Green Transition - Climate risks and their unpredictability for the financial system

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Abstract

A crise do Covid-19 colocou em cheqye a narrativa mínima do Estado como um caminho para as economias de mercado alcançaro desenvolvimento sustentável. A quádrupla crise se soma aos dilemas que o sistema neoliberal expõe, especialmente no que diz respeito ao aprofundamento das desigualdades sociais e econômicas e à rápida destruição ambiental e ao processo drástico de mudanças climáticas. Essa pode ser uma oportunidade de mudar o foco das políticas públicas para uma transição verde, visando uma mudança estrutural que centre o Estado como planejador de longo prazo focando na transformação estrutural sustentável. Nesse sentido, estamos obrigados a discutir o escopo das políticas macroeconômicas - mas a compreendendo que a economia política desempenhará um papel essencial na transição verde. É preciso repensar o papel do Estado, bem como as políticas econômicas e kits de ferramentas disponíveis ao Estado. A solução inclue a criação de instrumentos que apoiem as transformações necessárias. As instituições financeiras públicas, particularmente os bancos de desenvolvimento, são instrumentos essenciais de políticas públicas para garantir a transição verde e a inovação necessárias para desenvolver e promover o desenvolvimento sustentável. Nesse sentido, a construção de uma nova convenção para promover o desenvolvimento sustentável baseado na inovação tecnológica e na cooperação é essencial. O papel do planejamento de longo prazo assume importância central nesse conceito.

Covid-19's crisis has called in the minimum State narrative as a path for market economies to nurture sustainable development. The quadruple crisis adds to the dilemmas the neoliberal system exposes, especially concerning the deepening of social and economic inequalities and the rapid environmental destruction and drastic climate change process. It can be an opportunity to shift public policy focus to a green transition, aiming at a structural change that implies the State should combine long-term planning with the need for sustainable structural transformation. In this sense, we are bound to discuss the scope of macroeconomic policies - yet understanding the political economy will play an essential role in the green transition. It is necessary to rethink the State's role, as well as the economic policies and toolkits available to the State. The solution evolves the creation of instruments that support the green and social transformations. State-owned financial institutions, particularly development banks, are essential public policy instruments to ensure the green transition and innovation necessary to develop and promote sustainable economic and social structural change. In this sense, the construction of a new convention

to promote sustainable development based on technological innovation and cooperation is essential. The role of long-term planning assumes central importance in this concept.

1. Introduction

Covid-19's crisis has called in the minimum State narrative as a path for market economies to nurture sustainable development. The quadruple crisis – environmental, sanitary, economic, and political – adds to the dilemmas the neoliberal system exposes, especially concerning the deepening of social and economic inequalities and the rapid process of environmental destruction and drastic climate change. The pandemic's economic crisis, coupled with the environmental and sanitary disaster, showed the inherent instability of the current financialized neoliberal system (Chomsky and Pollin 2020).

The 2008-09 global financial crisis, the economic stagnation afterward in the frameworks of neoliberal reforms, and the present crisis of the Covid-19 pandemic point equally to a prospect, if not a necessity, for the rescue of effective development strategies led by State and its institutions. In this sense, we will argue in this paper that development banks are essential public policy toolkits to ensure the financing of the green transition and innovation necessary for developing and promoting sustainable structural change in the economy. Such institutions must be inserted in a State planning project focused on promoting structural changes, social and regional inequalities' reduction, and sustainable development.

We are bound to discuss the scope of macroeconomic policies – fiscal, monetary, external - yet understanding the political economy will play an essential role in the green transition. To this end, it is necessary to rethink the State's role, as well as the economic policies and toolkits available to the State. The relevance of monetary policy and central banks' power, aimed at inflationary control and financial stability as a central goal, do not adequately assess the environmental and social risks involved in boost changes in the current economic format - structural, regional, sectoral, and social inequalities and concerning the environment and sustainability of the production mode. In this context, the solution evolves the creation of instruments that support the green and social transformations. Therefore, it is necessary to return to the political economy scope, power relations, and social reform. (Crocco and Feil 2020)

Our assumption is that as long as there is no coordination between macroeconomic policies resulting from shifts in political relations of power, with the State and its institutions focused on economic development – a convention for sustainable

development[1] – we will remain jumping from crisis to crisis. This means that we will be exacerbating the social, economic, and environmental fissures inherent in the process of financialized capitalism today. In this sense, we propose that the State needs to return to act as a long-term planner, promote sustainable development, stimulate innovative enterprises, and enable structural change and the green transition. Moreover, this policy is only possible in an environment of global cooperation and shift in the financialized neoliberal order.

Nevertheless, the deconstruction of the neoliberal narrative requires criticism, theoretical elaboration and policy propositions that society will accept as real alternatives to the circumstances caused by the crisis. In this formulation, one of our premises is when there is a rupture of the conventions due to severe crisis, the State should operate through its institutions to rebuild confidence, guiding the agent's decision-making process in an uncertain environment. Covid-19 inflicted the necessity of new public policy instruments once the current ones reproduce the same economic system that caused the complications – underdevelopment, deforestation, environmental impact, poverty, and inequality, to name but the most evident ones. (Stiglitz 2019)

In order to address those issues, this article is divided in tree sections besides this introduction and a conclusion. Section two discuss the necessity of State as a main actor in the process of green transitions, recovering its functions as developmental State. The focus is on peripheral countries. Section three states the risks of the green transition for the financial sector. The next section proposes ways to finance the green transition.

2. The State as an actor of the green transition in peripheral economies

The quadruple crisis intensified by the Covid-19 should be seen as an opportunity to shift public policy focus, from what Reinert (2008) calls a palliative economy that targets economic misery's pains relieve, to the development economy, that aims at changing productive structures. Structural change in the new scenario of the green transition implies the State should combine long-term planning with the need for sustainable structural transformation. This is so because the growth pattern of economic activities influences the level of the overall development.

