

Brazilian reprimarization as a process of emission specialization in the 2010s

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This article examines how changes in Brazil's export pattern during the 2010s altered not only what the country sells abroad, but also the amount of greenhouse gas (GHG) emissions associated with those exports. The starting point is the observation that, in a context of weak domestic growth, exports gained relative importance as a source of dynamism, while the export basket became increasingly concentrated in primary commodities and more heavily oriented toward China. We argue that this process has a distinct environmental dimension: reprimarization can be interpreted as a form of emission specialization, meaning a structural reorientation of the external sector toward goods and markets with higher emission content per unit of exported value.

To measure this dynamic, we estimate emissions embodied in Brazilian exports between 2010 and 2021 using an extended input-output framework that combines (i) sectoral emission coefficients (including energy- and process-related emissions, and incorporating land-use change through a transition matrix), (ii) domestic production linkages captured by the Leontief inverse, and (iii) export vectors disaggregated by destination. We then apply a Structural Decomposition Analysis (SDA) to disentangle the change in export-related emissions into five mechanisms: (1) emission intensity (emissions per unit of output), (2) technology (domestic technical coefficients), (3) export scale (level effect), (4) sectoral composition (product mix), and (5) geographical composition (trade destinations). The analysis is conducted at constant relative prices, which is crucial in a period marked by significant fluctuations in the prices of oil, iron ore, and agricultural commodities. Controlling for sector-specific price changes prevents nominal valuation effects from being mistaken for structural shifts in the carbon content of exports.

The results reveal a substantial increase in the carbon content of Brazil's external sector. Between 2010 and 2021, emissions embodied in exports rose by 65.3%, increasing from 364.6 to 602.8 MtCO₂e (an absolute rise of 238.2 MtCO₂e), corresponding to a geometric average annual growth rate of 4.68%. Structural decomposition indicates that this growth cannot be explained solely by exporting more; it also reflects exporting in a more emission-intensive way. While the scale effect is the main driver over the full period, reprimarization-related effects—namely changes in the product mix and the redistribution of trade destinations—account for a substantial share of the increase, signaling a rise in the average emission intensity of exported goods.

The geographical dimension of trade plays a decisive role. China emerges as the main contributor to emission growth, reflecting both its increasing share in Brazil's exports and the concentration of bilateral trade in agriculture, livestock, and resource-intensive activities. In contrast, the European Union and Argentina exhibit negative or marginal contributions, consistent with declining relative shares and a comparatively less emission-intensive export profile. The Rest of the World remains important in absolute terms, but its net effect is one of relative containment when compared to the rapid expansion of exports to China.

From a sectoral perspective, the rise in embodied emissions is heavily concentrated in livestock and agriculture, which display markedly higher emission intensities than manufacturing sectors. Industrial activities show a limited aggregate contribution, although they remain relevant in specific hard-to-abate segments such as basic industrial commodities. Subperiod analysis reveals a qualitative shift in the mechanism of emission growth. Between 2010 and 2014, the increase was predominantly compositional, driven by changes in the export basket toward more

emission-intensive goods. Between 2015 and 2021, however, growth was mainly associated with export scale and rising emission intensity, indicating consolidation of the reprimarized pattern and greater environmental pressure per unit of output.

We conclude that Brazil's reprimarization during the 2010s should also be understood as a process of environmentally regressive specialization, with important implications for the compatibility between export-led growth strategies and climate mitigation goals. The findings underscore the need for policies that combine productive diversification—reducing dependence on highly emission-intensive primary sectors—with effective deforestation control, particularly in activities linked to livestock expansion, as a short-term measure to curb the carbon content of the country's exports.