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Many of the arguments developed in this report originate from the debates held within the framework of the Chair of the Maria Sibylla Merian Center for Advanced Latin American Studies (CALAS) and the Dialogue Platform “Climate Change, Inequality, and Socio-Ecological Transformation: Challenges for Green Fiscal Policies,” funded by the Fritz Thyssen Foundation, between November 2022 and April 2023.

Content

Summary

This document emphasizes the need to adjust the tax policy tools of countries in Latin America and the Caribbean to address the climate transition. This entails creating more efficient instruments to safeguard environmental assets and mitigate greenhouse gas emissions, employing eco-friendly levies tailored to regional nuances in their structure and execution. Establishing a contemporary tax framework necessitates accounting for revenue, environmental, and societal factors to align with decarbonization objectives and fulfill international obligations regarding climate change. Environmental taxes have significant potential in the region to contribute to sustainable development and increase tax revenues. Latin American tax systems need significant improvement in the technical capacities of tax administrations to support the redesign of new tax instruments, efficiently manage them, and generate information to evaluate their impact. The need to strengthen green tax policy is emphasized, focusing on analyzing the needs of tax administrations in the region to address this ecological transition efficiently, effectively, and equitably.

The study provides an overview of green taxation in the region, reviews experiences with environmental tax reforms, and analyzes the fiscal space for the implementation of environmental taxes, as well as the role of taxation on extractive activities. It also addresses the objectives and technical aspects of green taxation, along with its relationship with tax administration, focusing on information requirements, control mechanisms, human resource training, and required capacities. Additionally, it suggests a comprehensive approach to defining an environmental fiscal and tax strategy, emphasizing the importance of coordination among different levels of government. Finally, it provides some concluding thoughts on the future role of tax administrations in the processes of incorporating fiscal and tax adjustments aimed at strengthening impacts on the transition of economies towards carbon neutrality by 2050-2070.

1 Introduction

The changes needed to tackle the challenges of climate transition require governments to undergo an intense process of adjusting public policy instruments. In this context, the development of new and more effective forms of regulatory intervention aimed at preserving environmental resources and reducing greenhouse gas emissions (GHGs), which are at the core of global warming, must be complemented with the more intensive use of green tax instruments specifically designed to address the negative environmental externalities associated with climate change. The scale of the changes likely to occur in the coming years in the tax systems of countries in Latin America and the Caribbean (LAC) requires a significant effort to adapt the technical capacities of Tax Administrations (TAs), both to support governments in redesigning new tax instruments and to efficiently manage them and generate information bases that contribute to improving the assessment of impacts from the application of environmental taxes.

Climate change is one of the major challenges to development in the 21st century. Indeed, climate change has broad and widespread effects, some of which are nonlinear and irreversible, on economic activities, social well-being, and the environment (IPCC, 2014, Dell et al., 2014). The Paris Agreement on climate change aims to stabilize the increase in global temperature to between 1.5°C and 2°C during this century by ensuring that the global economy becomes carbon neutral between 2050 and 2070.

Addressing the challenge of climate change requires structural transformations to current patterns of production and consumption, the energy matrix, and mobility patterns. To achieve this, a new fiscal strategy is essential that builds a new generation of consistent economic incentives. On the one hand, these incentives should align with sustainable development and responses to climate change. On the other hand, they should mobilize greater resources to finance the development of sustainable infrastructure.

The challenges of climate change take on significant regional specificities in Latin America and the Caribbean (LAC). Most countries in the region are particularly vulnerable to the effects of climate change. This vulnerability

is largely attributable to characteristics of the technologies used in production processes, high dependence on the exploitation of natural resources, a large proportion of the population living in poverty, significant income inequality both on a personal and regional level, weaknesses in the welfare state manifested in notable deficiencies in social protection and healthcare systems, the importance of vulnerable ecosystems, and the diverse biodiversity existing in the region (Fanelli, Jiménez, & López Azcúnaga, 2015; Galindo & Lorenzo, 2020).

It's crucial to incorporate these regional specificities into the risk map considered in the design of public policies in general and in the implementation of environmental-related fiscal and tax reforms. This is essential to build a development strategy that addresses the challenges of climate change. Specifically, the prevailing vulnerabilities in the region necessitate that the redesign of tax tools be tailored to the specific reality of countries in Latin America and the Caribbean (LAC).

The importance of prioritizing green fiscal instruments is justified in the current context due to their potential contribution to achieving ambitious environmental goals that must be reached within a limited time frame. In this sense, green fiscal policy serves as a powerful tool for minimizing the costs associated with ecological transition while also promoting development, encouraging investment in less polluting technologies, and generating new green jobs, fostering a new economic dynamic.

Compared to other regions, and given their historically low tax levels, governments in Latin America and the Caribbean (LAC) have enormous potential to collect taxes whose implementation contributes to sustainable development while also increasing tax revenues that finance the production of public goods. From this perspective, it is observed that green taxes in the region are generally quantitatively lower as a percentage of GDP compared to what occurs in OECD countries, and, more importantly, they often have lower design quality compared to countries that have been at the forefront of implementing Environmental Tax Reforms (Jiménez, 2023).

Building a modern tax system requires explicitly incorporating revenue considerations as well as environmental and social criteria into the design of instruments. This is essential to meet the goals of deep decarbonization and to achieve the commitments made in the Sustainable Development Goals (SDGs) of the 2030 Agenda. Additionally, fulfilling international commitments regarding mitigation and adaptation to climate change requires forming broad political and social consensus that lays the groundwork for a just climate transition.

Incorporating environmental, economic, and social considerations into the development of fiscal instruments presents a multifaceted challenge. At times, it requires acknowledging the impracticality of implementing an excise tax that perfectly aligns with the specific negative externality it seeks to mitigate. This externality varies among producers and consumers. The conventional approach usually entails applying a standardized rate (or a modified value), which considers additional factors like political economy dynamics, distributive goals, or the aim to preserve economic competitiveness. This frequently involves iterative trial-and-error methodologies.

Therefore, starting from the recognition of the need to strengthen green tax policy, the objective of this study is to focus the analysis on the needs of tax administrations in the region to address this necessary ecological transition efficiently, effectively, and equitably.

The work is organized as follows. Section 2 provides an overview of green taxation in Latin America and the Caribbean (LAC), reviewing experiences with environmental tax reforms, considering the actual space available in countries of the region to increase the use of environmental taxes, and evaluating the role taxation plays in extractive activities. Section 3 outlines the objectives of green taxation linked to ecological transformation and analyzes the main technical aspects to be considered in developing new fiscal instruments. Section 4 addresses the links between Tax Administration and green taxation, focusing on information requirements, essential control mechanisms, human resource training, and capacities needed to manage compensation mechanisms that aid in ecological transition. Section 5 presents the foundations of a comprehensive approach to defining an environmental fiscal and tax strategy for Tax Administrations in Latin American countries, identifying the main areas for tax interventions and emphasizing the importance of coordination and cooperation between national and subnational governments. The final section offers some concluding remarks regarding the role of Tax Administrations in supporting future fiscal and tax changes in the region.

2 Overview of environmental taxation in Latin America

2.1 Environmental tax reform

The concept of Environmental Tax Reform (ETR) emerged in the late 1980s and solidified in the 1990s, mainly within the framework of reforms carried out in Europe. The basic idea behind ETR was to utilize price mechanisms, due to their ability to provide information and influence incentives, to correct distortions caused by environmental degradation and unsustainable use of natural resources. These processes were based on the principle of "the polluter pays," with tax changes inspired by the logic of so-called "Pigouvian taxes" (Pigou, 1920). Ultimately, ETR aimed to ensure that market prices incorporated the economic and social costs of negative externalities generated by certain production and consumption activities (Gruber, 2009).

The evidence on environmental tax reforms internationally is extensive and varied (Gago and Labandeira, 2010; Galindo and Lorenzo, 2020). These reforms had an initial phase in Northern European countries such as Finland (1990), Sweden (1991), Norway (1992), Denmark (1994), and the Netherlands (1995), where taxes, mainly on energy, were significantly increased.

Later, in a second phase, primarily in Finland (1997), Germany (1999, 2003), and the United Kingdom (1996, 2001), while the tax instruments applied were similar to those used previously, governments explicitly resorted to what is known as "fiscal recycling measures". This means that a portion of the resources from new environmental taxes was used to finance compensations, such as reducing contributions to social security or labor taxes. In this way, the aim was to simultaneously control the negative externality and promote employment, which was defined as a "double dividend".

The third phase of ETR (i.e., Ireland and Australia) included the use of more diverse taxes, such as those on solid waste, and incorporated a less rigid approach where tax revenues are not earmarked for specific purposes, contributing even to the consolidation of public finances.

There is a fourth, more heterogeneous phase, in which both fiscal recycling processes and various types of environmental tax strategies are applied. These strategies include specific taxes combined with subsidy schemes and the issuance of green bonds.

Currently, it is observed that the main green taxes focus on energy products, motor vehicles, and activities that generate pollution of water resources and various types of waste.

2.2 Fiscal space for environmental taxation in the region

A green tax is defined as a tax whose taxable base is a physical unit (or a substitute for it) that has a specific and proven negative impact on the environment (OECD, 2017). In other words, these are tax instruments that aim to produce changes in the behavior and investments of individuals and companies, on the revenue side, aimed at generating lower greenhouse gas emissions or promoting sustainable use of natural resources, ultimately reducing the impact on the environment (Committee of Expert Individuals - IEF, 2022).

To achieve this, it is necessary for the tax base of the environmental levy to be related to the issue under consideration (the environmental damage caused by certain emissions or the use of products closely linked to such damage), and for the structure of tax rates to help capture environmental damage or achieve predetermined environmental objectives.

This broad definition allows for the inclusion of taxes that were originally introduced for purely revenue-generating purposes (for example, taxes on hydrocarbons or automobiles) but have undeniable associated environmental effects.

Environmental taxes can be classified according to their tax base, based on the following typology:

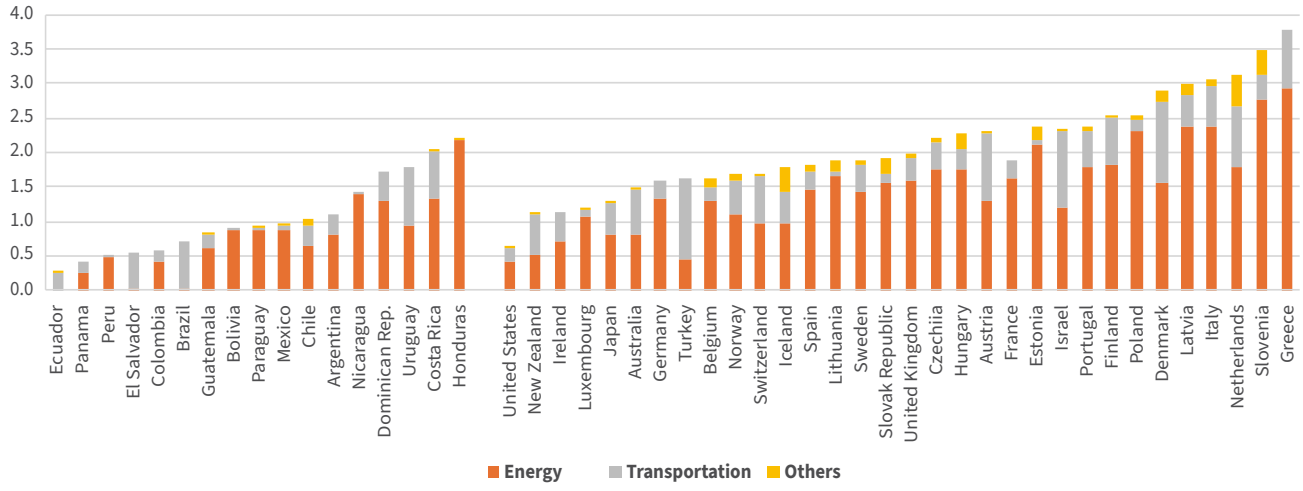
- **Energy** (generation, distribution, and utilization in its various forms): encompasses taxation on fossil fuels and electricity, including transportation fuels such as gasoline and diesel. It also includes carbon taxes and other greenhouse gases.

- **Motor vehicles and transportation**: includes taxes on their imports or sales, recurring taxes on their ownership, registration, or use, and other taxes and charges related to the transportation of people and goods, fees on vehicular congestion, taxes on the "last mile," charges on home deliveries.

- **Others** (pollution and natural resources): include taxes on substances that deplete the ozone layer, management of drinking water and wastewater, waste management, plastic waste, mining and quarries, pesticides, and fertilizers, among others.

In Latin America and the Caribbean (LAC), environmental taxes are significantly lower, in terms of GDP, than those applied in OECD countries (Figure 1). On the other hand, the importance of these taxes in the tax structure of countries in the region is highly heterogeneous, with a different specific weight in each country. The contrast is evident between countries like the Dominican Republic, Honduras, Costa Rica, or Uruguay, with revenue from environmental taxes between 1.7% and 2.2% of GDP in 2021, and others like Ecuador, Panama, Peru, or El Salvador, where these concepts are very insignificant in terms of GDP. Regarding their structure, taxes on energy are generally significantly more important.

FIGURE 1.
Tax revenues from environmental taxes in selected OECD and Latin American countries, 2021 *(GDP %)*



Source: OECD Data Explorer. Environmentally related tax revenue. Data extracted on 29th. December 2023.

