terms of development. Moreover, the scientific works on climate have warned governments of the risks of continuing to finance polluting productive activities. Since the 2015 Paris

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Climate Conference (COP21), the climate goal has been to reduce the increase in global temperature by 2100 (below 2 degrees Celsius above pre-industrial levels and even more than 1.5 degrees Celsius under the Paris Climate Agreement, 2016). It is clear that the economic and social model we have experienced is no longer able to guarantee the survival of the planet and its hosts. There is an urgent need to move towards a new paradigm in terms of production and funding solutions. The ecological transition is the stage that should allow a change in our consumption, work and production patterns to meet key environmental issues (climate change, reduction of resources and biodiversity and increase in natural disasters). The ecological transition affects all economic sectors, and takes many forms. It is multi-sector, ranging from the agri-food transition to the industrial transition through the preservation of biodiversity, an overhaul of taxation through waste management for example and a reconsideration of urban planning and transport. To meet the challenge of ecological transition, considerable investment is required. Its success depends on the large budgets needed to transform profoundly our economies. The latter must be a priority. States must be on the front line and many private and public actors are mobilized to conduct actions for sustainable development. Among all the players, it appears that central banks (CBs) are best able to meet the challenge. However, they should not be alone in fighting the tragedy on the horizon.

The paper explores the different types of risks associated with ecological transition. It reveals the absence of those risks in the instruments of control and regulation at a time when climate change threatens financial stability and can lead to a systemic crisis. Risk management is particularly sensitive given its uncertain nature. The paper aims to discuss the role central banks could play in the ecological transition.

This article begins by examining ecological risks and the absence of control and regulatory tools. The second section deals with the role of CBs in supporting the ecological transition by proposing and implementing green monetary instruments.

How are ecological risks and issues apprehended?

Without ecological policies, the planet will experience an increase in temperatures, from 3.7 to 4.8 degrees Celsius at the end of this century. The impacts on earth are obviously dramatic. A rise in temperature has a direct impact on agricultural sectors and water availability. As early as 2013, the World Bank commissioned work to analyse the potential impacts of a temperature increase of 4 degrees Celsius (World Bank Reports, 2012 to 2019). The results and conclusions are alarming. In summary, in many cases, extreme heat waves, rising sea levels, more intense storms, droughts and floods will threaten the world, especially the poorest and most vulnerable. In 2015, the Governor of the Bank of England delivered a speech entitled *Breaking the tragedy of the horizon – climate change and financial stability* (see Carney, 2015). His presentation echoes Hardin's *Tragedy of the Commons* back in 1968. It highlights the overexploitation of common resources (public goods). In his speech, the governor referred to three types of climate change risks. First,

physical risks arise when climate change affects the spheres of production and finance. Climate change is creating new economic risks, namely negative impacts on business productivity. In the event of a natural disaster, the company's profits decrease and losses affect the valuation of the asset portfolio.

The second risk is the risk of transition. For example, when a company develops a low-carbon strategy policy, the results are random and part of a long-term perspective. The third risk is liability. Natural disasters are the main cause. The insurance industry is on the front line. This fact requires a review of the insurance business plan since it assumes that natural catastrophes are rare. The analysis framework of insurance industry resilience assumes low probability and high severity (Louaas and Picard, 2018). With climate change, this hypothesis needs to be reconsidered. Today, the probability of a natural disaster is not so low (rare events) and will naturally increase significantly in the future. This hypothesis should be introduced in the literature on insurance theories to develop stress tests consistent with reality. Stress tests are instructive in quantifying how financial and economic systems are affected by a climate disaster. In addition, these stress tests should take into account all institutional sectors and all countries because of their interdependencies. At this stage, we can notice that there are several recent central banks' studies that aim at measuring the impact of natural catastrophes on banking and insurance branches (Regelink et al. 2017; Bourtembourg et al., 2019; Schellekens and Van Toor, 2019).

Other risks, corollary to those described above, will appear. Refugees will no longer be economic or political but climate. These influxes of people may lead to tensions and even wars. The supply of water, food, breathable air, etc. is likely to be ongoing question that will lead to rationing to manage shortages (e.g. water or food), assuming these variables are in the hands of states. If they are the responsibility of large private companies, it is likely that violent social conflicts will break out everywhere and that poverty should explode.

