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Distributive Impact of Green Taxes in Mexico

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Abstract
Carbon pricing is one of the most effective tools available worldwide for the regulation of greenhouse gas (GHG) emissions. There is extensive theoretical and empirical research on optimal pricing instruments, such as environmental taxes —carbon and energy taxes, in particular— and emissions trading systems. In Mexico, as in most countries globally, energy taxation, particularly through taxes on fuels, serves as the primary carbon pricing instrument.

This study quantifies the size and the distributive effects of green taxes (and anti-green subsidies) in Mexico, principally focusing on excise taxes (IEPS, from its initials in Spanish) levied on coal and fuels, as well as subsidies for residential electricity consumption. We analyse the distributive effect of fuel taxes within Mexico's broader fiscal system, including the main tax and public expenditure instruments, spanning the 2014-2022 period. In terms of the effect on extreme poverty, consumable income (disposable income net of subsidies and indirect taxes) shifts from a reduction of 2.3 ppt (with respect to household market income) to an increase of 0.5 ppt between 2014 and 2020. In other words, the increase in indirect taxes implies that their impoverishing effect completely eliminates the poverty-reducing effect of all direct transfers for the extremely poor. As in many other countries, energy subsidies in Mexico or their equivalent in energy tax exemptions, have been motivated by considerations of equity. However, given Mexico's high income inequality, broad energy subsidies are proven to be inefficient redistributive instruments, especially compared to targeted or even universal transfers.

Keywords
Taxation, environment, inequality, fiscal policy

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Résumé

La tarification du carbone est l'un des outils les plus pour la réglementation des émissions de gaz à effet de serre (GES). Il y a des recherches théoriques et empiriques approfondies sur les instruments optimaux de tarification, comme les taxes environnementales — en particulier les taxes sur le carbone et l'énergie — et les systèmes d'échange de droits d'émission. Au Mexique, comme dans la plupart des pays à l'échelle mondiale, la taxation de l'énergie, en particulier par le biais des taxes sur les carburants, est le principal instrument de tarification du carbone.

Cette étude quantifie la taille et les effets distributifs des taxes vertes (et des subventions anti-vertes) au Mexique, en se concentrant principalement sur les taxes d'accise (IEPS, de ses initiales en espagnol) prélevées sur le charbon et les combustibles, ainsi que les subventions pour la consommation d'électricité résidentielle. Nous analysons l'effet distributif des taxes sur les carburants dans le système fiscal mexicain, y compris les principaux instruments fiscaux et de dépenses publiques, couvrant la période 2014-2022.

En ce qui concerne l'effet sur l'extrême pauvreté, le revenu consommable (revenu disponible net des subventions et des impôts indirects) passe d'une réduction de 2,3 ppt (par rapport au revenu du marché des ménages) à une augmentation de 0,5 ppt entre 2014 et 2020. En d'autres termes, l'augmentation des impôts indirects implique que leur effet appauvrissant élimine complètement l'effet de réduction de la pauvreté de tous les transferts directs pour les plus pauvres. Comme dans de nombreux autres pays, les subventions à l'énergie au Mexique ou leur équivalent en exemptions de taxe sur l'énergie ont été motivées par des considérations d'équité. Cependant, compte tenu de la forte inégalité des revenus au Mexique, il est prouvé que les vastes subventions à l'énergie sont des instruments de redistribution inefficaces, en particulier par rapport aux transferts ciblés ou même universels.

Mots-clés

Imposition, environnement, inégalités, politique fiscal et budgétaire

Introduction and motivation

Carbon pricing is one of the most effective tools available to regulate greenhouse gas (GHG) emissions worldwide. There is extensive theoretical and empirical research on optimal pricing instruments, such as environmental taxes, in particular carbon taxes; energy taxes and subsidies; and emissions trading systems (ETS) (see Mehling & Dimantchev, 2017 for Mexico's case). As with most of the rest of the world, Mexico's main carbon pricing instrument is energy taxation, especially through taxes on fuel consumption.

In 2014, the Mexican Ministry of Finance (SHCP, by its initials in Spanish) established a special carbon tax (IEPS on carbon). Initially, the Carbon IEPS was presented as a green tax designed to reduce green gas emissions associated with fossil fuels, mainly gasoline and diesel. However, due to low tax revenues (MXN 4,699 million in 2014, MXN 4,305.8 million in 2022) and a limited environmental impact, particularly when compared to the IEPS that directly taxes the consumption of gasoline and diesel (IEPS on fuels), this instrument is not widely regarded as a central element of the country's environmental fiscal policy.

In this sense, it is evident that Mexico's environmental fiscal policy heavily relies on the dynamics of the IEPS on fuels. Over the past decade and until 2014, this tax exhibited a negative value, effectively functioning as a subsidy. However, since 2015, it has been restructured into a tax, resulting in a significant increase in revenues in recent years, amounting to nearly MXN 300 billion in 2019 and 2020 (see Figure 2, section 3: 2004-2015, 2022). This tax emerges as the primary instrument for carbon pricing in Mexico, raising concerns for three main reasons. Firstly, concerning coherence with the GHG reduction objectives, the design of this tax does not consider central objective. Secondly, from a fiscal planning standpoint, the heavy reliance on international fuel prices renders the instrument inherently unstable, posing challenges for estimating fiscal revenues and expenditures. Finally, in terms of distributive incidence, such instruments tend to be inefficient in their redistributive capacity. Consequently, a call is made to broaden the range of environmental fiscal instruments to be used according to international principles and experiences, while also considering their redistributive capacity.

Among the most comprehensive and detailed measurements of pricing instruments is the Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate action (OECD, 2022; see also the World Bank's wide range of resources and databases[1]). Its most recent report (2022) shows estimates for a large group of countries for two recent years: 2018 and 2021. In the case of Mexico, comparing these years reveals a set of similar green tax policy instruments. However, while the positive net fiscal effects (taxes net of subsidies) appear relatively large, they do not accurately reflect most of Mexico's recent fiscal history. Moreover, this characterisation does not align with Mexico's environmental fiscal orientation in 2022, where the excise tax (IEPS) on fuels assumes negative values, transforming the environmental fiscal policy from a significant tax into a subsidy for fossil fuel consumption (see Figure 2, section 3: 2004-2015, 2022).

