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Estrutura econômica, especialização exportadora e emissões de gases de efeito estufa na América Latina

Economic structure, export specialization and greenhouse gas emissions in Latin America

Estructura económica, especialización exportadora y emisiones de gases de efecto invernadero en América Latina

Blanca B. Del-Toro-Rodriguez[1]
Camila Jimenez-Jaime[2]
Melanny Hernandez-Garcia[3]
Paola M. Obregon-de-la-Garza[4]
Carlos A. Carrasco[5]

[1] BA in Economics, Universidad de Monterrey (UDEM, Mexico). ORCID: https://orcid.org/0009-0004-3810-6334. email: blanca.deltoro@udem.edu.
[2] BA in Economics, Universidad de Monterrey (UDEM, Mexico). ORCID: https://orcid.org/0009-0007-9519-1653. email: camila.jimenez@udem.edu.
[3] BA in Economics, Universidad de Monterrey (UDEM, Mexico). ORCID: https://orcid.org/0009-0000-1029-504X. email: melanny.hernandez@udem.edu
[4] BA in Economics, Universidad de Monterrey (UDEM, Mexico). ORCID: https://orcid.org/0009-0006-6380-3590. email: paola.obregon@udem.edu
[5] Associate Profesor of Macroeconomics at Universidad de Monterrey (Mexico), member the National System of Researchers Level II and Associate Researcher of the Structuralist Development Macroeconomics Research Group. ORCID: https://orcid.org/0000-0002-5439-4960. email: carlos.carrasco@udem.edu.

Resumo: As sociedades industriais aumentaram substancialmente as emissões de gases de efeito estufa, elevando as temperaturas médias em relação à fase pré-industrial, modificando o equilíbrio socioambiental e tornando cada vez mais frequente a presença de eventos climáticos extremos. Diante desse cenário, diversos atores lançaram uma estratégia de desenvolvimento que concentra parte da agenda na redução dos efeitos ambientais da atividade humana. Para atingir esse objetivo, é essencial identificar a relação entre a estrutura econômica e a emissão de poluentes, de forma a permitir a formulação de estratégias de política industrial que acelerem a transição para uma economia mais verde. Neste trabalho, focamo-nos na América Latina, uma região altamente vulnerável às mudanças climáticas devido à sua localização geográfica e dependência de atividades do setor primário e do turismo. Nossa análise destaca a importância crítica de identificar fatores que colocam em risco a sustentabilidade socioambiental.

Palavras-chave: Estrutura econômica; especialização exportadora; gases de efeito estufa; sustentabilidade socioambiental.

Abstract: Industrial societies have significantly increased greenhouse gas emissions, resulting in higher average temperatures compared to pre-industrial levels. This has disrupted the socio-environmental balance and led to more frequent extreme climatic events. In response, several organizations have developed strategies that prioritize reducing the environmental impact of human activities. Achieving this goal requires a thorough understanding of the relationship between economic structures and pollutant emissions to elaborate industrial policies that promote a transition to a greener economy. This study focuses on Latin America, a region highly vulnerable to climate change due to its geographical characteristics and reliance on primary sector activities and tourism. Our analysis underscores the necessity of identifying factors that jeopardize socio-environmental sustainability.

Keywords: Economic structure; export specialization; greenhouse gases; socio-environmental sustainability.

Resumen: Las sociedades industriales han incrementado de forma sustancial las emisiones de gases de efecto invernadero, elevando las temperaturas medias respecto a la etapa preindustrial, modificando el equilibrio socioambiental y haciendo cada vez más frecuente la presencia de eventos climáticos extremos. Ante este escenario, diversos actores han puesto en marcha una estrategia de desarrollo que centra parte de la agenda en aminorar los efectos ambientales de la actividad humana. Para lograr lo anterior, es fundamental identificar la relación entre la estructura económica y la emisión de contaminantes tal que permita formular estrategias de política industrial que aceleren la transición hacia una economía más verde. En este trabajo nos enfocamos en América Latina, región altamente vulnerable al cambio climático debido a su situación geográfica y a la dependencia de actividades del sector primario y el turismo. Nuestro análisis subraya la importancia crítica de identificar los factores que ponen en riesgo la sostenibilidad socioambiental.