All these risks are uncertain and interrelated; thus, their occurrences are not foreseeable. The challenges to tackle or avoid these risks are huge and action should be significant. For instance, according to the International Energy Agency, a direct consequence of the pandemic lockdown will be a great annual decrease in the CO2 (-8%) by the end of 2020 (Global Energy Review, 2020). A GDP loss and an explosion of unemployment have accompanied the emissions decline. We have to bear in mind that to meet the climate change recommendation of the Intergovernmental Panel on Climate Change (IPCC), it will be suitable to reduce the CO2 in the same proportion. Therefore, the challenge is not trivial. Climate change, like COVID-19, has a large spectrum since they affect the whole economy from the bottom to the top and currently our economies are not immunized against this kind of shocks. It became obvious that fundamental transformations of our societies are vital to coping with the climate change challenges.

Finally, the difficulty in defining a harmonized framework at European or even global level represents a significant danger as opportunistic behaviour can emerge. The carbon tax is a perfect example of this.

Until now, climate risk has not found its place in the tools for controlling the formation of imbalances within regulatory bodies. For example, in June 2019, European Banking Authorities introduced the Economic, Social and Governance (ESG) criteria in the supervisory assessment of entities – see Art. 98(8) of CRD V[4], Art. 501c of CRR5[5] and Art. 449a of CRR2 (EBA Action Plan, 2019; Directive EU, 2019). However, work is still underway. The European Systemic Risk Board (ESRB) dashboard does not contain ecological variables while it is supposed to prevent systemic risk. It has already started reflecting on introducing climate variables. The Bank of England has promised to provide a climate stress test in the first quarter of 2020 but it has been postponed to the end of 2020 (Marsh, 2020).

It is clear that risks must be properly defined and analysed to avoid or contain systemic risks. Climate change threatens financial and economic stability. Recognition of the climate emergency has led to the creation of working groups, analytical centres or workshops. One example is the Financial Stability Board (FSB) initiative in 2015. The FSB, at the request of the G20, has created a Task Force on Climate-Related Financial Disclosures (TFCD). This group provided recommendations and information to economic agents, such as investors, insurers, lenders, etc. In 2017, the CBs and Financial System Greening Supervisors Network (NGFS)[6] were established. In April 2019, it released a report that comes up with six recommendations to green the financial system. Four recommendations pertain to supervisors, CBs and policy makers. They focus, overall, on the integration of green micro- and macro-prudential tools in their missions and on the development of a harmonized, accurate and reliable database. Transparency of information and sharing of data/knowledge are also required. Policymakers should develop a taxonomy of green activities and actively participate in the publication of reliable public reports on climate and environment, and ensure compliance with climate rules. This taxonomy is at an embryonic stage and its current construction is far from meeting the requirements of ecological problems.

In December 2019, Christine Lagarde stressed the need to recognize the importance of climate risks. She also detailed three areas (macro-economic perspective, banks and financial portfolio) in which the European Central Bank (ECB) should intervene. The ECB is expected to introduce green variables for growth forecast. It should advise banks on how to assess properly the risks associated with climate change. Crisis simulation exercises for banks are crucial for financial stability. The ECB should also focus on green assets in its asset portfolios. On 18 March 2020, the ECB announced a new Pandemic Emergency Purchase Programme (PEPP) in the wake of the health crisis that has been raging in Europe since the first quarter of 2020. The amount of this transaction amounted to € 750 billion. On 4 June 2020, the Governing Council decided to increase the envelope of the PEPP by € 600 billion for a total of € 1,350 billion. In response to the downward revision of inflation linked to the pandemic, the expansion of the PEPP will further ease the general direction of monetary policy, supporting financing conditions in the real economy, particularly for businesses and

[4] CRD, Capital Requirements Directive.

[5] CRR, Capital Requirements Regulation.

[6] They are not publicly available and the database is not reliable.

households. Purchases will continue to be flexible over time, between asset classes and between jurisdictions.