Long-term planning requires synergy and coordination among policymakers and State's policies, especially if we consider reducing carbon emissions once it requires a shift in production and consumption behavior. The Paris Agreement aims to increase the global

[1] This expression is based on the notion of "convention to growth", coined by Antonio Barros de Castro. The argument suggests that the government commitment to growth and industrialization in Brazil generated a state of expectations among economic agents that incentive investment. Consequently, development tends to be a self-fulfilling prophecy. (Castro 1993)

temperature below 2ºC above pre-industrial levels by 2050, zeroing CO_2 global net emissions, setting a bold plan that implies the need for a swift transformation in society. The green transition - the passage from a high-intensity carbon dioxo economy to a low-intensity one -, essential to achieve sustainable development is a synergistic phenomenon and requires a diversified industrial sector. According to Chenet et al. (2017), the green transition demands financing, tax benefits for selected activities, cheap credit, and subsidies. The challenges imposed by the Paris Agreement in 2015 combine a conversion to environment-friendly production processes and behaviors, creations of new technologies and infrastructure to replace the current ones (Chenet 2019). To limit global warming below +2ºC above pre-industrial levels as established, or +1.5ºC understood as ideal, a massive capital reallocation is necessary. That is to say, the capital flow must shift from high-carbon assets to low-carbon ones, marking a critical green transition in the economy.

In this context, it is up to the State to signal growth resumption, generating positive expectations in order to change the productive structure for future recovery, and even [re]launching the historical process of developmental State, focusing on sustainable development green transition with social inclusion.

Economic opening and policy space in peripheral countries

The intensification of the financialization process in peripherical countries[2] since the 1980s subordinated macroeconomic policies to external factors. Therefore, they lean to procyclical behavior – intensifying, rather than alleviating, the adverse impact of the downturns on growth. Ocampo and Vos (2006) argue the macroeconomic policies are severely influenced by capital account pass-through volatility to the domestic business cycle and the institutional framework and restrictive rules guiding fiscal and monetary policies, negatively impacting the development process. Consequently, the State's capacity to increase investment levels is damaged because the macroeconomic policy is procyclical. In this environment, the role of the State coordinating the development process has become synonymous of inefficiency.

The current stage of financialization has been taking shape for some decades. The resumption of the liberal economic project, which has its embryo launched in the 1970s, with Lucas' criticism of "Keynesian" policies, presupposes that it is necessary to reduce the State's size substantially. In this sense, macroeconomic policy goals have changed, focusing on stability to the detriment of growth policies. The consequence for peripheral

[2] In the context of this article, peripheral economies are those where the systems of accumulation are driven by exogenous alterations in global capitalism instead of domestic directives. (Saad-Filho 2018). According to Fritz et al. (2017), frequently the term peripheral economy is used as a synonymous of emerging or developing economies.

economies was the abandonment of any remnant of State policy aiming at structural changes.

The "new" order tends to deepen domestic socio-economic and structural disparities and financial dependence on central countries. The subordination of industrial capital to financial capital drastically changes national states' power relations, integrating the different world economies and subjecting economic decisions to the financial sector's interests. The short-term macroeconomic balance is essential for maintaining the financialized order since it allows economic projections to be more accurate, contributing to increasing financial investor confidence. Economic policies will privilege productive interests over financial once' (Boyer 2000). Fiscal austerity, inflationary control policies, and the need for national economies' structural reforms through privatization, trade, and financial openness - financial deregulation and capital mobility - become priorities. In this sense, the contradictions of the capitalist system are widened. (Onaran 2016)

With the integration between countries due to globalization and high capital flows, financial cycles influence different economies regardless of their trade relations (Rey 2015). This process highlights the fragility of peripheral economies. Accentuating this relationship, the economic instruments available to minimize financial crises' effects become innocuous or inefficient. Nation's growing dependence limits their ability to implement economic policies and pursue structural changes (Kregel 2008).

To summarize, economic policies' subordination to financial interests changes the State's role, influencing national production and domestic product, reverberating its insertion in the world market. Similarly, it affects the social system of power through politics since the guarantee of price stability becomes the State's primary objective. (Palley 2008)

The financial opening and the unrestricted mobility of capital decrease national autonomy concerning adopting policies and priorities focused on developmental strategies. The objective of growth and increase in industrial production is replaced by to goal to sustain economic stability through monetary policies and fiscal austerity. Financial subordination generates the fragility of national economies in the face of developed countries' economic policies. Hence, it is not a matter of a big State, but rather which State is operating and its purpose.

The role of the State in monetary economies and the green transition

Under the assumption that economic decisions are made in a non-ergodic world, expectations on future returns are the principal guide to decisions involving the long-term resources commitment. If, as in Keynes (1997), we assume that there is no systematic tendency towards full employment once there is no direct relationship between expenditure, income, and current production, there is no market coordination capable of linking future decisions to present investment determinations. The agents' behavior,

seeking to maximize their profits, can generate crises originated in the fall or lack of effective demand. That is, excess savings, in opposition to the mainstream belief, does not antecede investment but can precipitate a crisis in the face of the disappointment of expectations about the future profits. The fall in investments reduces income levels and decreases marginal capital efficiency, starting a vicious circle that will only be reversed through an external incentive. Thus, under Keynes' view, the State's economic policy should ensure an environment favorable to investments. The supply conditions, the state of confidence regarding the potential yields, and the liquidity preference determine the flow of new investments. It is the environment of long-term expectations that drive agents to invest.

Therefore, modifications in expectations will produce changes in investment decisions. The elements of long-term expectations rely on the level of confidence the agents have in the future outcome of the economy, reflected in the conventions, assuming that the current favorable business situation will continue indefinitely - unless there are concrete reasons to believe there will be a shift in the state of events.