Palabras clave: Estructura económica; especialización exportadora; gases de efecto invernadero; sostenibilidad socioambiental..

1. Economic development and environmental degradation

In recent years, increasing concerns have arisen regarding human activities' impact on the environment and the overall trajectory of planetary development (Cook et al., 2016; Ripple et al., 2019). This intensified awareness has prompted deeper analyses of the environmental, societal, and economic ramifications.

Human actions have significantly altered the environment, surpassing ecological thresholds and jeopardizing the socio-environmental sustainability of the planet (United Nations Development Programme, 2020). The repercussions of prevailing production paradigms necessitate a reevaluation of the developmental strategies.

Latin America faces a particularly intricate situation. As a region, it comprises countries susceptible to climate change due to their geographic positioning and heavy reliance on economic sectors directly vulnerable to its impacts, such as agriculture, mining, and tourism. Consequently, the economic repercussions of climate change could be severe. Economic activities in the region have contributed to biodiversity loss and ecosystem degradation, diminishing the region's capacity to absorb carbon dioxide (Comisión Económica para América Latina y el Caribe, 2019).

Rethinking the economic development strategy entails viewing national economic growth as a means rather than an end, striving to decouple economic progress from environmental degradation through policies that facilitate mitigation and adaptation to climate change, thereby fostering a transition to sustainability. This reevaluation of the production model necessitates, among other things, the pursuit of environmentally efficient growth and consumption models, while addressing issues of structural inequality and vulnerability to climate change (United Nations Development Programme, 2020).

Among the numerous threats posed by human activities, air pollution stands out due to its detrimental effects on public health. Defined as the presence of various agents or particles that disrupt the natural atmospheric balance, air pollution poses significant risks to individuals exposed to these pollutants. According to the (World Health Assembly, 2018, p. 71), approximately 6.5 million deaths worldwide annually are attributed to air pollution. Recent data from the World Health Organization (2022) underscores the severity of the issue, revealing that in 2019, 99% of the global population resided in areas failing to meet air quality standards, with associated health problems including stroke, heart disease, lung cancer, and

respiratory ailments. Most premature deaths from air pollution occur in middle- and low-income countries.

While pollution stems from various sources, manufacturing firms notably impact a country's environmental landscape. Air pollution correlates with international trade, economic growth, urbanization, technology adoption, and industrial structure (Nasrollahi et al., 2020; Ouyang et al., 2019; Zhu et al., 2019). Structural transformation efforts should concentrate on fostering an economic framework that minimizes humanity's ecological footprint. Addressing environmental concerns mandates transitioning towards industries capable of producing, adapting, and embracing more eco-friendly technologies (Kim, 2021; Schneider, 2021; Smirnov & Willoughby, 2021).

These concerns motivated the United Nations' 2030 Agenda for Sustainable Development, which introduced 17 Sustainable Development Goals (SDGs). Noteworthy among these goals related to transforming the production model are SDG 7 on affordable and clean energy, SDG 8 on decent work and economic growth, SDG 9 on industry, innovation, and infrastructure, SDG 11 on sustainable cities and communities, and SDG 12 on responsible production and consumption.

Despite efforts in Latin America to advance the SDGs, progress in preserving ecosystems and the environment has been insufficient to foster a healthy environment and contribute effectively to the development goals. If the green transition cannot be accelerated by boosting technological improvements, achieving current goals could require experiencing markedly slow economic growth, which could entail negative consequences such as increased unemployment.

2. Export specialization, greenhouse gas emissions and structural change in Latin America

The impact of economic performance on the environment is intricately linked to the economic structure, with export industries assuming a pivotal role. The influence of the export structure on the environment is multifaceted, hinging upon various factors such as technological advancements associated with external sector development (Levinson, 2009; Sharma et al., 2021), trade diversification (Doğan et al., 2022; Iqbal et al., 2021), and the complexity of exporting industries (Boleti et al., 2021; Rafique et al., 2021).

Export industries, particularly those engaged in technology-intensive activities, exhibit

a greater propensity to develop and integrate environmentally friendly technologies (Iqbal et al., 2021; Sharma et al., 2021). Positioned at the technological forefront, these industries facilitate the adoption of more efficient green technologies, thereby mitigating pollution and enhancing environmental quality (Iqbal et al., 2021; Jiang et al., 2022; Levinson, 2009; Sharma et al., 2021). Notably, manufacturing industries demonstrate significant potential for the development and adoption of green technologies, contrasting with the secondary sector's status as a major polluter, underscoring the imperative for promoting green transition within this sector.