On the other hand, there is an extensive empirical literature on the distributive incidence of environmental tax instruments (see Álvarez, 2018, for a recent meta-study covering 205 estimates in 68 articles). This body of work reveals important variations in the estimated distributive incidence of these instruments, influenced by factors such as the level of economic development, the use of the tax revenues generated (with respect to neutral estimates of income), the estimation of direct vs indirect effects, as well as other methodological variations (analysis based on revenues vs expenditures). Generally, it has been observed that the effects of green taxes tend to be more progressive in developing countries, where access to private transport is more restrictive, particularly when revenues are progressively recycled. However, this literature often overlooks the variation of green fiscal policies over time, which is an important aspect to consider.

In this context, the study of the distributive incidence of Mexico's environmental fiscal policy is particularly important. As in other countries, energy subsidies in Mexico, or their equivalent in energy tax exemptions, have been driven by equity considerations and, more recently (2022), by inflationary pressures. However, given Mexico's substantial income inequality, generalised energy subsidies often prove inefficient as redistributive instruments, especially when compared to targeted or even universal transfers. Therefore, for the environmental fiscal instruments in the country to be both redistributive and effective, there is a need to implement energy taxes and allocate the resulting public revenues towards the most effective spending instruments benefiting the population living in poverty. Such a fiscal reform would combine three advantages: a) an effective reduction of GHG, b) fiscal efficiency of energy taxes, in the form of low price elasticity of demand and improvements in revenue/spending planning, and c) redistributive capacity in a context of low income and high inequality.

[1] https://www.worldbank.org/en/programs/the-global-tax-program/environmental-taxes#3

In view of the heavy reliance on the IEPS on fuels, this study proposes to estimate the distributive effect of those taxes in the context of Mexico's fiscal system as a whole, including the main tax and spending instruments. This analysis holds significant relevance for Mexico at present, as the transition from subsidies to taxes represents the primary fiscal reform implemented in the country over the last decade. This reform is notable not only in terms of tax revenues (from about MXN –300 billion to MXN +300 billion in tax revenues), but also in terms of distributive incidence. Fuel taxes have significant impacts on the entire population, both directly on middle- and high-income households through private transport, and indirectly on low-income households through public transport and transportation costs for goods and services, especially food. The analysis for 2020 shows that the increase in the indirect tax burden associated with fuel taxes for the population in poverty can reverse the poverty-reducing effect of direct transfers, even following their recent expansion (2019-2022).

1. Green taxes: concepts and comparative experiences

In order to illustrate and, if possible, suggest the adoption of a complementary green fiscal policy tool for the Mexican case, this section examines the main fiscal policy instruments available and used globally to reduce carbon gas emissions. In particular, this paper describes the international experiences related to these tools, the principle of optimality for determining the associated prices, and the concept of compensatory recycling of the tax revenues obtained through them.

Main tools to reduce carbon in the environment

According to international evidence, besides fuel consumption taxes, there are five main tools that can be used to reduce the amount of carbon in the environment: carbon taxes, emissions trading system (ETS), crediting mechanisms, internal carbon pricing, and results-based climate financing (RBCF).

1.1. Carbon tax

Carbon taxes represent one of the most straightforward approaches for tackling greenhouse gas emissions. There are two main forms of GHG taxes: one targets direct emissions, based on the amount of gases an entity emits; the other targets goods or services that are typically emissions-intensive, such as a tax on the carbon content (per metric ton of CO_2) of fossil fuels. The main advantages of carbon taxes lie in their application of a fixed rate to measurable elements (emissions or amount of carbon) and their direct collection mechanism.

A carbon tax can be implemented at any point in the energy supply chain, but for ease of collection, it is recommended to focus on entities in the upstream sector involved in the production and emission of carbon, rather than on those in the downstream sector engaged in the consumption of associated products, such as companies and households. While the amounts to be collected from carbon taxes can be reasonably estimated, the drawback of the carbon tax is that it does not guarantee per se that emissions will be reduced. This is because its design is aimed at penalising the quantity of emissions and/or CO_2 content without promoting, in a complementary manner, mechanisms for the adoption of new technologies, typically costly for developing countries. Thus, when assessing the costs and benefits of reducing their emissions, entities subject to the tax, lacking low-cost alternatives for the adoption of new technologies, tend to assume the cost of the tax without substantially modifying their emissions.

1.2. Emissions trading system

The emissions trading system (ETS) is a market-based instrument designed to reduce GHG emissions. Its creation as a policy for reducing emissions is based on the cap and trade principle. The system works as follows: a regulator sets an upper limit for greenhouse gas emissions in specific sectors of the economy and allocates permits or emission allowances to the companies involved. At the end of the defined time period, each company must surrender a number of allowances corresponding to their emissions during that period, subject to third-party verification. Companies that have emitted less than the number of allowances they hold can sell any excess allowances to other participants in the system. This setup incentivises entities with access to emissions reduction mechanisms to reduce their emissions, while those lacking such mechanisms, can opt to comply by purchasing additional allowances from the market. Consequently, participants face a choice: invest in emissions reduction technologies or acquire allowances from the market, as they have a market value.

Compared to a carbon tax, the emissions trading system offers greater environmental certainty in controlling global emissions, as they are directly linked to emission quantities that can be periodically adjusted to achieve a gradual reduction in emissions. The flexibility and profitability of the ETS stem from its allowance for emitting companies to determine how and where to reduce emissions. However, it is important to note that both the institutional and legal frameworks must enable prices to be determined by market forces within a transparent supervisory framework.

In brief, the ETS is an effective, market-based alternative for incentivising emissions reduction without imposing a prohibitive costs on developing countries. Its measurability, reportability, and verifiability make it more efficient compared to other forms of environmental policies. Regulated sectors benefit from flexibility in identifying the most cost-effective methods to decrease emissions, thereby fostering technological innovation.

The ETS also offers flexibility in compliance and can adapt to economic fluctuations. Moreover, the coordination of ETSs from different countries promotes coordination in achieving joint global GHG emissions reduction targets. However, despite these advantages, studies such as that of Evans et al. (2021) point out that the main obstacles to the widespread adoption of the ETS lie in the design of mechanisms that facilitate the effective participation of the main stakeholders, as well as the development of capabilities within government entities, particularly in those related to regulation, supervision, and compliance.

1.3. Crediting mechanisms

Crediting mechanisms, also known as carbon credits (baseline and credit systems), constitute another of the tools that can be implemented to reduce GHGs. This mechanism is similar to the ETS, with the main difference being that for crediting mechanisms, the upper limit of emissions is not fixed. The concept of a reference point or baseline allows the identification of emission levels by companies that are above or below it. This creates rights (credits) or obligations (liabilities) to each agent in said activity or sector that can be traded to balance emissions in general. The central perspective in its design and implementation is to encourage compliance with emissions reduction through the adoption of projects that benefit the companies that do reduce emissions. Such compliance also encourages the inclusion of compliant agents in business ecosystems that promote favourable economic performance for them.