The main component of environmental taxation in the countries of the region consists of fiscal instruments on various tax bases linked to energy generation (Cetrángolo and Fontañez, 2022). Primarily, this includes taxes on fossil fuels, taxes that levy CO_2 emissions (mainly when they are linked to the use of fossil fuels), and those that fall on the production, distribution, and commercialization of electric power in all its forms of provision.

In past decades, domestic prices of petroleum-derived products were not governed by conventional price-setting rules based on marginal costs or opportunity costs. Instead, political considerations, income distribution goals, and the promotion of industrialization were considered (Cetrángolo and Fontañez, 2022).

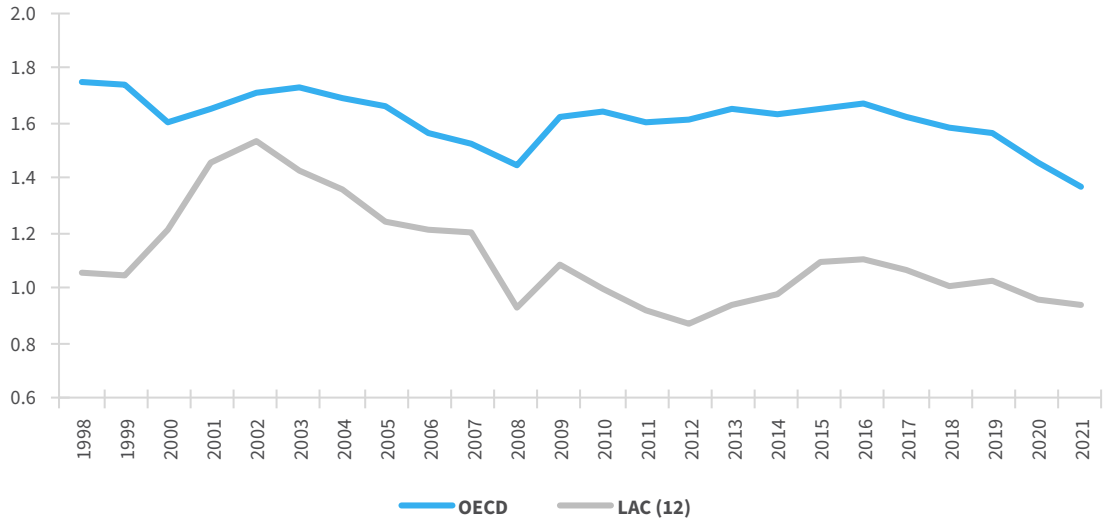
In oil-exporting countries in the region, and even in non-exporting countries with state-owned oil companies, this has meant granting an implicit subsidy (due to foregone export revenues by the central government and the absence of negative externalities costs), which often produces effects contrary to the originally intended ones and, in most cases, undermines environmental objectives by promoting excessive fuel consumption (Coady, et al., 2019).

In this regard, particularly in Latin America and the Caribbean (LAC), the existence of substantial subsidies to energy products, including fuels, in several countries poses a significant challenge in terms of environmental policy.

Furthermore, fuel taxes contribute a significant amount of tax revenue in several countries in the region, which typically fund part of the operation of public transportation as well as the costs of maintaining road infrastructure.

However, in line with international trends, there has been a decrease in tax revenues obtained from the application of these energy taxes in recent years, especially compared to what was observed a decade ago, where it appears that a peak in revenue collection was reached in most countries (Figure 2).

FIGURE 2.
Tax revenues derived from energy taxes in the OECD and Latin America, 1998- 2021 *(GDP %)*



Note: The average for Latin America includes the following countries: Argentina, Bolivia, Chile, Costa Rica, Colombia, Guatemala, Honduras, Mexico, Paraguay, Peru, Dominican Republic, and Uruguay.

Source: Self-made based on OECD data. Data Explorer. Environmentally related tax revenue. Data extracted on 29th December 2023.

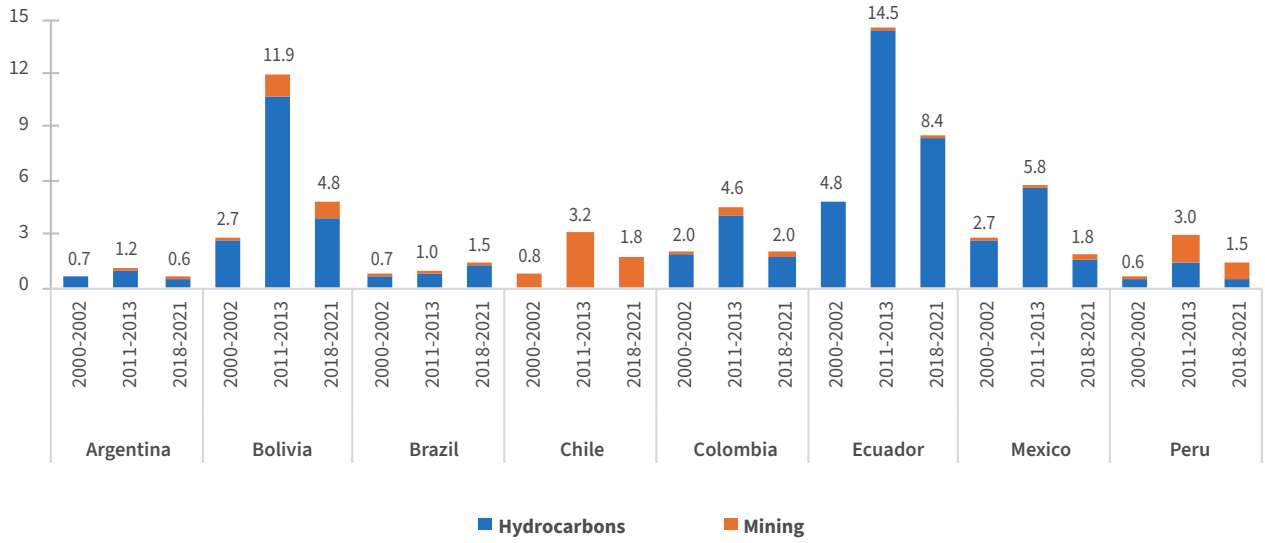
This phenomenon, observed at the regional level, may have been reinforced, at least partially, by the increased fuel efficiency of new motor vehicles. It has been exacerbated by the presence (common in the region) of a series of tax exemptions and differential treatments associated with these taxes—such as those for public transportation or freight transport—that significantly limit the effective revenue derived from their application (Cetrángolo and Fontañez, 2022).

2.3 Taxes on the extractive industry

While the nomenclatures commonly used by international organizations (OECD, European Union) to classify environmental taxes include taxes on natural resources, those taxes that levy extraction and production in the extractive industry are not usually considered environmental taxes. The European Union maintains that taxes on mineral and oil extraction "do not influence prices in the way that other environmental taxes, namely product taxes, do" (European Union, 2001).

Thus, although the dominant objective of taxation on production and extraction is the appropriation of extractive rent and revenue collection, many of these taxes, such as royalties, for example, have a significant—and often unintended—environmental impact through production reduction. Therefore, while they are not considered environmental taxes, their high environmental impact in extractive industries, as well as their fiscal importance (Jiménez and Podestá, 2023), make them potentially an important tool in the design of environmental tax reform (Figure 3).

FIGURE 3.
Tax revenues derived from the exploitation of non-renewable natural resources. Selected countries in Latin America, 2000-2021 *(GDP %)*



Source: Jiménez and Podestá (2023) based on CEPALstat.

These tax forms become particularly relevant when considering that the exploitation of natural resources (hydrocarbons, mining, and agriculture) is of utmost importance in the region and has a different impact on the environment. This suggests the use of differentiated tax instruments for each of these activities.

In countries specialized in hydrocarbon extraction, these activities often have two significant environmental impacts: one during their extraction and production, and another at the moment of their use. In these cases, fiscal policy plays a central role. Firstly, in extracting rent from these sectors, especially through the use of fiscal instruments applicable to extraction and production (upstream taxes) such as royalties, corporate income taxes, windfall taxes, etc. Secondly, through excise taxes on the consumption of these

products, especially through the implementation of taxes on fossil fuel consumption. These taxes, originally designed for revenue generation purposes, gradually evolved into precursors of green taxation, to the extent that they now represent the core of environmental taxation in the countries of the region.

In addition to the issues related to the limited quantitative relevance of environmental taxation, there is concern about the low "quality" in the design of many tax figures (Committee of Expert Individuals - IEF, 2022). Among these qualitative factors, on one hand, there is the lack of coverage by taxation of numerous environmental problems (significant sectors and polluting activities are outside the tax bases), and on the other hand, the persistence of tax rates that do not adequately reflect environmental impacts, thus thwarting the non-fiscal objectives of environmental protection and health. Furthermore, there is widespread use of the label of environmental taxes for taxes that do not address environmental pollution, with the intention of creating environmental reputation ("greenwashing") or simply serving as a "politically correct" argument to improve revenue. The reality in the region shows excessive administrative complexity and an uneven and uncoordinated proliferation of figures at different competency levels, where some tax bases often have little connection with the environmental issues underlying the taxes (Committee of Expert Individuals - IEF, 2022).

3 Environmental taxation and the objectives of ecological transition

The opportunity for a more active involvement in environmental taxation arises clearly when we examine the negative externalities stemming from the consumption and use of certain goods and products and compare the currently applied effective tax rates with those prevalent in developed countries.

Currently, there is a vast literature on the application of excise taxes and the environment. Ramsey (1927) initiated modern optimal taxation theory with his analysis of special taxation in a model with identical consumers, finding that optimal rates of special taxes vary inversely with the demand elasticities of the taxed goods. Ramsey's setup restricts the government to collecting a certain amount of revenue exclusively from special taxes. The resulting optimal tax pattern reflects that the excess burden of a tax increases the impacts they have on economic agents' behavior.

Diamond (1975) generalized the so-called "Ramsey rule" to configurations with heterogeneous individuals, showing that the resulting modified optimal special taxes reflect considerations of efficiency (lower tax rates on goods with elastic demand) and distributional concerns (higher tax rates on goods purchased by wealthy individuals).

Corlett and Hague (1953-54) emphasize the government's inability to tax leisure, which prevents uniform special taxes from being optimal in the Ramsey model. As a "second best," the optimal tax configuration involves imposing higher excise taxes on goods and services that are complementary to untaxed leisure.

In this context, under what circumstances would a government with access to a full range of income tax instruments want to impose special taxes at differentiated rates?

In response to this question, Atkinson and Stiglitz (1976) demonstrated that if consumers have identical utility functions that are weakly separable in consumption and leisure, then there is nothing to gain from complementing an optimal nonlinear income tax with differentiated special taxes. The reason is that, in

such a context, consumption patterns of basic goods fail to convey information to the government that is not already captured by income levels. However, special taxes can serve the function of controlling externalities, a consideration overlooked in the Atkinson-Stiglitz framework (Hines, 2007).

Pigou (1920) proposed imposing corrective special taxes at rates equal to marginal external damages, noting that doing so restores economic efficiency. Sandmo (1975) illustrates the optimal application of "Pigouvian" taxes when the government relies on special taxes to increase revenues. In practice, governments impose heavy taxes on energy products, motor vehicles, and other means of transportation, waste management, substances depleting the ozone layer, and other products and activities that could create externalities in environmental degradation.

According to Cnossen (2010), excise taxes can be explained by the following aspects:

- Revenue efficiency.
- Correction of externality.
- Information failures.
- Profit shifting.
- Enhancement of progressivity.

In practice, most excise taxes were originally enacted for revenue purposes because they are easier to administer than other taxes.

Taxes on tobacco, alcohol, gasoline, and motor vehicles can be a solid revenue stream because these products are easily recognizable, have high sales volumes, and are produced in concentrated ways, making administration and collection simpler. Moreover, there are usually few alternative products that consumers find as satisfying, so consumption, and therefore tax revenues, stay high even with the higher prices caused by excise taxes.

The higher taxation on taxable goods for revenue purposes also has an economic justification. The lack of close substitutes for these products, whether they are essential like energy or addictive like tobacco, alcohol, or sugar, implies that the demand for them is relatively inelastic. This means that the potential distortion of economic decisions due to the imposition of excise taxes is relatively small.

In a broader context, Ramsey (1927) showed that, under some fairly restrictive conditions, the total excess burden of taxes on products can be minimized by setting tax rates such that the percentage reduction in the quantity demanded of goods as a result of taxation is the same, considering cross-price effects on demand.

Taking these considerations into account, the 'Ramsey rule' can be reinterpreted in two ways, depending on the assumptions made about utility functions. If it is assumed that the demand for each good is independent (i.e., the cross elasticities are zero) and that each good represents a trivial fraction of expenditure (so that income effects can be ignored), the result is the so-called inverse elasticity rule. This rule states that the optimal tax rate on each good is proportional to the inverse of the price elasticity of demand for that good. The intuition behind this is that the least distorting tax system affects more those goods for which demand is invariant to their own price[1].

Excise taxes are often justified as charges for the negative externality that consumers or producers of such products impose on others, but which are not reflected in the price. This means that the marginal cost of action facing an individual consumer or producer is lower than the marginal cost of their action for society, and as a result, the individual engages more in the activity than is socially optimal. Charging consumers or producers for external costs, which they should internalize to reduce their activities to the socially optimal level, is known as the "Pigouvian prescription." This prescription indicates that efficient consumption or production can be achieved through the tax system by imposing an excise tax on the activity equal to the marginal cost of the damage caused to third parties.

