RED SUR
Red Sudamericana de Economía Aplicada

Red Sur Working Paper N°3/2023

PROMOTING A PANDEMIC RECOVERY:
EVIDENCE TO SUPPORT MANAGING THE GROWING DEBT CRISIS PROJECT

CONSUMPTION PATTERNS AND ENVIRONMENTAL TAXATION IN LATIN AMERICA

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CSEA Centre for the Study of the Economies of Africa
EPRC 30
Addis Ababa University
fundación ARU
cadep Centro de Análisis y Difusión de la Economía Paraguaya
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ABOUT RED SUR

The South American Network on Applied Economics (Red Sudamericana de Economía Aplicada, Red Sur), is a policy-oriented research network integrated by public and private universities and centers of knowledge production in the region. It conducts research in the areas of economic development, productivity and innovation, natural resources, inclusive growth, employment, integration, trade and value chains.

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Red Sur WP N°3/2023

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Working Document of the Project "*Promoting a pandemic recovery: evidence to support managing the growing debt crisis*" (IDRC - Red Sur N° 109742-001)

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www.redsudamericana.org

October, 2023
Communication and design: Damián Osta
Production: Diego García

CONTRIBUTIONS AND ACKNOWLEDGMENTS

This work was made possible with support from the International Development Research Centre (IDRC Canada). IDRC promotes and funds research and innovation in and with developing regions to drive global change (see more information on their website: https://idrc-crdi.ca/es).

Red Sur led the project "Promoting a pandemic recovery: evidence to support managing the growing debt crisis", aimed at restructuring public debt for socio-economic recovery and sustainability in Africa and Latin America and mobilized seven research centres from both regions.

The project was led by Fernando Lorenzo (Centro de Investigaciones Económicas, CINVE/Red Sur). The academic direction of the project and the process of elaboration of this document was carried out by Red Sur Regional Technical Coordination team, composed of Andrés López (IIEP-UBA-CONICET/Red Sur), Ramiro Albrieu (Red Sur), Luis Miguel Galindo (Universidad Nacional Autónoma de México, UNAM) and Álvaro Ons (CINVE/Red Sur).

The researchers and centres by country that made up the project's research consortium in Latin America were: the ARU Foundation of Bolivia, under the leadership of researchers Omar Velasco, Wilson Jiménez, Josué Cortez and Diego Peñaranda. The study in Honduras was led by Luis Miguel Galindo (UNAM), Gerson Urtecho and Sergio Sánchez. The study in Paraguay was conducted by Centro de Análisis y Difusión de la Economía Paraguaya (CADEP), under the leadership of Belén Servín, Juan Cresta, Fernando Masi, Fernando Ovando and Dionisio Borda.

The researchers and centres per country that made up the project's research consortium in Africa are listed below. In Nigeria: Centre for the Study of the Economies of Africa (CSEA), under the leadership of Mma Amara Ekeruche, with the participation of Chukwuka Onyekwena; Chris Heitzig; Oreoluwa Adenuga; Oludele Folarin and Kashema Bahago. In Ethiopia, Addis Ababa University - UAA and Institute of Development Policy Research (IDPR), under the leadership of Alemayehu Geda, with the participation of Addis Yimer and Getnet Alemu. In Uganda, the Economic Policy Research Centre (EPRC), under the leadership of Corti Paul Lakuma, with the participation of Sarah N. Ssewanyana; Ibrahim Kasirye; Wilson Asiimwe; Brian Sserunjogi; Rehema Kahunde; Ambrose Ogwang and Smartson Ainomugisha.

For the discussion of the project dimensions of analysis, a series of research workshops were held between December 2021 and October 2022, with the participation and inputa of Red Sur regional team, national teams and with contributions from Cecilia Alemany (UN Women), Arjan de Haan, Paul Okwi, Walter Ubal from IDRC.

The series of publications resulting from the project includes the following titles that are published as Red Sur Working Papers and Policy Briefs, available at www.redsudamericana.org:

Number	Title	Authors/Institution
Policy Brief No 1/2022	G20 Policy Brief Indonesia 2022. Policy Proposals for External Debt Management and Sustainability in Developing and Low-Income Countries TF7 - International Finance and Economic Recovery	Fernando Lorenzo (Centro de Investigaciones Económicas), Luis Miguel Galindo (Universidad Nacional Autónoma de México), Ramiro Albrieu (CIPPEC), Dionisio Borda (Centro de Análisis y Difusión de la Economía Paraguaya), Paul Lakuma (Economic Policy Research Centre), Mma Amara Ekeruche, Alemayehu Geda (Addis Ababa University), and Arjan de Haan (IDRC)
Policy Brief No 2/2023	LAC Policy Brief "Results and Policy Implications in Latin America"	Miguel Galindo (UNAM), Fernando Lorenzo (CINVE/Red Sur) and Ramiro Albrieu (Red Sur)
Policy Brief No 3/2023	Construyendo un futuro sostenible en el Sur Global	Ramiro Albrieu (Red Sur)
Policy Brief No 4/2023	Policy Brief I - Ethiopia: Profile of Ethiopian Debt and its Institutional Challenges: An Exploratory Analysis	Getnet Alemu and Alemayehu Geda (Addis Ababa University/AAU)
Policy Brief No 5/2023	Policy Brief II - Ethiopia: Fundamental and Proximate Drivers of Public Debt in Ethiopia (1980-2023)	Alemayehu Geda and Addis Yimer (Addis Ababa University/AAU)
Policy Brief No 6/2023	Policy Brief III - Ethiopia: A Two-Edged Sword: The Impact of Public Debt on Economic Growth—The Case of Ethiopia	Addis Yimer and Alemayehu Geda (Addis Ababa University/AAU)
Working Paper No 1/2023	Background Document 'Fiscal and Financial Challenges of Climate Transition in Latin America'	Luis Miguel Galindo (UNAM) and Fernando Lorenzo (CINVE/Red Sur)
Working Paper No 2/2023	Climate Change, Fiscal Risks and Public Debt Management in Latin America	Luis Miguel Galindo (UNAM) and Fernando Lorenzo (CINVE/Red Sur)
Working Paper No 3/2023	Consumption Patterns and Environmental Taxation in Latin America	Luis Miguel Galindo (UNAM) and Fernando Lorenzo (CINVE/Red Sur)
Working Paper No 4/2023	Investment Incentives and Sustainable Productive Transformation in Latin America	Andrés López (IIEP-UBA-CONICET/Red Sur) and Alvaro Ons (CINVE/Red Sur)
Working Paper No 5/2023	Estudio País: Construyendo un Futuro Sostenible en Bolivia (in Spanish)	Omar Velasco, Wilson Jiménez, Josué Cortez and Diego Peñaranda (Fundación ARU)

Number	Title	Authors/Institution
Working Paper No 6/2023	Estudio País: Construyendo un Futuro Sostenible en Honduras (in Spanish)	Gerson Urtecho, Sergio Sánchez and Luis Miguel Galindo (UNAM)
Working Paper No 7/2023	Estudio País: Construyendo un Futuro Sostenible en Paraguay (in Spanish)	Dionisio Borda, Juan Cresta, Fernando Masi, Fernando Ovando, Belén Servin (CADEP/Red Sur)
Working Paper No 8/2023	Effects Of Gender-Inequality During Global Health Emergencies: Evidence from Nigeria	Centre for the Study of the Economies of Africa (CSEA)
Working Paper No 9/2023	Debt for Climate and Development Swaps in Nigeria	Centre for the Study of the Economies of Africa (CSEA)
Working Paper No 10/2023	Determining the Optimal Carbon Pricing for Nigeria	Centre for the Study of the Economies of Africa (CSEA)
Working Paper No 11/2023	Sustainable, Inclusive and Environmentally Responsive Debt in Uganda: Implication of COVID 19	Economic Policy Research Centre (EPRC)
Working Paper No 12/2023	Profile of Ethiopian Debt and Its Institutional Challenges: An Exploratory Analysis	Getnet Alemu and Alemayehu Geda (Addis Ababa University/AAU)
Working Paper No 13/2023	Fundamental and Proximate Drivers of Public Debt in Ethiopia	Alemayehu Geda and Addis Yimer (Addis Ababa University/AAU)
Working Paper No 14/2023	A Two-Edged Sword: The Impact of Public Debt on Economic Growth: The Case of Ethiopia	Addis Yimer, African Child Policy Forum (ACPF) and Department of Economics Addis Ababa University (AAU) and Alemayehu Geda, Addis Ababa University (AAU)

CONTENT

EXECUTIVE OVERVIEW

The objective of this study is to determine the main features that characterize consumption patterns in Latin America, evaluating the possibilities and limitations of the adoption of a new environmental fiscal strategy aimed at building a carbon neutral economy in the regional context for the 2050-to-2070-time frame.

The evidence presented indicates that consumption patterns in Latin America, similar to all modern economies, are not sustainable in the long-term considering the set of negative externalities that are generating like local atmospheric pollution, contamination of water resources and soil, and greenhouse gas emissions that cause climate change.

In addition, they create a segmented and highly unequal economy and society. The share of food expenditure in total expenditure decreases as income increases in line with Engel's law. The increase in the share of expenditure on transportation, education and health normally covers these new spaces in consumption.

This reflects the dissatisfaction of low and middle-income groups with public transportation, health and educational services, which drives a migration process from public transportation to private transportation, from public health to private health, and from public education to private education. These migration processes from public to private transportation, for example, are inconsistent with the Paris Agreement on climate change, which implies the construction of a carbon-neutral economy between 2050 and 2070.

Environmental fiscal policy can contribute to changing these consumption patterns by modifying the matrix of relative prices against the use of fossil fuels and activities with a high carbon content and support a just climate transition. The application of an environmental fiscal policy is based on solid evidence on the presence of several negative externalities. Based on the experiences of developed countries it can be observed that there is fiscal space in Latin America for green taxes, particularly for energy and waste taxes. These fiscal instruments can help reduce and control the various negative environmental externalities, increase tax revenues and also have a double dividend impact on the product and income distribution.

The available evidence of the consequences of environmental fiscal policy is complex but shows that environmental taxes contribute to reducing negative externalities. However, though it is common that they are insufficient to control the negative externality completely, they are important revenue-raising instruments. This is because the demands for the goods that cause the negative externality normally have high-income elasticities and low-price elasticities in absolute terms.

Likewise, evidence on tax incidence indicates that fuel and car taxes have, in general, progressive effects on income distribution considering the percentage of expenditure on these goods in total expenditure by income quintile. Electricity taxes, in contrast, have mixed effects on income distribution. In this sense, it is important to consider fiscal recycling processes to ensure that green tax reforms have positive effects on income distribution. In this context, the potential relevance of a carbon tax stands out.

I. INTRODUCTION

The objective of this study is to determine the main features that characterize consumption patterns in Latin America and to evaluate the possibilities and limitations of the adoption of a new environmental fiscal strategy that is aimed at building a carbon-neutral economy by 2050 - 2070 in the regional context.

Considering these dimensions together implies taking into account the close relationships that exist in the economy of the 21st Century between economic development, fiscal policy and the environment (Levinson and O'Brien, 2019; Monnet and Wolf, 2016). Consumption patterns represent a fundamental component of the current development style insofar as they reflect the high concentration of income distribution and, to a large extent, are responsible for atmospheric pollution, inadequate use of soil and water resources, and the increase in greenhouse gas (GHG) emissions that cause climate change. These externalities are eroding the very foundations of economic dynamism itself. Latin America must, therefore, move forward in defining a new modality of insertion in the global economy and take on an active role in the creation of an international institutional framework that aims to contribute to the preservation of public goods like climate and public health, within the framework of the challenges posed by the Sustainable Development Goals (SDGs). As Stern (2006) points out, the current structure of consumer spending may even erode the basis for sustaining economic dynamism on a global scale.