Within this mechanism, credits originate primarily from sustainable projects that reduce or eliminate GHG emissions and meet the requirements established in the Kyoto Protocol. The procedure is relatively simple: once a project receives a certificate of compliance issued by a third party —such as the Carbon Development Mechanism (CDM)—, the compliant company is granted credits that can be sold to companies seeking to offset their emissions. There are several types of carbon credits, depending on the type of project that generates them, their activity, or the sector in which they will be developed. For instance, projects for the construction of facilities using renewable energy sources, for reforestation and conservation, as well as projects based on the transformation of waste into energy.

The primary benefit of employing this tool lies in that the establishment of a credit market is directly linked to emissions reduction compliance. This is because the incentives for obtaining and exchanging carbon credits for companies that do not emit or that reduce their emissions come in the form of projects aimed at reducing emissions. However, according to Evans et al. (2021), this type of mechanism tends to be more complex (the baseline has to be calculated for each activity or sector) and more costly to manage compared to the ETS, and that is the main barrier to its widespread adoption internationally.

1.4. Internal carbon prices

This tool has been created, voluntarily, by companies as a mechanism to anticipate future regulatory requirements. Its implementation would allow them to finance a potential transition to low-emission technologies when requested to do so or when it makes economic sense. Carbon pricing applies, in principle, the same structure as carbon taxes in that a monetary value is associated with emissions and/or content. The difference between them is that, instead of being the result of a sectoral consensus or a regulatory requirement, the company establishes a unit price per metric ton of CO2 that it will use as a reference to internalize the environmental impact of the emissions. Two of the main approaches for setting such a price are shadow pricing or carbon content-based rates (surcharge). Both use time horizon considerations, as well as the organisation's strategic approach to investing, financing, and establishing desirable emission levels.

This market-oriented approach to price setting aims to ensure that the quantity of emissions is more clearly internalised by agents within their economic activity. In this way, the environmental objective can be achieved flexibly and at the lowest cost to society, while also promoting technological innovation and economic growth with low carbon emissions. In this regard, as noted by the World Bank (2023), the primary constraint on the adoption of this tool is related to the low incentives and high costs companies face for its voluntary implementation. Furthermore, while the models for establishing shadow prices or carbon fees are not complex, they are not yet considered strategic in the business environment.

1.5. Results-based Climate Financing

Results-based climate financing (RBCF) pertains to financial resources allocated specifically to financing climate projects following the attainment of desired outcomes in terms of GHG emission reduction or adaptation to climate change. These funds can originate from different sources (public and/or private at the local, national or transnational level). The operation of RCBF is similar to that of crediting mechanisms, but in this case, compliant entities directly receive the associated incentive amount instead of receiving credits that they subsequently attempt to place in a market.

In that sense, RBCF can be seen as a tool for emissions reduction through direct financing related to the achievement of objectives and/or the adoption of climate projects. Because financing is linked to the achievement of specific targets, RBCF encourages transparency and accountability in climate projects. The World Bank (2017) identifies three main areas where RBCF is beneficial: natural solutions to climate change, sustainable infrastructure, and fiscal and financial solutions that directly or indirectly mobilize resources to mitigate climate change. It also indicates that the main areas of opportunity for widespread RBCF adoption are the methodological elements for the adequate establishment of the objectives to be met by the companies, as well as the securing of financing at the sectoral and/or national level.

Use of revenues derived from the tools to reduce carbon emissions in the environment

The work of Marten and Van Dender (2019), based on data reported for 2016, analyses the revenues collected from the different tools used to reduce GHG emissions. Considering the reasons for their adoption, they focus on those related to fuel excise taxes, carbon taxes, and ETS auctioning for 40 OECD and G20 countries. The general concept of Effective Carbon Rates (ECR) refers to the total price that applies to carbon dioxide emissions from energy use as a result of these three market-based instruments. In this regard, the gains reported by these authors are related to the revenues generated by these three sources and are used as a benchmark for the countries analysed.

It is observed that, in general, most countries do not add restrictions or earmarks to the expenditure associated with the additional revenues derived from fuel excise taxes. In OECD countries, only 28% of those revenues are earmarked for specific items, either as a destination or as a political commitment. It is also noted that the main destination of the expenditure (69.4%) associated with these revenues is the transport sector, either for the road infrastructure expansion, or its maintenance and rehabilitation. Finally, a high federal concentration of these revenues is observed, since only 16.7% of the countries provide for their distribution among the regions, states, and/or municipalities in their tax policy measures.

As for the revenues generated by carbon taxes, it is illustrated that some countries allocate them for social expenditures and/or for alleviating the burden of taxes on labour and capital. For example, in Norway, these revenues are earmarked for the Government Pension Fund; in Canada, they are partly used to regulate electricity prices; in Colombia, they go to the Fund for Environmental Sustainability and Sustainable Rural Development; and in France they are used to compensate electricity suppliers for using renewable energies.

Finally, concerning the revenues from ETS auctioning, it appears that 86% are earmarked for specific programmes. Some examples are the financing of social and energy programmes, such as the renovation of homes and buildings to reduce energy consumption and bills, compensating industries at risk of carbon leakage, improving public accessibility to electric mobility, promoting renewable energies, and creating funds for environmental protection and conservation. Noteworthy examples include the New Green Savings Programme in the Czech Republic; compensation for industries in France, Germany, Greece and the Slovak Republic; the allocation of revenues to the Carbon Fund in Portugal; and the use of these revenues to subsidise renewable energy consumption in Austria and Slovenia.

In general, the cited study finds evidence that the revenues derived from carbon taxes and the ETS are often associated with legal and/or political restrictions on the use of those revenues (through earmarking), while those coming from fuel excise taxes are subject to less restrictions. Moreover, it highlights that tax revenues raised from fuel excise taxes are mostly used discretionarily at the federal level, with a focus on expenditures within the transport sector, thus limiting their redistributive potential.

In view of these results, it is interesting to analyse the composition of the ECRs, considering that, if they are mostly based on fuel excise taxes (as is the Mexican case), their redistributive capacity will be limited. Likewise, it is observed that a crucial aspect for aligning the objectives of revenue collection, expenditure, and emissions reduction through ECRs is precisely that the determination of their value be closely linked to principles of optimality. Below is a brief review of these principles.