However, marginal costs are often difficult to identify and measure, as they depend on who does what, where, and under what circumstances. In practice, therefore, average external costs are estimated, and a "pooling" approach (similar to insurance) is adopted by charging for these costs. Consumers as a group bear the costs by paying a uniform tax calculated as the total external costs divided, for example, by the number of cigarette packs, beverages consumed, or liters of gasoline used. This average cost approach seems acceptable if the damage, for example, through smoking or pollution, is roughly proportional to the cost.

1 Crawford, Keen and Smith (2010) point out that the implications of the inverse elasticity rule can be dangerously misleading. On the one hand, if the assumption that each good represents a trivial fraction of expenditures is relaxed (as it must be for tobacco, alcohol, and energy), an increase in the tax on that good has effects on the demand for other goods, particularly if they are related, such as beer versus wine and spirits. Thus, there would be distortionary and revenue-raising effects on other goods, while it would not be clear a priori whether the effects would be welfare-enhancing.

Nevertheless, measurement issues become relevant again if there is a consumption threshold below which adverse effects are absent or attenuated. In this situation, ideally, "Pigouvian" taxes should be non-linear in the level of consumption, which can become extremely complex to design.

Nonetheless, according to Pogue and Sgontz (1989), uniform taxation can still improve overall welfare if the reduction in external costs caused by consumers of a harmful good outweighs the loss in welfare of the "moderate" consumer. Sandmo (1975), on the other hand, demonstrated that Ramsey and Pigou optimal taxes can be applied sequentially. In fact, the least distortive tax is applied to each good according to the "Ramsey rule", and then "Pigouvian" taxes are additionally applied to those goods whose consumption is responsible for generating negative externalities.

In many cases, moreover, the goods that can be subject to both Ramsey and Pigou optimal taxes are the same: tobacco products, alcoholic beverages, gambling activities, and petroleum-derived products; so according to these criteria, the level of taxation on these goods should be quite high.

Green fiscal levies take on various forms, for example:

a) **Road services** (and similar transport services) resemble goods produced in the private sector that are optimally used when their price, commonly known as the user fee, equals the total social costs of operating the road network. Rates for road and highway users can be set to cover the total operating costs of the road network or the difference between the marginal social cost and the average private cost of road use.

As a result, road user payments may primarily include charges for the following categories of uncharged external costs:

- Consumption of road infrastructure, covering marginal damages to roads, namely the physical wear and tear caused by vehicles using transportation routes.
- Environmental costs, including atmospheric pollution (global and local), emissions of gases and nitrogen oxides contributing to acid rain, as well as particles (which can cause health issues), noise pollution, and landscape degradation, among others.

- Congestion costs, referring to the additional travel time imposed on other road users by road users themselves.
- Accident costs, associated with the costs of injuries and deaths caused to pedestrians and other road users.

b) Tax instruments on **fuels** include:

- Excise taxes on motor fuels, in general, differentiated by fuel type (gasoline versus diesel, leaded versus unleaded).
- Vehicle license fees vary based on the type of vehicle (cars versus trucks) and their characteristics (weight, engine, etc.).
- Tolls and congestion charges.
- Taxes on the purchase of new vehicles; and sometimes, surcharges on insurance premiums to account for accident costs.
- Regulatory measures such as technical inspections and checks and the use of special equipment like catalytic converters. Therefore, there are various regulatory practices that support green tax strategy, which ultimately also represent an additional cost.

4 Tax administrations and environmental taxation

Environmental tax reforms (ETRs) have aimed to shift taxes from conventional goods and services to activities that harm the environment, with fiscal recycling to compensate specific groups or promote specific activities (European Environmental Agency, EEA, 2005). These environmental taxes reduce the externality, although they do not completely eliminate it (Bosquet, 2000; Hoerner and Bosquet, 2001; De Mooij et al., 2012).

A reform of this kind primarily aims to address the negative externality by reducing the demand for the good or service causing it and, as a secondary objective, to contribute to greater economic efficiency by reducing the distortion caused by taxes, promoting technological innovation, and generating a positive impact on employment, output, or income distribution (Ekins and Speck, 2011). This secondary objective leads to the possible presence of a "weak or strong double dividend," where environmental taxes, in addition to addressing the negative externality, have positive effects on output or income distribution, based on fiscal recycling or directly (Galindo and Lorenzo, 2020; Gago et al., 2016). However, evidence regarding the existence of a "double dividend" remains uncertain (Freire-González, 2018).

In this context, tax administrations face a set of challenges related to generating information regarding the nature of externalities and the expected impacts of implementing green taxes, both on revenue and on production, employment, and income distribution. The availability of precise and detailed information about these impacts is key to strengthening the tasks of supervision, control, and advising to finance ministries, which are inherent to the usual responsibilities of tax administrations. Likewise, this quality information is crucial for establishing effective links with environmental goals, especially concerning each country's Nationally Determined Contributions (NDCs), and for enhancing the connection between tax instruments and the fulfillment of international commitments assumed within the framework of the 2015 Paris Agreement on Climate Change.

4.1 Evidence on potential repercussions

To design an environmental tax system that achieves its objectives, a proper assessment of the impacts resulting from the application of such taxes is required, primarily focusing on three aspects: a) the environmental externality being addressed (ecological damage); b) output and employment; and c) income distribution.

a) Information on ecological damage

In the presence of negative externalities, the market price of a particular good or service may be lower than the social cost of that good or service. Ultimately, a negative externality causes a collateral impact on the welfare or incomes of other agents or economic activities (Cropper and Oates, 1992; Galindo and Lorenzo, 2020).

Conceptually, the use of taxes or fines to address a negative environmental externality stems from the argument that ecological damage depends on pollutants generated by economic activities (consumption or production). Thus, the equilibrium point, which maximizes economic benefit, is achieved when the difference between the benefits and damages of pollution is equalized (the marginal price or cost of pollution equals the marginal benefit). Therefore, a "Pigouvian" tax corresponds to the marginal cost of pollution for each unit that generates pollution (Perman et al., 2003).

However, as already argued, designing a Pigouvian tax is highly complex because it requires determining the specific marginal cost of pollutant emissions. Therefore, in practice, it is common to use an approach where an average tax is applied, combined with the traditional standard and pricing approach, where an environmental standard is set and the tax is determined iteratively to meet the preset standard (Baumol and Oates, 1971). Hence, constructing a green fiscal strategy requires identifying the magnitude of the damage caused by negative externalities.

An increase in the relative prices of goods and services that generate negative externalities results in a reduction in their demand, usually accompanied by a rise in the overall price level. However, it is common for environmental taxes to fall short of their proposed goals due to various factors such as low price elasticities of demand or the complexities of political economy that arise from tax implementation.

To determine the consequences of implementing a tax strategy aimed at addressing the negative externality, it is necessary to characterize the demand for the good or service in question. In particular, it is relevant to estimate the price elasticities and income elasticities of demand for the good or service, thereby allowing us to estimate the demand response to tax changes.

The evidence presented in Table 1 shows that the demand for gasoline in Latin America is inelastic to price and, in absolute terms, lower in developing countries than in developed countries. Additionally, the income elasticities of goods and services that cause negative externalities are high and greater in developing countries than in developed ones[2]. Thus, the demand for private transportation in the current consumption pattern will continue to increase, leading to a rise in its negative externalities. This indicates that substitutes for private transportation in Latin America are limited and imperfect.

TABLE 1
Income and price elasticities of gasoline demand in the international literature.

	OECD countries	Latin American Countries
Income elasticity		
Long-run elasticity	0.55	0.69
Short-run elasticity	0.24	0.26
Price elasticity		
Long-run elasticity	-0.41	-0.31
Short-run elasticity	-0.22	-0.17

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. ECLAC Review.

It is also necessary to identify sustainable substitute goods, since the reduction sought in demand through taxation can drive an increase in the demand for goods that would promote the development of a sustainable or green economy. In this context, Coady et al. (2019) argue that a global price on fossil

2 Economic theory (Cnossen, 2015) suggests applying excise taxes to luxury goods and services that exceed unitary income elasticity, which can improve the progressivity of the tax system.

fuels, incorporating 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. In contrast, Galindo et al. (2015) estimate with a meta-analysis inelastic lower price elasticity, in particular, for developing countries.

b) Impact on output and employment

Environmental tax reforms (ETRs) generate additional collateral effects on economic activity. The impacts of green taxes on output and employment are highly heterogeneous and fundamentally depend on fiscal recycling. Indeed, the use of green taxes can potentially generate a "weak double dividend." This would be the case where fiscal taxes, aided by "fiscal recycling," generate positive collateral effects on output (or income distribution) or a "strong double dividend" with a direct positive effect on output (or income distribution) (Ekins and Speck, 2011; Agnolucci, 2011). Examples of "double dividend" effects associated with the application of gasoline or carbon taxes can be found in Stern (2007) and Labandeira et al. (2021).

Currently, environmental tax reforms (ETRs) must consider in their design aspects directly associated with the effects of climate transition on economic activity, among which the following stand out:

- Green taxes constitute a significant source of fiscal revenue that is relevant, given the magnitude of public resources required to advance the construction of sustainable infrastructure.

- The new tax modalities must be consistent with the establishment of a carbon-neutral economy between 2050 and 2070 (Parry et al., 2021), which entails the stranding of assets and the disappearance of activities with high carbon content, resulting in a significant loss of tax revenue for some countries in Latin America (McGlade and Ekins, 2015).

- In a context of deep decarbonization, the price of carbon, considered as the sole policy, could reach values between USD 300 tCOSource Sans 3 e and USD 700 tCO_2e (NGFS, 2020), which implies a significant reconfiguration of fiscal policy and tax revenue collection.

c) Distributional impacts

The available evidence on the direct effects of applying green taxes on income distribution is highly variable and depends on a set of factors, including the country's level of development, the type of energy taxed, and the process of "fiscal recycling" (Bosquet, 2000; Hoerner and Bosquet, 2001; Mooij, et al., 2012).

The available evidence shows that, on average, there is a small negative impact on output and income distribution, where "fiscal recycling" generates a weak or strong double dividend (Goulder, 1994; Parry and Oates, 2000; Hoerner and Bosquet 2001; Patuelli, et al., 2005; Barker, et al., 2007; Ekins and Speck; 2011). For example, fuel taxes for the private vehicle fleet primarily affect middle- and high-income groups and are usually progressive, if rural households are excluded, where they can have regressive impacts. Energy taxes for households in the United Kingdom, Ireland, Germany and France, Spain and Italy are weakly regressive, although this originates from the effects on middle-income groups (Smith, 1992; McNally and Mabey, 1999; Speck, 1999; Aasness and Larson, 2002; Bach et al., 2002; Symons et al., 2002; Ekins and Dresner, 2004; Bork, 2006; Ekins and Speck, 2011; de Mooij et al., 2012; Sterner, 2012).

The evidence also seems to indicate that a carbon tax has negative effects on output and marginal regressive effects on income distribution, which can be offset with fiscal recycling (Smith 1992; Repetto and Austin, 1997; Barker and Kohler, 1998; Labandeira and Labeaga, 1999; Bovenberg and Goulder, 2001; Ekins and Dresner, 2004; Paltsev et al., 2007; Metcalf et al., 2010; Metcalf, 2008; Williams and Wichman, 2015; Morris and Mathur, 2015; Dinan, 2015; Galindo et al., 2017).

To mitigate the regressive effects of environmental taxes, progressive excise taxes can be applied, targeting luxury consumer goods primarily consumed by wealthier individuals (such as airplanes, high-end cars, etc.), implementing fiscal recycling to reduce contributions to social security or capital, or applying taxes along with fiscal recycling in the form of lump-sum payments to all households. Other strategies include social tariffs or subsidized consumption quotas, eco-bonuses where environmental tax revenues are recycled based on per capita income, as well as subsidies, economic incentives, and soft credits to promote energy efficiency improvements (Galindo and Lorenzo, 2020).

4.2 Criteria for the design of environmental taxes

The technical criteria that a tax administration should follow to define its contribution to the design, collection and enforcement of taxes based on environmental criteria include the following aspects:

- Determining the external costs (negative externalities), primarily environmental, caused by the consumption of a good, using the abundant information available in the specialized literature;
- The contribution of green taxes to reducing (or controlling) negative environmental externalities;
- Estimation of the dynamic trajectory of potential fiscal revenue generated by the implementation of green taxes (taking into account that the successful application of these taxes will reduce the tax base and, therefore, imply a decrease in revenue);
- Quantification of the potential effects of green taxes on economic growth and income distribution;
- Identification of the main factors of political economy to consider in the implementation of tax innovations.

The methodology for analyzing green taxes necessarily includes the precise identification of negative externalities, which can be achieved through a review of available international literature and by seeking advice from external experts in each of the subjects involved in quantifying environmental damage.

In the case of consumption taxation, the methodological approach that tax administrations should apply involves a specific study of consumption patterns of goods and services to be taxed, allowing for the determination of the expected impact on potential revenue. This requires having estimates of the income and price elasticities of the good (or service) whose consumption causes the negative externality, as well as the main cross-price elasticities of goods (substitutes or complements). For this purpose, countries in the region have access to information from secondary sources that provide data on the structure of personal income distribution and household expenditure composition (by deciles or quintiles of population income). In particular, estimating the parameters of interest of demand functions requires the specification and estimation of econometric models using microdata from Income and Expenditure

Surveys. However, the information provided by these models must be approached with caution, considering methodological problems that may arise from the application of statistical-econometric procedures, especially regarding the estimation of price elasticities with cross-sectional data.