Since 2020, several ECB Expert groups specialized in Climate change have emerged. In March 2020, the European System of Central Banks (ESCB) Statistics Committee (STC)[7], more precisely the STC Expert group in climate change and statistics, for instance, seeks to obtain an accurate picture of the green data. Based on surveys amongst the National central banks, as well as the ECB and the European Insurance and Occupational Pensions Authority (EIOPA), the expert group has tried to make an inventory of existing and ongoing works. In April 2020, the Committee on Monetary Financial and Balance Task Force on the statistics on sustainable finance and climate related risks (TF SuFiR) has appeared to take stock of the current and future needs relative to statistics on sustainable finance and climate risks and monitoring of related policies. The TF is allowed to cooperate with the relevant structures of the European Statistical System (ESS), the ESCB, and the European Committee of Central Balance-Sheet Data Offices (ECCBSO). In 2019, the EIOPA has provided a Dashboard on protection gap for natural catastrophe (EIOPA, 2019). This work is still in progress. In July 2020, the EIOPA decided to use the PACTA (Paris Agreement Capital Transition Assessment) methodology (PACTA, 2020) of 2 Degrees Investment Initiative to detect investments of insurance companies that do not respect the 2 degrees scenario. This point is essential to classify assets from brown to green activities. Moreover, the classification should be homogenous that is not the case of private green label agencies. Indeed, for instance many Funds certification agencies have appeared in the financial landscape. Amongst them, we can cite Luxflag (Environment and climate change). This Luxembourg non-governmental organization created in 2014 provides labels based on ESG criteria to classify funds. Other European label entities have played the same role (FibelFin QS for Belgium; FNG-Siegel for Germany; label ISR and label Green fin for France). Nevertheless, when we compare the methodologies and the thresholds associated with each of the variables, there are slight differences. This means that some funds may be qualified sustainable by some entities and rejected by others (Novethic Report, 2019: 3). In line with the same report, there are also great disparities amongst the types of labels, the targeted variables, the variables' thresholds, and the annual costs (Novethic Report, 2019: 4, 6).

All of these initiatives have demonstrated that the urgency of climate risks is publicly recognized. However, the facts do not illustrate this urgency. Indeed, there is a kind of ratchet effect. We are aware of the ecological risks, but CO2 emissions are not drastically reduced. "The dataset (EDGARv5.0_FT) shows that global fossil-like and anthropogenic CO2 emissions increased by 0.4% in 2016 compared to 2015 and by 1.2% in 2017 compared to 2016 to reach 37.1 GT of CO2." This shows that the ecological transition will take time; this is a structural change. The evaluation of the CO2 raises several questions. Indeed, the

[7] The ESCB's statistical function is based on a legal mandate "to collect all necessary and relevant data in order to produce and disseminate impartial, reliable, appropriate, timely, consistent and accessible statistics in the areas under the ESCB's responsibility. Where appropriate, these statistics comply with European and internationally agreed standards, guidelines and good practices" (ECB, 2020).

Corporate's standard covers the accounting and reporting of seven greenhouse gases (GHG) as defined by the Kyoto Protocol – carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF6), and nitrogen trifluoride (NF3). The emissions of each GHG are calculated and converted into CO2 equivalents according to their global warming potential. There are three scopes measuring the indirect and the direct emissions. The first scope takes into account the direct emissions, whereas the second scope and the third scope include indirect emissions. Companies are compelled to report the first and the second scopes but the third one is optional, which means that the evaluation of CO2 emissions may be under evaluated since the third scope can be the largest source of emissions for some companies (GHP, 2013). To conclude, the ongoing initiatives and the facts are far from resolving the climate change problems. Only a powerful institution could change the game and put again economies on the path of ecological transition, driving a dynamic that encourages other financial players. In our view, the ECB has an important role to play to face such a challenge.

Central banks and green alternatives

The aim of this section is to answer two questions: Why should CBs actively participate in the preservation of natural resources and biodiversity? How should they act? For the first question, the history of the CBs provides some answers. Over the centuries, CBs have provided a range of tools to contain financial crises. Most existing instruments could be adapted to support the ecological transition. The second question requires that the euro area should look at the macro and micro-prudential tools put in place by the ECB to deal with systemic crises.

To understand the role of CBs in sustainable financial management, we propose to present succinctly the history of the CBs. Indeed, CBs did not always exist. Since their inception, they have expressed concerns about the currency in circulation. The term *Central Bank* appeared in the second half of the 19th century with the creation of the Bank of England (Ugolini, 2017). Ugolini (2017) describes the CBs as an extension of government policies focused on financial and monetary stability. History has shown that the emergence of CBs in Europe is linked to monetary crises, in particular liquidity risks. The financial crises have led the CBs to behave as a lender of last resort. Overall, the economic and financial environment has always conditioned the policies of the CBs. More recently, during and after the last financial crisis, the ECB reinvented monetary policy (unconventional policies) and did not hesitate to use out-of-the-ordinary financial instruments to prevent a collapse of the banking system. It is worth noting that even during the 2020 health crisis, the ECB intervened to support the European economies. It proposed an emergency purchase programme of € 750 billion (PEPP) to reduce borrowing costs and expand lending in the euro area. This shows that over the years, CBs have been actively involved in averting a global economic crisis. As a result, CBs have the power to promote sustainable policy both at the macro and micro-prudential levels to combat climate change.