From a social perspective, the most favorable investment policy will not necessarily be the most profitable one. An intelligence center would be necessary to coordinate investments more efficiently than private firms aiming at long-term profit. The social purpose of the well-oriented investment must counterbalance the forces surrounding private decisions guided by money returns. In this sense, conventions should be built to allow for the State's coordination of private decisions. A particular case is when there is a rupture in the conventions due to a severe economic crisis or paradigm shifts; State's intervention through its institutions is essential to rebuild trust in expectations that guide private agents' decision-making in an environment of exacerbated uncertainty. (Keynes 1997)

The claim for the State's superior coordination capacity of economic decisions can be explained considering how private agents, in a non-ergodic environment, make their expectations about the unforeseen future. According to Knight (1921), risks are linked to a measurable probability, while uncertainty is connected to an indeterminate and unquantifiable situation, non-ergodic. Uncertainty results in a scenario where it is not possible to make reliable estimates about the future. The green transition will require a complete reorganization of the economic and social structure. Therefore, profit-orientated private agents lack the means, complete knowledge, and the social requirement to undertake such a process without State coordination. Current premises, essential for the formulation of expectations and conventions, might no longer hold if climate change becomes a clear threat to business. Therefore, the logic of decision-making will no longer be established. It is a rupture in the processes, and as such, State intervention will be

required not only to redirect investment but also the reinforce a new convention, pro sustainable development based on the green transition – a sustainable green convention.

Carvalho (1999) explained that the active and continued State intervention in the economy had become an essential aspect of modern capitalism, notably after World War II. We can add that this intermediation remains vital despite the liberalization, the dismantling of economic planning institutions, companies' privatization, and social security systems' disassembling. To put Keynes's view in an environmental approach, it would be a permanent conflict between sustainable development and the pursuit of profit maximization. Productive and behavioral transformations required to limit global warming have profound implications for economic policies' instruments once it depends upon a rapid revolution of global economic structure that will not occur through market alone (Krogstrup and Oman 2019). The challenges faced in order to mitigate climate change pose unprecedented challenges for society, State, and the financial system in the sense that a green transition means moving towards a new production system based on lesser CO_2 emission. (Bolton et al. 2020)

In this sense, a set of tools must be activated in order to achieve the green transition. Krogstrup and Oman (2019) suggest that three categories of policy tools are required: fiscal, financial, and monetary. Due to the green transition's scope and nature, it can only be coordinated by the State and its institutions to socialize the investment. That is not to say the private sector and civil society are not prominent players; they must act alongside the State for a successful transition. Sound public institutions capable of facing such challenges are fundamental for the green transition's success. Therefore, public sector articulation with the private market's structures is necessary, making the intersection between public and private even more essential. (Evans, Rueschemeyer, and Skocpol 1985)

3. Climate change and green transition's financial risks: uncertainty involved in the risks of climate change

The role of the financial sector in the green transition

Drastic economic and political reforms will be fundamental to catalyze a transition to zero carbon emissions to ensure efficient passage and minimize social, economic, and financial impacts. The green transition requires new, greener sectors with less greenhouse gas emissions, meaning that most of the existing economic leading industries will be extinct or will have to be readapted. The changes go through planning, a collective project of transformation and coordination. In other words, the metamorphosis must be profound and structural once it requires a complete reordination of the capitalist mode of production.

In addition to long-term planning, a new financing structure must be modeled. Difficulties in building a new green sustainable convention policy driven by a developmental State rely on the fact that different sectors of economic activities have different maturation times to adapt to the goals established at Cop 21. Therefore, meeting the challenges posed by climate change will lead to the closure of the economy's traditional sectors simultaneously to create new ones.

The financial system plays a central role in the green transition, given its ability to drive investments to generate structural changes focused on innovation and environmental efficiency. However, despite its protagonism, the green transition presents an inherent risk to the financial system's stability, risks that have only recently been considered (Carney 2015). Provided the imminent changes required for the green transition, stranded assets risk[3] is becoming a more frequent, regular, and spread-out feature of the economic system, increasingly affecting the financial stability. According to research developed by the Interamerican Development Bank - IDB, recent events have shown they are becoming increasingly related to the environmental phenomenons, and this trend is set to rise in the next few years. (Campiglio et al. 2018)

As Carney (2018) says, success in transitioning to a cleaner economy within the established time frame can generate a paradox where success is a failure. That is, a swift move towards a low-carbon economy could materially undermine financial stability. A general reassessment of the outlook, as climate-related risks are reassessed, could destabilize markets, triggering a loss cycle and leading to a persistent tightening of financial conditions – which the author called the Minsky climate moment.

That is to say that despite the green transition's essentiality, the inherently unstable, procyclical, and short-term private financial system cannot conduct the transition process by itself. The financial system does not operate in society's best interest as it is profit-orientated and inherently unstable, limiting the investors' ability to promote sustainable development (Kregel 2017; Minsky 1992). According to its institutional structure, financial services can create gaps in the finance of specific segments, especially those demanding long-term credit, and build up barriers for the green transition. As put by Stiglitz (1994), even if the social return of a project has an appreciable impact, it may be funded in the face of deficient private returns that financial institutions naturally lend top priority.

[3] Stranded assets are defined as assets that have suffered from unanticipated or premature write-downs, devaluations, or conversion to liabilities (Campiglio et al., 2018:5)

Financial institutions operate pro-cyclically, expanding credit operations in boons cycles and retracting in boost cycles[4] (Minsky 2008). Financial institutions' liquidity preference is directly related to agents' expectations throughout the economic cycle. The expansion of credit in periods of growth and its contraction in times of crisis are intrinsic characteristics of banking activity, especially of the private sector that follows a profitability logic. The expansion of credit in phases of growth and its contraction in phases of crisis are inherent banking characteristics. Therefore, crises are an endogenous monetary economy phenomenon, justifying regulation, intervention, and State coordination - a new sustainable green convention. In a world where expectations are uncertain, financial institutions are subject to intrinsic failures limiting their ability to fund the structural changes required for the development process and, in this phase, the green transition. Failures in the credit market create gaps in financing certain segments, especially those that demand long-term credit and innovation and generate impediments to reducing regional, sectoral, and regional inequalities. Even if the social return of financing to the productive sector has an appreciable social impact, this may not occur if it is not justified by the private return financial institutions naturally prioritize (Stiglitz 1994).