Within the structuralist development macroeconomics approach, Guarini & Da Costa Oreiro (2023) advocate addressing environmental challenges through ecological technological progress and ecological structural change, emphasizing the augmentation of green activities to enhance environmental efficiency. Thus, understanding the nexus between economic structure and polluting emissions is paramount for effectuating ecological structural change.

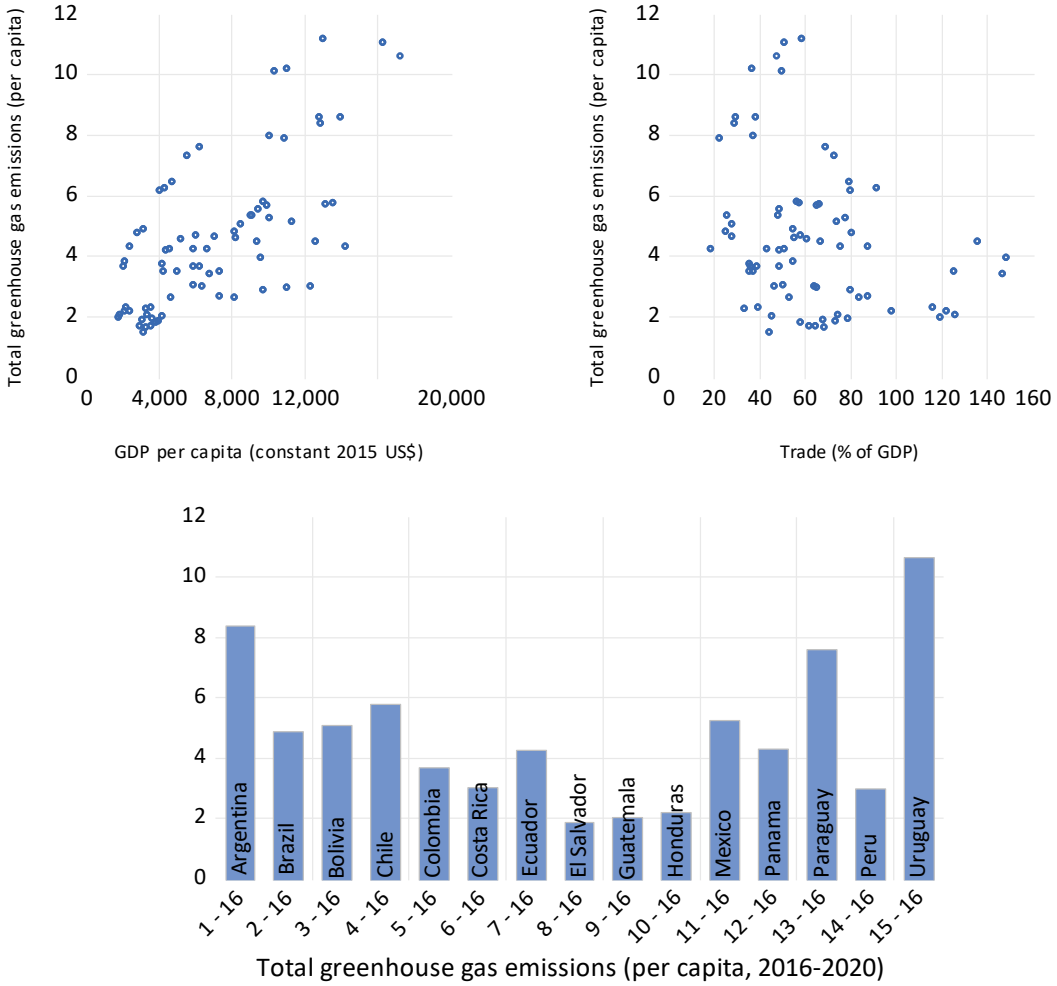
In Latin America, the liberalization of the 1980s has coincided with premature deindustrialization, reducing added value and employment in the industry, exacerbating the problems related to the presence of the Dutch disease in the region (Bresser-Pereira, 2019).