Evidence indicates that current consumption patterns in Latin America are incompatible with long-term sustainable development. The inconsistency derives not only from household consumption structures but also from the fact that an increasing trajectory of household income would translate into a progressive decrease in food expenditure as a proportion of total expenditure and an increase in consumption that leads to increases in GHG emissions. In effect, new consumption spaces are occupied by increased expenditure on fuels for transportation and the purchase of motor vehicles and household appliances. At the same time, expenditure on transportation, health and education is increasing in a process characterized by a migration from public to private services.

In addition to the considerations that the advance of these processes deserves in terms of growing inequality and social segmentation, the consolidation of this type of consumption patterns represents a threat and is responsible for the creation of a complex matrix of negative externalities.

In this context, the adoption of a new fiscal strategy is key to preserving macroeconomic stability, ensuring the sustainability of public debt and addressing the challenges arising from climate change and environmental preservation (Ruiz-Huerta, 2022). A new fiscal framework should promote fundamental structural transformations to current consumption patterns to make them consistent with sustainable development and with the Paris Agreement climate change goals that are necessary to stabilize the temperature increase between 1.5º C and 2º C during this century.

A tax strategy of this type is of particular importance in the current circumstances, given the strains on public finances in having to deal with the economic and social emergencies caused by the Covid-19 pandemic. Selective consumption taxation appears then as an instrument capable of contributing to controlling negative externalities (Parry and Small, 2005).

Tax innovations defined on the basis of environmental criteria in particular, could contribute to a just climate transition, by means of an appropriate design of taxes on the consumption of

transport fuels, on the purchase and sale of motor vehicles that use fossil fuels, on the consumption of electricity (when the electricity generated does not come from renewable sources), and on other consumption that generates waste that pollutes the environment.

Tax policy offers tools, such as selective consumption taxes, that allow environmental considerations to be explicitly incorporated into their design (Cnossen, 2020a). These tax modalities can contribute to supporting a long-term fiscal development strategy, making the traditional collection function that has characterized the application of selective taxation compatible with the ability to address the effects of various negative externalities associated with prevailing consumption patterns.

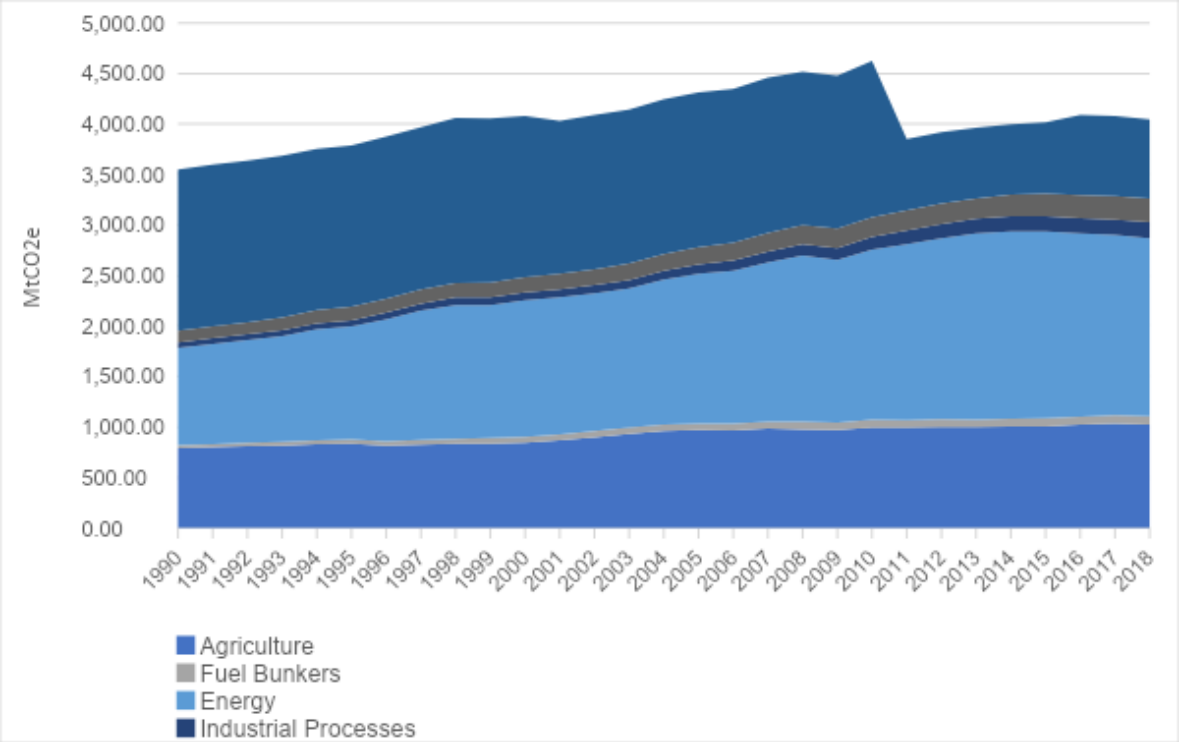
In practice, however, there is still a high level of uncertainty about the potential revenue-raising capacity of some of these tax modalities and there are controversies regarding their capacity to act effectively on the externalities that give rise to them, and regarding their capacity to mitigate the possible collateral consequences that the application of these tax modalities may have on the distribution of income, the level of production and employment (Ekins and Speck, 1999, 2011). In fact, the contemplation of these aspects can provide fundamental information when implementing environmental tax reforms.

This study is divided into five sections. Section 2 presents the characteristic features of the consumption behaviors that predominate in the countries of the region and analyzes their implications in terms of environmental sustainability and GHG emissions. The third section presents the technical and conceptual bases of environmental taxation and analyzes the capacity of these tax modalities to address environmental externalities by considering the particularities and characteristics of the use of these tools in the region's countries. It particularly highlights the heterogeneity of the situations observed across countries, ranging from insufficient use of environmental taxation to the use of subsidies that stimulate the consumption of many of the goods and services that contribute most to GHG emissions. Section 4 describes the main environmental taxes on consumption, providing information on aspects that are of interest when making decisions about their design in Latin America. The fifth section summarizes the existing empirical evidence on the application of environmental taxation in terms of reducing negative externalities. Section 6 draws conclusions and provides some considerations concerning the possibilities of moving towards the use of environmental taxation to support the structural transformation process required to build a low-carbon and climate-resilient economy.

II. GHG EMISSIONS AND CONSUMPTION PATTERNS

In 2018, Latin America and the Caribbean (LAC) emitted about 3.9 billion CO_2e, representing about 8% of total emissions, with an average annual growth rate of 0.40% between 1990-2018 (WRI-CAIT, 2021). This implies an average of 6.22 tCO_2e per capita in 2018, which is similar to the global average of 6.45 in 2018. The structure of CO_2e emissions in Latin America and the Caribbean shows the relevance of energy sources, land use change and forestry and agriculture, the high dynamism of emissions from waste and the continuous growth of emissions from industrial processes (Figure 1). The configuration of emissions in Latin America and the Caribbean is different from the global configuration, where emissions from land use change are not relevant.

Structure and evolution of greenhouse gas emissions in LAC, 1990 - 2018.

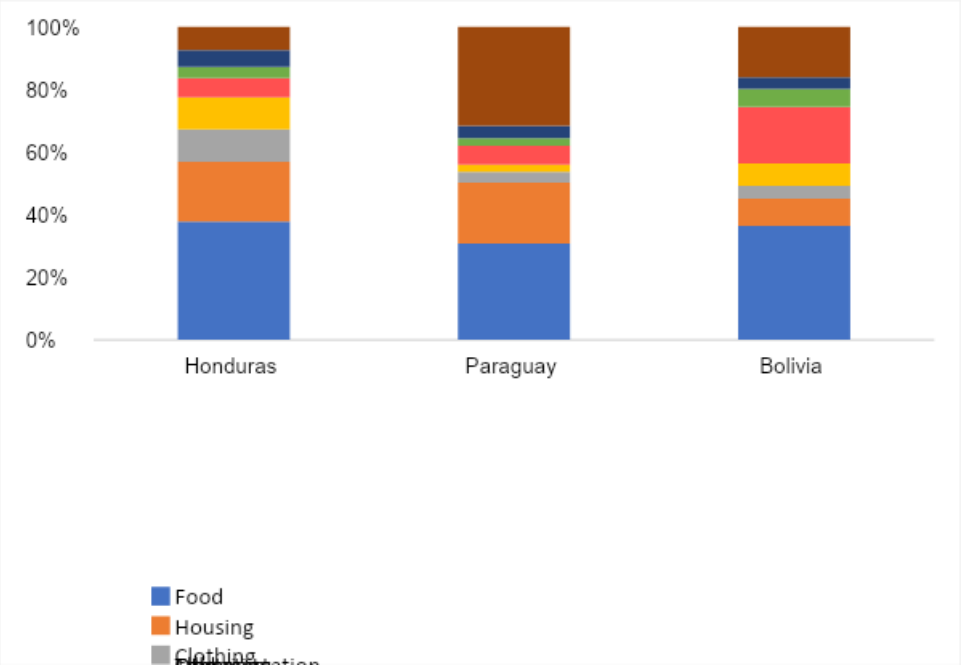


Source: Galindo et al. (2022), based on data from WRI-CAIT (2021).

The characteristics of the endowment of natural resources and the lower historical per capita emissions of greenhouse gases compared to what is observed in developed countries, are features that should be considered when outlining strategies to respond to climate change, determining that public policy priorities in the countries of the region are different from those of more developed OECD countries (PRIMAP, 2020; Galindo and Lorenzo, 2021; Galindo et al., 2022).

The main components of household consumption expenditure in Latin American countries correspond, in general, to food, transportation, electricity, housing, education and health. Figure 2 shows, however, that some important characteristics and particularities differ across countries and these are far from irrelevant. Consideration of the existing heterogeneities in the consumption structures of the different countries may have implications in terms of the characteristics of GHG emissions and changes in consumption patterns to meet the challenges of climate change.

Figure 2. Structure of household consumption expenditure (selected Latin American countries)