In this sense, State-owned financial institutions, inserted in a broad context of developmental State, now directed at the green transition, are essential. State-owned financial institutions should assume national development resumption, acting as a public policy tool and carried out through development strategies.

Climate change financial risks

Climate change will affect economic dynamics and inflicts risks to the financial system once the transition will impact most economic sectors, especially those highly intensive in Co_2, influencing risk management. As the transition's uncertainty tends to spread into the financial sector, such risks cannot be treated conventionally. Financial regulators must actively guide market actors in a clear direction to a managed green transition - to ensure a scenario that minimizes the damages to the financial system and the economy in general. Central banks and policymakers must downplay such impacts, acting as regulators for the green transition (Chenet, Ryan-collins, and van Lerven 2019). "Societies thus face the challenging tasks of achieving a rapid structural shift to a low-carbon economy, while concurrently avoiding excessive economic losses and safeguarding the stability of the financial system" (Campiglio et al. 2018)

[4] Minsky (2008) separates the financing structures into three stages: Hedge, when the income streams of agents cover as much interest as the principal of financial loans; Speculative, when short-term income streams will cover interest only; and Ponzi, when short-term revenues are insufficient to cover interest, so that debt increases. Throughout the expansionary economic cycle, financial positions evolve from hedge to speculative and Ponzi positions.

A few central banks worldwide (European Central Bank, Federal Reserve, De Nederlandsche Bank, to name a few)[5] started to regulate the financial market towards a greener approach, incorporating into the prudential supervision some guidelines for financial institutions' measurement of the transition risks. However, Ryan-Collins (2019) argues that, despite the evidence of climate change, financial institutions have not yet incorporated the transition risk into their models, suggesting that Central Bank's role should become more proactive.

Climate impacts are long-term, while the financial institution's logic is limited by the short term and is profit-orientated. This is what Mark Corney coined as the "tragedy of the time horizon." There is a misassociation in the maturity of a green investment project and the period when the government (not the State[6]) or private investors demand their profits or externalities from the project (Generation Foundation 2017). The financial market has a short-term logic that does not capture investments with long-term horizons. Hence, green transition investments require guidance that the private financial market or capital market cannot handle. As long as the global warming impacts are not reflected in prices and indicators, there will be no incentives for financial institutions to incorporate the transition risk into their analyses or shift their assets towards a greener portfolio. "Knowing that the tangible risk will manifest at some point is not enough to trigger a reaction from financial markets, as long as the occurrence does not coincide with their own time horizon" (Chenet, 2019: 5).

The literature describes the problem with climate change as following. Due to the natural inertia of the climate response, global temperature will continue to rise for an extended period, even if greenhouse gas emissions cease completely. The major impacts of climate change will come long after, usually with a period higher than the time horizons of public managers and financial managers. As put by Chenet (2019), the typical turnover of investment portfolios is about one to two years; most of the portfolio manager's incentives are annual and financial analysis is limited to five years.

But the threat of climate change to the financial system is much bigger.The financial system generally addresses the climate issue from the perspective of the social and environmental risks the projects bring to society and the environment. This approach meets most global monetary authorities' regulatory requirements, linked to the financial

[5] A group of central banks and financial regulators form, in 2017, the Network for Geening the Financial System (NGFS) to share best practices and responses to meet the requirements to achieve the goals to the Paris agreement.

[6] The understanding that there are risks envolved in the green transition that will eventually damage some business and consumers makes it a difficult political choice, leading to government not to act at the speed and scale required. (Campiglio et al. 2018)

institutions' reputational risk. The analysis is limited to the project's risk to the environment without considering any impact the environment can cause on the project.

This second form of approach is rarely part of traditional risk analysis models: credit, liquidity, market, and operational. In other words, the climate analysis carried out in financial institutions considers the environmental impact of the projects being investigated. It does not consider the climate impacts on the economy as a whole, which can significantly transform the economic sectors. They do not consider the possibility of climate accidents that can destroy production – out-of-season cyclones, earthquakes, tsunamis, and similar events. Therefore, the dangers posed by global warming have the potential to cause considerable financial losses. (Bolton et al. 2020) Not analyzing the impact of the environment in the project, as Chenet, Ryan-collins, and van Lerven (2019) put it, is the very denial of climate change per se. Financial institutions' risk models consider the environment as a given and constant element, being only marginally affected by the effects of the project financed at that time alone

Climate risks are just beginning to materialize, and their consequences are unknown, as they are only projected (Campiglio et al. 2018; Carney 2015; Gros et al. 2016; TCFD 2017). In this sense, environmental risks still need to be integrated into financial and market supervision models. Financial institutions' microeconomic efficiency needs a new risk analysis model that incorporates the new reality, and this will depend on the resilience of the financial system itself to new changes. (Bolton et al. 2020:20–21)

Carney (2018) points out three main channels of risk through which climate risks affect the stability of the financial system:

i**. Physical risks** - emerged from weather conditions changes and their direct impacts on assets (e.g., global warming, heatwaves, droughts, rising sea levels, extreme weather events), causing property damage and significant trade effects in goods and services.

ii. **Liability risks** - derived from those who have suffered losses resulting from climate change and seek compensation from those they hold responsible for such changes.

iii. **Transition risks** - materialized from the socio-economic reaction to the rapid adjustment to the low-carbon economy resulting from policies to mitigate or adapt to the effects of climate change (e.g., the introduction of policies related to climate change, such as carbon taxes, new regulations or rules producing certain goods, technological development and deployment, changing consumer preferences, litigation).