To elucidate the relationship between greenhouse gas emissions and economic variables, particularly the export structure, data from 15 Latin American countries spanning 1996-2020 are analyzed. Utilizing non-overlapping 5-year averages allows for the elimination of cyclical outliers, enabling focus on the medium-term trends. The countries included are Argentina, Brazil, Bolivia, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, and Uruguay.

As a central measure of environmental degradation, total greenhouse gas emissions (GHG) per capita, quantified as metric tons of CO2 equivalent, are employed. This variable is estimated from total greenhouse emissions in kilotons of CO2 equivalent and population data retrieved from the World Development Indicators.

Figure 1 illustrates the relationship between greenhouse gas emissions, GDP per capita, and trade openness. The first graph reveals a positive correlation between GDP per capita and GHG emissions. However, the second graph depicting trade openness fails to exhibit a discernible relationship. The third graph portrays the 2016-2020 average of total greenhouse gas emissions per capita by country, highlighting Uruguay, Argentina, Paraguay, Chile, and Mexico as the highest GHG emitters per inhabitant, while El Salvador, Guatemala, and Honduras record the lowest levels.

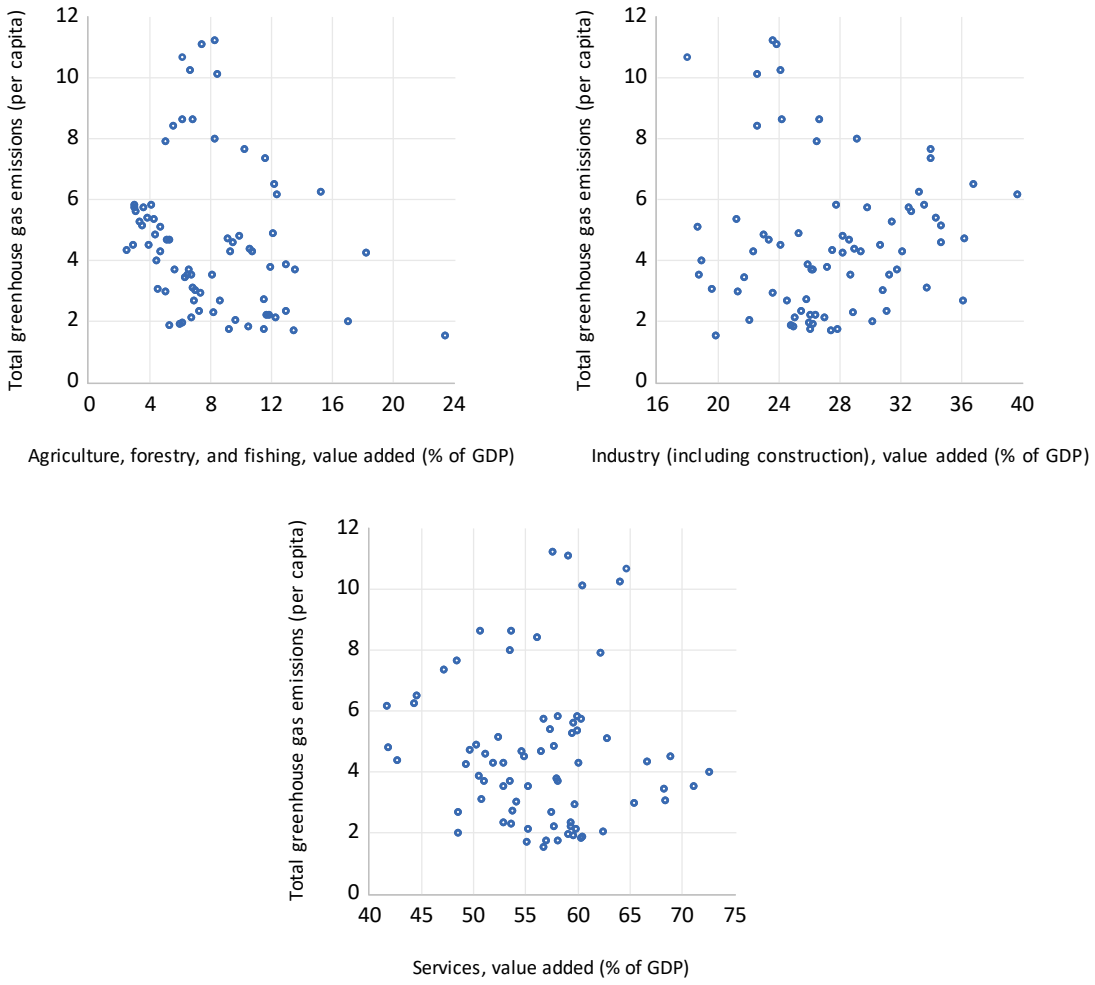
Figure 1 - Total greenhouse gas emissions, GDP per capita and trade openness.