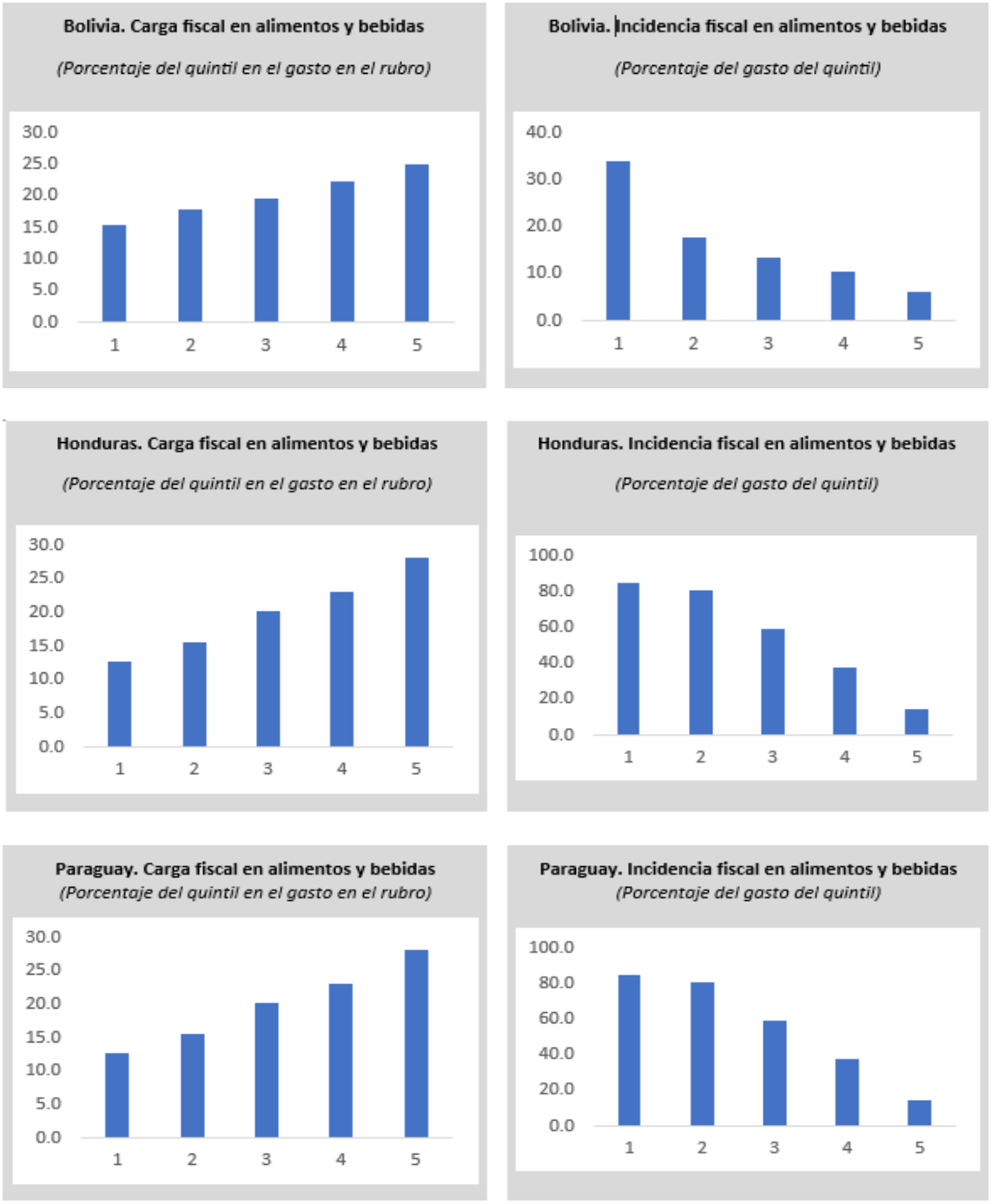


Source: Authors' elaboration based on data from Honduras' 2021 Household Survey, Bolivia's 1999 National Household Income and Expenditure Survey (ENIGH) and Paraguay's 2011-2012 Income and Expenditure and Living Conditions Survey (EIGyCV).

The regional evidence allows us to identify the **tax burden,** which corresponds to the share of each quintile's expenditure in total household expenditure on a specific good or service, and the **tax incidence,** which corresponds to the share of the expenditure of the item in question in the total expenditure corresponding to each quintile of the population's income distribution. The fiscal incidence is therefore related to the potential distributional consequences that the application of a consumption tax could have (Metcalf, 1999).

The analysis of consumption patterns by income strata of the population reveals the relevance of Engel's Law, which states that household food expenditure decreases as a proportion of total expenditure when income increases (see Clements *et al*., 1994; Ramezani et al., 1995). This empirical regularity is usually accompanied by a reduction in food expenditure elasticities when household income increases (Alderman, 1986). Figure 3 shows that expenditure on food and beverages is more important in the higher income quintiles and that tax incidence decreases with income. In this sense, taxes on food and beverage expenditures are regressive in terms of tax incidence despite the fact that, in terms of tax burden, the highest tax revenues come from the highest income quintiles.

Tax burden and tax incidence on food and beverage expenditures (selected countries in Latin America)



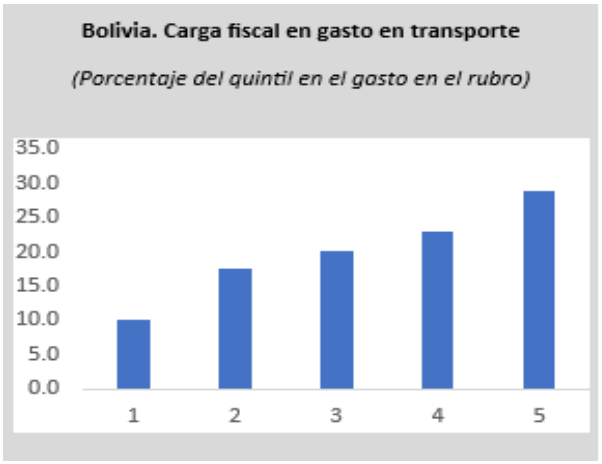
Source: Authors' elaboration based on data from the 2021 Household Survey of Honduras, the 1999 National Household Income and Expenditure Survey (ENIGH) of Bolivia and the 2011-2012 Income and Expenditure and Living Conditions Survey (EIGyCV) of Paraguay.

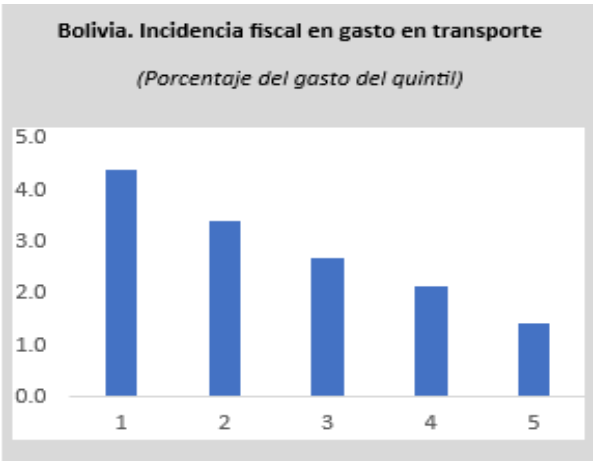
The increase in income also implies an intensification of the use of private transport, to the detriment of public transport, and of private education and health, replacing public services. This might express a dissatisfaction of some sort of middle-income groups with public services. The process of migration from public to private provision has a negative impact on the fulfilment of climate objectives insofar as the greater preference for private transport contributes to increasing a set of negative externalities such as air pollution, accidents and

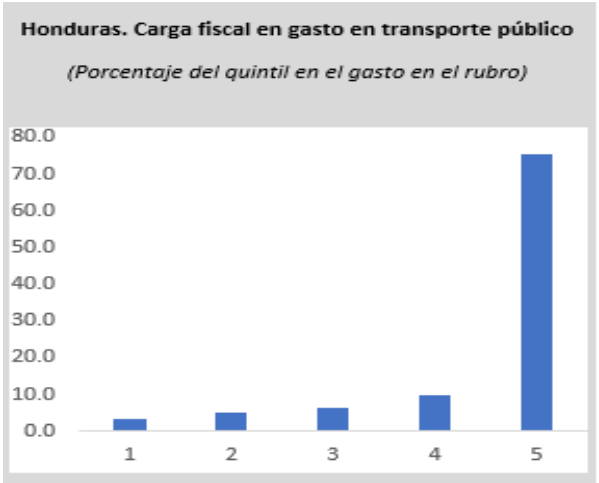
road congestion, and the generation of greenhouse gases that cause climate change (Parry and Small, 2005).

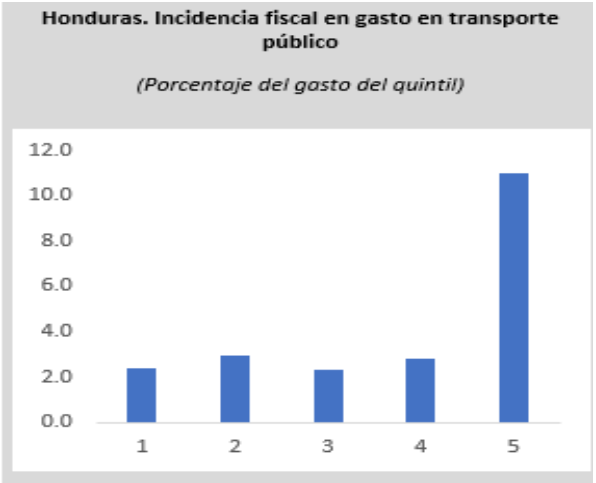
Figure 4 shows that the tax burden on transportation expenditures is concentrated in the higher income quintiles, and particularly in the highest income quintile, and that the tax incidence increases when household income rises. Motor vehicle taxes would therefore have progressive effects on income distribution. In the case of fuel expenditures, the tax burden is concentrated in the higher income quintiles, particularly in the highest quintile, and the tax incidence increases with income. Thus, taxes on fuel expenditures also have progressive effects on income distribution.

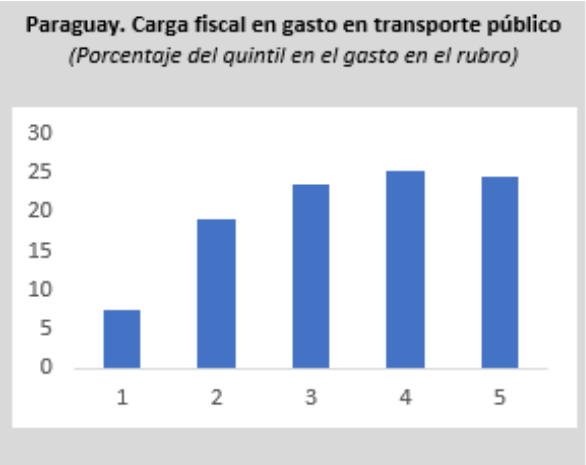
Tax burden and tax incidence on transportation spending (selected Latin American countries)