The physical risks are related to the notion of green swans. In early 2020, a group of researchers from the Bank for International Settlements - BIS (Bolton et al. 2020) indicated that the environmental crisis and its consequent physical risk could lead to green swan-like events, referencing the black swan concept by Nassim Nicholas Taleb (2007). Black swans are determined by unexpected and rare events, the impacts of which are

broad or extreme and can be characterized only after the fact occurred. The existence of black swans requires alternative risk epistemologies based on the recognition of uncertainty. They can take various forms from terrorist attacks, disruptive technological changes, or even financial crises, such as the one in 2008. Although unexpected, statistical techniques can at least partially provide some form of protection against black swans. (Crocco and Feil 2020)

Green swans, in turn, resemble typical black swans but are related to the environment and climate change; their chances of occurrence are not reflected in past data, and the possibility of extreme values is expected. Green swan events are an example of Keynes-Knight uncertainty expectations discussed in earlier sections of this article. In such a sense, green swans cannot be adequately precified; they have to be estimated. Therefore, expectations are uncertain. Green swans refer to more severe phenomena than the global financial crisis of 2007/2008, as they may pose an existential threat to humanity itself. Its effects can chain reactions whose cascading consequences can generate fundamentally unpredictable environmental, geopolitical, social, and economic dynamics (Bolton et al. 2020).

The crisis caused by the Covid-19 pandemic is considered an example of a green swan since it is characterized by an unanticipated global impact event that was able to produce unprecedented paralysis in socio-economic activities on a global scale, as advocated by extreme weather events. Like a typical green swan, the pandemic has multiple and complex transmission channels that turn physical risks into a global financial crisis. As in climate risk, the current pandemic (and the possible nearby ones) is not correctly priced by the market in global production chains' final costs. At the global level, many actions led by the National States have been adopted to contain the Covid-19 crisis. The main objective is to expand sanitary actions to circumscribe the pandemic's spread and preserve economic agents' income/liquidity. The most used measures are credit lines or guarantees, deferral of taxes and income transfer for the most affected people, direct investments in the health system and research and technology, as well as macro-prudential measures.

In this context, the deep uncertainties involved and the necessary structural transformation of our global socio-economic and financial system are such that no single model or scenario can provide a complete view of the potential political, geographic, macroeconomic, sectoral, and social impacts caused by climate change. However, it can be affirmed that green swans have unknown consequences since they have multiple interrelated events, placing the need for coordination in many aspects: sanitary, economic (micro, macro, fiscal, monetary), environmental, but also in their political scale, necessarily global.

The transition risks also deserve to be highlighted. Given the current global warming stage, the actions necessary to increase the earth's temperature below 2ºC (ideally 1.5ºC)

needs a quick productive and consumption transformation. This transformation will generate winners and losers, the first being those industrial sectors that can provide low-carbon technological innovations and the second those CO_2 intensive industries/sectors. This implies significant impacts on both the risk and profitability of financial assets. In other words, the speed of the change required to zero carbon emissions may be too short for the amortization of investments already made in CO_2 intensive activities, with severe consequences for the financial architecture.

According to McGlade and Ekins (2015), to achieve the goal of 2ºC, the total CO_2 emission between 2011 and 2050 should reach 1,100 gigatonnes (Gt). The total greenhouse gas emissions in current fossil fuel reserves are estimated to be three times higher than this amount. The authors suggest that "a third of oil reserves, half of gas reserves and over 80 per cent of current coal reserves should remain unused form 2010 to 2050 in order to meet the targe of 2ºC." (McGlade & Ekins, 2015:187)

Table 1 presents the share of oil, gas, and coal that should remain unburnable according to different regions. The scenery considers using the Carbon Capture Storage (CCS is the process of capture waste carbon dioxide, transport it to a storage place, and drop it where it will not enter the atmosphere.) and not using it. Considering the use o CCS, 33% of the global oil reserves, 49% of the gas, and 82% of the coal must remain unburned. It shows how drastically regions will have to adapt in order to accomplish the requirement set by Cop 21. An IDB (Inter American Development Bank) estimates that 60 to 80% of public listed fossil fuel reserves must be "unburnable", the equivalent to US$ 28 trillion in revenues. (Caldecott et al. 2016)

Table 1 - Regional distribution of reserves unburnable before 2050 for de 2ºC scenarios with and without Carbon Capture Storage (CCS)[7]

	2ºC with CCS						**2ºC without CCS**					
	Oil		Gas		Coal		Oil		Gas		Coal	
	Billions of Barrels	%	Trillions of m³	%	Gt	%	Billions of Barrels	%	Trillions of m³	%	GT	%
Africa	23	21	4.4	33	28	85	28	26	4.4	34	30	90
Canada	39	74	0.3	24	5.0	75	40	75	0.3	24	5.4	82
China and India	9	25	2.9	63	180	66	9	25	2.5	53	207	77
Former Sovieti Union Countries	27	18	31	50	203	94	28	19	36	59	209	97
Central and South America	58	39	4.8	53	8	51	63	42	5.0	56	11	73
Europe	5	20	0.6	11	65	78	5.3	21	0.3	6	74	89

[7] Resources are taken to be the remaining ultimately recoverable resources - the quantity of oil, gas or cola remaining that is recoverable over all time with both current and future technology, irrespective of currente economic conditions. Reserves are a subset of resources that are defined to be recoverable under current economic condictions and have a specific probability of being produced. (McGlade & Ekins, 2015:188)

Middle East	263	38	46	61	3.4	99	264	38	47	61	3.4	99
OECD Pacific	2.1	37	2.2	56	83	93	2.7	46	2.0	51	85	95
Other Asian Countries	2	9	2.2	24	10	34	2.8	12	2.1	22	17	60
USA	2.8	6	0.3	4	235	92	4.6	9	0.5	6	245	95
Global	431	33	95	49	819	82	449	35	100	52	887	88
Fonte: McGlade, C. e Ekins, P. (2015)												