Source: World Development Indicators
Note: Total greenhouse gas emissions are measured as metric tons of CO2 equivalent. Figure 1 shows nonoverlapping 5-year averages for the period 1996-2020.

Figure 2 delineates the relationship between total greenhouse gas emissions and value added by economic sectors. Regarding the primary sector, the relationship is not clear, although a negative relationship with high dispersion around the trend can be observed. In the primary sector, livestock production and the use of fossil fuels in agriculture are important sources of air pollutants. Moreover, as for the industry, the relationship is positive, especially when the outliers generated by the inclusion of Uruguay are removed. The industry, whose energy demand is high, presents an opportunity to reduce emissions by developing and incorporating cleaner and more efficient green technologies. Finally, the third graph shows the relationship between GHG and value-added in the services sector, whose graph does not show a clear trend between the variables.

Figure 2 - Total greenhouse gas emissions and value added by sector.



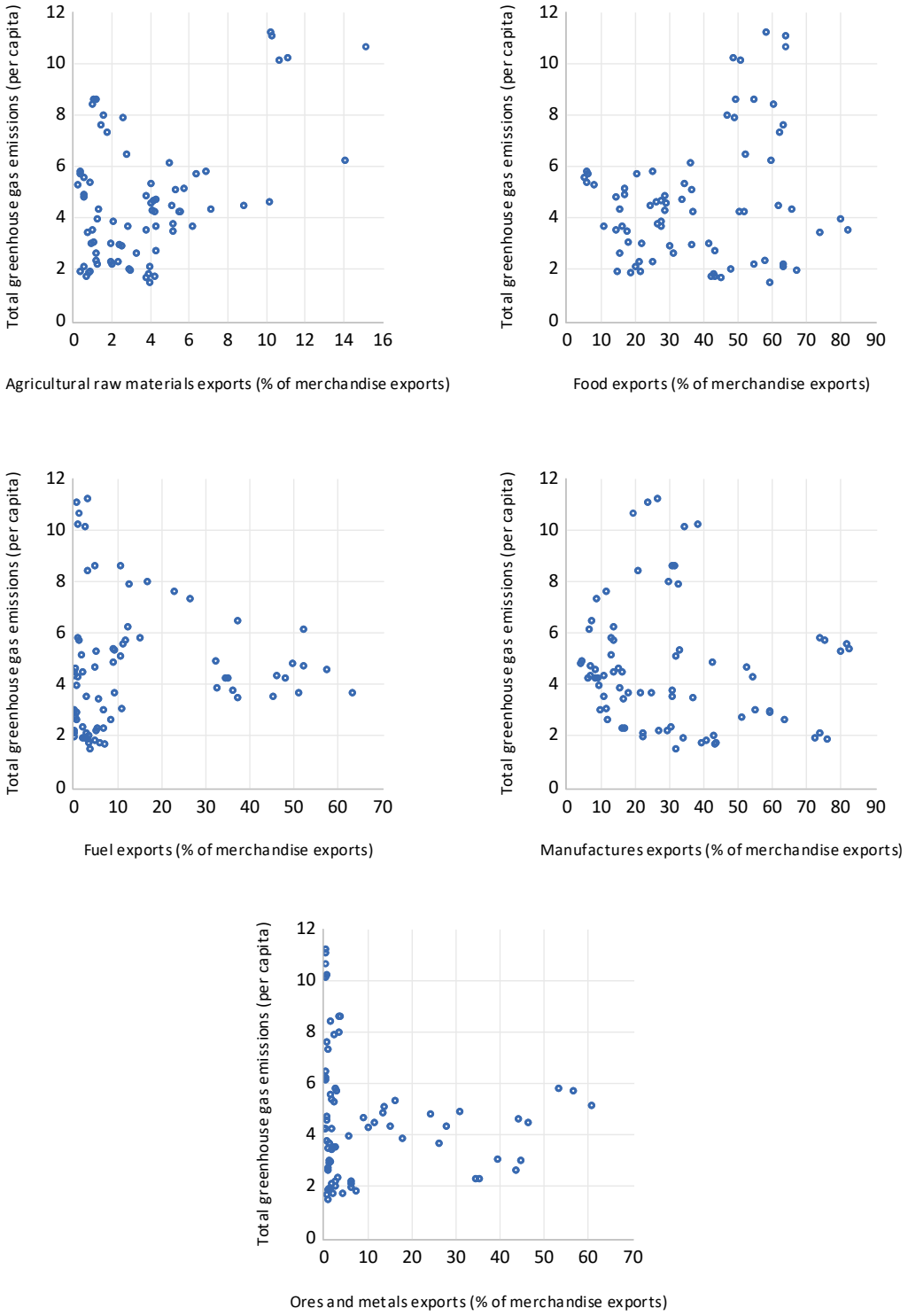
Source: World Development Indicators
Note: Total greenhouse gas emissions are measured as metric tons of CO2 equivalent. Figure 2 shows nonoverlapping 5-year averages for the period 1996-2020.