The analysis of potential distributive effects should be based on traditional tools used for assessing tax burden and incidence (before and after tax redesign), considering, for example, the information provided by Kakwani, Suits, and Reynolds-Smolesnky indexs (Jenkins, 1988).

The empirical study of consumption patterns and the fiscal impact resulting from a redesign of the structure of excise taxes for environmental purposes requires consideration of a classification of goods and services that allows for:

- Identify systematic behaviors in consumption patterns accurately;
- Mitigate potential bias issues that may affect econometric estimates based on microdata;
- Estimate potential effects of the considered levies on production and employment (with appropriate sectoral breakdowns);
- Establish relationships, as accurately as possible, between green taxes and the negative externalities they aim to correct.

Furthermore, the foundational analysis required to incorporate environmental criteria into Excise Taxes must consider that the relationship between negative environmental externalities associated with the consumption of goods and the applied tax is flexible. This is because environmental criteria are specific to the particular good or service and the location of emissions. Therefore, to convert them into tax burdens, one must rely on average estimates or an aggregate general tax.

Thus, it is a common practice to apply a tax that represents the second-best option of a “Pigouvian” tax. This tax is conceptually derived from a Pigouvian tax, but its specific rate is adjusted based on other considerations (such as average or aggregate effects of the negative externality, political economy, distributive considerations, or its effects on business competitiveness).

4.3 Technical aspects for emblematic cases

When assessing existing excise taxation systems and crafting proposals with environmental concerns in mind, tax authorities can leverage the conceptual framework of excise taxation. This approach should integrate recent advancements that clarify the functions of these tax structures, with particular attention to their role in addressing externalities and their distributive effects. Special emphasis should be placed on understanding how these taxes correct market failures and their implications for income distribution.

These taxes can be collected with low administrative and compliance costs and can be designed to enhance economic efficiency, promote environmental sustainability, and improve the progressivity of the tax system.

One of the fundamental areas of application where the use of these tax modalities has been extended is for environmental protection and correction of negative environmental externalities related to climate change (consumption of fossil fuels, use of transportation means, roads and highways, water consumption, motor vehicles, international travel, and even to tax carbon emissions).

In Latin America and the Caribbean (LAC), there are numerous examples of various excise taxes on consumer goods. According to how the tax liability is determined, these levies can be ad valorem (based on the value of the goods) or specific (based on quantities). In many countries in the region, excise taxes have an ad valorem structure, which does not easily lend itself to the incorporation of environmental criteria, as the prices and values of consumed goods do not provide relevant information about the environmental externality that is sought to be corrected through the application of a tax.

In most excise taxes aimed at correcting externalities, particularly environmental ones, the tax base should focus on a harmful element or cost-causer (either individual or social) that is not adequately reflected in the prices of consumed goods and that should be internalized through tax intervention. Technically, when the tax is used as a user fee, the tax base should be the best available proxy for its use. For example, fuel consumption for engines serves as an indicator of drivers' use of public roads. Therefore, substitute goods (alternatives) that do not lead to negative externalities should not be included in the tax base. Including substitute goods in the tax base of an excise tax can discourage

desirable shifts from more harmful to less harmful goods. To promote behavior that reduces harm, tax burdens should reflect differences in harm. Achieving this is very difficult with environmental externalities correction schemes that use ad valorem frameworks.

When excise or special taxes are collected to internalize negative externalities, it makes sense to collect the tax per quantity. Furthermore, if the tax is applied based on price, consumers have the opportunity to reduce trade (switching from premium products to discounted products) to limit their tax liability. Ad valorem taxes incentivize manufacturers to invest less in product development since price increases are penalized by the tax design itself. The same argument applies when considering motor fuel taxes, which are used as a proxy for road usage. It is not the dollar amount spent but rather the liters of gasoline used that serve as a proxy for road usage. Precisely for this reason, specific excise taxes are the most common.

Specific taxes have additional benefits, as it is often simpler to calculate the tax based on weight, volume, or quantity rather than value. This is especially true since goods are often produced by vertically integrated production units and therefore do not have a market value to tax. If a tax is applied based on value, the taxpayer or taxing authority must calculate an artificial monetary value to tax if the tax is not applied at the retail level. Although there are rules for making this calculation, technically known as transfer pricing, its implementation can create problems or perverse incentives.

When aiming to correct environmental externalities, the general principle is that the determination of the tax burden (tax rate) should be based on internalizing costs not reflected in market prices. It is well known that, from a technical standpoint, it is nearly impossible to accurately determine the non-internalized cost of driving a mile on a public road. Therefore, the determination of the tax burden to be applied should strive to approximate as closely as possible the monetary value of the externality being corrected.

It should not be overlooked that “fully efficient” taxes aiming to recover external social costs can vary depending on the location of consumption and the person consuming the goods in question. This means that theoretically, a corrective tax should address considerations that cannot be fully addressed in practice. Attempting to explicitly account for these differences would make the tax system extremely complex. Therefore, strict consideration of these criteria should be regarded as a guiding reference in determining tax rates.

Below are examples of the type of information that tax administrations can rely on to conduct the necessary technical analyses to support the design of green taxes.

a) Taxes on motor vehicles

There is extensive literature on the negative externalities caused by transportation such as local air pollution, traffic congestion, road accidents, greenhouse gas emissions contributing to climate change, noise, and infrastructure wear and tear (Parry & Small, 2004, 2005; Antón & Hernández, 2014, 2017; Cnossen, 2015). As an example, the Pan American Health Organization (2014) estimates around 7 million premature deaths due to diseases directly linked to environmental pollution.

In this context, there persists a tradition of applying various taxes on transportation, which includes type of vehicle, sale price, engine size, emission levels, taxes based on congestion levels, usage of specific roadways, or on gasoline consumption (Cnossen, 2020). For example, some of the taxes imposed on the acquisition, use, or ownership of vehicles, adjusted for their age or registration year, are summarized in Table 2.

There are schemes in Austria, Belgium, France, Germany, Italy, and the United Kingdom that relate the tax rate to the efficiency or emission of polluting gases. To be more illustrative in this regard, in Europe, the specific tax base corresponds to 2 euros for every 100 cm3 of gasoline consumption and 9.50 euros for every 100 cm3 for diesel vehicles, and the CO_2 tax is 2 euros per g/km emitted over 95g/km. In the case of cars with CO_2 emissions below 95 g/km, they are exempt and only cover the rest of the tax. Table 2 refers to private vehicles or vehicles intended for private transport.

TABLE 2

Taxes on the ownership or use of motor vehicles: International evidence

Country	Description	Exception
Australia	Annual registration fees are charged. Fees for commercial vehicles are generally higher than fees for private vehicles. In most states, **fees for trucks vary depending on the type of vehicle and the gross vehicle weight**. License renewal fees vary to reflect validity periods ranging from one to five years.	
Austria	**Motor vehicle tax:** Motor vehicles exceeding a gross permissible weight of 3.5 tonnes are subject to a motor vehicle tax based on the vehicle's weight (ranging from 1.55 EUR to 1.90 EUR per month and tonne depending on the weight). **Motor vehicle insurance tax:** Applicable to motor vehicles up to a maximum gross permissible weight of 3.5 tonnes. For first registrations before 1-10-2020: the tax is based on engine power in kilowatts (cars) or engine displacement (motorcycles). For first registrations after 1-10-2020: CO2 emissions are also taken into account in addition to engine power/engine displacement. For cars: (engine power in kilowatts - 65) * 0.72 EUR + (CO2 emissions - 115) * 0.72 EUR per month. For motorcycles: (engine displacement - 52) * 0.014 + (CO2 emissions - 52) * 0.20 EUR per month.	**Relevant exceptions:** motorcycles with a maximum displacement of 100 CC; vehicles used solely in agricultural and forestry production; vehicles used for disabled persons.

Country	Description	Exception
Belgium	**Wallonia Region:** The tax rate **depends on the fiscal horsepower and engine displacement** and is set according to a progressive scale ranging from 80.52 EUR to 2060.92 EUR. For vehicles with more than 20 HP (more than 41 cylinders), an additional amount of 112.33 EUR per HP is charged. Vehicles older than 30 years (25 years in the Brussels Capital Region) are subject to an annual tax of 36.53 EUR. **Flemish Region: F**or cars, dual-purpose vehicles, and minibuses registered as of January 1, 2016, as well as vehicles intended for the transport of goods, funeral cars, tractors, or trailers with a maximum authorized mass (MMA) of 2500 kg or less registered by June 30, 2017, **the tax rate depends on the fiscal horsepower and engine displacement**, but includes "eco-bonus" and "eco-malus." This means that the tax is modulated based on CO2 emissions, Euro norm, and fuel type (except in the case of rental cars). For leased vehicles and other non-leased vehicles, the tax rate depends solely on the horsepower and engine displacement and is set according to a progressive scale ranging from 80.52 EUR to 2060.92 EUR. For vehicles with more than 20 horsepower (more than 41 cylinders), an additional amount of 112.33 EUR is collected. Vehicles over 28 years old are subject to an annual tax of 38.08 EUR. Starting from the fiscal year 2022, this annual tax only applies to cars that are 30 years or older. **Brussels Capital Region:** The tax rate **depends on the engine power expressed in fiscal horsepower** and is set on a progressive scale ranging from 83.83 EUR to 2148.30 EUR. For vehicles with an engine power exceeding 20 horsepower (more than 41 cubic centimeters of displacement), an additional amount of 117.21 EUR per horsepower is applied. Electric cars are subject to the minimum rate. Vehicles over 25 years old are subject to an annual tax of 38.08 EUR. (The age at which a vehicle is considered a "veteran" will gradually increase from 25 to 30 years by 2025). For motorcycles, there is a flat-rate annual tax of 59.27 EUR. In the case of light vehicles weighing up to 3.5 tons with a maximum laden weight, as well as for motor-homes, the tax rate depends on the maximum laden weight. For heavy vehicles with a maximum permissible laden weight of more than 12 tons, the tax rate depends on the maximum permissible laden weight, the number of axles, and the type of suspension. In all regions, an additional annual circulation tax is applied to vehicles powered wholly or partially by liquefied petroleum gas. This tax is based on a progressive scale depending on the engine power, ranging from 89.16 EUR to 208.20 EUR. **Mileage tax:** In all regions, a mileage tax is applied to motor vehicles or combinations of articulated vehicles intended or used for road transport of goods with a maximum authorized weight exceeding 3.5 tons.	Motorcycles with a maximum displacement of 250 cc. **Flemish Region:** Starting from the fiscal year 2016, a tax reduction of 100 EUR is applied to vehicles running on liquefied petroleum gas. Exemption is granted to cars using certain fuels: pure electric, hydrogen plug-in hybrid (until 2021), CNG / LNG (until 2021).

Country	Description	Exception
Canada	Annual fees: All provinces impose annual fees for the use of motor vehicles. Generally, the rates depend on the type of vehicle and in most cases on the weight of the vehicle.	
Chile	The annual motor vehicle tax is collected by municipalities for the use of motor vehicles on public roads based on the vehicle's commercial value. Light vehicles: based on the vehicle's commercial value. Passenger vehicles: **fixed rate**. Cargo vehicles: based on loading capacity.	
Colombia	Annual Motor Vehicle Tax: This tax is collected by municipalities for the use of motor vehicles on public roads, and the **rates depend on the commercial value of the vehicle** as follows: (a) 1.5% of the vehicle's commercial value when the value is less than 48,029,000 Colombian pesos; (b) 2.5% of the vehicle's commercial value when the value is more than 48,029,000 and less than 108,063,000 Colombian pesos; (c) 3.5% of the vehicle's commercial value when the value is more than 108,063,000 Colombian pesos.	
Denmark	**Biannual Tax:** **The tax is based on fuel consumption**, with different rates for gasoline and diesel. The rates range from 310 Danish crowns (>20km/l) to 10,830 crowns (<4.5km/l) for gasoline cars, and from 130 crowns (>32.1km/l) to 16,100 (<5.1km/l) for diesel cars. **Annual Tax for Trucks:** Vehicles registered for the first time until April 24, 2007: The tax for private use is 1,060 Danish crowns annually for cars with a total permitted weight of up to 2000 kg and 5,920 crowns annually for cars with a weight between 2000 and 4000 kg. **Private Use Tax:** Vehicles registered on or after April 25, 2007: The private use tax is 5,920 Danish crowns annually for cars with a total permitted weight of up to 3000 kg and 17,590 crowns annually for cars with a weight between 3000 and 4000 kg. For cars used for both private and commercial purposes, the rates are 50%. Cars used exclusively for commercial purposes are exempt.	