Fossil fuel companies are primarily accountable for global greenhouse gas emissions. These institutions' investment practices will shape the green transition's rate and nature as well as the speed and nature of the global financial system's parallel transition. "Under capitalism, finance is the lifeblood of the myriad large organizations, public and private sector alike, that shape our collective ecological futures through their actions in the crucial climate-related spheres of fuel extraction, power generation, industrial processing, and transportation." (Christophers, 2019: 755)

Both physical and transition risks can affect the financial system in several ways. Risk materializes in companies' and sectors' physical assets levels through their operations, market, or value chain, acting on income and expenses. Thus, having started at the company level, the risk can materialize at the financial market level through credit risk, liquidity, operational, and possibly systemic. Those financial institutions highly exposed to firms linked to old polluting technologies – oil, deforestation, minerals, are those that may bankrupt and are subject to large asset losses shortly. (Chenet et al. 2019)

4. How to finance the green transition: the role of State-owned financial institutions

The green transition process relies upon a change in the funding structure to redirect investments to cleaner projects and ensure the shift does not affect the financial system's stability due to its current leverage in sectors intensive in carbon dioxide emission. The strategy adopted so far has been to reinforce market failures' theory, believing that market mechanisms would redirect capital allocation. However, as the recent work by Christophers (2019) and KPMG (2017) show, a voluntary disclosure may not be sufficient to modify the financial systems' investment and financing pattern. In this way, a successful green transition requires a different approach from that suggested by the market failures. It would be up to an integrated State action to create markets through investment projects and structure for sustainable products, from clean energy to sustainable agriculture.

Implementing this movement requires new State actions instead of the current ones based on available economic toolkits or a policy based on austerity's assumptions[8]. This way, the State initially enters with public investments to reduce risks and leverage climate investments to attract private investors. A State's ability to plan requires a political bargaining chip, economic tools, and strong institutions. State-owned financial institutions (SFIs) play a central role in the process once they are essential in shaping the market, directing the investment process, and offering credit to those sectors and projects accountable for the transition. However, this obliges specific SFIs' vision to address such challenges. (Crocco and Feil 2020)

At this point, the State-owned financial institutions' role in general, and development banks, in particular, is very relevant. The private financial system structure strengthens the current market model, exacerbating the risks of the green transition. Fast and ambitious measures may be the most desirable from the point of view of climate mitigation, but not necessarily from the point of view of financial stability in a short-term horizon, as the destruction of sectors could dramatically affect financial liabilities. In this case, both physical and transitional risks are characterized by deep uncertainty and nonlinearity.

More than SFIs, we reinforce the need for development banks, which are not only responsible for providing long-term capital – this is just one of their functions. Development banks are essential to ensure productive transformation funding. In this sense, they must act intentionally, seeking to fulfill their mission, inserted in a developmental State that promotes the economy's structural change. (Mazzucato and MacFarlane 2019) The development bank's intentionality, its mission, is a concept of public policy in which it integrates and acquires an orientation of strategy of action, industrial policy, innovation policy, and financing policy. Moreover, as we propose here, development banks will act more efficiently if aligned with a national policy project to promote development.

There is a consensus in the economic literature that the credit mechanism is fundamental for the investment's achievement and, consequently, a determinant of growth and development (Seccareccia 2011). However, as seen, the idiosyncrasies of private financial systems – procyclical action, concentrating from regional and sectoral perspectives and focused on the pursuit of profit in the short term – limit credit's primary function for financing activities with high uncertainty as to expected returns over a long period (Stiglitz 1994). In these cases, State intervention in financial intermediation may

[8] Economic agenda in peripheral countries have been dominated by austerities issues, in compliance with international mains multilateral organizations – such as IMF – in order to adequate for international financial flows.

compensate for the limitation. In order for such intervention to have greater scope in the development process, SFIs must act as a public policy arm as a means available to the government to achieve its mission – which, in the case of a peripheral country, is in promoting productive catching up, encouraging sustainable development (Feil and Feijó 2019).

SFIs have accumulated experience in providing long-term reimbursement resources for high uncertainty activities such as infrastructure or innovation projects and other (presumed) high-risk ones. It is assumed that their repeated performance in financing growth, capital formation, and infrastructure formation allowed them to gather tacit or systematic knowledge about the structure and actors of the economy, thus constituting intelligence centers that can be adequately mobilized in the planning and execution of public policies. This experience is one of the credentials of SFIs to, as long as they are effectively integrated into a coordinated development strategy, act as a public policy arm, helping to operationalize projects and redesign the productive structure where they operate. In a word, in addition to mitigating the impact of financial crises or acting countercyclically, or even performing on market failures, SFIs should behave as agents of transformation of productive activity aiming at structural catching up. (Feijó, Horn, and Feil 2020)

Thus, the role of SFIs with the State is not limited to financing specific projects. SFIs in a green transition program should play an important role in coordinating public policies, reducing problems associated with information, that is to say, mitigating uncertainty in Keynes-Knight view, and fostering a state of trust that expands the supply of liquidity. This expansion of liquidity is oriented not only to encourage companies and production chains but also to allow structural transformations that reinforce the green transition and promote new productive arrangements that enhance the development and reduction of sectoral, social, and regional inequalities.

The SFIs in a developmental State: a proposal

The realization of the potential of the SFIs requires its articulation with other entities of the State to carry out a national development strategy and its concrete consequences. It is necessary to summarise this articulation, inserting public financial institutions in the center of the planning and execution of development policy. In a recent paper, Fernández-Arias, Hausmann, and Panizza (2019) argue that development banks may exercise their knowledge as a new intelligence agency. The development bank must exploit the complementarities between the market and State once they are in a unique position of moderate both agents.[9] To better equip its functions, the bank must have well-established

[9] The role of an intermediate institution is also defended by Reinert (2008) as state previously.

communication channels with the government to incorporate an intelligence role. At the limit, the institution president could receive a State minister's status at the federal level and secretary within the federative units' scope. So or more important is that the arrangement of development policy has the direct presence, without delegation, of the head of the government himself – in the presidency of the economic development committee or in some other way that makes the themes of this policy occupy the center of the government. Such a structure could modify agents' perception regarding the State's economic activity, thus influencing the conventions that guide private decisions in the economic sphere. (Feijó et al. 2020)

As we propose, the change in private agents' perception in the face of a new institutionalization for development deserves constant attention from governments because nothing implies a priori that this reaction is necessarily positive. In particular, the years of dissemination of neoliberal doctrine have reinforced these agents' propensity to resist a conscious development strategy coordinated by the State. When the State plays a vital role in the national development strategy, its institutions do not constitute the mere transmission of central government policies, but they actively contribute to the formulation of the strategy itself by creating developmental, sustainable programs. The main idea is economic and political coordination.