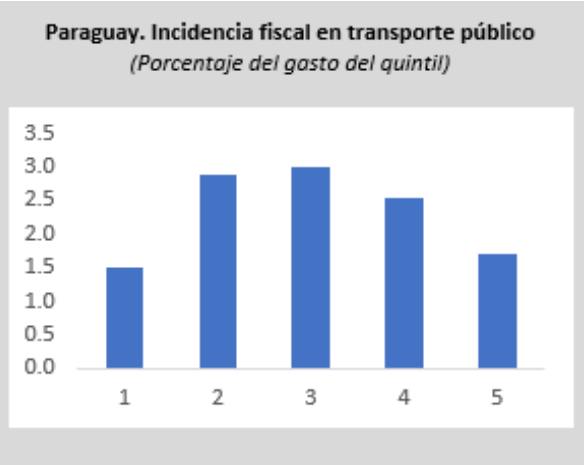


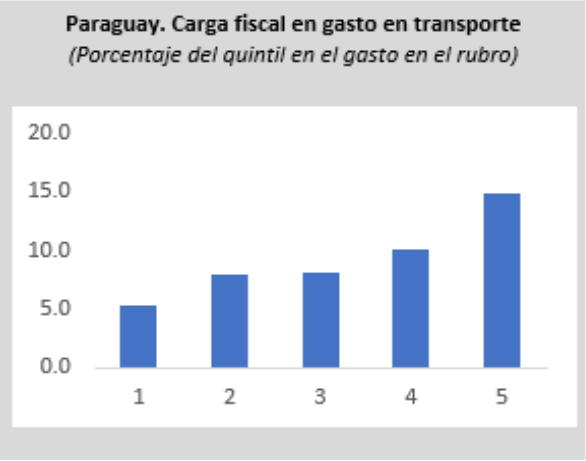


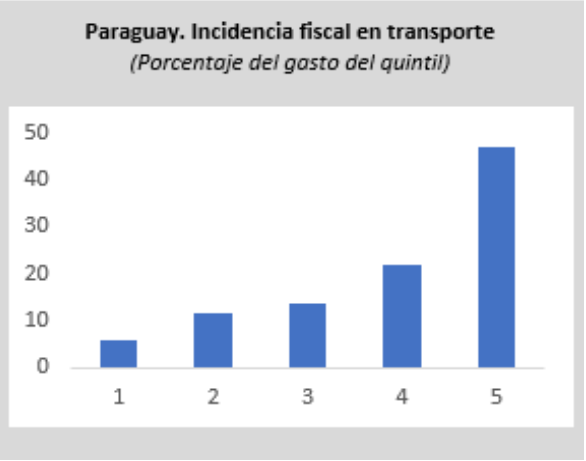










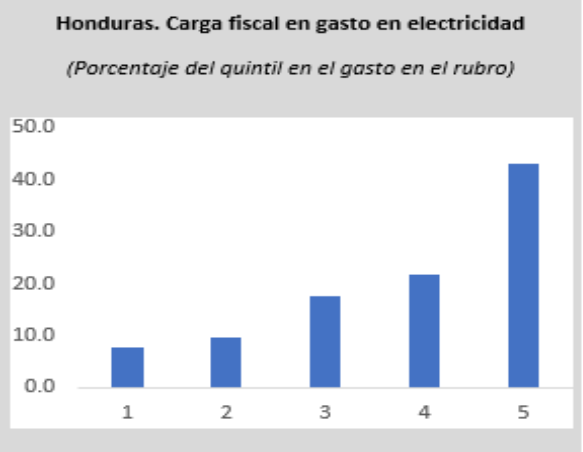


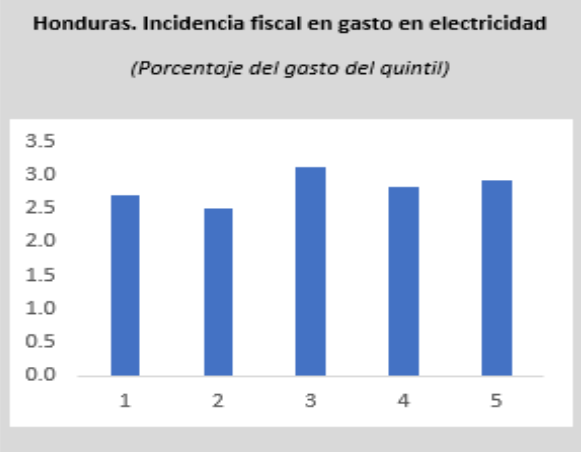
Source: Authors' elaboration based on data from the 2021 Household Survey of Honduras, the 1999 National Household Income and Expenditure Survey (ENIGH) of Bolivia and the 2011-2012 Income and Expenditure and Living Conditions Survey (EIGyCV) of Paraguay.

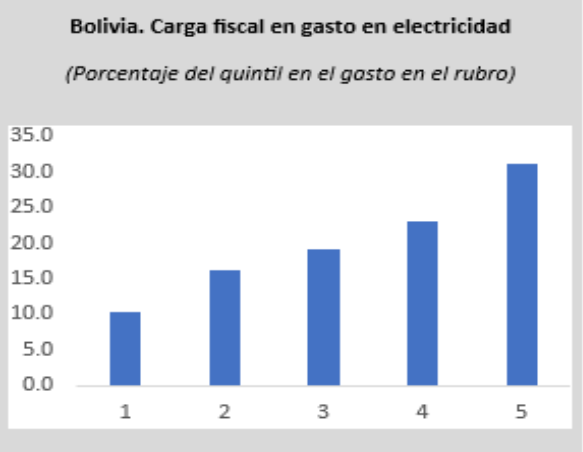
There are, however, some exceptions to these regularities in the behavior of spending on transportation. In the case of Bolivia, for example, the behavior of the proportion of household consumption expenditure is concave, though when analyzing this characteristic, it should be taken into account that this expenditure includes two clearly distinguishable components. The first corresponds to expenditure on public transportation, which normally decreases as income levels increase, while the second corresponds to private transportation, which behaves inversely. The case of Bolivia illustrates the consequences of the transition process from public to private transportation for middle-income groups supported by fuel subsidies.

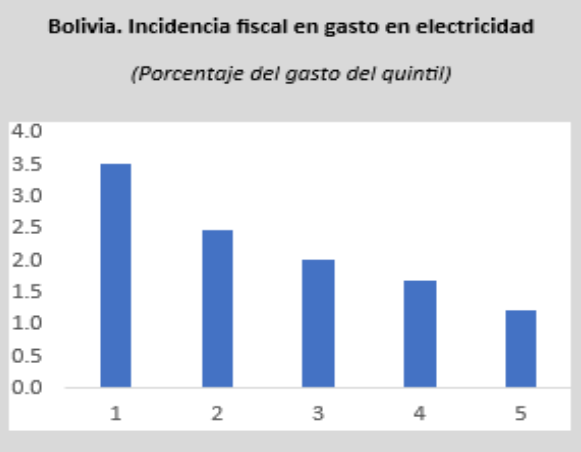
The relative share of electricity expenditure in total household expenditure for the different income strata is country-specific. An example of this surfaces from the data analysis for Paraguay and Honduras, where increases in the relative share of total expenditure are observed for middle-income groups (see Figure 5).

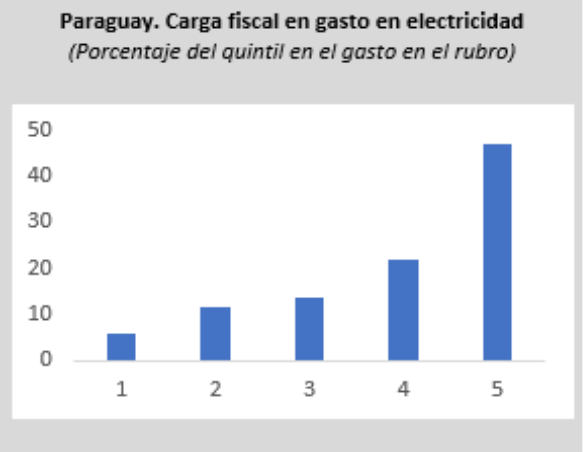
Tax burden and tax incidence on transportation spending (selected countries in Latin America)

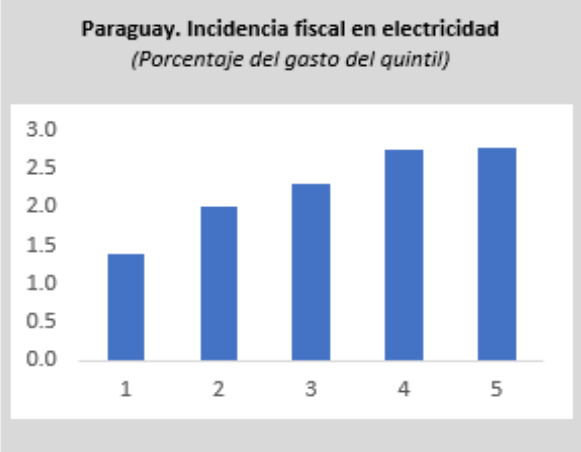












Source: Authors' elaboration based on data from the 2021 Household Survey of Honduras, the 1999 National Survey of Household Income and Expenditures (ENIGH) of Bolivia and the 2011-2012 Survey of Income and Expenditures and Living Conditions (EIGyCV) of Paraguay.

Most of the empirical regularities observed in the consumption patterns of Latin American countries are not sustainable in the long term. The threat of environmental unsustainability is present in the cases of Honduras, Paraguay and Bolivia. Previous studies have found that similar characteristics are present in the other countries of the Southern Cone of Latin America (Galindo and Lorenzo, 2021).

The ability of environmental taxes to control negative externalities and to contribute to revenue collection depends on the values of the income and price elasticities of the set of goods that cause environmental damage. Table 1 presents estimates of the income and price elasticities of the demand for various key goods in an environmental tax reform based on a synthesis of the literature and presents the results of a meta-analysis of the estimates available in the specialized literature on the parameters of the consumer demand functions for fuels. These types of estimates are based on Engel expenditure curves that were built on the basis of models of Engel expenditure curves, Almost Ideal Demand (AIDS) models and Quadratic Almost Ideal Demand (QUAIDS) models (Deaton and Muelbauer, 1980; Banks et al., 1997). They are calculated on the basis of micro-data from household consumption expenditures. The general structure of this type of econometric model is presented in the Appendix.

In general, the values of income and price elasticities suggest that environmental taxes have a limited capacity to control expenditure on polluting consumption, but they can make an important contribution in terms of generating tax revenues. In fact, the high-income elasticities of the goods that cause negative externalities indicate that in a scenario of continued economic growth and moderate price increases, increases in the consumption of these goods will continue to be observed.

Table 1. Income and price elasticities of demand for various goods and services

	Income elasticity	Price elasticity	
Gasoline	0.7	-0.2 y -0.4	
Vehicles		-0.4	
Electricity	0.8	-0.1 y -0.20	
Natural gas		-0.24	
CO2e		-0.2	
Waste	0.8	-0.4 y -0.33	
Cigars		-0.25 y -0.5	
Alcohol		-0.5 y -0.8	
Sugar		-1	
Vehicles/km		-0.90	
Flights		International: -0.90	National: -0.87
Appliances		-0.8 y -1.8	

Source: Authors' elaboration based on Ruiz-Huerta (2022).

Meta-analysis of income and price elasticities of gasoline demand by region.

	OECD countries	*Latin America*
Income Elasticity		
Long-term elasticity	0,55	0,69
Short-term elasticity	0,24	0,26
Price elasticity		
Long-term elasticity	-0,41	-0,31
Short-term elasticity	-0,22	-0,17

Source: Galindo et al. (2015). Note: The estimation of the standard deviation-weighted elasticity was performed by the random effects model. In all cases, the Q test rejects the null hypothesis of homogeneity of the estimates. Similarly, the I2 statistic indicates for the long-run and short-run income and price elasticities that the proportion of the observed variation in the magnitude of the effects attributable to heterogeneity across studies is greater than 85%. OECD refers to member countries of the Organization for Economic Co-operation and Development, excluding Mexico and Chile. These results correct for potential bias problems in the individual estimates.

The empirical estimates show that the demands for fuel and for household appliances are price sensitive. Although the estimates of price elasticities are negative and statistically significant, the sensitivity to price changes is low (demands are inelastic). In the case of expenditure on fuel and motor vehicles, there is a high sensitivity to changes in income, which is clearly seen in the corresponding Engel curves by expenditure item.

These regularities show that economic growth will be reflected in a persistent increase in the share of these consumption items in total household expenditure. The combination of inelastic demands with respect to price increases and high-income elasticities means that the recourse to specific consumption taxation generates an increase in revenue, but that the resulting price increase is insufficient to significantly control negative externalities. On the other hand, it should not be overlooked that during the transition to a low-carbon economy, the tax base of some of these taxes may be eroded (this is especially important in the case of fossil fuels).

III. CONSUMPTION TAXATION AND NEGATIVE ENVIRONMENTAL EXTERNALITIES

Environmental consumption taxes are tax instruments whose tax base is a physical unit (or a substitute for it) on which transactions on which consumers carry out transactions and which have a specific and proven negative impact on the environment (Table 3). The introduction of these tax modalities aims to encourage changes in the behavior of economic agents to contribute to the elimination or reduction of negative externalities, including those generated by GHG emissions. Thus, environmental taxes are intended to reduce the current and future impact of consumption behaviors that are incompatible with sustainable development (Ruiz-Huerta, 2022).

In order for environmental consumption taxation to meet the objective of resolving negative externalities, the tax bases of these taxes must be related to environmental damage, and, in addition, the rate structure applied must effectively contribute to compensating for the

damage to the environment. In the case of climate change, the objectives of this type of taxation are generally aimed at strengthening national strategies to mitigate GHG emissions.

In Latin America, excise taxes on goods and services whose consumption causes environmental damage or which are incompatible with the transition to carbon neutrality were originally introduced with revenue-raising objectives and the impacts of such consumption on the environment was not explicitly considered in their design. The most notorious cases are taxes on the consumption of hydrocarbons and on the purchase of motor vehicles.