Lastly, Figure 3 juxtaposes GHG emissions with the share of various export types relative to total merchandise exports. Recent literature underscores the significance of export composition in economic performance and emphasizes the necessity of identifying its relationship with environmental variables to outline emission reduction strategies. Positive relationships are observed between GHG emissions and agricultural raw materials exports as well as food exports, while the relationship with fuel exports remains ambiguous. Similarly, the relationship with manufacturing exports and ores/metals exports lacks clarity, warranting further disaggregation.

In summary, the graphical analysis underscores the positive associations between GHG emissions and GDP per capita, industrial value added, agricultural exports, and food exports. Delving deeper into these relationships will inform economic policy interventions

aimed at enhancing environmental efficiency and fostering socio-environmental sustainability.

Figure 3 - Total greenhouse gas emissions and merchandise exports.



Source: World Development Indicators
Note: Total greenhouse gas emissions are measured as metric tons of CO2 equivalent. Figure 3 shows nonoverlapping 5-year averages for the period 1996-2020.

Final remarks

The prevailing development paradigm has long prioritized economic growth as the primary objective of economic policy, often neglecting the detrimental impact on the environment and thereby jeopardizing the socio-environmental sustainability of the planet. However, the persistent environmental challenges have forced us to reconsider the approach to development, striking a delicate balance between core economic imperatives, such as fostering productive capacity expansion, addressing social goals like reducing inequalities and safeguarding environmental priorities, such as preserving the delicate balance of our planet.

This paradigm shift is explicitly expressed in initiatives like the United Nations 2030 Agenda and the Sustainable Development Goals (SDGs). Within this framework, the concept of ecological structural change emerges as pivotal. This entails a strategic realignment of heavily polluting industries towards more environmentally efficient alternatives. Export industries, particularly those within the manufacturing sector, stand at a critical link, given their capacity for technological advancement and adoption, making them indispensable agents in accelerating the environmental transition.

In the context of Latin America, two interrelated challenges are prominent. First, premature deindustrialization stemmed from the trade and financial liberalization processes initiated in the 1980s. This, intensified by the Dutch disease phenomenon, has resulted in secular stagnation across the region. Second, there is an urgent need to embark on an accelerated ecological structural transformation, redirecting efforts towards environmentally sustainable economic activities.

Thus, identifying the relationship between economic structure and polluting emissions is vital in formulating industrial policy strategies to speed up the transition to a greener economy. The emission of greenhouse gases (GHGs) and its nexus with the prevailing economic structure is of particular concern. While our analysis provides a basic understanding, it underscores the criticality of identifying economic drivers that jeopardize the socio-environmental sustainability.

A more complete analysis would offer deeper insights into how economic structures can be reshaped to foster sustainable economic growth and consumption patterns. By researching the interplay between economic activities and environmental outcomes, policymakers can develop targeted interventions that promote sustainable development while mitigating environmental degradation.

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