Country	Description	Exception
Estonia	Heavy Vehicle Tax: Varies from 0 to 232.60 EUR (per quarter) depending on the combination of the following factors: weight range (12 tons to 40 tons and more), axle combination (2, 3, 4, 2 + 1, 2 + 2, 2 +3, 3 + 2, 3 + 3), type of suspension (pneumatic, others).	
France	Company Car Tax is based on two components: 1) **CO2 and other air pollutant emissions.** For CO_2 emissions, the rates vary from 1 euro per gram emitted for cars emitting from 20g of CO_2/km to 60g of CO_2/km, up to 29 euros per gram emitted for cars emitting more than 250g of CO_2/km. 2) **For other air pollutants**, the rate is 20 euros for unleaded gasoline and 40 euros for diesel. **Annual Tax on Polluting Vehicles:** Owners of vehicles emitting from 250g of CO_2/km for cars registered in 2009 to 190g of CO_2/km for cars registered from 2012 onwards must pay an annual tax. The rate is 160 euros per year.	Cars over 10 years old; electric or gas-powered cars (for hybrid vehicles using both petrol and gas, the exemption is halved). Vehicles using both gasoline and LPG are exempt up to 50%.
Finland	Annual fee for delivery vans and passenger vehicles based on CO_2 emissions. If the vehicle does not have emissions data in the Vehicle and Driver Data Register, the tax is based on the total vehicle mass. Tax rates range from 53.29 EUR for vehicles emitting from 0 g CO_2/km to 654.44 EUR for vehicles emitting 400 g CO_2/km or more. A driving power tax is applied to diesel cars and vans, based on the total vehicle mass. The driving power tax also applies to other cars and vans using less taxed fuels than gasoline. For trucks, there is an annual tax based on the maximum gross weight, number of axles, and trailer usage.	

Country	Description	Exception
Greece	**Annual circulation tax** on private cars registered for the first time in Greece / European Union / European Economic Area before 31-10-2010 (as well as those with initial international registration before 2002), and also motorcycles regardless of their date of registration: **based on a cylinder capacity** from 22 EUR to 1380 EUR. For the above category, there is an additional criterion of years of automobile circulation. Private cars and cabs registered for the first time in Greece / European Union / European Economic Area after 1-11-2010: based on CO_2 emissions from 0 EUR to 3.72 EUR per gram of CO_2. Annual road tax on trucks based on gross weight and on buses on number of seats. From 7/31/2020 new registration tax rates are defined with a progressive tax scale on the taxable value (retail price before tax), which are further differentiated depending on the CO_2 emissions of passenger cars and the emission standard.	The main exemptions include: electric cars; hybrid vehicles registered until 10-31-2010 with a displacement of less than 1,549 cc; private cars registered after 11-1-2010 with CO_2 emissions below 90g/km; motorcycles up to 300 cc displacement used to replace older technology motorcycles (replacement must be done by 12-31-2009). For motorcycles with displacement over 300 cc used to replace older technology motorcycles, the exemption applies for 5 years only after the date of the new motorcycle's first registration. There are exemptions from registration tax since 7-31-2020 for hybrid cars with CO2 emissions below or equal to 50 g/km. These are exempt from registration tax by 75%; hybrid vehicles with CO_2 emissions of 51 g/km or more are exempt from registration tax by 50%; Additionally, caravans are also exempt from the registration tax.
Germany	Motor vehicle tax. For cars registered for the first time from July 1, 2009: the Motor Vehicle Tax is mainly based on CO_2 emissions. **It consists of a base tax (based on engine displacement) and a tax on CO_2 emissions**. The base tax rates are 2 euros per 100 cc (petrol) and 9.50 euros per 100 cc (diesel), respectively. The CO_2 tax is linear, at 2 euros per g of CO_2/km. Cars registered for the first time before July 1, 2009 are taxed based on their pollutant emissions (EURO standard) and engine displacement.	Cars with CO_2 emissions below 95 g/km are exempt from the CO_2 component. Only the base tax must be paid. Exemption for pure electric cars for ten years after the first registration, if the car is registered between May 18, 2011, and December 31, 2025. The time-limited tax exemption is only available until December 31, 2030, at the latest.
Ireland	Private Car Motor Tax: Based on CO_2 emissions. Rates range from 120 EUR (for 0 g CO_2/km) to 2350 EUR (above 225 g CO_2/km). Commercial Vehicle Tax: Based on net weight. Rates range from EUR 333 (<3000 kg) to EUR 5195 (> 20000 kg).	Electric Propulsion Vehicles: Flat rate of 120 EUR for private vehicles and Flat rate of 92 EUR for commercial vehicles weighing less than 1500 kg.

Country	Description	Exception
Italy	Annual property tax varies from 2.58 EUR per KW to 4.95 EUR per KW **based on engine displacement** and emissions. Regions can adjust the national rate. A surcharge is levied on the usage of cars and vehicles for transporting people or goods at a rate of 20.00 EUR for every KW exceeding 185 KW of engine power. This surcharge decreases by 40%, 70%, and 85% after five, ten, or fifteen years from the vehicle's construction, respectively.	Special measures for reducing the motor vehicle tonnage tax include: Environmentally friendly vehicles, barrier-free buses and taxis, trucks equipped with collision damage relief braking systems, etc. Special refund measures for motor vehicle tonnage tax include: Vehicles properly scrapped or destroyed due to certain disasters before the expiration date of the valid inspection certificate. Special measures for reducing the Automobile Tax and Light Vehicle Tax include: Environmentally friendly vehicles.
Japan	**Motor Vehicle Tonnage Tax** (national) levies commercial vehicles based on their weight. The tax rate for passenger vehicles ranges from 4,100 yen to 6,300 yen per 0.5 ton, and for trucks from 3,300 yen to 6,300 yen per ton. **Automobile Tax: Taxes commercial vehicles based on engine displacement.** For passenger vehicles, it ranges from 25,000 to 110,000 yen; for trucks (4-5 ton maximum load), it's 25,500 yen; for buses (capacity of 41 to 50 passengers), it's 49,000 yen. **Light Vehicle Tax (local):** Applies to light vehicles and motorcycles according to engine displacement and standards. Vehicles with low environmental impact, barrier-free buses and taxis, trucks equipped with collision damage relief brake control devices, etc.	Vehicles with low environmental impact, barrier-free buses and taxis, trucks equipped with collision damage relief brake control devices, etc.
Korea	**Car tax: Rates are applied based on engine displacement**, ranging from 80 won per cubic centimeter to 200 won per cubic centimeter for non-commercial vehicles; and from 18 won per cubic centimeter to 24 won per cubic centimeter for commercial vehicles.	Full exemption for disabled persons

Country	Description	Exception
Luxembourg	**Car Tax:** The annual circulation tax is based on CO_2 emissions. Tax rates are calculated by multiplying CO_2 emissions in g/km by 0.9 for diesel cars and 0.6 for cars using other fuels respectively, and with an exponential factor (0.5 below 90 g/km and increased by 0.1 for every additional 10 g of CO_2/km). Heavy Vehicle Tax (also known as "Eurovignette"): Applies to vehicles (trucks) with a gross weight of 12 tonnes or more for the use of highways. Taxes also vary according to European standards.	Electrically powered cars.
Mexico	As of 2012, the federal property tax was abolished. State governments may impose a property and/or periodic registration tax. The registration fee averages 990 pesos, and the property tax typically ranges from 3.0% to 19.1% depending on the value, type of vehicle, and number of passengers.	States exempt hybrid and electric vehicles used for public passenger transportation. Some states offer exemptions for private use as well. Additionally, some states provide a 100% subsidy for vehicles of any value.
Netherlands	The motor vehicle tax is based on the curb weight and the type of fuel used. A provincial surcharge is applied. The heavy vehicle tax (also known as "Eurovignette") is applied to vehicles (trucks) with a gross weight of 12 tons or more for highway use in the Netherlands. Taxes also vary according to European standards (diesel category).	Vehicles with zero CO_2 emissions are exempt from taxes. Low-emission vehicles (CO_2 emissions not exceeding 50 g/km) pay 50% of the taxes. Other examples of exemptions include: Ambulances (for animals), Vehicles used by fire brigades and police/ defense, Funeral vehicles, Vehicles used for cleaning, maintenance, or construction of roads, Taxis and vehicles over 40 years old There are also other special regimes, such as reduced tax rates for delivery vans owned by entrepreneurs and used for commercial purposes at least 10% of the time, and for vans equipped and used by disabled individuals.

Country	Description	Exception
Portugal	Annual state and municipal tax on vehicle ownership (revised on July 1, 2007). For passenger vehicles and mixed-use automobiles with a gross weight not exceeding 2500 kg registered after the reform, the tax rate is based on the engine capacity and CO2 emissions. For vehicles registered from 1981 until the reform, rates vary according to the engine capacity or voltage, registration date, and fuel type.	Vehicles owned by the State (central, regional, or local administration), fire departments, foreign states, diplomatic and consular missions, international organizations, specialized European organizations, and persons with disabilities; vehicles seized by the State as part of a criminal process are also exempt. Ambulances, passenger vehicles for rental or taxi services, tractors, funeral vehicles, non-motorized vehicles that are purely electric or powered by renewable energies are also exempt. As of April 1, 2020, a tax exemption also applies to certain types of vehicles under 30 years old, considered of historical interest, and whose annual mileage does not exceed 500 kilometers.
Spain	Motor vehicle tax (levied by municipalities) based on the engine power of passenger cars, passenger capacity of buses, cargo capacity of trucks, and cylinder volume of motorcycles.	Official vehicles belonging to public bodies of diplomatic offices, ambulances, vehicles adapted for disabled persons, public transport vehicles with more than nine seats, tractors and other vehicles for agricultural use; historic vehicles.

Country	Description	Exception
Sweden	The annual circulation tax for cars from 2006 onwards or older cars that meet at least Euro 4 exhaust emission standards is based on CO_2 emissions. Similarly, campervans, light vehicles, and light buses used in 2011 or later are subject to taxes based on CO_2 emissions. The tax consists of a basic fee of 360 crowns plus 22 crowns for each gram of CO_2 the vehicle emits above 111 g/km. If the vehicle can be driven with diesel fuel, this sum is multiplied by 2.37 plus 250 or 500 crowns, depending on the vehicle's year. For vehicles that can be driven with alternative fuels, the tax is 360 crowns plus 11 crowns for each gram of CO_2 the vehicle emits above 111 g/km. New vehicles subject to taxation for the first time after July 1, 2018, model year 2018 or later, with high CO_2 emissions will be taxed at a higher rate for the first three years. For gasoline-powered vehicles, the tax consists of a basic fee of 360 crowns, plus a CO_2 amount consisting of 82 crowns for each gram of CO_2 the vehicle emits above 95 g/km up to 140 g/km and 107 crowns for each gram of CO2 the vehicle emits above 140 g/km. If the vehicle can be driven with diesel fuel, the same principles apply, plus the CO_2 amount g/km emitted by the vehicle is multiplied by 13.52 plus 250 crowns. After the first three years, the CO_2-related amount is 22 crowns per gram over 111 grams per kilometer.	An exemption from the annual circulation tax applies to eco-friendly cars for the first five years. That set of rules has expired, but still applies to vehicles that are taxable for the first time before July 1, 2018. New rules came into effect on July 1, 2018, for new vehicles subject to taxation for the first time after July 1, 2018, and classified as eco-friendly vehicles with low CO_2 emissions qualifying for a purchase bonus. The exemption applies to cars, campervans, light vehicles, and light buses with low CO_2 emissions in proportion to the vehicle's weight. The vehicle's CO_2 emissions will not exceed a calculated value of (95 + 0.0457 x (vehicle weight in kg – 1,372)). For alternative fuel vehicles, the value is calculated as (150 + 0.0457 x (vehicle weight in kg – 1,372)). Electric cars should not consume more than 37 kWh / 100 km.
United States	The tax on the use of heavy vehicles on highways applies to the use of trucks weighing 55,000 pounds or more. For those trucks (except logging trucks) weighing no more than 75,000 pounds, the tax is $100 per year plus $22 for each 1,000 pounds exceeding 55,000 pounds. For trucks weighing more than 75,000 pounds, the tax is $550. For logging trucks, the tax is $75 per year for trucks weighing at least 55,000 pounds plus $16.50 for each 1,000 pounds exceeding 55,000 pounds. For logging trucks weighing more than 75,000 pounds, the tax is $412.50. A tax credit can be claimed in the following year if the vehicle was driven 5,000 miles or less (7,500 miles or less for agricultural vehicles). State and local governments may impose periodic registration, operator licenses, parking fees, and inspection, as well as property taxes.	

Source: OECD (2020), Consumption Tax Trends 2020: VAT/GST and Excise Rates, Trends and Policy Issues, OECD Publishing, Paris, https://doi.org/10.1787/152def2d-en. Text corresponds to Source.

b) Fuel consumption tax (gasoline) for transportation

A gasoline[3] consumption tax that accounts for the full range of negative externalities including congestion and road accidents, local air pollution, and climate change can be estimated based on the methodologies of Parry and Small (2005) and Antón and Hernández (2014, 2017).

These estimations take into account the negative externalities of local air pollution, accidents, road congestion, and greenhouse gas emissions. In the implementation of these estimations, various scenarios can be considered, such as different levels of carbon pricing or various alternatives for calibration based on more recent parameter estimates. Specifically, it is important to incorporate into the analysis that the health costs associated with diesel pollution per liter are higher than for gasoline. Recent studies have shown that despite diesel engines burning less fuel than gasoline engines, the combustion process produces higher levels of airborne particles that lead to cancer, respiratory problems, and pollution.

These estimations support the implementation of specific taxes on transportation fuels, which can be broken down into taxes on fuels, vehicles, and payment for road usage.