Table 3. Negative environmental externalities: relevant consumptions

Electricity	Electricity consumption is associated with a set of negative externalities such as greenhouse gas emissions and NOx air pollutants.
Fuel Gasoline	Fuel consumption is associated with several negative externalities, such as local air pollution, road accidents and vehicle congestion, and greenhouse gas emissions (Parry and Small, 2015). Coady et al. (2019) estimate that transport fuel prices are between USD $1 and USD $1.5 per liter of gasoline. The tax on transport fuels is generally progressive (Sterner, 2012).
Vehicles	Vehicle use generates significant negative externalities such as local air pollution, vehicle congestion, road accidents, greenhouse gas emissions that generate climate change, noise and wear and tear on infrastructure (Parry and Small, 2005; Antón and Hernández, 2014; Cnossen, 2015). Various estimates suggest that a "Pigou-type tax" to compensate for the negative externalities of local air pollution, vehicle congestion, road accidents and greenhouse gas emissions lies between USD 0.30 and USD 0.60 per liter of gasoline in Latin America (Parry and Small, 2005; Antón and Hernández, 2014). Coady et al. (2019) argue that a global fossil fuel price that incorporates the costs of negative externalities would reduce carbon emissions by 28% and deaths associated with air pollution by 46%, and raise tax revenues by 3.8% of GDP. International evidence suggests that, generally, fuel taxes for private transport and for vehicles are progressive (Sterner, 2012).
Waste	The generation and inefficient management and disposal of solid waste causes contamination of land, rivers, aquifers and oceans, loss of biodiversity and negative health effects. In addition, waste burning causes air pollution, which includes particulate matter and toxins, and generates about 5% of global greenhouse gas emissions (World Bank, 2018; Akinbile and Yusoff, 2011). Charges on municipal solid waste generation can have regressive effects on income distribution (Welivita et al., 2015; Reschovsky and Stone, 1994). Plastic waste has relevant environmental and health costs (Cnossen, 2020a and OECD, 2018). There are levies of around USD 0.10 per bag in Uruguay and Ecuador.
Appliances	The consumption of household appliances (watches, televisions, radios, video devices) contributes to several negative externalities associated with electricity consumption, waste generation and/or water demand.

Source: Authors' elaboration.

Considering the characteristics of their tax base, it is possible to define the following typology of excise taxes:

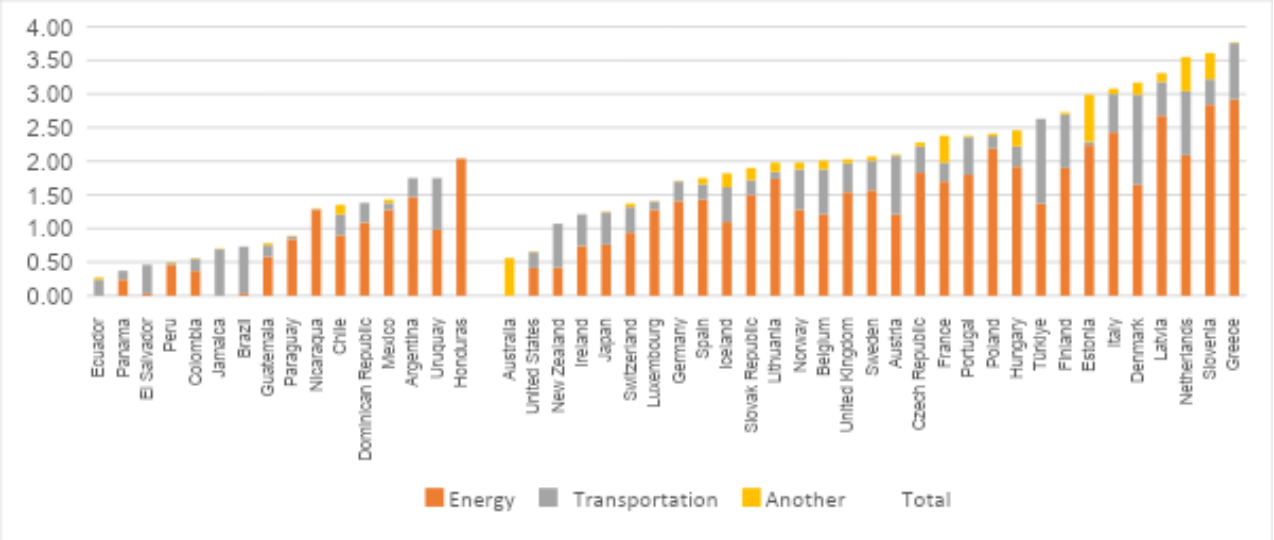
- **Energy**: includes taxation on the consumption of fossil fuels and electricity that is not generated from clean sources (including transport fuels such as gasoline and diesel).
- **Motor vehicles and personal transportation**: includes taxes on vehicle sales and imports, recurrent taxes on vehicle ownership, registration or use - generally levied by sub-national governments - taxes related to the use of personal transportation, vehicle congestion charges, "last mile" taxes and delivery charges.

- **Pollution and natural resources**: including taxes on substances that impact the ozone layer, drinking water consumption, waste treatment, and plastic waste, for example, from household appliances and plastic bags, among others.

These tax modalities also include carbon taxes, which have only recently been incorporated into the region's tax systems and are currently in a phase of expansion.

Figure 6 shows that the effective collection of environment-related taxes in Latin American countries in terms of GDP is significantly lower than in OECD countries. It should be noted, however, that the relative importance of these taxes in the tax structure differs per country. The contrast is evident when comparing countries such as Honduras, Uruguay or Argentina, which have a collection of environment-related taxes (IRMA) that in 2020 was between 1.5% and 2% of GDP, with other countries such as Ecuador, Panama or El Salvador, where tax revenues generated by these taxes represent a fraction of very little relevance, both in terms of GDP and in terms of their share in total tax collection.

Tax revenues generated by environmental taxes (% of GDP)
OECD and selected Latin American countries, 2020



Source: OECD.Stat. Environmentally related tax revenue. Data extracted on 22 Dec 2022

The White Paper (Ruiz-Huerta, 2022) stresses that in terms of environmental tax collection, the problems related to the low quantitative importance are exacerbated by the low quality of their technical designs. The lack of coverage of multiple externalities, the notorious inadequacy of the rates applied - which are often unrelated to the environmental impacts of the consumption they are intended to limit - and the use of the "label" of environmental taxes to qualify taxes that are not related to any form of environmental pollution (¨green washing"), are among the most notorious deficiencies in this area.

III.1. ARGUMENTS IN FAVOUR OF ENVIRONMENTAL TAXATION

The greatest benefit is obtained by maximizing the difference between the benefits and damages of pollution, where the break-even point, which is at the efficient level of pollution, represents the price (or marginal cost) of pollution.

The most traditional approach used to justify the use of selective consumption taxes for environmental purposes, is based on Pigou's (1920, 1938) corrective taxation proposal. In this context, the justification for public intervention is based on the identification of the effects of a given environmental externality.[1] In the case of behaviors that generate some type of environmental pollution, the criteria underlying this approach lead to the application of taxes that penalize the consumption that generates the externality. From this perspective, corrective taxation of the "Pigouvian" type takes the form of a "payment for damage". The argument in favor of the use of this type of tax tool is based on the need to reestablish the concordance between private conduct and the general interest, which the presence of the environmental externality has altered. Thus, a "Pigouvian" tax is applied to each unit of pollutant emissions and corresponds to the marginal cost of pollution (Perman et al., 2003).

The "Pigouvian" logic implies, strictly speaking, that corrective taxes must be specifically designed to compensate for the effects of the externality, so there must be a strict link between the tax and environmental damage. This makes the application of a Pigou-type corrective tax complex since it is necessary to identify the specific marginal cost of polluting emissions. For this reason, it is common to use a standard and pricing approach for the design of corrective taxes, where an environmental standard is established, and taxes are used repeatedly until the proposed standard is reached (Baumol and Oates, 1971). The introduction of selective consumption taxes for environmental purposes thus aims to shift the conventional logic of specific taxes on conventional goods and services onto forms of consumption that damage the environment.

III.2. EXPECTED IMPACTS

The incorporation of selective consumption taxes for environmental purposes in the region's tax systems aims to contribute to achieving impacts on three different areas.

First, environmental taxes must **reduce or eliminate the environmental externality**. The ability of these tax tools to contribute to resolving negative externalities crucially depends on the price elasticity of consumer demand. A relatively inelastic behavior of the demand for the good or service on which the environmental tax is applied could entail a limited reduction in consumption, which would go against the reasoning behind the introduction of the tax. An increase in the relative prices of goods and services whose consumption generates polluting emissions, on the other hand, could result in a reduction of consumption that would cause an increase in the general price level of the economy. This could then create a transitory shock to inflation that could spread to other components of the consumption basket and thus extend over time through the indexation mechanisms that usually exist in many economies (Bosquet, 2000; Hoerner and Bosquet, 2001; De Mooij et al., 2012).

[1] There are various public policy options to address negative environmental externalities, including regulations (command and control mechanisms) and market instruments, such as the use of fiscal instruments (taxes and subsidies) and tradable permit systems.

Secondly, environmental taxation can **have an impact on the overall level of activity of the economy,** either positively or negatively. The way environmental taxation's effects on consumption are transmitted to production basically depends on two factors. On the one hand, it is important to consider the importance of domestic production as a source of supply. If the consumption that needs to be reduced is mainly supplied by imports, the impact on the level of domestic activity could be virtually nil. If it is an exportable good, it is also likely that the effects on the production in question will not be relevant since a reduction in domestic consumption could imply an increase in foreign sales. The substitution effects on consumption caused by environmental taxation, on the other hand, could generate opportunities for the expansion of production in other areas of the economy. In this sense, reductions in the consumption of goods and services that pollute the environment can boost the consumption of substitute goods, so that these forms of taxation could promote the development of a new green economy (Patuelli et al., 2005).

Thirdly, **these tax modalities have effects on income distribution**. The distributional impacts depend on household consumption patterns. If consumption expenditure of the good in question expands when income increases, environmental taxation will have progressive distributional impacts. However, if the highest consumption levels correspond to the lowest income strata, the application of environmental taxes would be regressive. In this case, the mitigation of undesirable distributive effects would require the application of compensatory measures. These "fiscal recycling" actions could take different forms, depending on the characteristics of the fiscal and budgetary structures of each country. More specifically, compensation schemes can be implemented through: i) increases in tax expenditure by modifying the design of some tax figures to be applied to certain taxpayers (exemptions and non-taxation, rebates, reduced rates, etc.); ii) granting explicit subsidies to, for example, facilitate the change of installations and equipment for vulnerable households that are affected by the application of environmental taxation; iii) implementation of personalized monetary transfer systems limited to certain socioeconomic strata, depending on, for example, their income level, place of residence and family composition, etc.). In highly unequal societies such as those in Latin America, the design of compensatory schemes represents a central part of an environmental fiscal reform. Important elements of political economy must therefore be considered when defining their forms of implementation.

Ultimately, environmental taxes have the primary objective to reduce the demand for the good or service that causes the negative externality and, as a secondary objective, to contribute to greater economic efficiency and equity, boosting the generation of employment and improving income distribution (Ekins and Speck, 2011).

The positive collateral effects can create a "weak double dividend" situation, in which environmental taxes, in addition to addressing the environmental externality, also create resources that can be assigned to implementations that generate positive effects on the level of activity and on income distribution. In certain situations, the implementation of environmental taxes can have a "strong double dividend", insofar as their application leads to increases in production and greater distributive progressiveness, which directly leads to improvements in general welfare (Galindo and Lorenzo, 2020; Gago et al., 2016).

III.3. THE CASE OF ENERGY SUBSIDIES

In several region's countries, fuel prices are heavily subsidized and usually receive tax treatments similar to those of other goods and services. There are several countries where the retail price of fuels derived from oil and gas lies considerably below international reference prices. This reality can be considered an anomaly in price formation. But these policies also

have important distributive effects and entail a distortion that affects the efficient allocation of the economy's resources.