Moreover, the role of CBs in their green growth mission is compatible with their primary mission, which is price stability. Dikau and Volz (2019) have analysed 133 central banks. Only 12% of central banks explicitly declare in their missions support for socially responsible activities ("sustainable economic growth/sustainable growth/ sustainable contribution to economic growth/balanced and sustainable economic development"). This means that many central banks will need to better define their legal framework to implement sustainable policies in the near future.

As the history of central banks attests, CBs have continued to evolve to meet the needs of the economy in times of crisis. Climate change creates both risks and uncertainty and therefore makes the financial system vulnerable. Uncertainty is at the root of instability and in particular financial instability (Minsky, 1986). The "Minsky moment" is when the financial world shifts from optimism to pessimism. According to Jeffers and Plihon (2019), in a Minsky moment climate risks can lead to a systemic crisis.

Dikau and Volz (2019) have defined different areas of action for a CB, based on micro and macro prudential regulations to support green finance. They point to the adoption of a standard framework for assessing environmental risks. At the macro-prudential level, stress tests and capital buffers are exposed. These instruments are well known because they are used in response to financial crises. However, CBs need to define the environmental framework in a precise and harmonized manner. From a prudential (micro and macro) perspective, variables such as liquidity, capital, reserves and lending thresholds are highlighted. It should be noted that Crockett (2000) and Borio (2003, 2006) have made a precise distinction between macro and micro-prudential approaches. The prudential macro tools are integrated into the requirements of the Basel texts (I, II, III).

Table 1 shows the main policies being debated to support the financial system. These policies are famous and often implemented by the CBs.

Table 1. Main instruments of monetary policies

Policies	Instruments	Conventional (C) or Non conventional (NC)	Objectives
Monetary	Interest Rate Credit Control	C/NC (negative interest rate)	"Without prejudice to the objective of price stability", the Eurosystem shall also "support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union". These include inter alia "full employment" and "balanced economic growth" (ECB/ Monetary Policy).

Policies	Instruments	Conventional (C) or Non conventional (NC)	Objectives
Macro-prudential[8]	Capital Liquidity Monitoring of credits	C	Short-term objective: to avoid or limit the distress of the financial system; Long-term objective: to avoid or limit GDP losses.
Micro-prudential	Regulatory standards applicable to financial intermediaries	C	Short-term objective: avoid or limit the bankruptcy of individual institutions; Long-term objective: consumer protection.
Quantitative easing (QE)	Large-scale asset purchases of long-term public debt and private assets.	NC	Reduce long-term interest rates and thus stimulate economic growth.

Source: Created by the authors

A quick glance at Table 1 shows that these tools could be used to reorient the traditional financial system towards socially responsible finance without considerable effort.

The purpose of the following section is to show how CBs can help move from a traditional financial system to another system that would meet the objective of 2 degrees Celsius above pre-industrial levels to limit the increase in temperature (see UNCC/The Paris Agreement), as outlined in the Paris Agreement. We explain below the propositions related to green macro-prudential instruments and to green non-conventional instruments.

Interest rate

Numerous theoretical and empirical articles have attempted to explore how the interest rate should optimally direct financial flows towards sustainable sectors (Kempf 2020; Muller, 2019). It is possible to define an ecological interest rate because climate change has negative impacts on natural interest rates and economic growth. This adjustment variable should take into account the externalities produced by gas emissions. This instrument should be lower when the project is sustainable and higher for brown projects. The sustainable interest rate is a useful tool in a context of "normal rates". It is therefore not certain that its implementation is feasible in an environment of low (or even negative) rates. Indeed, this climate-friendly policy is not appropriate in the case of an unconventional monetary policy (negative rates) since, more often a CB tends to use it because the interest rate instrument is no longer effective. Some articles have attempted to demonstrate that, during a long

[8] The macro-prudential approach takes into account all players in the financial sector, banking and insurance, the non-financial banking system (shadow banking), including market infrastructures and payment systems.

period of low (even negative) interest rates, QE has failed to restart economic growth due to headwinds that would generally occur in the wake of recessions and non-linear effects of interest rates.