Principles and characteristics for optimal ECRs

International experience confirms that having a clear view of policy objectives and national circumstances from the beginning can provide a sound basis for making informed decisions regarding emissions reduction. Besides, economic models help provide information on the possible effects that different design options will have on the key policy objectives. The goals that a government seeks to achieve with a tax, such as mitigating GHG emissions, raising revenues, promoting sustainable development, or increasing the efficiency of the tax system, will affect a variety of design options.

The more specific the objectives (for example in terms of emissions trajectories or revenue collection targets), the better governments will be able to design the tax to best achieve their goals. Carbon taxes will be more effective if the specific context of the jurisdiction is taken into account when designing them. Having a clear picture of the relevant capabilities and governance limitations also informs scoping decisions, considering that some designs will require broader and more complex management than others.

When considering design options according to policy objectives and the national context, policymakers can use a set of principles to evaluate and shape these different options. These principles include: a) equity, reflecting the "polluter pays" principle, and helping to ensure an equitable distribution of costs and benefits, avoiding disproportionate burdens on vulnerable groups; b) alignment of policies and objectives, using carbon pricing as one among other measures that promote competition and openness, ensure equal opportunities for low-carbon alternatives, and interact with a broader set of climate and non-climate policies; c) stability and predictability, implementing carbon prices within a framework of stable policies that send a constant, credible, and strong investment signal, the intensity of which should increase over time; d) transparency, ensuring clarity in the design and implementation; e) efficiency and profitability, ensuring that the design promotes economic efficiency and decreases the cost of emissions reduction; and f) reliability and environmental integrity, allowing for a measurable reduction in environmentally harmful behaviour. In short, when it comes to evaluate design options, policymakers should consider these principles to ensure that the carbon tax achieves policy objectives fairly and effectively.

When designing a carbon tax, one of the first and most important decisions to make is defining the tax base, which refers to the fuels, sectors, and specific firms that are liable to pay the tax. Although there are various ways of defining the tax base, a basic distinction can be made between the taxes known as upstream and downstream taxes on the production, import, and sale of fossil fuels, and the taxes on direct emissions. The choice of the tax base will have significant implications for the impact and effectiveness of the carbon tax. Thus, policymakers should carefully consider the available options and select a tax base corresponding to the policy objectives and national circumstances.

In regard to the carbon tax rate, its design involves two important aspects: the appropriate determination of the tax rate, and the definition of how it will evolve over time. Concerning the first aspect, according to the OECD (2022), policymakers have generally adopted one of four basic approaches to setting the carbon tax rate: the social cost of carbon (SCC) approach, the reduction target approach, the revenue target approach, and the benchmarking approach. The SCC approach consists in adjusting the carbon tax rate to estimates of the social costs of GHG emissions, which makes it one of the most economically efficient approaches. Although this approach is difficult given the wide range of SCC estimates, it provides a strong argument for not allowing the effective carbon tax rate to fall below the SCC's minimum estimates, as lower rates would not respect the polluter pays principle.

The reduction target approach involves choosing a carbon tax rate that is expected to lead to reduction levels consistent with the jurisdiction's emissions reduction goals, making it a good option for jurisdictions seeking to achieve specific mitigation objectives. The revenue target approach is designed to generate a given amount of revenue through the imposition of the carbon tax, which is particularly useful for jurisdictions motivated by the need for additional public funds. As for the benchmarking approach, it links the carbon tax rate to carbon prices in other jurisdictions, especially in neighbouring countries, trading partners, and competitors.

Regarding the second aspect, the following options have been identified as the primary adjustments to the taxes in the years following its initial implementation: 1) a static tax, which remains constant over time and which may or may not be linked to the inflation rate; 2) a gradually increasing carbon tax, for which a trajectory of carbon taxes is defined in the initial design; in general, it starts from a relatively low level and increases over time; 3) a tax linked to the SCC, for which the tax rate changes according to the adjustments in official SCC estimates; 4) an adjustment formula, stipulated by policymakers during the design process, which will be used to periodically adjust the tax rate; 5) periodic reviews by experts, government administrators, and other stakeholders who conduct reviews and recommend adjustments to tax rates; or 6) an ad hoc policy approach, where legislators or policymakers decide on an occasional or periodic basis on the adjustments to the tax rate. When choosing the appropriate option for adjusting the tax rate over time, policymakers must balance the need to provide stability and predictability to investors with the desire to maintain some flexibility to allow for changing circumstances.

In sum, the economic literature suggests that climate change mitigation does not have to come at the expense of economic prosperity, and that carbon taxation plays a major role in defining an appropriate climate strategy. If done properly, it can stimulate the development of clean technologies and superior technical capabilities associated with a structural shift towards higher value-added industries. However, given the high costs of transitioning to clean energies, there could also be an increase in production costs for carbon-intensive companies, making them less competitive. In this sense, the definition and determination of ECRs have been central to this debate. The following section will discuss this concept and contextualize the behaviour of ECRs for OECD member countries.

ECRs calculated in OECD countries and emissions reduction potential results

Among the available databases, the one published by the World Bank is the most detailed in terms of ECR behaviour and how carbon emissions are priced in different OECD and G20 countries. In this sense, the work presented by the OECD (2022) is an analysis of the data on the ECRs, based on their past behaviour, as well as a foresight study regarding the goals to be met in the future. Additionally, it measures the ECRs for six economic sectors: industry, electricity generation, residential and commercial energy use, road transport, off-road transport, and agriculture and fisheries. Interestingly, it points out that 44 OECD and G20 countries account for 80% of global carbon emissions.

The report addresses progress in setting ECRs on the basis of three benchmarks. The first one is EUR 30 per tonne of CO2, a historic low-end price benchmark of carbon costs and a minimum price level to trigger meaningful reduction efforts; the second, is EUR 60 per tonne of CO2 , a forward-looking low-end and medium-range benchmark for the years 2020 and 2030; and the third benchmark is EUR 120 per tonne of CO2, a central estimate of carbon costs for the year 2030.

These are the key findings of the report. Firstly, progress with carbon pricing remains modest. Around 60% of carbon emissions from energy use in OECD and G20 countries remained entirely unpriced in 2018. The 44 OECD and G20 countries together have not even reached a fifth of the goal to price all emissions at least at EUR 60 per tonne of CO 2 (i.e. the CPS60) in that year. Moreover, less than a quarter of the countries studied are more than halfway to the EUR60 benchmark, and just three countries have reached more than two-thirds of the benchmark.