Energy subsidies obviously stimulate energy consumption. This has important consequences for the use of private transportation, which generates problems of congestion, pollution, traffic accidents, and accelerated deterioration of roads and transportation infrastructure. There is evidence that subsidized fuel prices encourage smuggling activities to neighboring countries and that these illegal activities can be a cause of worsening insecurity problems.

An ever-increasing vehicle fleet has an impact on the growth in the number of transport accidents, causing loss of human lives, additional costs for health systems and increases in the costs of insurance premiums. Basically, all major cities in Latin America suffer from problems related to transportation congestion, and this has consequences in terms of productivity losses and welfare costs for the population. The situation takes on special characteristics when considering that in many countries of the region, only a minority of the population is the owner and regular user of motor vehicles. In 2005 in Venezuela, it was estimated that the richest 5% of the population received almost 90% of the fuel subsidies for private cars (IMF, 2013b).

From a social point of view, these intervention modalities are highly regressive and accentuate the pre-existing inequality in the countries of the region. In some cases, as in Ecuador and Venezuela, the annual value of subsidies on these products represents more than 5 percentage points of GDP. To get a real idea of the importance of these policies in the context of taxation in these countries, it can be observed that the subsidies received by the private sector represent a higher figure than the public budgets dedicated to health or education (Barrios and Morales, 2012; Commander, 2012).

It is evident that these policies represent an incentive for families to consume more energy. This "excess consumption" of energy products has undeniable environmental repercussions insofar as part of the GHG emissions and environmental pollution in Latin America’s main cities is related to fossil fuel consumption. The intensity of energy consumption has become the real and potential factor that generates the greatest environmental problems in most of the region's countries.

The revision of subsidy policies for the consumption of energy products will have important economic and social repercussions. At the same time, it will be making a significant contribution to tackling some of the environmental problems that exist in the region. Given the magnitude of the resources involved in sustaining these policies and considering the number of actors that could be affected by their modification, it is clear that the reform of these intervention modalities will not be a simple task from a political point of view. If progress is to be made in this direction, it will be necessary to understand the economic effects and the particular interests that will be affected by reform initiatives.

The available information and the various studies that have been carried out in recent years suggest that a reform of subsidy policies will lead to improvements in the level of welfare of society as a whole. In many cases, it will generate progressive distributive effects and eliminate costly and inefficient distortions in the allocation of resources. However, the implementation of reform initiatives might face difficulties and reactions that could call their implementation into question. This is one of the areas of public policy in which political economy can manifest itself with the greatest intensity.

The main difficulty that the reform of these policies will face is related to the diversity of actors that might be affected and to the difficulties that the promoters of the reforms might encounter when explaining the advantages of the initiative for society as a whole.

Higher-income sectors of society are among the actors that could be harmed. This is generally a minority that belongs to the upper deciles of the income distribution. A relevant part of economic power is concentrated in this group, which usually influences politicians and rulers. With data corresponding to 2005, Barrios and Morales (2012) estimated that the richest 5% of the Venezuelan population appropriated 25% of the total subsidies implicit in the prices of petroleum-derived fuels, while the poorest 25% received benefits that did not even represent 5% of the subsidies. In Mexico, it was estimated that in 2008, fuel subsidies received by the richest decile of the population represented more than double the total amount of subsidies received by the poorest decile. This amount included subsidies corresponding to food support programs - the so-called popular insurance - all energy subsidies and the rest of the programs that establish direct benefits for the lowest income sectors. In both cases, it is clear that a small minority of the population is taking advantage of the largest part of the benefits, while the State loses an important source of tax revenues that could be used to strengthen policies with a high distributive impact.

The poorest and most vulnerable sectors of society could benefit from the revision of these policies, although it is likely that in this part of society the idea might prevail that higher energy prices will cause them, as consumers, direct harm and that other actions will not offset this effect.

The adverse reaction of these sectors would be partly based on the increase in fuel prices and partly on the uncertainty and distrust concerning the destination of the increased resources that result from the tax reform, as well as the potential second-round effects of the increase in gasoline prices on, for example, public transportation fares or food prices. The promise of applying these resources to programs with a strong progressive impact in terms of income distribution may not be believed.

The promoters of the initiatives need to expressly contemplate reducing the uncertainty concerning the final results of the policy. The viability of the reform depends to a large extent on the authorities' ability to design reform proposals that ensure improvements for society as a whole and their ability to make the specific benefits that majority sectors of the population will receive perceptible. There are instances of governments that have used the resources generated by energy reforms for socially valued programs. Studies conducted by the IMF (2013a, 2013b) specifically mention the cases of Jordan, Indonesia and Ghana as successful examples in this area.

IV. INTERNATIONAL AND REGIONAL EVIDENCE

The evidence on the results of the use of environmental consumption taxes is very heterogeneous across countries. In general, the final net impacts critically depend on the use of the resources collected, i.e. fiscal recycling (Goulder, 1995; Parry and Oates, 2000; Patuelli et al., 2005; Barker et al., 2006; Hoerner and Bosquet, 2001; Ekins and Speck, 2011).

In general, it can be said that environmental taxes reduce the negative externality but do not completely eliminate it (Bosquet, 2000; Hoerner and Bosquet, 2001; De Mooij et al., 2012) and can represent an important source of tax revenue. Likewise, environmental taxes have marginal negative effects on the level of activity, but these can also be marginally reversed with a fiscal recycling process. The International Monetary Fund (Titelman et al., 2022), for example, estimates that green recovery can contribute to an increase in the average annual growth rate of 0.7%, and there are also positive effects related to the creation of public

infrastructure and the implementation of a care system (Bracco et al., 2021; Izquierdo et al., 2019).

The effects on income distribution depend on the type of good that is taxed and the process of the method of tax recycling that is implemented, where the presence of a "weak double dividend" and, in certain situations, a "strong double dividend", is common (Ekins and Speck, 2011; Goulder, 1995; Hoerner and Bosquet, 2001; Patuelli et al., 2005). Vehicle fleet fuel taxes, for example, typically have progressive effects (Speck, 1999; Ekins and Dresner, 2004; McNally and Mabey, 1999; Sterner, 2012). Taxes on transport fuels are also generally progressive (Ekins and Speck, 2011; Aasness and Larson, 2002). Energy and CO_2 taxes for households in the UK, Ireland, Germany, France, Spain and Italy are slightly regressive, although this originates from effects on middle-income groups (Smith, 1992; Ekins and Speck, 2011; Symons et al., 2002). Moreover, the regressive effects of levies are higher for electricity than for transport, and for energy than for CO_2e (Speck, 1999; De Mooij et al., 2012; Sterner, 2012), although the regressive effect is moderate (Bach et al., 2002; Bork, 2006).

Internationally, the available evidence on the direct effects in terms of income distribution shows that the final net result depends on a set of factors such as the country's level of development, the type of energy taxed and the fiscal recycling process of the resources generated by its collection (Metcalf et al., 2010; Baker and Koler, 1998). Motor vehicle fuel taxes, for example, tend to have a negative impact on middle- and high-income groups, and their distributional effects, therefore, tend to be progressive. In contrast, evidence for the United Kingdom, Ireland, Germany, France, Spain and Italy indicates that taxes on household energy consumption, especially on electricity, are regressive (Smith, 1992; Bork, 2006; Speck, 1999; McNally and Mabey, 1999; Aasness and Larson, 2002; Symons et al., 2002; Bach et al., 2002; Ekins and Dresner, 2004; Ekins and Speck, 2011; De Mooij et al., 2012; Sterner, 2012).

In fact, the collection potential of environmental taxes is a key aspect when defining the GHG emissions mitigation strategy insofar as the allocation of revenues generated by these tax modalities plays an important role in terms of compensating the most vulnerable groups of the population.

In terms of distributional impacts in Latin American countries, evidence indicates that low-income groups contribute a smaller proportion of GHG emissions but are the most vulnerable to the effects of climate change (Galindo and Lorenzo, 2021). This is because low-income households typically reside in regions with higher vulnerability to extreme weather events. Poorer households also have fewer resources and less human capital, making it more difficult for them to adapt to changing climatic conditions and face serious problems when needing to recover their productive activities or income after a natural disaster. Likewise, from the point of view of the effects of environmental taxation aimed at limiting GHG emissions that cause climate change, it should not be overlooked that lower-income households consume less energy and use private transportation less frequently (ECLAC, 2015).

The effects of the application of these tax modalities on income distribution are usually mixed. Taxes on electricity consumption, on the one hand, have regressive consequences on income distribution. Specific taxes on transport fuels, motor vehicles, and household appliances have, on the other hand, generally progressive effects on income distribution. Some countries, however, show mixed effects due to potential negative impacts on the middle and lower-middle income strata of the population. The correction of these undesirable distributive effects requires fiscal recycling mechanisms to compensate vulnerable groups.

V. MAIN ENVIRONMENTAL EXCISE TAXES

V.1. VEHICLE TAXES AND FUEL TAXES

There is extensive literature on the negative externalities that are caused by transportation, such as local air pollution, vehicular congestion, road accidents, greenhouse gas emissions that cause climate change, noise and wear and tear on infrastructure (Parry and Small, 2005; Antón and Hernández, 2014, 2017; Cnossen, 2015). PAHO (2014), for example, estimates around 7 million premature deaths from diseases directly linked to environmental pollution. Likewise, for Costa Rica, air pollution health costs are estimated to increase mortality by 475 additional people. Alpizar et al. (2017) estimate that satisfactory air quality implies avoiding premature deaths with 229 people. Coady et al. (2019) estimate 1.8 deaths from air pollution per thousand inhabitants in Costa Rica and indicate that the levels of PM2.5 concentrations in 2020 are 18 in reference to safe levels below 10 µg/m3.

There is a long tradition of applying various taxes on transportation, including vehicle type, sales price, engine size, emission levels, congestion taxes, use of specific roads or gasoline consumption (Cnossen, 2020a). Examples of these vehicle taxes on the acquisition or use, or ownership of the vehicle adjusted for the age of the vehicle or the year of registration are summarized in Table 1. Thus, there are programs in Austria, Belgium, France, Germany, Italy and the United Kingdom that relate the tax rate to efficiency or pollutant emissions. In Europe, for example, the specific tax base corresponds to 2 euros per 100 cm^3 of gasoline consumption, 9.50 euros per 100 cm^3 for diesel vehicles, and the CO_2 tax is 2 euros per g/km emitted over 95g/km. Cars with CO_2 emissions below 95 g/km are exempted and only cover the rest of the tax. The table was drawn up with respect to private vehicles or vehicles intended for private transportation.

It should also be noted that generally speaking, private transportation demand normally shows a high income elasticity of demand and that its negative externalities will, therefore, increase with the current consumption pattern (Table 4). Estimates of price elasticity are very dissimilar, ranging from inelastic values to values greater than one, although, in general, estimates of low price elasticities predominate. Coady et al. (2019), for example, argue that a global fossil fuel price that incorporates the costs of negative externalities would reduce carbon emissions associated with air pollution by 28% and deaths by 46, and raise tax revenues by 3.8% of GDP. In contrast, Galindo et al. (2015) use a meta-analysis to estimate price elasticities of less than one.

