MACROECONOMIC CHALLENGES FOR THE ENERGY TRANSITION

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**Overview**

The effects of human activity on the environment and climate define what has been called the Anthropocene. It is also important to mention that among the various economic activities, the energy sector appears as the largest emitter of CO². The International Energy Agency (IEA) highlights that the sector is responsible for approximately 75% of CO² emissions. Therefore, when talking about limiting or reducing CO² emissions, we are talking about a structural change in the arrangement of primary sources of energy supply, which reduces the share of fossil sources in favor of renewable sources, or, as is more common , in promoting an energy transition.

Nowadays, national competitiveness is closely linked to a country's ability to develop industries with high energy efficiency, low CO2 and waste emissions. To this end, financing new technologies is a sine qual non condition for the flourishing of this new economy.

Therefore, a national strategy for the energy transition must be thought of as an essential and inherent part of a national socioeconomic development policy, and encompass horizontal and vertical, macro and microeconomic policies. As necessary as the energy transition is, and it is, this is not a trivial process due to its diverse geopolitical, social, economic, technological and financial aspects. Therefore, in this article, the aspects associated with the underlying technological dispute will be addressed more broadly, as well as what is understood to be the most favorable macroeconomic arrangement for promoting the energy transition.

**Methods**

The level of investment required to achieve Net Zero Emissions (NZE) demonstrates the importance of coordinating efforts to channel sufficient resources for the proposed challenge. According to IEA, the urgent challenge is to increase the pace of new clean energy projects, especially in many emerging and developing economies outside China, where investment in energy transitions needs to increase by more than five times by 2030 to reach the levels required in the NZE Scenario (WEO, 2023, pg. 19).

The IEA highlights that the total increase in investment is an 80% increase over 2022 levels by 2030 in the NZE Scenario, given the need for more initial capital for clean energy investment. Clean energy represents 4.2 trillion dollars of the 4.7 trillion invested in 2030 in the NZE scenario. For the IEA, advanced economies will more than double their investment in clean energy by 2030 in the NZE scenario, while investment in China almost doubles its current level. The increase in other emerging and developing economies is much greater, with investment in clean energy increasing in the NZE scenario in 2030 to five times the current level. The magnitude of the necessary increase partly reflects the difficulties that the countries in question have encountered so far in increasing investment in clean energy. Scaling clean energy investment in these economies is a key challenge for orderly and just transitions and requires action in three interrelated areas. (WEO, 2023, pg. 197).

The logic of private financing of low-carbon projects depends on factors such as the expected return of entrepreneurs in relation to the cost of capital, expected demand and prices and pricing of externalities.

A possible solution to this misalignment of incentives is the State's action through public financing, to enter first or in conjunction with private investment, - coordinating or encouraging investments through development agencies - in order to develop incipient markets or non-existent, guaranteeing minimum demand, internalizing externalities, in order to enable future investments and evaluation and governance mechanisms for green projects. The role of the State as an allocator of the public budget must be considered, through the instruments available to the State: loans, subsidies, tax credits, shareholdings, local content, preference margins, technological orders, government purchases and public investment (NIB, 2024, p. 9). Achieving increased investment in clean energy in the NZE Scenario by 2050 requires a major reallocation of capital across the energy sector and a reconfiguration of the global financial infrastructure to accommodate this change. (WEO, 2023, pg. 200).

# In this area, the so-called macroeconomic prices - interest, exchange rate, wages, inflation and profit - constitute true key variables, which involve and shape the space of microeconomic decisions. Development and competitiveness policies that - aim at a green transformation - must understand that economic development is a complex process that involves technical progress, movements of induced and autonomous expansion of effective demand and transformation of institutions. Thus, the macroeconomic *locus* defines the minimum conditions for the flourishing of the so-called animal spirit and the emergence of Shumpterian creative destruction.

# Firstly, the interest rate is of fundamental importance in determining the capital costs of the private sector and consequently in the discount rate that will be used to decide whether new greenfield projects will be approved. It determines the capital costs of the private sector. High interest rates penalize firms, high costs, weak demand and financial restrictions (rate of return) on growth. Second, the so-called equilibrium exchange rate plays a fundamental role in the emergence of new industries, either by defining prices (import parity or export parity) or by allowing the import of machinery for new units. The exchange rate also affects microeconomic decisions, especially for investors who compare internal and external returns. A competitive exchange rate must ensure access to this demand. Third, the inflation rate must be low enough to preserve consumers' purchasing power and plan investment decisions with a long payback period. Predictable and (preferably low and stable) inflation is essential to ensure long-term planning by macroeconomic agents and consequently encourage investment decisions. Fourth, the wage rate must be compatible with labor productivity (the variation can be greater only when capital productivity is increasing). They must be compatible both with the industry's productivity and to guarantee effective demand from those who will consume the products. And fifth, finally, all these prices, once situated at the appropriate level, end up guaranteeing a margin and, consequently, an average profit rate (in aggregate terms) sufficient to stimulate the amount of investment necessary for the growth process, and which varies according to the stage of the development process of each society. Maintaining these five prices at their correct levels and the resulting investment will lead, with the help of an industrial policy aimed at technological improvement, to the productive sophistication of the economy (Bresser-Pereira; Oreiro; Marconi, 2015).

Studies point to the need for active coordination of macroeconomic policies with microeconomic policies, in order to promote the volume of investments towards green technologies and technologies favorable to employment. It is clear that investments in energy transition, critical minerals, bioeconomy and circular economy require very high volumes of financial investments and research, development and innovation (RD&I) of products, markets and business models. The presence of coordination failures between these policies can delay or even nullify green development objectives.

**Conclusions**

The assumption always confirmed by data and research is that investment is the main cause of economic development: the higher the investment rate, the higher the growth rate. Thus, for economic development to occur, a reasonable difference is necessary between the profit rate expected by entrepreneurs and the market interest rate. The development of disruptive technologies, whether to create new technological routes or to reduce the costs of existing routes, requires balancing macroeconomic prices in order not to kill entrepreneurship in its infancy.

There is no doubt that in the years to come, commercial protectionism will be increasingly inseparable from environmental protectionism. The developed world, especially the European Union, tends to put strong pressure on China - as well as developing countries like Brazil - by imposing carbon taxes and import tariffs. In this new trade war, Brazil cannot do without a national decarbonization plan that considers competitiveness and the insertion of Brazilian industry in global value chains. There is a lot to be done, but to achieve this it is necessary that measures be taken today in order to guarantee a future for Brazilian industry.

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