The implementation of these fuel taxes must consider that:

- There are arguments regarding the negative environmental and health externalities for a specific tax on fossil fuel expenditure;
- Fuel taxes can be disaggregated into spending on gasoline, on vehicles, and other expenses associated with private transportation;
- International evidence suggests that, in general, fuel taxes applicable to private transportation and vehicles are progressive (Sterner, 2012);

3 The economic costs associated with the negative externalities caused by transportation are particularly significant. According to Coady et al. (2019), subsidies to fossil fuels globally amounted to 6.5% of global GDP in 2017.

- Aggregate estimations suggest a "Pigouvian corrective tax", primarily compensating for negative externalities of local air pollution, traffic congestion, road accidents, and greenhouse gas emissions, ranging[4] between USD 0.30 and USD 0.60 per liter of gasoline in Latin America (Parry and Small, 2005; Antón and Hernández, 2014) (see Table 3);

- Specific taxation on transportation fuels can be implemented by distributing the tax burden across a set of vehicles or by resorting to charging for the use of road infrastructures.

TABLE 3
Optimal gasoline tax: selected countries

Author	Optimal gasoline tax and country
Parry and Small (2005)	USD $1.01 per gallon for the United States in 2011.
Parry and Strand (2012)	USD $2.35 per gallon for Chile in 2006.
Hernández and Antón (2017)	USD $27.5 cents per liter in Guatemala in 2013.
Antón Sarabia and Hernández (2014)	USD $1.90 per gallon in Mexico in 2011.

Source: Hernández-Trillo, F. and A. Antón-Sarabia (2017) "El Impuesto Óptimo a la Gasolina en Guatemala." Working Paper, ECLAC, Santiago de Chile and Antón-Sarabia, A. and F. Hernández-Trillo (2014) "Optimal gasoline tax in developing, oil-producing countries: The case of Mexico", Energy Policy, 67, 564-571. See also Parry, Black, and Vernon (2021) p.18.

c) Taxes on household appliances

Household appliances generate various negative externalities. Generally, it is observed that their demands have a high income elasticity and a low price elasticity, so the current consumption pattern will increase negative externalities (see Table 4).

4 For example, a tax of USD 20 per ton of CO2e results in an increase of 18 cents per gallon of gasoline (one gallon is 3.78 liters).

TABLE 4

Price elasticities of demand for household appliances: a review of the literature

	Price elasticity	Income elasticity	Price elasticity of the brand	Implicit discount rate	Years	Period
Clothes dryers[1]	-0.14	0.26	-	-	1947-1961	Combined
Air conditioner[1]	-0.37[6]	0.45	-	-	1946-1962	Combined
Dishwasher[1]	-0.42	0.79	-	-	1947-1968	Combined
Refrigerators[2]	-0.37	-	-	39%	1997	CP
Various[3]	-	-	-0.76[7]	-	-	Combined
Air conditioner[4]	-	-	-1.72	-	1949-1961	CP
Clothes dryers[4]	-	-	-1.32	-	1963-1970	CP

Source:

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

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

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

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

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

The main negative externalities associated with the consumption of household appliances (televisions, dishwashers, washing machines, dryers, refrigerators, electric kettles, coffee makers) and vehicles correspond to electricity usage, generation of waste or consumption of water and other inputs. The available evidence on these negative externalities in household appliances is summarized in Table 5.

TABLE 5
Negative externalities in household appliances

Source	Externality
Natural resources use	On average, it requires 240 kg of fossil fuels, 22 kg of chemicals, and 1,500 kg of water to produce a desktop computer. For a car or refrigerator, it requires between 1 and 2 times their weight in fossil fuels.
Energy 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 of e-waste in 2017. 70% of solid waste in landfills corresponds to electronic waste. Inadequate management contaminates soil and water.

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

The available international evidence shows that there are various specific taxes on electronic devices (see Table 6). These tax experiences vary greatly with a wide range of levies, which raises various technical and administrative problems of definition, collection, and compliance that may even induce their purchase abroad.

There are arguments regarding the negative environmental and health externalities for a specific tax on expenditure on household appliances. These taxes exhibit high variability depending on the type of appliance and the country, and are closely related to negative externalities and levies on solid waste.

TABLE 6
Taxes on household appliances

Commodity	Puerto Rico	Italy	South Korea	Latvia	Poland	Portugal	Slovenia	Switzerland	Canada	United States
Air conditioning appliances	35%	€ 2		€1.44 per kg for household equipment	€0.41 per kg	€1.62 - €72.60 per unit	€0.0083 per unit of pollutant			
Refrigerators	10%	€ 16		€1.44 per kg for household equipment	€0.41 per kg	€1.65 per kg	€0.0083 per unit of pollutant	€34.12 per unit	€34.12 per unit	
Washing machines, including those with drying function, and clothes dryers, up to 10 kg.	10%			€1.44 per kg for household equipment	€0.41 per kg		€0.0083 per unit of pollutant			
Electric razors, hair clippers or shears, and depilatory appliances, with built-in electric motor	15%			€2.33 per kg. Small household appliances	€0.41 per kg	€0.01 - €0.30 per unit	€0.0083 per unit of pollutant	€0.5139 per unit		
Turntables, record players, cassette players, and other sound reproducing devices, without built-in sound recording capability				€2.33 per kg. Small household appliances	€0.41 per kg	€0.22 - €0.62 per unit	€0.0083 per unit of pollutant	€0.5139 per unit		
Devices for recording or reproducing images and sounds (videos), including those with built-in image and sound signal receiver		€0.50		€2.33 per kg for monitors	€0.41 per kg	€0.22 - €0.62 per unit	€0.0083 per unit of pollutant	€0.5139 per unit		€3.62 - €4.52 per unit
Devices for receiving radiotelephony, radiotelegraphy, or broadcasting, including combinations thereof (cabinet with sound recorder or player or with a clock)	15%		0.3374 EUR per kg	€3.33 per kg for mobile phones	€0.41 per kg	€0.02 per unit	€0.0083 per unit of pollutant	€0.5139 per unit		
Television receivers	15%	€7		€3 per kg	€0.41 per kg	€1.04 - €7.50	€0.0083 per unit of pollutant	€0.5139 per unit	€10.23 - €27.28 per unit	
Incandescent lamps		€0.14 for lamps €0.26 for light bulbs		€8.58 per kg for lamps €0.14 per bulb for light bulbs	€1.72 per kg	€55 per kg	€0.0083 per unit of pollutant	€0.5139 per unit	€0.1705 - €0.2728 per piece	

Source: OECD (2021). PINE database - Environmental Policy Instruments.

Note: For Canada, taxes correspond to those applied in the provinces of Alberta and British Columbia. For the United States, it corresponds to the state of California.

d) Taxes on plastics (plastic bags)

Plastic waste incurs significant environmental and health costs (Cnossen, 2020; OECD, 2018). For instance, in the fishing, shipping, and tourism industries, annual global losses due to improper plastic waste management are estimated at USD 13 billion (UNEP, 2014). Additionally, there are health costs associated with the ingestion of microplastics that are not removed by household water treatment (Lippelt, 2017).

There are different types of taxes applied to the use of plastic bags (see Table 7). For example, in France, there is a charge of 10 euros per kg of this type of waste, Portugal has a tax of 0.20 euros per kilogram, Ireland has 0.22 euros, and levies of around USD 0.10 in Uruguay and Ecuador.

TABLE 7
Taxes on the use of plastic bags

Country	Tax (€ per kg)
Belgium	3,00
Denmark	9,32
France	10,00
Italy	0.434 for plastic with recycling chain 0.005 € per bag
Estonia	2,50
Hungary	5,78
Ireland	0,22 € per bag
Latvia	0,70
Lithuania	0,51
Netherlands	0,43
Poland	0,047 € per bag
Portugal	0,20
Spain	0,05 € per bag
Ecuador	0,04-0,10 per bag up to 2023
Uruguay	0,11 per bag

Source: OECD (2021). PINE database.

In the application of these taxes, it should be considered that there are arguments based on negative environmental and health externalities for a specific tax on the use of plastic bags, and that taxes on plastic bags and plastics, in general, are becoming more widespread globally.

e) Taxes on solid waste (electronic items)

The generation, inefficient management, and disposal of solid waste cause a range of negative externalities such as land, water, and ocean pollution, as well as health effects. The incineration of waste causes air pollution, including particulate matter and toxins, and generates approximately 5% of global greenhouse gas emissions (World Bank, 2018; Akinbile and Yusoff, 2011). In this regard, taxes on waste can help reduce its generation and improper disposal, promoting the development of better collection and management infrastructure.

TABLE 8
Costs of solid waste collection and disposal in Latin America

	Unit costs (USD/tonne)
Collection	34,22
Final disposal	20,43

Source: IDB (2015).

Internationally, different charging methods are used (fees per weight, per container, per bag or sticker) for waste generation or collection, with the following charging schemes standing out[5]: fixed amount; per bags or stickers; per volume; per weight; per collection frequency; hybrid systems. Some of the taxes on solid waste are summarized in Table 9.

5 See Watkins et al. (2012), Alzamora and de Barros (2020), and Galindo and Lorenzo (2020).

TABLE 9
Types of taxes on solid waste at the international level

Country	Tax
Australia	€23.52 per metric tonne.
Austria	Varies between municipalities.
Belgium	€35.00 per tonne of waste if the household produces more than 240 kg per person per year.
Denmark	€63.79 per tonne of waste.
France	Fee per volume of collected waste, determined by each municipality.
Germany	Between €0.0760 and €1.40 per kilogram of waste, depending on the type of waste.
Italy	1-5% of the local tax for urban waste. Each municipality defines the fee for waste management and disposal.
Japan	Fee defined by municipalities.
Mexico	€0.0611 per kilogram when urban solid waste exceeds 50 kilograms.
United States	Between €0.8308 and €4.99 per tonne.
United Kingdom	€87.89 per tonne.

Source: OECD (2021). PINE Database.

The implementation of taxes on solid waste should consider that there are arguments based on negative environmental and health externalities to impose this specific tax. Levies on urban solid waste generation can have regressive effects on income distribution (Welivita, et. al. 2015, Reschovsky and Stone, 1994). In fact, these taxes may represent more of a property tax than a waste tax, which leads to them being regressive by design (Agovino et. al. 2021).

4.4 Ecological impact control mechanisms and tax consequences

The control of the ecological impact of taxpayers' actions involves implementing mechanisms that minimize or mitigate the negative effects of human activities on the environment and that, through tax incentives, allow production methods and consumption patterns to be compatible with the preservation of environmental resources. Procedures may vary depending on the sector considered and the type of environmental impact focused on.

Below are some examples intended to illustrate the kind of general approaches that help identify behaviors consistent with environmental care, explicitly mentioning the possible consequences from the standpoint of tax structure and tax administration. It is important to emphasize that tax consequences can vary significantly depending on the specific legislation of each country or region.

In the case of energy efficiency, the design of green taxes often aims to create incentives to encourage the adoption of technologies and production practices that contribute to reducing energy consumption and greenhouse gas emissions. Some jurisdictions offer tax incentives, in the form of credits or tax deductions, to companies that adopt cleaner technologies and reduce their polluting emissions. In certain circumstances, incentives can be implemented through deductions in other types of taxes, for example, in corporate income tax.

In terms of waste, green tax designs should encourage the development of effective waste management systems, including recycling and waste reduction. From a tax perspective, there are examples of systems that offer tax benefits in certain areas or locations for taxpayers who have implemented recycling and waste reduction programs. Similarly, the existence of recognized environmental certifications can signal companies' commitment to adopting sustainable production practices. This certification can serve as a necessary condition for the granting of tax benefits or for achieving more favorable consideration in tax assessments.

Participation in reforestation and ecosystem conservation programs can be considered as an indicator of taxpayers' willingness to take actions to offset harmful impacts of their productive activities on the environment. Similar to energy efficiency, investments made can receive tax benefits for companies that participate effectively and certified in these types of activities.

The implementation of actions aimed at disseminating information about the economic and social value of environmental care and the development of educational experiences on environmentally sustainable practices, for employees of the company or open to the participation of local communities, can also be examples of behaviors that serve as a guide for the granting of tax incentives.

In the field of technological innovation, green tax designs can encourage investment in research and development of cleaner and more sustainable technologies, enabling expenses in these areas to be eligible for the granting of tax credits.

4.5 Human resources training

The development of an agenda to advance the redesign of tax systems including environmental considerations would require the establishment, within the senior leadership of tax administrations, of a high-level group responsible for planning capacity-building needs and conceiving specific analytical programs on specialized subjects. In this regard, it would be advisable for training experiences to involve the joint participation of technical staff from the administration itself and external experts.

When defining the implementation modality for each component of the program, efforts should be made beforehand to determine how the production of technical inputs (analytical reports) will be coordinated with the strengthening of human resources training.

The necessary consistency among the various topics included in the agenda implies prioritizing the importance of having a macro and microeconomic framework (simplified) that serves to:

- establish a conceptual framework to guide the development of analytical studies;
- design tools that allow understanding the effects of policy interventions and evaluate their consistency with relevant climate scenarios (including the necessary training process for human resources).