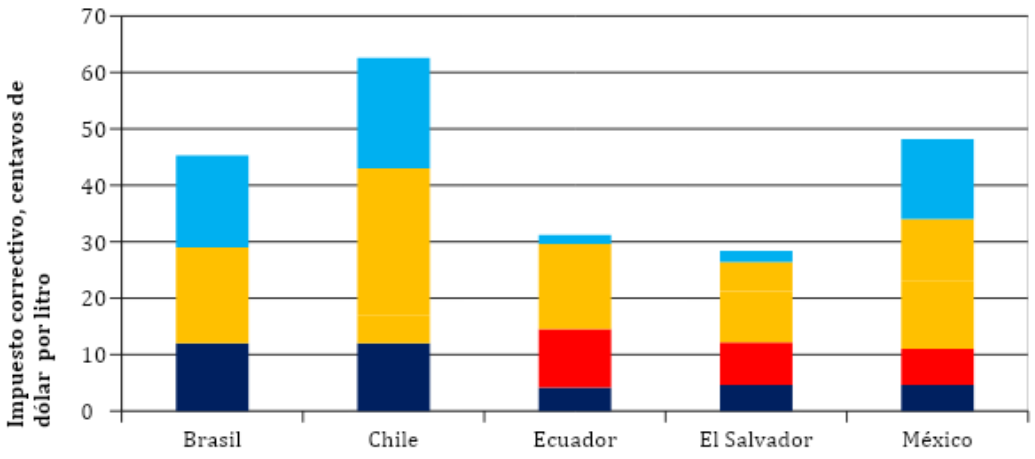
Table 4. Statistics of gasoline demand elasticities. in international literature

Variable	*No. Observations*	*Average*	*Std. dev.*	*Min*	*Max*
Income Elasticity					
Long-term elasticity	119	0.63	0.34	0.04	1.19
Short-term elasticity	108	0.34	0.19	0.01	0.94
Price elasticity					
Long-term elasticity	213	-0.44	0.28	-1.63	-0.32
Short-term elasticity	130	-0.21	0.19	-1.03	0.31

Source: Galindo, L. M., Samaniego, J., Alatorre, J. E., Ferrer, J., and Reyes, O. (2015). Meta-analysis of income and price elasticities of gasoline demand: Public policy implications for Latin America. CEPAL Journal.

International evidence suggests that taxes on transport fuels and vehicles generally have progressive effects on income distribution (Sterner, 2012). Figures 6 and 7 show that estimates for different countries indicate that a "Pigouvian" tax, which essentially compensates for the negative externalities of local air pollution, vehicle congestion, road accidents and greenhouse gas emissions, would be located[2] between USD 0.30 and USD 0.60 per liter of gasoline. On their part, Parry and Small (2005) and Antón and Hernández (2014) estimate a gasoline price, including negative externalities, of between USD 1 and USD 1.5 per liter, so that under current conditions, an implicit subsidy in the price of gasoline persists in many countries of the region. These estimates coincide with those provided by Coady et al. (2019), who estimate a price for transport fuels that includes a corrective tax in which the diesel tax is slightly higher than that of gasoline.

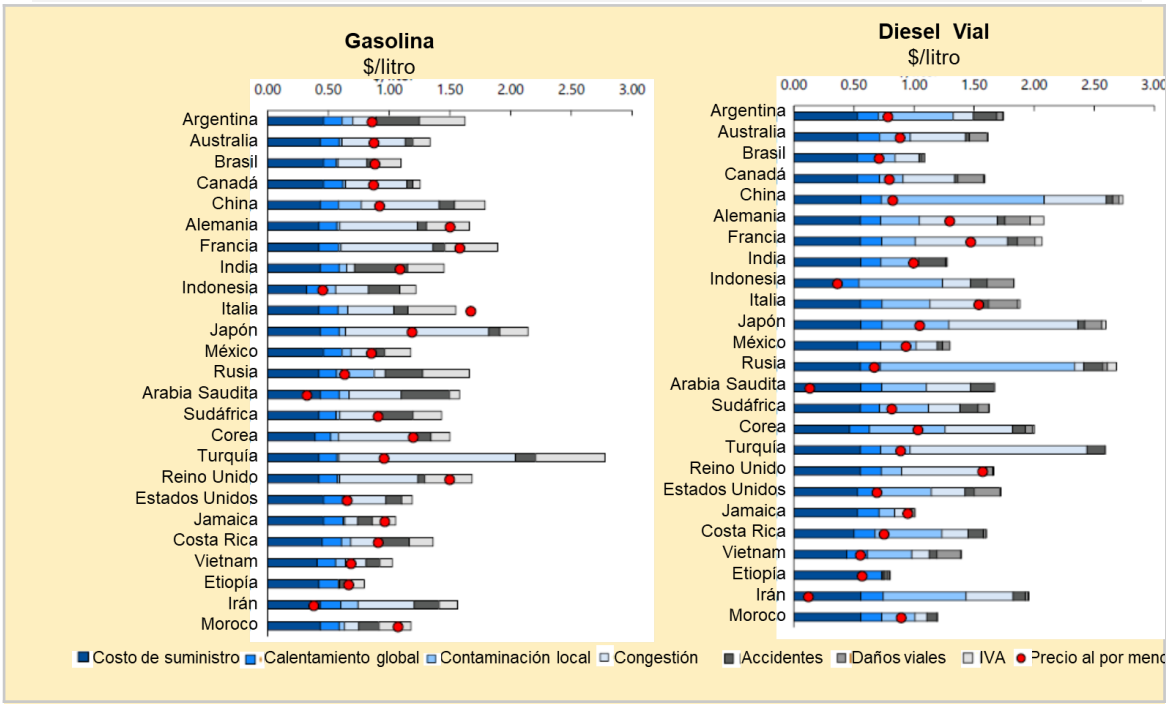
Graph 7: "Pigouvian" gasoline tax in selected Latin American countries.



Source: ECLAC (2016).

[2] For example, a tax of USD 20 ton/CO_2 implies an increase of 18 cents per gallon of gasoline (a gallon is 3.78 liters).

Graph 8. Current and efficient fuel prices (2020)



Notes: Coal and natural gas prices average fuel consumption in the power generating, industrial, and residential sectors, while gasoline and diesel prices are for highway fuel consumption only (diesel averages over light and heavy vehicle uses). The externalities of congestion, accidents and road damage are scaled by the fraction of fuel price elasticities that reflect changes in driving (as opposed to changes in fuel economy).

Source: IMF Staff and Parry, Black and Vernon (2021) p.18.

These estimates support the implementation of specific taxes on transport fuels that can be separated into fuel taxes, vehicle taxes, and road user fees.

There are arguments in support of a specific tax on fossil fuel expenditures that are related to the negative environmental and health externalities. The price elasticities of demand for fuels are statistically significant, indicating that taxes will affect the evolution of consumption. However, an increase in taxes, with the possible presence of inelastic price elasticities and high income/expenditure elasticities, and in an environment of continued rapid economic growth, will lead to an increase in demand. This tax can be separated into taxes on gasoline, automobiles and others that are related to private transportation.

V.2. TAXATION OF HOUSEHOLD APPLIANCES

The consumption of household appliances (watches, televisions, radios, video devices) and vehicles contribute to various negative externalities ranging from electricity use, waste generation and/or water demand. Parry and Small (2005) estimate a tax of 25 euros per ton on black coal and 17.5 euros on brown coal used for electricity generation. Most European residential electricity taxes are between 0 and 0.02 per KWh (Barde and Braathen, 2005). Thus, the available evidence on negative externalities in household appliances is summarized in Table 5.

Table 5. Negative externalities in household appliances.

Source	*Externality*
Use of natural resources	An average of 240 kg of fossil fuels, 22 kg of chemicals and 1,500 kg of water are required to produce one desktop computer. A car or refrigerator requires 1 to 2 times its weight in fossil fuels.
Power consumption	About 30,000 Mjoules of energy are required to produce an average computer.
Effects of manufacturing processes	Generation of heavy metals: Antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, mercury, selenium, aluminum, copper, manganese, palladium, platinum, among others. Generation of hazardous chemicals: nitrogen trifluoride, brominated retardants, among others.
E-waste generation	Global per capita generation of 6.3 kg in 2017 of e-waste. 70% of solid waste in landfills corresponds to electronic waste. Improper handling contaminates soil and water.

Source: Authors' elaboration based on Dutta et al. (2019).

Available international evidence shows that there are several taxes specific to electronic appliances. The experiences with taxation of household appliances are highly differentiated, exhibiting a wide range of levies applied (Galindo, Jiménez and Lorenzo, 2022). This raises various technical and administrative problems of definition, collection and enforcement, which may even lead to a preference for making purchases abroad.

It should also be noted that household appliances normally show a high income elasticity of demand and that with current consumption patterns, negative externalities will, therefore, increase. Likewise, it is observed that price elasticities are high, which suggests possible substitution processes (Table 6).

Table 6. Price elasticities of demand for household appliances

	Income elasticity	*Income elasticity*	*Brand price elasticity*	*Implicit discount rate*	*Years*	*Period*
Automobile[1]	-1.07	3.08	-	-	CP	
Automobile[1]	-0.36	1.02	-	-	LP	
Clothes dryers[2]	-0.14	0.26	-	-	1947-1961	Combined
Air conditioning[2]	-0.37[6]	0.45	-	-	1946-1962	Combined
Dishwasher[2]	-0.42	0.79	-	-	1947-1968	Combined
Refrigerators[3]	-0.37	-	-	39%	1997	CP
Various [4]	-	-	-0.76[7]	-	Combined	
Air conditioning[5]	-	-	-1.72	-	1949-1961	CP
Clothes dryers[5]	-	-	-1.32	-	1963-1970	CP

1 S. Hymens. "Consumer Durable Spending: Explanation and Prediction" Brookings Papers on Economic Activity. 1971.

2 P. Golder and G. Tellis, "Beyond Diffusion: An Affordability Model of the Growth of New Consumer Durables" Journal of Forecasting. 1998.

3 D. Revelt; K.Train, "Mixed Logit with Repeated Choices: Households Choice of Appliance Efficiency Level" Review of Economics and Statistics. 1997

4 G. Tellis. "The Price Elasticity of Selective Demand: A Meta-Analysis of Econometric Models of Sales." Journal of Marketing Research. 1988.

5 D.Jain; R.Rao. "Effect of Price on the Demand for Durables: Modeling, Estimation and Findings" Journal of Business and Economic Statistics. 1990.

6 The logit probability results are not directly comparable with other elasticity estimates in this table.

7 Average brand price elasticity in 41 studies.

Source: Dale, L. (2008). An analysis of the price elasticity of demand for household appliances.

There are arguments in relation to the negative environmental and health externalities in favor of a specific tax on expenditure on household appliances. These taxes show high variability depending on the type of appliance and the country. This tax has a close relationship with negative externalities and solid waste levies. The estimated price elasticities are, in many cases, even higher than one. This suggests that the levies will have an impact on the evolution of the demand for household appliances, although an important substitution process will probably be observed**.**

V.3. TAXES ON WASTE AND PLASTIC BAGS

There are arguments for a specific tax on solid waste based on negative environmental and health externalities. This tax is, however, limited to consumption and in any case represents an argument in favor of a tax on electronics expenditure. There are several examples of solid waste taxes, by weight, by volume or a fixed amount (See Galindo, Jimenez and Lorenzo, 2022).

Plastic waste has relevant environmental and health costs (Cnossen, 2020a, OECD, 2018). When considering fisheries, shipping and tourism, for example, annual global losses due to improper handling of plastic waste are estimated at USD 13 billion (UNEP, 2014). Globally, approximately 95% of plastic material is lost due to decomposition, inadequate treatment and, in addition, a loss of value is observed due to inadequate recycling processes. These losses were estimated to globally be between USD 80 billion and USD 120 billion in 2016 (WEF, 2016). An emerging problem yet to be fully identified is the impact that ingestion of microplastics that are not removed by current water treatment methods can have on human health (Lippelt, 2017).

Examples of taxes applied to the use of plastic bags include very dissimilar rates, averaging €3.65 per kg. France has implemented a charge of €10 per kg of this type of waste, while Portugal charges just €0.20 per kg.

There is also a program to charge per bag where the highest tax value corresponds to Ireland with €0.22, while Italy has the lowest with €0.005. In Latin America, there are taxes of this type in several countries, with rates that, in the cases of Uruguay and Ecuador, are around USD 0.10 per unit.