Secondly, progress between 2015 and 2018 varies across countries. Some improved their carbon pricing performance significantly. For example, the ten best performing countries in 2018 progressed by around 6% towards the EUR60 benchmark. By contrast, the ten worst performing countries in terms of the EUR60 benchmark in 2018 showed no improvement since 2015. Thirdly, carbon pricing performance varies across sectors. ECRs are particularly low in the electricity and the industry sectors. In the residential and commercial sector, there is significant heterogeneity, where some countries are 70% on the way to pricing all carbon emissions at EUR60 per tonne of CO2 or more, but with very low carbon prices in other nations. Finally, fuel excise taxes dominate ECRs, since they account for 89% of the effective marginal carbon rates, while the ETS and carbon taxes represent 7% and only the remaining 4%, respectively.

Regarding the relative efficiency of the fuel excise tax, Sen and Vollebergh (2018) estimate the long-term effect of a uniform carbon tax on energy consumption. Their results show that a one euro increase in energy taxes reduces carbon emissions from fossil fuel consumption by 0.73 percent in the long run. This result is in line with the findings of Davis and Kilian (2011) in that fuel taxes have a modest impact on emissions abatement in the short term, but can lead to considerable reductions in long-term emissions if consumers internalize these costs and modify their consumption as a result of this process. In short, both works posit that fuel excise taxes have a marginal effect on emissions reduction in the short term, so that their impact may be limited if they are used as a sole instrument to achieve that goal.

Meanwhile, the climate scenarios presented by the Network of Central Banks and Supervisors for Greening the Finance System (NGFS, 2022) based on a risk management approach, are intended to analyse the impact of climate change on local and global financial systems. The document provides a summary of the major transition risks, physical risks and economic impacts of climate change. The series includes three representative dimensions, each covering different scenarios.

The first dimension, which includes "Orderly" scenarios, assumes that climate policies are introduced early and become gradually more stringent, leading to a net reduction of CO2 emissions to zero by 2070, with a 67% probability of limiting global warming to less than 2ºC. The physical and transition risks related to such scenarios are relatively low, while assuming full availability of technologies for the removal of carbon dioxide from the environment.

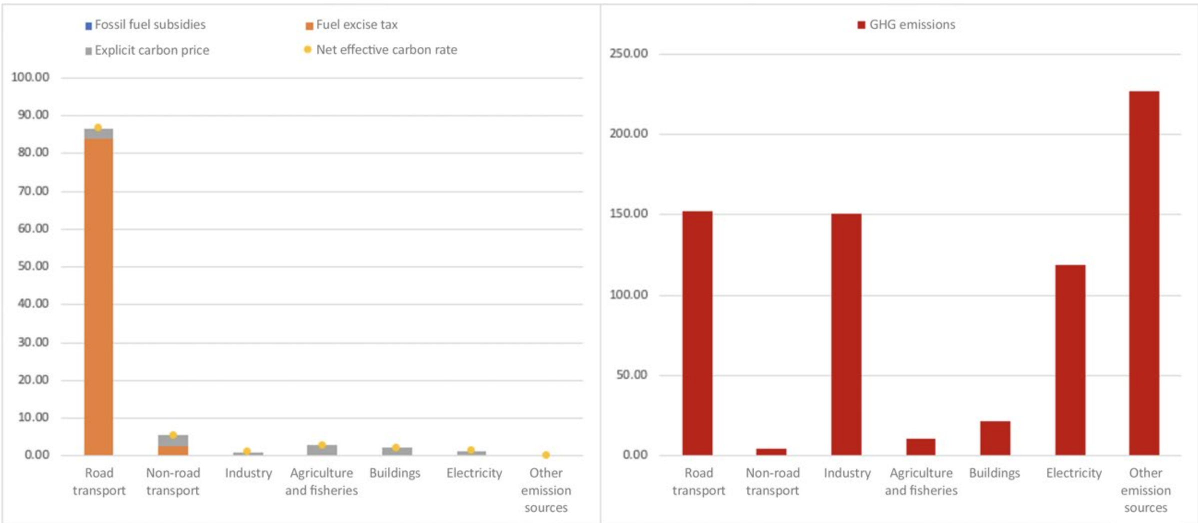
In the second dimension, which includes "Disorderly" scenarios, it is assumed that climate policies are not introduced until 2030 (a delayed adoption) and, therefore, emissions reductions need to be more drastic compared to those of the Orderly scenarios if the same goal of limiting global warming is to be met. Considering the consequent delay in the adoption, this carries a greater transition risk. Finally, in the third dimension, called "Hot house world", the scenarios assume that only the currently implemented policies are preserved, thus leading to irreversible changes in the environment.

This reflects the almost immediate need to adjust ECRs globally, in order to improve the chances of not having to resort to extreme measures, as suggested in the second scenario dimension of the NGFS (2022). Although an adjustment in that direction has been observed internationally, there are still cases, such as Mexico, where the composition of the ECR is highly dependent on fuel excise taxes. As described, this tax has a moderate expected effect in terms of emissions reduction and its revenues are commonly used discretionarily. Furthermore, since it can work in two possible directions, it is sometimes used as a tax, and at other times, as a subsidy, so that its redistributive impact is ambiguous. This behaviour will be analysed in Section 4 of this document on the Mexican case. Before that, the following section provides a more detailed characterisation of the Mexican case in relation to the environmental fiscal policy instruments in recent years.

2. Green taxes in the context of the Mexican fiscal system

This section analyses the key environmental fiscal instruments implemented in Mexico, including IEPS on fuels and carbon, state carbon taxes, and the recent pilot ETSs, to assess their recent evolution and their importance in the context of Mexico's fiscal system. As illustrated in Figure 1, according to OECD estimates (2022), Mexico's ECRs are highly dependent on fuel excise taxes. Moreover, this tax, applied to the road transport sector, makes up almost 90% of the ECR for 2021. Taking into account that this sector contributes 22.3% of the country's total GHG emissions, there is evidently no connection between the application of the tax and a potential reduction in emissions. In other words, sectors such as electricity and industry have a marginal contribution within the ECR, but show emission levels similar to those in the transport sector. In this regard, any adjustment to the country's ECR needs to have an impact on the emissions of the largest emitting sectors if it is to help meet the GHG reduction goals.