A section of the literature deals with the question of whether transmission is different when rates are low. The effectiveness of monetary policy can vary depending on the different phases of a recession. In the initial phase, expansionary monetary policy can be very effective in countering the uncertainty and risks of economic collapse. After this first phase, the conditions of offers and counter-demands reduce the stimulus and these headwinds inherited from the past (uncontrolled expansion of credit, increase in the prices of financial assets, reckless risk-taking by agents etc.) counteract the beneficial effects of political actions (Borio, 2014/a, 2014/b). The debt accumulated during good times and the loss of GDP make repayment difficult since the future revenues of the time were overstated by economic agents. Financial sectors, particularly banking, tend to reduce their credit offerings in order to protect themselves despite regulatory intervention. Uncertainty is pervasive and threatens the economic balance. In such an environment, when the interest rate is close to its floor limit (Effective Lower Bound (ELB), this has costly effects on financial stability (Borio and Hofmann, 2017; Borio and Zabai, 2018). Lhuissier et al. (2020) have found, using *A Structural Vector Auto-Regression* (SVAR) modelling, that in some cases, monetary policy could have a positive impact on growth even during periods when interest rates are close to 0.

Capital, liquidity and credit control

Overall, macro-prudential instruments are based on reserves, capital, credit control and liquidity. For the latter, several tools are defined in the Basel III requirements: the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). The LCR is expected to provide information on short-term liquidity while the NSFR takes into account the long-term outlook. These two ratios should be modified to develop sustainable activities because, as they are currently calculated, they penalize long-term projects and favour short-term investments. Socially responsible activities require long-term investments and lower liquidity ratios are thus necessary. For credit, sustainable projects should be given priority. A prioritization of cap appropriations should be established (Fry, 1995; Volz, 2017). Support for environmental credits at the expense of brown credits should be an obligation for financial institutions (Fry, 1995; Schoenmaker and Van Tilberg, 2016).

Capital Ratio (CR) requirements should also be reviewed in terms of sustainable activities as RCs encourage brown activities because of their short-term construction. Risk-weighted assets needed to calculate the CR should introduce climate risks. In addition, differentiated reserve requirements (DRR) for banks that finance sustainable projects should be implemented (Volz, 2017; Jeffers and Plihon, 2019). Finally, it is entirely possible to green the countercyclical capital buffer (CCB) by introducing counter-cyclical capital buffers in excessive periods of non-ecological credits, for example. As a result, banks will be more resilient during cyclical turnarounds and more sensitive to environmental requirements.

Notice that the CB rate is based on the bank credit differential granted to non-financial households and businesses relative to GDP (Basel definition), a questionable variable.

All of these adjustment tools can promote a sustainable transition if they are optimally adjusted. However, we need more studies and hindsight to assess correctly the impacts of green tools on economic growth and financial stability. There is an urgent need to develop metrics and stress tests including climate risks as soon as possible. With regard to micro-prudential scopes, according to Dikau and Volz (2018), regulators should propose regulatory standards geared towards sustainable activities, provide strict dissemination rules and set a clear legal framework to protect consumers (depositors and investors).

Quantitative easing

For unconventional monetary policies, namely QE, it may be worthwhile to implement a "green" debt-buying programme to promote sustainable sectors and stop financing brown activities. In the debate on greening the financial system (see the works of the NGFS) and promoting climate-related financial publications (see TCFD studies), increasing attention is being paid to QE through its Corporate Sector Purchase Program (CSPP). Various articles sought to identify areas supported by the CSPP. They conclude that there is a kind of discrimination between polluting and non-polluting sectors. Buyback policies create distortions in favour of carbon-intensive sectors (Matikainen et al., 2017; Schoenmaker and Schramade, 2019). In addition, Battiston et al. (2017) based on 1557 securities issued by 282 companies concluded that more than 60% of the shares purchased financed brown enterprises (fossil fuel production and distribution, automotive sectors, power generation). The analysis also revealed that the Bundesbank and Banca d'Italia are the most exposed to car companies and other CO2 emitters. These conclusions should be taken into account in the ECB's upcoming rounds of private debt purchases.

Table 2 and table 3 summarize the main (non-exhaustive) proposals for greening regulatory instruments and outline the pros and cons of each of them.