Skocpol (1985) argues that the intersection of actions between the State and the market is precisely where the development process becomes successful. SFIs act as representatives of the State in the market, representing the State with the private sector. Therefore, development banks are the ideal institutions to link those actors. The repeated performance of SFIs in financing economic growth and infrastructure, among others, allowed them to gather tacit or systematic knowledge about the structure and actors of the economy, constituting intelligence centers that can be adequately mobilized in the planning and execution of public policies, as long as they are effectively integrated into a development strategy.

In this sense, the process of assets' losses due to the leveraged sectors intensive in carbon dioxide emissions will require a "**Green Industrial Policy and Innovation for Productive Conversion**." An industrial policy coordinated by the State and providing instruments to promote the green transition process through incentive measures and requirements that allow the sectors intensive in CO_2 emission to carry out a change of action. It is worth noting here the issue of so-called stranded assets, prior mentioned. As the risks related to these assets are not yet priced in companies' value, a rapid and successful climate transition may generate a loss of substantive value for these companies with a significant impact not only on the entire production chain but also on all financial architecture that sustains it.

The Green Industrial Policy and Innovation for Productive Conversion must ensure workers' subsistence guaranteed by a welfare State. Workers from brown industries may be reinserted into a new expanding labor market. However, this intermediary process must ensure their well-being so that this group no longer represents a hindrance to the transition (Chomsky and Pollin 2020).

Another central issue is the **financial institutions' mismarriage between assets and liabilities**. SFIs cannot have a fundraising logic with the same temporal rationality as the financial market. Financial institutions' financial model is not neutral. In this sense, the implications of what kind of funding the SFIs will have - public resources or the capital market - are essential. When resorting to issuing securities in the capital market, banks will need to comply with a series of governance, management, operations, and financial rules that adapt to the private market's needs and logic. Thus, the institutions will follow the capital market rules and, therefore, short run, maximizing the profit orientations. SFIs financing logic will apply to fund projects that should be guided by a State mission. When choosing to finance themselves with capital market securities, there is a contradiction with SFIs' activities, especially development banks that have investments with a longer maturity horizon. This funding strategy does not fit in an SFI in a developmental State committed to the green transition.

Humphrey (2016) argues that multilateral development banks such as the World Bank, Inter-American Development Bank, and the Andean Development Corporation's initial mandates were directed to promote development and industrialization in countries' members. However, as those institutions are controlled by more than one country, they rapidly raised funds from the private capital market. In doing so, the multilateral development banks' practices shift away from the developmental mission to obey the capital market rules. Those three institutions' evidence demonstrates that financial pressures pushed them to operational practices in disarray with their developmental mandate, approaching bankable projects. The need to raise funds in the private capital market shape their operations and financial policies.

Additionally, when issuing securities on the capital market, any institution needs to acquire a risk rating from rating agencies, indicating the market's degree of risk. Thus, State-owned financial institutions need to adjust their performance and financial structure to these agencies' methodology. Dealing with climate change investments and reducing economic and social structural heterogeneities requires a foundation that the capital market cannot handle.

In this context, not only financing the transition process can only be carried out by State-owned financial institutions, with emphasis on development banks, but the sources of funds to act must be guaranteed without interference from private logic, which, as mentioned, tends to deepen the contradictions of the financialized capitalist system.

However, there is no doubt that, taking into account the structural incapacities of the private financial system to face the challenges posed by the present day, it is precisely up to the SFIs in general, and the development banks in particular, to take advantage of this process, directing credit – and consequently the sector and the productive orientation itself. Not only that - coordinated action by the State and its institutions is essential. With public policies that exceed the government's temporal horizon, the developmental State is essential in this new reality that is imposed.

The role of the Central Bank: a proposal

The reformulation of the role of central banks will play an essential part in this new State mission. Ultimately, Central Banks may have to act as climate rescuers of last resort, as indicated by Bolton et al. (2020) "The Green Swan". The authors argue that events caused by "green swans" affect the financial system's health may require the central banks to buy assets.

We claim that Central Banks should play an even more central role in the process. The monetary authority should develop a policy such as a "**Green Quantitative Transition**". That is, to ensure that this transition does not affect the financial system, the Central Banks would play a key role by aiding the financial system through the purchase of depreciated assets due to the rapid climate transition, with the condition that this rescue package is directed to the financing of environmental sustainability projects or green industries. (Crocco and Feil 2020)

The Green Quantitative Transition would be a policy inspired by Quantitative Easing, initially implemented by the Bank of Japan at the beginning of the century, and disseminated by the Federal Reserve, the U.S. central bank, and later the European Central Bank, to deal with the financial crisis that began in the 2007/2008 biennium and the subsequent euro crisis in the following years. That is the injection of liquidity into the economy by purchasing assets from financial institutions and government bonds' issuance. Green quantitative easing would be implemented with the same principles but directed to the climate transition process. In this way, the central bank would issue securities to capitalize on the public bank to ensure that the institutions could finance the projects necessary for the transition without bumping into the obstacles resulting from the private credit market, discussed in this article.