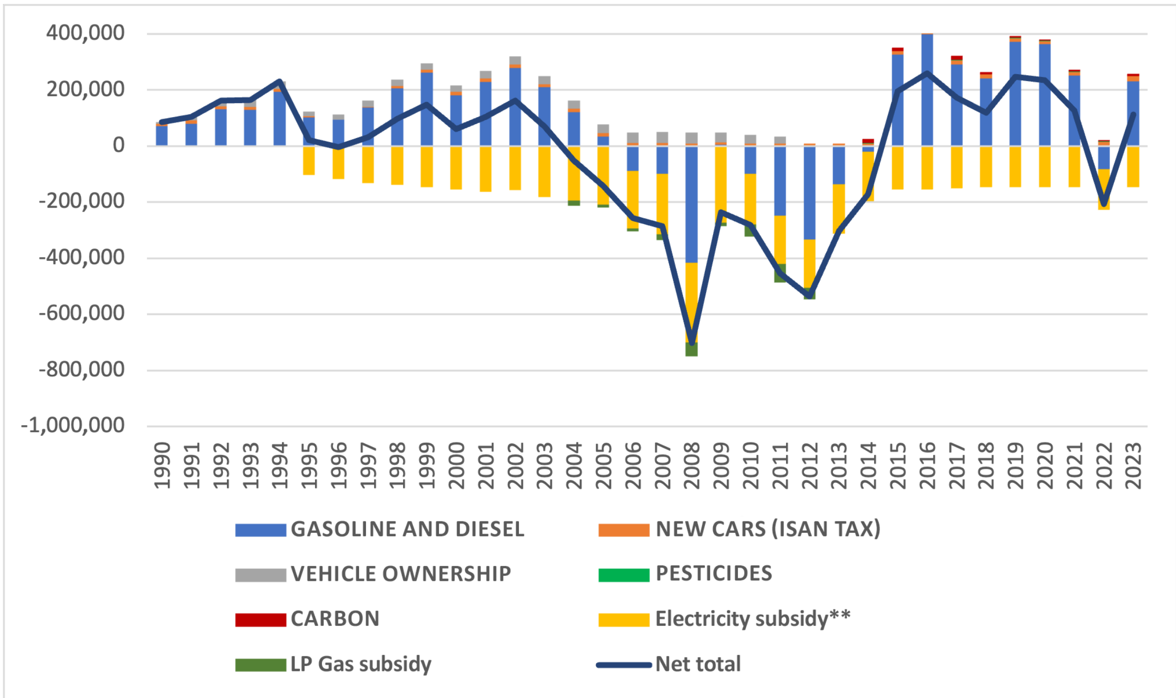
Figure 1. Average effective carbon rates: EUR per tonne of CO2 (left) and GHG emissions: megatonnes of CO2 (right) by sector, 2021: Mexico



Source: Author's own compilation based on data from OECD, 2022.

Concerning fiscal instruments with an environmental impact, Figure 2 illustrates that the most important of these in the country are concentrated in energy taxes and subsidies, chiefly on fuels and electricity consumption. The electricity subsidy can be seen, in principle, as an "anti-green" instrument since more than 80% of electricity in Mexico is currently generated from fossil fuels; therefore, electricity generation, distribution, and consumption are closely linked to an increase in emissions associated with fossil fuels.

Figure 2. Main environmental taxes and subsidies in Mexico: 1990-2023 (MXP December 2023)



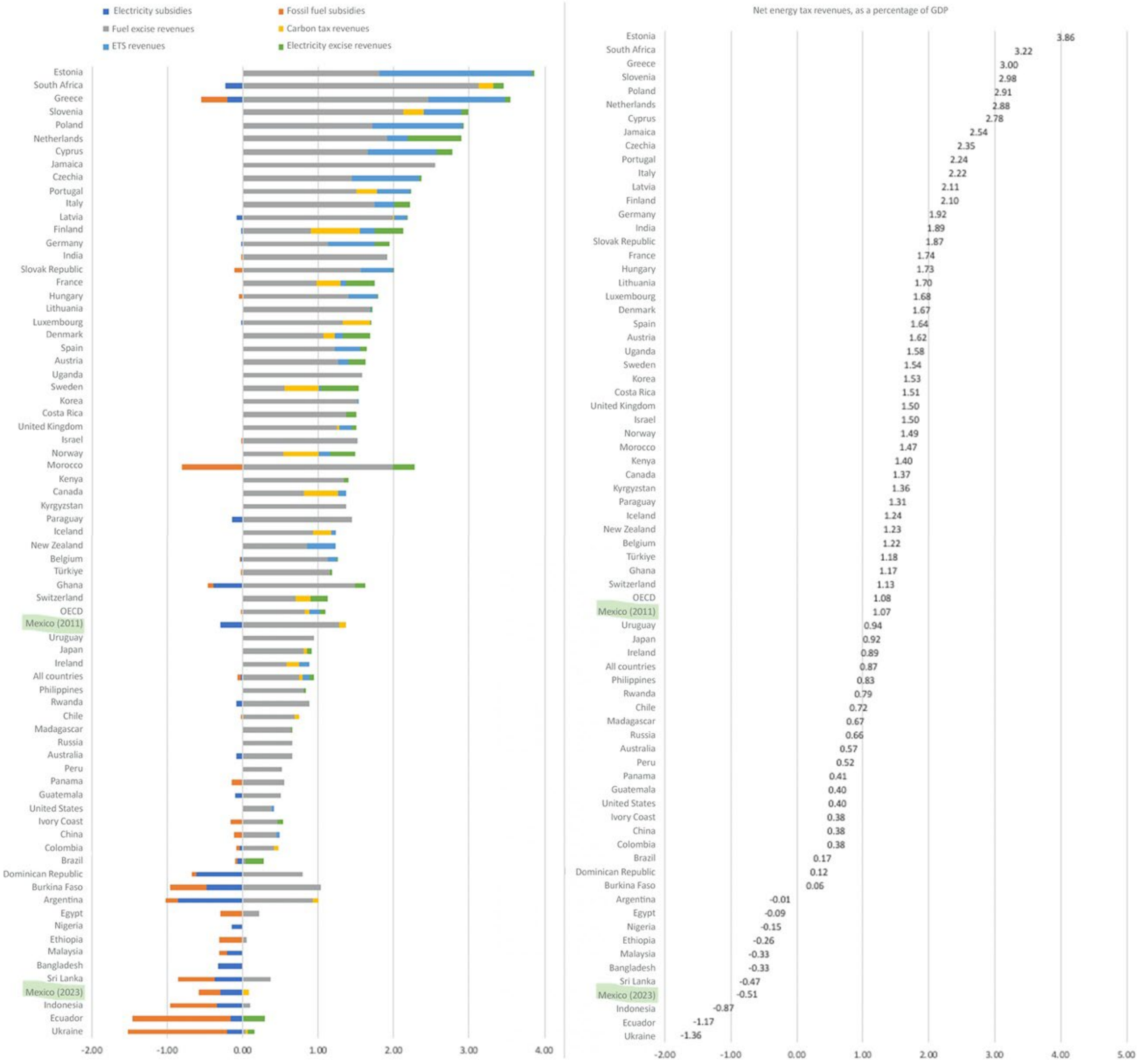
Source: Authors' own compilation based on data from the SHCP (Mexican Ministry of Finance), *Estadísticas oportunas de las finanzas públicas de México*, and the SENER (Mexican Ministry of Energy), Sistema de Información Energética.