V.4. CARBON TAX

A carbon (CO_2) tax consists of the application of a tax rate to the price of all forms of fossil fuel use (oil, coal and natural gas), depending on their degree of emission (defined in tons of CO_2). In general, this type of tax is (wholly or partially) passed on to consumers and is reflected in the price of electricity, gasoline and any other type of energy-intensive products or services produced from fossil fuels. International evidence shows that carbon taxes have a high potential tax collection capacity but can have a negative impact on the overall level of economic activity (Table 7).

Table 7. Potential tax revenue from a tCO tax2 on energy (selected Latin American countries) as a percentage of GDP

	USD 30	USD 100	USD 300	USD 700
Bolivia	1.80	5.99	17.98	41.96
Honduras	1.11	3.70	11.09	25.88
Paraguay	0.73	2.43	7.29	17.02

Source: Authors' elaboration based on the Ministry of Finance of Paraguay (2021), Ministry of Finance of Honduras (2022), and Ministry of Economy and Finance of Bolivia (2021). World Bank (2021). Macro data 2021.

From a consumption perspective, the effects of a carbon tax have both direct and indirect impacts. The main direct effect of carbon taxation is to increase the relative prices of CO_2-intensive goods in order to discourage their consumption (stimulating a reduction in demand). The indirect effects involve encouraging the use of cleaner fuels and renewable energies as well as a demand for less CO_2 intensive products (promoting substitution).

There is evidence that poorer households spend a larger share of their income on energy than higher-income households. An increase in the price of carbon would thus imply an increase in energy costs, which could have regressive effects from the point of view of income distribution (Baker and Koler, 1998; Repetto and Austin, 1997; Metcalf, 2008; Dinan, 2015; Bovenberg and Goulder, 2001; Paltsev et al., 2007; Metcalf et al. 2010; Morris and Mathur, 2015; Williams and Wichman, 2015; Galindo et al., 2017). Alternatives to mitigate possible regressive effects require transferring a certain percentage of the revenue generated by the carbon tax to low-income households in order to compensate for the increase in energy costs (Barker and Kohler, 1998; Labandeira and Labeaga, 1999; Ekins and Dresner, 2004; Smith 1992).

VI. SUMMARY AND FINAL CONSIDERATIONS

The current consumption patterns in Latin America are unsustainable since they generate an increasingly segmented and unequal society and produce several negative environmental externalities.

The progressive reduction in the share of food expenditure in total expenditure associated with the increase in per capita income is offset by an increase in the consumption of goods and services that generate a set of negative externalities, such as private transportation. There is a migration from public transportation, public health services and public education to private transportation, private health services or private education. This results in a society where public services are used by the lower income groups and middle classes but high income groups are excluded. An environmental fiscal strategy is required to transform these consumption patterns.

International evidence indicates that Latin America has fiscal space to implement new environmental taxes, mainly on energy, motor vehicles and plastic waste. There are also opportunities to increase tax revenues by introducing a carbon tax. This tax strategy should, however, consider that it is common for goods that cause greenhouse gas emissions, such as gasoline or electricity consumption, to have a high-income elasticity and a low price elasticity in absolute terms. In this sense, it is hard to believe environmental taxation will suffice to control GHG emissions in a context of continued economic growth.

The analysis of consumer spending patterns of Latin American households suggests that an environmental tax strategy will have a mixed effect in relation to income distribution. Taxes on electricity have, generally speaking, mixed impacts on income distribution, while taxes on private transportation and motor vehicles have, generally speaking, a progressive impact on income distribution. Taxes on transport fuels also have a progressive impact on income distribution, though with some exceptions related to the impact in middle-income groups.

In short, a new environmental fiscal strategy can help control negative externalities, generate additional fiscal resources and contribute to a better income distribution and greater economic dynamism. For these multiple dividends to materialize, it is necessary to implement fiscal recycling mechanisms to compensate the most vulnerable income groups and to complement fiscal tools with new regulations and the construction of infrastructure consistent with climate change goals. In this way, a fiscal strategy with a long-term vision will be in a position to contribute to macroeconomic stability and fiscal sustainability while at the same time help shape environmentally sustainable and socially inclusive development.

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ANNEX 1 - MICROECONOMIC ANALYSIS OF CONSUMPTION PATTERNS AND DETERMINATION OF THE EFFECTS OF THE INTRODUCTION OF ENVIRONMENTAL TAXES

The methodological approach for estimating the relevant parameters of the demand functions is based on the estimation of micro-econometric models that are fundamental to determine the potential revenue of tax tools and to evaluate the foreseeable impact of these tax innovations on income distribution and poverty. These models are estimated on the basis of data from the countries' Household Income and Expenditure Surveys.

The analysis of consumption patterns, the estimation of Engel curves of expenditure, of Almost Ideal Demand Models (AIDS) and of some indicators of expenditure concentration such as the Kakwani and Reynolds-Somolesky indices (Gasparini et al., 2012).

Engel expenditure curves relate the proportion of expenditure on a particular good *i* to total expenditure from the following specification:

(1) $$w_i = \left(\frac{p_i q_i}{x}\right) = \alpha_i + \beta_i ln\left(x_i\right) + \lambda + u_i$$

(2) $$w_i = \left(\frac{p_i q_i}{x}\right) = \alpha_i + \beta_i ln\left(x_i\right) + \gamma_i ln(x_i)^2 + \lambda + u_i$$

where i is the household or individual, w_i is the share of total expenditure of good i, $w_i = \left[\frac{\partial logc(U,P}{\partial log P_i}\right] = \frac{p_i q_i}{x}$, x_i is the total expenditure, λ includes several control variables and u_i is the error term. The coefficient β_i in equation (26) represents the change in the participation in the budget of good i as a consequence of a 1% change in income. Thus, $\beta_i < 0$ identifies a necessary good and $\beta_i > 0$ a luxury good and u_i is the error term.

Following the approach proposed by Deaton and Muelbauer (1980) and Banks et al. (1997), the Almost Ideal Demand (AIDS) and Quadratic Almost Ideal Demand (QUAIDS) models establish that the share of expenditure on good *i* as a percentage of total expenditure is a function of total expenditure (linear or quadratic) and the prices of the different goods and services and some control variables such as economic, social and demographic characteristics of households. $(w_i = p_i q_i / x)$ is a function of total expenditure (linear or quadratic) and of the prices of the different goods and services, and of some control variables such as economic, social and demographic characteristics of households.

(3) $$w_i = \left(\frac{p_i q_i}{x}\right) = \alpha_i + \beta_i ln\left(x_i\right) + \sum_{h=1}^{h} \gamma_{ih} ln\left(\pi^*_{ih}\right) + \lambda + u_i$$

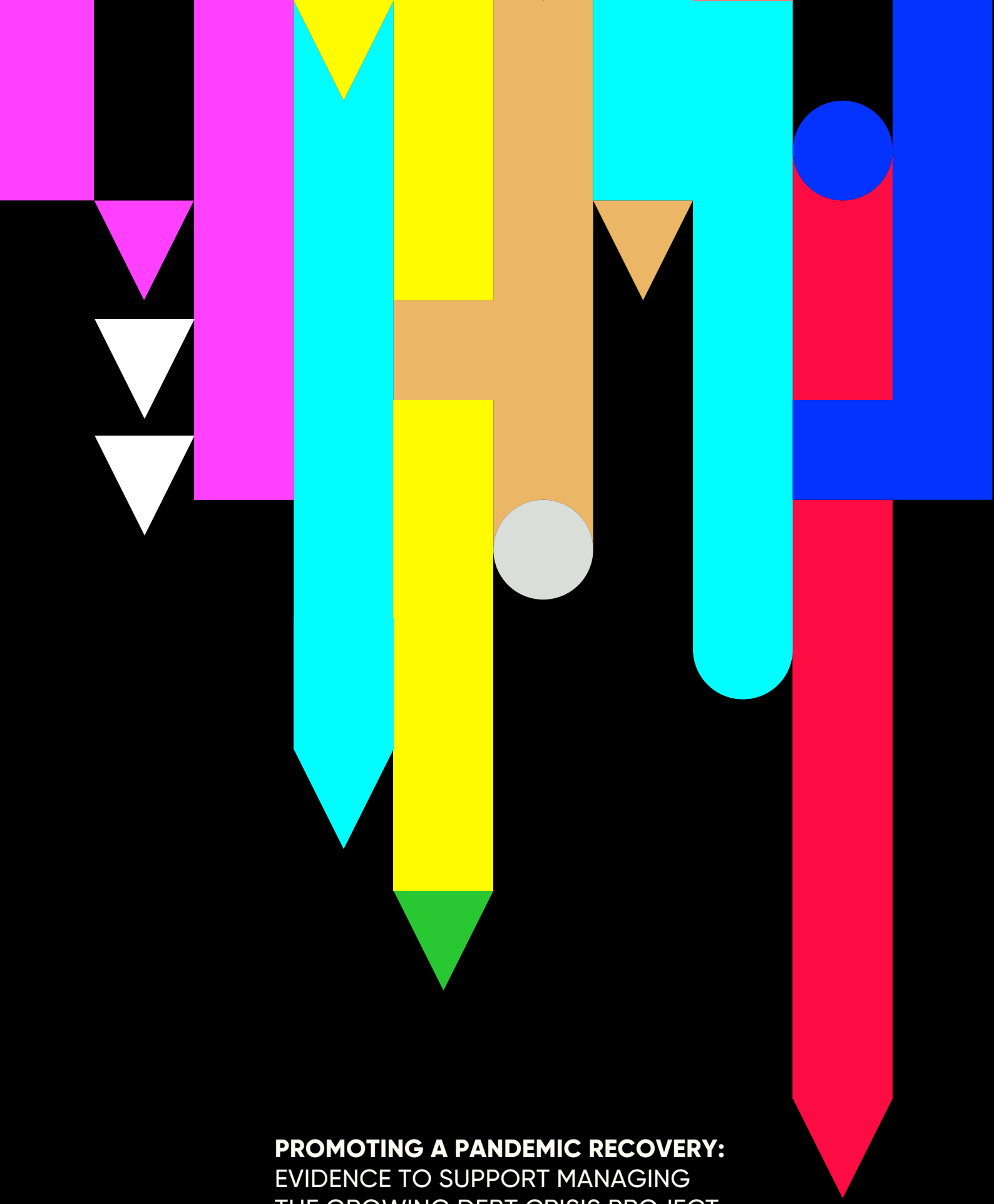
(4) $$w_i = \left(\frac{p_i q_i}{x}\right) = \alpha_i + \beta_i ln\left(x_i\right) + \delta_i ln\left(x_i\right)^2 + \sum_{h=1}^{h} \gamma_{ih} ln\pi^*_{ih} + \lambda + u_i,$$

where w_i is the expenditure share of each good i in total expenditure, α_i captures the expenditure share of the good in total expenditure, β_i represents the change in the budget share of good i as a consequence of a change in income. $\beta_i < 0$ identifies a necessary good, $\beta_i > 0$ a luxury good and ui is the error term.

The price variable (π^*_{ih}) corresponds to Stone's price index (1954), which is constructed with the weighted weights of the expenditure shares for each agent in the sample (Labandeira *et al*., 2006) and is defined as the geometric mean of the basic consumer price indexes that will be weighted by the consumption structure of each of the households included in the sample:

(5) $$ln\pi^* = \sum_{j=1}^{M} \overline{w}_j ln\pi_j$$

where $\overline{w}_j$ is the average expenditure share of item *j* representing the major consumption items such as: food and beverages; alcoholic beverages and tobacco; clothing and footwear; housing, water, electricity, gas and other fuels; furniture and household items; health; transportation; communications; education; recreation and culture; and miscellaneous goods and services (personal care, insurance, etc.).



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THE GROWING DEBT CRISIS PROJECT