In general terms, analytical tools should help to monitor climate change issues in a flexible format, so that new challenges can be identified and emerging issues can be detected early, incorporating aspects related to:

- international climate change negotiations and their economic consequences (such as the formation of stranded assets);
- the evolution of greenhouse gas emissions and the degree of compliance with mitigation commitments;
- new mechanisms for estimating the economic costs of climate change;
- the development of green tax innovations;
- procedures for estimating losses in tax revenue associated with the reduction (disappearance) of taxable bases, which can entail considerable revenue losses;
- the determination of a carbon price that considers the economic and distributive consequences of implementing a hybrid system of tradable permits and carbon taxes;
- the incorporation of climate financing alternatives, including the development of bankable projects (public and private);
- the analysis of climate transition risks for the economy of the country in question;
- the definition of a development strategy consistent with reducing climate vulnerability and building a carbon-neutral economy (alignment between the NDC and the Long-Term Strategy);
- the development of analytical tools to monitor and simulate various fiscal scenarios in the context of climate change.

Ultimately, tax administration training programs should focus on the development of their human resources, covering various aspects related to the deep decarbonization of the economy and the use of fiscal and tax tools that contribute to defining a new system of economic incentives aimed at producing a structural change in current consumption patterns and modes of production that drive climate change.

4.6 Skills to establish and manage compensation mechanisms

The growing concern about the effects of ecological transition demands special attention to the distributive impacts, both personal and regional, as well as intergenerational, of green taxes. This involves establishing and managing compensatory measures to mitigate such effects and thus generate the political and social viability conditions required by the processes of change involved in responding to the challenges of climate change. These issues, central in the current analysis and debate on taxation, play a fundamental role in the definition and evaluation of the various components that deserve to be considered in an environmental tax agenda and, therefore, should be integrated into the strategy of tax authorities.

From the perspective of tax design, it's important to highlight that green taxes are clearly visible to taxpayers. This represents a significant difference compared to other environmental regulation and control alternatives that also generate distributive effects through various channels (price changes, increased costs, etc.). It is precisely the transparency of green taxation that facilitates the establishment of compensatory measures to correct undesired distributive impacts and, in parallel, simplifies the introduction of technical adjustments in tax designs to protect the competitiveness of companies belonging to affected sectors.

Environmental taxes also have an additional advantage over other public policy alternatives, in that they generate public revenues that can be used for multiple purposes, including compensating those potentially affected by the implementation of these tax modalities.

The available evidence for Latin America and the Caribbean confirms that lower-income groups contribute to a lesser extent to greenhouse gas emissions and, at the same time, are the most vulnerable to climate change (Galindo & Lorenzo, 2020). This is because extreme weather events have a more severe impact on populations with fewer resources to adapt to new conditions and who also face more difficulties in recovering their productive activities or their income levels prior to the occurrence of a natural disaster. Additionally, lower-income sectors consume less energy and use private transportation less frequently (ECLAC, 2015).

The implementation of fiscal instruments to incentivize environmental care and promote energy transition has a significant distributive impact among families, sectors, and regions. Therefore, it is impossible to consider

the adoption of a Green Fiscal Reform (GFR) without explicitly addressing the complex dimensions of political economy associated with its implementation. In this context, the design and management of compensation mechanisms play a fundamental role in the implementation strategy of green taxes.

Compensations can be carried out through different types of instruments, namely:

- **Tax expenditure** through modifications in the tax structure (exemptions and non-taxation, bonuses, reduced rates, etc.) in favor of certain groups of taxpayers;

- **Subsidies** to facilitate the transition of facilities and equipment for households most affected by climate change and to enable companies to preserve their competitiveness (in the medium and long term);

- **Personalized and targeted cash transfers** limited to certain regions, sectors, and socioeconomic groups (based on income level, location, family composition, etc.) that, as they do not affect taxes on emissions or polluting consumption, are more advisable.

Each of the compensatory alternatives incurs a fiscal cost, expressed in terms of a reduction in tax revenue (net of compensations). Additionally, there are risks that compensation mechanisms may conflict with the very purpose of environmental taxes, which aim to improve the sufficiency of resources and achieve efficiency gains in the tax system as a whole. Nevertheless, in highly unequal societies like those in Latin America and the Caribbean, the design and management of compensatory instruments should be considered a central component of government strategies to ensure the political viability of Green Fiscal Reforms.

a) Compensatory packages

During the course of ecological transition, the economic and social impacts of green taxes can be significant and affect a significant number of families and businesses within a limited time horizon. In this context, it is essential to explicitly consider the adoption of compensatory measures that correct undesirable impacts on income distribution and competitiveness (Expert Committee - IEF, 2022). Such actions are particularly relevant in cases where green taxes affect, on one hand, access to essential goods and services from the standpoint of the general interest, and on the other hand, when the short-term impacts of environmental taxation can result in significant budgetary constraints for families.

The corrective purpose of environmental taxation, aimed at restoring economic efficiency by eliminating negative externalities, has evident distributive implications. Firstly, environmental damages tend to impact groups with lower economic capacity more intensely, so the reduction of such impacts will not be neutral from a personal and regional income distribution standpoint. Secondly, there is a strong relationship between economic capacity and polluting emissions among countries and individuals, meaning a well-designed and effectively implemented environmental taxation will largely be borne by the wealthiest sectors of society. Nevertheless, the core of these environmental taxes is the protection of society from environmental deterioration, so any potential regressive effects should not be used as an argument to limit their introduction, especially when it is feasible to implement adequately designed compensatory measures. In any case, a gradual approach to the process of change in the tax structure should allow for the minimization of collateral distributive impacts and facilitate the gradual adaptation of the agents responsible for environmental deterioration, with reasonable and manageable costs.

From this perspective, it's important to avoid "watering down" green taxes through preferential tax treatments for certain groups or sectors, as this would limit the effects derived from the new incentive framework and could imply a loss of effectiveness in correcting the environmental externality itself. Similarly, it's crucial that compensations, established for distributive purposes or to prevent loss of competitiveness, do not work against environmental improvement.

In general, and in line with the most recent developments of Green Fiscal Reforms (GFR), it is often advocated to use a portion of the revenue generated by green taxes to finance environmental conservation activities (Gago et al., 2014) and to apply the majority of the new fiscal resources to implement distributive compensations. Specialized literature emphasizes the need to apply non-generalist or uniform strategies, which would identify and compensate households or economic activities affected almost on a personalized basis. Compensations could be provided through direct transfers, adjustments in the design of personal income taxation, or by granting specific bonuses associated with certain types of consumption. There is also the option of applying explicit subsidies to facilitate equipment change and to favor accelerated depreciation as a means to address, in the medium and long term, distributive impacts and impacts on competitiveness. In both cases, the distributive profile of such compensations and their additionality (the ability to induce investments that would not have been made without their contribution) must be considered to avoid regressive and inefficient use of public resources (Gago et al., 2021).

Some proposals, which involve dedicating a portion of the revenue to the adoption of certain technologies, incorporate considerations regarding the varying degrees of maturity of innovations that could have more favorable environmental effects. As a precedent to these initiatives, the recent Dutch experience in the industrial sector should be considered, where carbon taxation is combined with "fiscal recycling," promoting the adoption of cleaner technologies. An approach of this kind would reinforce the effectiveness of environmental taxation in the medium and long term, simultaneously mitigating its negative effects on competitiveness and consequently reducing the undesired distributive impacts associated with lower remuneration of productive factors.

Tax authorities have various capacities to establish compensation mechanisms for the distributive impacts of green taxes. To address these distributive impacts, various strategies can be employed, which in some cases involve actions that tax authorities can undertake independently, while in other cases, regulatory adjustments in tax matters are required.

i) Direct compensation:

- *Capacity:* establishment of direct compensation programs targeting those groups or individuals disproportionately affected by environmental taxes.

- *Use:* funds collected through green taxes can be allocated to finance specific programs, implementing, for example, subsidies for low-income groups or investments in affected communities.

ii) Differentiated rates or exemptions:

- *Capacity:* application of different tax rates or exemptions for certain sectors or economic activities that may be more vulnerable to the economic impacts of green taxes.

- *Use:* such a strategy can help prevent certain groups or industries from being severely affected, while maintaining the overall effectiveness of the tax.

iii) Tax credits or incentives:

- *Capacity:* granting tax credits or incentives on corporate income tax to mitigate undesired distributive impacts and to encourage the adoption of more sustainable production practices.
- *Use:* taxpayers who adopt sustainable practices could access tax benefits, thus contributing to balancing the economic impacts of green taxation.

iv) Education and training programs:

- *Capacity:* tax authorities can invest in education and training programs to help taxpayers adapt to new environmental policies and improve the efficiency of their production practices.
- *Use:* allocation of resources for educational and training purposes to help reduce barriers faced by taxpayers in adopting more sustainable practices (especially important in the case of small businesses).

v) Continuous monitoring and evaluation:

- *Capacity:* tax authorities can implement continuous monitoring systems to assess the distributive impacts of green taxes.
- *Use:* the information collected in surveys can be used to adjust tax policies and refine the design of compensation mechanisms, taking into account actual results and changing needs.

vi) Dialogue and citizen participation:

- *Capacity:* tax authorities can promote dialogue and citizen participation in decision-making regarding environmental taxes and compensation mechanisms.
- *Use:* community involvement can help better focus the impacts of green taxes and design solutions that are more equitable and accepted by taxpayers.

It's essential that these strategies are designed and implemented carefully and transparently to ensure that the benefits and costs of green taxes are distributed equitably. Additionally, cooperation between various governmental entities, civil society, and the private sector can be crucial in addressing distributive impacts effectively.

b) Tax expenditure

The commitment of governments to the construction of this new fiscal policy, consistent with sustainable development, involves considering various aspects related to sources of tax revenue and the structure of public expenditure together. From this perspective, the role of tax authorities in the design of an environmental tax reform necessarily includes a review of current tax instruments and a rigorous analysis of how these impact production, the environment, and income distribution.

The erosion of tax bases and the establishment of exemptions and exceptions to the general tax treatment of the production or consumption of certain goods and services constitute a widely spread reality in the tax systems of Latin American countries. The tax expenditure associated with these practices often involves revenue losses that in some countries reach several percentage points of GDP.

The conduct, and especially the public dissemination, of studies on the level and effects of tax expenditure allows for greater transparency in fiscal policy and proves to be a useful tool for preliminary evaluation of any tax reform initiative, whether aiming to increase revenue, simplify procedures, or enhance tax burden equity.

Tax expenditure studies constitute a relevant input for conducting a cost-benefit analysis, allowing authorities to assess the granting, continuation, or elimination of tax benefits in favor of a better income distribution. For example, in the case of Costa Rica, authorities have made progress in estimating tax expenditure with environmental impact. According to the publication of the Ministry of Finance "Costa Rica: Tax Expenditure (TE) 2020, Methodology and Estimation," based on data from the year 2020, environmental tax expenditure with negative environmental impact amounts to ¢ 87,829.03 million, which represents 0.24% of GDP.

To have a comprehensive diagnosis of the impact of such tax benefits, a holistic analysis is required, which includes the joint consideration of various economic, social, and environmental effects. Within this framework, one of the central issues to address is directly related to the effects of tax expenditure with negative environmental impact, including its impact on production and distribution. This analysis must necessarily take into account that modifications to tax expenditure can influence the production structure and consumption patterns, thereby affecting, through both channels, the current levels of greenhouse gas emissions.

More specifically, these types of studies should provide quantitative evidence on the following aspects:

a) Updated estimates of environmental tax expenditure (ETE) with negative environmental impact, quantifying the fiscal cost of preferential treatments corresponding to the taxes under review.

b) Identification of specific goods and services that benefit from tax advantages and would be subject to reform, considering the goods and services that should indeed benefit from these measures and that can facilitate the implementation of the reform.

c) Assessment of the potential distributive effects of modifications to tax expenditure, identifying sectors and production linkages.

d) Determination and estimation of the fiscal cost of compensatory budgetary measures to address potential undesirable distributive effects, providing information on how much and over what period should be invested in compensatory measures, and determining the possible source of the resources applied (national budget, autonomous entities, etc.).

e) Design of specific technical assistance and support measures for affected sector groups, including measures for just transition associated with employability, training, education, and financing, among others.

f) Quantification of the contribution of modifications in tax expenditure to six specific areas: i) mitigation of climate change; ii) adaptation to climate change; iii) transition to a circular economy; iv) sustainable use and protection of water and marine resources; v) prevention and control of pollution; vi) protection and restoration of biodiversity and ecosystems.

g) Definition of legal and operational guidelines for the design of a gradual and balanced reform of tax expenditure that includes the recommendations arising from the previous points.

h) Development of a technical proposal, from a green fiscal policy perspective, aiming to implement modifications in the current structure of tax expenditure, in order to build capacities for the application of impact assessment tools, as well as to determine the various elements that should be considered in a possible reform of existing tax benefits.

5 A comprehensive approach to environmental fiscal strategy in Latin America and the Caribbean (LAC)

Current patterns of production and consumption are unsustainable and underlie the generation of a complex set of negative externalities. Available evidence for Latin America and the Caribbean (LAC) from the estimation of Engel curves for spending on transport fuels and vehicles and appliances shows that with increasing income, there is a continuous migration process from public to private transport, leading to higher levels of local air pollution, a growing number of traffic accidents, increased traffic congestion, and a continuous increase in greenhouse gas emissions causing climate change. Additionally, the increase in the purchase of various appliances results in increased electricity demand and solid waste generation. This indicates the need to implement various structural changes to the current development style to meet the goals of the Sustainable Development Goals (SDGs) and the commitments made in the Paris Agreement on Climate Change, as defined in Nationally Determined Contributions and Long-Term Strategies.

In this context, the application of Pigouvian taxes can contribute to addressing these negative externalities, shaping sustainable patterns of production and consumption.