Note: SENER does not report the electricity subsidy after 2014 due to a change in the electricity law. We assume a constant value in real terms after this year.

In 2022, according to the World Bank, Mexico ranked second in Latin America for generating the highest absolute CO2 emissions (kt), trailing only behind Brazil. In terms of emissions per capita, it ranked third behind Chile and Argentina. In terms of revenues from energy taxes, the country's position varies depending on the year. Since 2015, it has remained at levels comparable to world averages (close to 1% of GDP), reaching a position very close to the OECD average in 2021, as illustrated in Figure 3. However, the reinstatement of fuel subsidies in 2022, as part of anti-inflationary measures, highlights the temporary inconsistency of this taxation approach, resulting in Mexico experiencing negative net energy tax revenues in 2023.

In sum, based on the most recent data available on Mexico, the ECR is highly dependent on the fuel excise tax of a sector (transport), its level of emissions is relatively high (compared to the region), and it generates tax revenues which align closely with the OECD average, except in cases where fiscal authorities convert it into a subsidy. Understanding the behaviour of the IEPS on fuels is essential in comprehending this situation. In this regard, the following section describes the evolution of this tax in recent years.

Figure 3. Estimates of net energy tax revenues with data for 2021 and 2023 for Mexico, and for 2021 for the rest of the countries



Source: Author's own compilation based on data from OECD, 2023.

Evolution of energy taxes in Mexico, 1990-2023

IEPS on fuels, carbon, and state carbon taxes

The first efforts to define an environmental fiscal policy in Mexico are evident in the incorporation of economic and environmental policy instruments in the General Law of Ecological Balance and Environmental Protection in 1996. These instruments sparked the activation of a series of mechanisms that were included in the 1980 Law of the Special Tax on Production and Services (LIEPS, by its initials in Spanish). In particular, those associated with the consumption of fossil fuels (IEPS on fuels) classified into three types: gasoline below 91 octane, gasoline 91 octane and above, and diesel. From its inception and continuing almost until 2015, the tax value was determined by administrative decisions of Petróleos Mexicanos (PEMEX) and/or fiscal decisions of the government reflected in the establishment of variable rates for its calculation.

Following the 2013 energy reform, this mechanism was modified and fixed rates were introduced for the determination of this tax (DOF, 11/18/2015, Decree 2015 amending, adding and abrogating various provisions of the Income Tax Law, the Law of the Special Tax on Production and Services, the Fiscal Code of the Federation, and the Federal Law of Budget and Fiscal Responsibility). However, given changes in the conditions and assumptions used for its initial determination, new rates were proposed in the Decree establishing fiscal stimuli in relation to the Special Tax on Production and Services applicable to the fuels indicated (DOF, 24 /12/2015). Since then, they are subject to annual updates through an updating factor established by the Ministry of Finance and Public Credit.

In this regard, it is important to note that, in the first stage of its design and implementation, the IEPS on fuels had a discretionary nature linked to administrative elements, mainly by PEMEX, and its amount did not fully reflect the price variations of oil and fuels in the international market. Despite the fact that since 2016 its determination has been based on fixed rates, in some periods it functions as a subsidy and in others, as a tax. In terms of its impact on emissions reduction, it is observed that, when it functions as a subsidy, it can encourage fuel consumption, while, as a tax, it can discourage fuel consumption. Hence, at least in the Mexican context, the IEPS on fuels cannot be viewed as a tool consistently aimed at reducing emissions.

In parallel with the IEPS on fuels as a tool for reducing GHG emissions, legislation was enacted to reduce carbon emissions. The 2012 General Law on Climate Change (LGCC, by its initials in Spanish) originally established ambitious goals for the reduction of carbon emissions, particularly that 35% of the electricity generated would come from clean energy sources by 2024 and that there would be a 50% reduction in emissions by 2050, with 2000 as the baseline year. However, the environmental fiscal policy was actually limited to the IEPS on fuels consumption and the New Cars Tax (ISAN, by its initials in Spanish). Considering that these two instruments are mainly concerned with fuel consumption, their impact on emissions reductions has not aligned with the reduction percentages declared.

In this context, various proposals were put forward with the aim of creating conditions conducive to greater sustainability, competitiveness, and energy security in Mexico. As part of this move towards greener strategies, the LIEPS was amended in its Article 2, Section I, Paragraph H to introduce a tax associated with the amount of carbon present in the production of fossil fuels, also called IEPS on carbon. This amendment, enacted in 2013 and implemented in 2014, represents the first effort to diversify the composition of the ECR in the country and, ideally, influence emissions from industries other than the transport industry.

A second endeavour was undertaken in 2018 concerning the design and implementation of an emissions trading system. The initiative unfolded in two phases, an experimental one, called the "Emissions Trading System Experimental Programme", followed by an operational one, based on international principles and best practices. Despite the Mexican government's efforts to implement an ETS, no substantive arrangements or draft legislation have been ratified to date, casting doubt on the possibility of implementing the operational phase in the coming years. Further details about its features and operation are outlined in the next subsection.

Although the adjustments made could influence the composition of the ECR, carbon taxes and certificates tradable in the ETS still have a marginal impact. That is, the ECR remains highly dependent on the IEPS on fuels. According to the OECD (2022), considering 2021 real prices, expressed in Euros, Mexico's ECR was EUR 19.92 per tCO2 , of which the excise taxes levied on fuels different from carbon taxes amounted to EUR 18.76 per tCO2 , carbon taxes amounting to EUR 1.16 per tCO2, without any record of prices obtained through the Mexican ETS. In 2021, despite it being a year in which the IEPS on fuels played a significant role as a tax, Mexico ranked 33rd out of 38 among OECD countries in terms of ECRs, with the rankings ordered from highest to lowest. Only Turkey (16.74), Chile (15.40), Australia (13.47), the United States (12.23), and Colombia (6.70) have a lower ECR than Mexico.