At the same time, it would be up to the central bank to create a company – along the lines of the Brazilian Emgea Asset Management Company – a non-financial company linked to the Brazilian Ministry of Finance created by the National Treasury under the Federal Financial Institutions Strengthening Program (Proef) in the late 1990s to transfer government bonds to federal banks in exchange for their problematic (or rotten) assets (Horn and Feil 2019). Such a company would manage the exchange of financial assets linked to old technology – or brown – for green technology assets. This process would

allow Central Banks to rescue financial institutions in trouble during the transition and, simultaneously, imposing conditionalities for their operations in a movement to [re]regulate the financial market. That is, Central Banks would have the potential to rescue financial institutions from the stranded assets problems, direct their operations towards green projects (by imposing conditionalities to the asset swaps), have instruments to coordinate the financial market, and even nationalize the private financial institutions, if and when necessary.

Finally, through quantitative easing for the green transition, the federal government could finance the Green Industrial Policy and Innovation for Productive Conversion through an expansionary fiscal policy, conditioned by technological change. Nonetheless, the intentionality to promote a successful green transition that involves inequalities' reductions and catching up of peripheral economies - requires the alignment of macroeconomic policies for this purpose. State planning, its institutions, and the strategies employed – fiscal, monetary, foreign exchange, and industrial, altogether with credit policy – must ensure the green transition sustainability. The financial system's stability and efficiency and the productive sector's productivity and maintenance focused on new technology would be guaranteed, ensuring economic and social development in peripheral countries such as Brazil. (Feil and Feijó n.d.)

Putting together SFI and Central Bank in a new convention of Developmental State: a proposal

The Green Quantitative Easing is a vital instrument for funding State-owned financial institutions. By taking the mission of financing the green transition, SFIs will face the double challenge of capitalization and availability of resources. Special government bonds could capitalize SFIs – manly of "Development Bonds" – with the Central Bank warranty and directed to the long-term financing of development projects through SFIs (Feijó et al. 2020). SFIs, especially development banks, would issue bonds for the Central Bank to buy, conditioned to finance the "**Green Industrial Policy and Innovation for Productive Conversion**."

Such an instrument would not affect public debt. The development bank issues bonds to the central bank, ensuring the necessary funding to finance the process without burdening its fiscal policy. Funding instruments need to evolve accordingly to societies' needs. State-owned financial institutions can only perform their missions inserted in a developmental State context. The importance of financing, whose objective is focused on the State's missions, which has as its north productive innovation based on energy efficiency and green technology, connected with the need to reduce social inequalities achieved through the economy's structural change, is essential.

The absence of State policy and coordination among its tools can inhibit the effective mobilization of climate change and the green transition. The policies need to be imposed

to be effective. The State should ensure the environmental integrity and fairness impacts of climate policies. Technological change is inherently dynamic and often disruptive to markets. Climate finance policies must anticipate the green transitions' changes and be able to respond to them. "Climate finance policies should be nested in a comprehensive set of regulatory, fiscal, industrial, market-based, and other climate change policies that disincentivize investment in polluting technologies and incentivize investment in low or zero-carbon technologies". (Bhandary, Gallagher, and Zhang 2021:13)

5. Conclusion

The crisis caused by social isolation measures necessary to contain the pandemic advance highlighted the financialized neoliberalism's inefficiencies, starting with the urgent need for change in economic and political paradigms. The environmental, sanitary, economic, political, and social crisis moves towards rapid destruction of society. In this sense, State-owned financial institutions, particularly development banks, are essential public policy instruments to ensure the financing of the green transition and innovation necessary to develop and promote sustainable economic and social structural change. Such institutions must be inserted in a State project focused on the green transition, promoting inequalities and sustainable development.

However, such changes are the result of political power. In this sense, even if we are tied to the trap of discussing the scope of macroeconomic policies – fiscal, monetary, exchange rate, industrial, etc., we understand that the political economy will play an essential role in the green transition. In this context, changes in macroeconomic policies only continue to reproduce the same economic structure, deepening the problems already existing, not addressing the need for structural change or sustainability. Not even the most heterodox currents of economists present a macroeconomic theory that significantly transforms society as necessary – concerning structural, regional, sectoral, and social inequalities and the environment and sustainability mode of production. It is, therefore, necessary to return to political economy, power relations, and social reform.

As long as there is no coordination between macroeconomic policies resulting from changes in political relations of power, with the State and its institutions focused on economic development, altering the social conventions, we will continue from crisis to crisis, exacerbating the social, economic, and environmental fissures inherent in the process of financialized neoliberalism. The State needs to return to work as a long-term planner, promoting sustainable development, stimulate innovative enterprises, and enable structural change, ensuring the green transition.

Restructuring, the current mode of production and consumption, is necessary to restrain global warming, and those changes must be rapid and drastic. A green transition – the passage from a high-intensity carbon dioxo economy to a low-intensity one – requires

changes in the market, society, and State ways of operating. Coordination and cooperation among countries and economic agents are essential. Furthermore, it is worth stressing that the green transition will only be possible alongside reductions in social, regional, and structural inequalities.

In short, the green transition process must change society's way of production and consumption - and this shift should be rapid. The State's action directing and encouraging this process is vital. Estimates indicate that the investments necessary to zero carbon dioxide emissions by 2050 are approximately 2.5% of GDP per year on average (public and private sector) will be needed. These investments should be directed towards energy efficiency and sustainable energy, complemented by a reforestation process (Chomsky and Pollin 2020). The policies suggested in this thesis (which are by no means exhaustive) can be coordinated in a long-term economic program.

In this sense, it is up to the State to plan and lead this process. In order to do so, its main institutions must operate efficiently, including the development bank, working as a development agency, and the central bank, working as a lender of the last resource for the green transition. State's tool kits would be directed to the mission of ensuring the green transition. The investment level in the green transition, the required funding, and the development bank's operation must work following the macroeconomics orientations. Coordination of domestic policies is essential for the green transition to be effective. It is not only an economic problem but rather and political-economic problem.

In this sense, the construction of a new convention to promote sustainable development based on technological innovation and cooperation is essential. The role of long-term planning assumes central importance in this concept.

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