The negative environmental externalities associated with the consumption of fossil fuels and the increasing use of private vehicles for transportation are well documented in countries across the region. In this context, conditions are ripe for the implementation of corrective taxes that raise the price of fuels and discourage gasoline consumption for transportation. In the case of spending on fuels and vehicles, there is a high sensitivity of demand to changes in income, highlighting that economic growth in Latin America and the Caribbean (LAC) leads to a persistent increase in household spending on vehicles and fuels. Additionally, there is a low price elasticity of demand in the region, resulting in a continuous shift towards private transportation and stemming from the limited substitutability between the supply of public transportation services and private solutions.

The evidence on negative externalities arising from household appliance consumption is extensive and encompasses various aspects. Some of these externalities have been incorporated into specific electricity taxes designs, although those related to solid waste have not yet been considered as part of green taxation. Consequently, in most countries in Latin America and the Caribbean (LAC), there is room to impose taxes on appliances or on the collection and disposal of solid waste. International evidence also shows that the demand for appliances is price-sensitive (with statistically significant negative price elasticities) and that spending on these goods increases as income expands (with statistically significant positive income elasticities). Therefore, it is necessary to complement fiscal strategy with a new infrastructure for waste management and disposal.

The importance of negative environmental externalities stemming from the use of plastic bags and plastic packaging opens up the possibility of incorporating specific taxes with potential positive effects in terms of proper solid waste management. This can be considered as an important complement to make consumption patterns more sustainable.

This evidence suggests that specific taxes could make a substantial contribution to controlling the negative externalities caused by the consumption of these goods. However, the combination of inelastic demands regarding price increases and high income elasticities means that resorting to these tax modalities leads to increased revenue, although the resulting price increase may be insufficient to effectively control the advancement of negative externalities. In response to this situation, it is necessary to complement fiscal policy with new regulations and greater efforts in public investment in sustainable infrastructure.

It is important to consider, furthermore, that the transition to a low-carbon economy may erode the tax base of some of these taxes (especially significant in the case of fossil fuels) or be associated with stranded assets. In this regard, there are other health-related taxes (sugar, alcohol, tobacco) that can be applied.

The analysis of distributive impacts, based on data on tax burden and incidence, along with information provided by the Kakwani and Reynolds-Smolensky indices, shows that excise taxes on fuels and motor vehicles have progressive effects on income distribution. This suggests that, from a distributive perspective, the best option would be to impose levies on private transportation, which

would also result in significant increases in revenue, considering the relative importance of these goods in total excise tax revenue in LAC and the values of price elasticities (without considering potential substitution effects or negative impacts on production at an aggregate level). Additionally, compensatory measures should be implemented to protect the most vulnerable income groups.

The information on consumption patterns and estimates of relevant demand elasticities suggest that applying additional rates on motor vehicles dedicated to private transportation appears to be the most suitable alternatives to be considered when designing reform options. It should be noted, however, that higher taxes on fuels and motor vehicles would be progressive, whereas those applied to household appliances could have regressive effects from an income distribution perspective. To correct these regressive effects, fiscal recycling strategies could be employed, involving the funding of high-impact programs with progressive income distribution from the revenue generated by these taxes. Additionally, potential second-round effects such as increased food prices resulting from higher transportation costs should be considered.

Specialized literature suggests that coordinating these taxes internationally, particularly regarding climate change, produces additional economic and environmental benefits (Parry, 2020). This stems from the global nature of the causes and impacts of climate change. Additionally, considering regional and local impacts, the reasons determining the establishment of an environmental tax exceed the territorial limits of the national or subnational entity that implemented it. Therefore, it becomes a priority at the internal level of each country to appropriately adapt the spatial scope of the taxes through relevant coordination systems or the implementation of a common policy among different levels of government. At the intergovernmental level, within the same country, the allocation of environmental management powers among levels of government is central (Somanathan et al., 2014; Oates, 2001). The literature emphasizes that the existence of environmental problems with a marked territorial and local character justifies the tax role of subnational administrations in this area.

Given the high degree of administrative decentralization in a significant portion of the countries in the region, these dimensions are especially important when defining environmental taxation strategy. The proper allocation of responsibilities among different levels of government regarding the design, implementation, and monitoring of appropriate instruments may vary depending on the magnitude

and scope of environmental externalities. While CO2 emissions produced by the use of fossil fuels mainly require addressing the problem from a global perspective since the effect of externalities extends beyond the geographical boundaries of the jurisdiction that produces them, in the case of issues related to negative externalities such as traffic congestion in densely populated areas, it may be more appropriate and efficient to apply corrective instruments at the local level (Cetrángolo & Fonteñez, 2022).

In decentralized contexts, it is crucial to address governance and intergovernmental relations when crafting tax interventions, given the distribution of responsibilities for environmental and tax policies across various territorial levels. These considerations are especially pertinent as subnational governments increasingly turn to environmental taxation (Expert Committee - IEF, 2022; Brosio & Jiménez, 2015). Coordination between government tiers in environmental protection policies should be determined by institutional organization and the relative advantages each level offers in different policy dimensions. This is particularly vital in Latin America, where several environmentally impactful taxes, primarily those imposed on the production and extraction (upstream) of non-renewable natural resources, are administered and regulated by subnational authorities.

Additionally, some of the environmentally impactful tax innovations are designed at the local level. For example, in certain subnational governments (such as Mexico City, New York, Pennsylvania, and Barcelona), there have been discussions or proposals to introduce a levy or tax targeting companies and e-commerce platforms dealing with physical goods, whether they are residents or not in the jurisdiction, as well as on home delivery services based on the number of deliveries made. In Mexico City, in 2022, a tax called “exploitation for the use of infrastructure” was created for applications and computer platforms dedicated to delivering food and other products within its territory, arguing that they utilize the city’s infrastructure. The tax rate is set at 2% of the total commissions or fees charged for intermediation, promotion, and/or facilitation, and its proceeds are primarily allocated to the maintenance of the city’s infrastructure. In the United Kingdom, the proposal emerged within the reflections of the Department for Transport regarding the environmental and economic impact of the final phase of distributing these products (“last mile logistics”), with a motivation similar to that of taxes on plastic bags.

The intense process of transforming public policies involved in addressing environmental challenges makes it necessary to ensure greater intergovernmental cooperation and coordination to ensure adequate and effective use of environmental taxes. The high heterogeneity existing among alternative designs and forms of implementation of these measures by subnational governments can jeopardize the achievement of environmental objectives. For example, attention must be paid to potential races to the bottom in levies among different territorial administrations aimed at enhancing competitiveness to promote greater investment and employment at the expense of environmental goals.

Given that the ecological transition will introduce relevant socio-economic costs and considering the high pre-existing inequality in Latin American countries, which makes the region one of the most unequal in the world in terms of income and wealth, particular attention must be paid to the distributive impacts—both personal and regional, as well as intergenerational—associated with the intensification or introduction of environmental taxes. It is essential to establish mechanisms that mitigate and compensate for these effects on certain social groups and economic sectors.

For these reasons, this article argues that the direction of the reforms to be undertaken by the governments of the region must necessarily include a comprehensive and cross-cutting vision of the tax system in the face of the multiple environmental challenges. Consequently, an integral approach to tax reform is proposed, which includes different instruments that should be developed technically and thoroughly evaluated on a case-by-case basis, taking into account national particularities, sectoral heterogeneities, and the limited availability of data to carry out illustrative simulations.

For this purpose, tax administrations must incorporate new routines, strengthen teams, gather new information, and identify the challenge of climate change within the context of their competencies.

6 Final considerations

The climate transition poses significant challenges that require strengthening the technical capacities of Tax Administrations to support the creation of new tax instruments or to modify existing ones, managing them effectively and generating the necessary information to facilitate accurate assessment of the impacts of environmental taxes.

In Latin America and the Caribbean countries, the challenges of climate change take on special relevance due to the high vulnerability of the region's countries to its effects. Consequently, designing a new fiscal strategy becomes important, one that considers generating economic incentives aligned not only with sustainable development and combating climate change, but also with the mobilization of additional resources for climate action financing.

Designing these fiscal tools is a complex task that requires integrating environmental, economic, social, and revenue criteria. Additionally, political economy considerations, distributive equity objectives, and minimizing the impact on economic competitiveness must be considered.

Facing these challenges, throughout this study, the specific needs of the Tax Administrations in the region have been examined to efficiently, effectively, and equitably address the transition to a more environmentally friendly model.

Regarding the characteristics of environmental taxes, it is important that the tax bases are related to the negative environmental externality being addressed and that the tax rate structure reflects the environmental damage as accurately as possible and contributes to achieving the established environmental objectives. Since the tax aims to internalize a negative externality, it is recommended that it be specific, meaning that it is collected based on quantity.

Furthermore, it is crucial to strengthen coordination among levels of government regarding the taxes applied in such a way as to simplify tax systems and unify criteria to ensure that tax bases are closely linked to the environmental issues being addressed.

In this context, one of the main challenges facing Tax Administrations relates to the generation of relevant information for the proper design and successful implementation of these instruments. In particular, there is a need for information regarding externalities, as well as the measurement of the expected impacts of introducing green taxes on revenue, consumption, production, employment, and income distribution, among others. The availability of reliable and detailed data is crucial for the correct assessment of the impacts resulting from the application of these types of taxes, as well as for strengthening the tasks of oversight, control, and advisory services of Tax Administrations to finance ministries, while establishing the links between green taxation and environmental goals.

In this regard, Tax Administrations need to have information to estimate the price and income elasticities of demand for the goods or services in question, as well as the main cross-price elasticities of goods (substitutes or complements) that are used to estimate the demand response to tax changes and the effects on tax revenue. Likewise, information is needed to assess the impact on production, employment, economic growth, and income distribution.

To progress in redesigning tax systems with environmental considerations, it is crucial to have a robust capacity development program for personnel, with targeted training experiences led by both technical professionals from within the administration and external experts. It's important for officials to have clear guidance for conducting analytical studies and to be trained in designing and using tools that allow them to understand the effects of green taxation in different climate scenarios.

Specifically, through training programs and the utilization of developed tools, officials are expected to gain the capacity to monitor various aspects related to climate change. These encompass international negotiations concerning climate change, adherence to national climate commitments, estimation of the economic costs associated with climate change, development of innovations in green taxation, estimation of tax revenue losses due to reduced tax bases, implementation of carbon pricing, exploration of climate financing options, and simulation of diverse fiscal scenarios within the framework of climate change, among other pertinent aspect.

On the other hand, to mitigate the impact of environmental taxes on income distribution, it is crucial to consider the role of compensation mechanisms. These can take various forms, such as tax expenditure (differentiated rates, tax credits, exemptions, etc. for more vulnerable sectors), subsidies for the acquisition of equipment and facilities, and targeted cash transfers. It is essential that these strategies are carefully and transparently designed and implemented, ensuring an equitable distribution of the benefits and costs associated with green taxes. At the same time, it is fundamental that the compensations do not counteract the environmental improvement achieved by green taxes or reduce the effectiveness in correcting negative environmental externalities.

A recommended practice is to allocate part of the revenue collected from green taxes to finance activities related to environmental preservation, as well as to use a portion of these fiscal resources to implement targeted distributive compensations, such as subsidies aimed at low-income groups or investments in affected communities. Tax administrations can allocate part of the funds collected to education and training programs, especially targeting small businesses, to facilitate adaptation to new environmental policies and improve the efficiency of their production practices.

It is important to establish continuous monitoring systems to assess the distributive impacts of green taxes, in order to adjust tax policies and improve the design of compensation mechanisms. Additionally, it is crucial to promote dialogue and citizen participation in decision-making regarding environmental taxes and compensatory measures, which can contribute to designing more equitable solutions that are accepted by taxpayers. Similarly, to effectively address distributive impacts, it is essential to promote cooperation among various government bodies, civil society, and the private sector.

Another area where the role of Tax Administrations is relevant is in the preparation of studies on tax expenditures, as they constitute relevant inputs for conducting cost-benefit analyses regarding these preferential tax treatments. In this sense, it is important to focus not only on tax expenditures with a positive impact on climate action but also to address the effects of tax expenditures with negative environmental repercussions, including their effects on production and distribution.

These types of studies should provide quantitative data on aspects such as tax expenditures with negative environmental impact, identify goods and services benefiting from preferential treatment that could be

subject to reform, assess potential distributive effects of a reform, estimate the fiscal cost of compensatory measures, design technical assistance actions for affected groups, quantify the contribution of reforms to climate change, circular economy, and preservation of water and marine resources, biodiversity, and pollution control, as well as to define legal and operational guidelines for the gradual implementation of tax expenditure reform, along with a technical proposal for its implementation.

In conclusion, tax administrations must progress in adopting new practices, strengthen the technical capabilities of their personnel, and gather detailed and updated information that allows for the evaluation of the impacts of green taxation on the economic, social, and environmental fronts.

Lastly, it's important to highlight that while specific taxes can be useful in addressing negative environmental externalities, the presence of inelastic demands limits the effectiveness of applying taxes to increase prices and fully control them. Therefore, it's necessary to complement green taxation with new regulations and increased public investment in sustainable infrastructure. Additionally, the widespread existence of fuel subsidies presents a significant challenge for environmental policy. In this context, reforms should take an integrated and cross-cutting perspective of the tax system, considering the implementation of different instruments that require careful technical development and detailed case-by-case evaluation to effectively address various environmental challenges.

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