Table 2. Green macro-prudential instruments propositions

Policies	Instruments' categories	Instruments	Advantages	Short time drawbacks
Macro-prudential	Reserves	DRR	Composition of the portfolio in favour of ecological sectors; Alignment of bank profits with climatic requirements	Non-transparent thresholds in terms of methodologies and choices; Opaque calibration of models ; Sectoral / regional specificities to be taken into account, which can introduce distortions

Policies	Instruments' categories	Instruments	Advantages	Short time drawbacks
Macro-prudential	Liquidity	LCR NSFR	Give priority to long-term investments; Protect banks against liquidity crises for green projects by reducing thresholds in terms of capital; Align capital with environmental requirements; Reduce the maturity risk for green projects (risks inherent to their nature); Protect economic and financial systems from ecological risks;	Under estimation of climate risks; Poorly specified financial system resilience test; Leave the choice of weight variables in the business model to the discretion of financial institutions;
Macro-prudential	Capital	CR CCB	Develop green loans in the portfolios of financial entities; Align with environmental requirements; Limit systemic risk; Avoid the risk of spread to other sectors; Limit brown loans via ceiling / floor thresholds;	Choice of non-homogeneous weights; Unspecified or worse poorly chosen adjustment variables (ex-post variables vs leading crisis indicators);

Source: Created by the authors

Table 3. Green non-conventional instruments propositions

Policies	Instruments' categories	Instruments	Advantages	Short time drawbacks
Monetary	Interest Rate	Green interest rate (zero or even negative);	Development of green loans in the portfolios of financial entities;	Low interest rate environment;
QE	Debts purchases	Green purchasing programmes;	Establish quotas for polluting entities; Converge towards a zero polluting entity portfolio by 2050;	No definition or taxonomy; No harmonization; Risk of opportunistic behaviour; No calendar

Source: Created by the authors

Finally, there is a chasm between the facts in favour of ecological transition and actions aligned with the objectives of climate change. The timetables for a minimum or no pollution

target are not yet studied or even discussed. The main cause of this misalignment, which represents a systemic risk, is a lack of definition, data/harmonized taxonomy and a kind of lethargy due to the long-term horizon. Moreover, European works such as those of the European Commission (EC) set out guidelines, proposals and recommendations, but no coercive measures. In view of the climate emergency, the EC should apply favourable weights to green projects by implementing Article 459 of the CRR before listing them in Articles 128 and 501 of the CRR22 (Philiponnat, 2020). "Losing time means losing more than blood; it is to mutilate one's being; it's committing a real suicide," this quote from Edward Young, author of the 18th, is a remarkable illustration of the consequences of our passivity in the face of the tragedy of the horizons.

Conclusion

Recently a great number of studies have shown that CBs have to be actively involved in promoting ecological transition (Batten, 2018; Volz, 2017; D'Orazio and Popoyan, 2018; Matikainen et al., 2017; Dikau and Volz, 2019; BIS, 2020; Bolton et al., 2020). However, they should not be alone in finding solutions to climate emergencies. Fiscal policies should also accompany the actions of monetary supervisors. Monetary and fiscal policies, which are complementary, must be coordinated to limit or avoid negative externalities. To go further, we argue that a genuine European fiscal and budgetary union would strengthen Europe's place at the global level, as well as the implementation of European aid in the event of crises and a better assessment of their effectiveness.

The COVID-19 pandemic and the economic crisis that hit all economies hard, even though they have not yet recovered from the last financial crisis of 2008, are signals of the ecological urgency. Economies and financial systems should recover from Covid-19, thanks to the support provided by governments and CBs. Whereas, climate change and its corollaries, if nothing is done, will lead to irreversible harm for present and future generations. Therefore, it requires a more specific attention even if economies cope with the current crisis. Actions taken today will definitively shape the world of tomorrow. What is sure is the COVID-19 has started to change the face of the world policy as witness the PEPP and other monetary policy initiatives. In our view CBs can and should play a crucial role in the process of ecological transition of the traditional financial system. It is a timely and necessary precondition for its realization.

Last but not least, various scientific studies show that the damage inflicted on the planet has led to new epidemics. Researchers also warn about the thawing risks associated with global warming or commonly known as permafrost, which is a Pandora's box. For hundreds of thousands of years, permafrost has contained bacteria or viruses that are not known to be released into the air. This argument is debated, but it should not be ignored. The most vulnerable countries will once again become the first victims of the economic excesses linked to a frantic search for profit in the short term. These apocalyptic perspectives reinforce the idea of a coherent and equitable international cooperation.

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