Progress in terms of emissions reduction is measured with the Carbon Price Score (CPS) concept, which measures the proportion of the ECR in relation to one of the three internationally considered benchmark values (EUR 30, EUR 60, and EUR 120 per tonne of CO2) linked to the emissions reduction targets. The closer the CPS is to the unit, the greater the progress that has been made in ensuring that the country's ECR represents the established goal. For example, Mexico's ECR in 2018 was approximately EUR 20.26 tCO2, which represents 33.76% against the benchmark of EUR 60 tCO2, this 33.76% being its CPS for 2018. For that year, but considering emissions related to the combustion of biomass, Mexico's CPS is 30%. In this regard, Sen and Vollebergh (2018) estimate, for the Mexican case, that an increase of close to EUR 40 tCO2 could lead to an expected reduction in emissions of almost 29.2%, when considering the base of EUR 60 per tCO2.

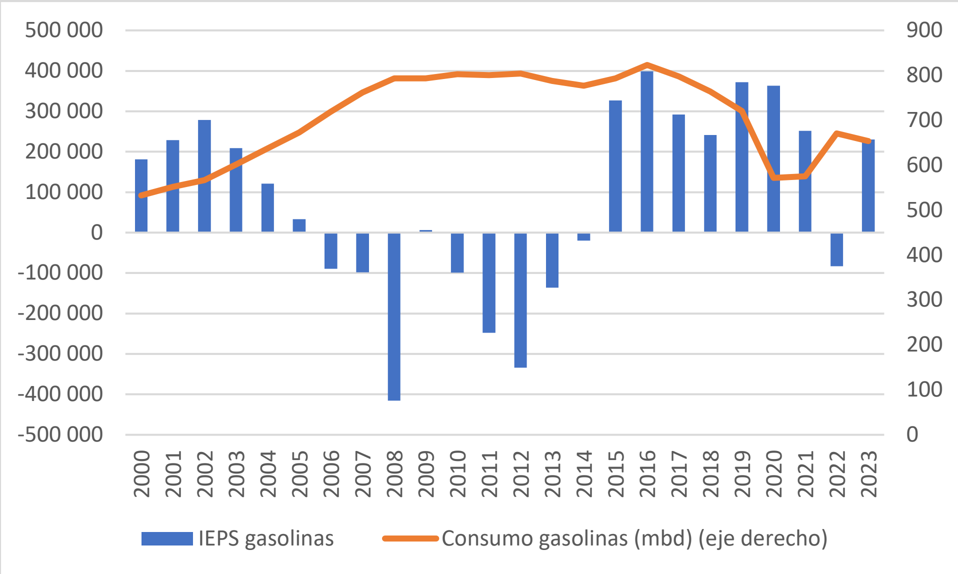
A comparison between the evolution of the IEPS on fuels and fuel consumption in the last two decades (Figure 4) suggests that this instrument does indeed have an important impact on GHG emissions. Given that this period includes almost a decade of subsidies for fuels (or close-to-zero taxes, 2005-2014), it provides a natural experiment to evaluate the impact of this tax. As the figure shows, this period is associated with an accelerated growth in fuel consumption (from 600 to 800 mbd), which decreases gradually as of 2015, once subsidies are removed and replaced with significant taxes. This reduction partly reflects the effect of the pandemic in 2020, but it is worth noting that it persists in 2021, only reversing with the temporary return to the subsidy in 2022. Thus, the consumption recorded in 2023 is less than that of 2005.

An evaluation of the impact of the IEPS on GHG clearly requires a more rigorous analysis, controlled by other determinants. Muñoz-Piña et al. (2022) estimate that the removal of fuel consumption subsidies, followed by the introduction of a carbon tax, contributed approximately 33% of the reduction in GHG emissions associated with gasoline and diesel consumption for the 2010-2019 period in Mexico. They also estimate that 65% of these reductions are attributable to the IEPS on fuels, while the remaining 2% is related to the introduction of the IEPS on carbon.

These authors propose two recommendations for Mexico to elevate its ECR and thereby achieve its emissions reduction targets. Firstly, the country should reassess the current rates of its federal taxes (IEPS on carbon and IEPS on fuels), considering three aspects: their gradual increase in stages, the removal of exemptions, and/or the implementation of a uniform rate per tCO2 for all fossil fuels included in the IEPS. As a second measure, given that it is a source of emissions with less coverage in excise taxes, the authors advocate for the development of an ETS so that there is a mechanism to incorporate industrial fuels directly into the carbon pricing structure.

The authors' findings align with the key element identified in this study: the significance of the IEPS on fuels as the primary green fiscal instrument. However, Muñoz-Piña et al. do not analyse the redistributive effects of the change of policy (from subsidies to taxes), nor that of the proposal to increase the IEPS on fuels. Consequently, this study is intended to contribute to the literature by estimating the redistributive effects of this transition and their implications for ensuring coherence between environmental and social policies.

Figure 4. IEPS on fuels evolution (millions of MXN) and fuels consumption (millions of barrels per day) 2000-2023



Source: Authors' own compilation based on data from the SHCP (Mexican Ministry of Finance), *Estadísticas oportunas de las finanzas públicas de México* and the SENER (Mexican Ministry of Energy), *Sistema de Información Energética*, *PEMEX*.

In short, despite recent efforts in terms of environmental fiscal policy, its operation remains centred on the collection of the IEPS on fuels, and its results regarding emissions reduction are rather modest. This situation is concerning, given that over the last two decades, Mexico has consistently ranked among the top 18 countries with the highest absolute levels of CO2 emissions (kt). Moreover, in 2020, Mexico ranked 15th on this list (World Bank, 2022).

Nevertheless, based on these same estimates, there is a great area of opportunity to increase revenue collection through other instruments with environmental impact implemented in the country. These alternatives, distinct from taxes and subsidies, have the potential to effectively reduce emissions, if adequately reflected through the ECR. Such efforts would align with both objectives set internally in the LGCC and with those acquired internationally. Given the characteristics outlined above, and the outcomes observed in the international community, the partial recommendation in this regard is to develop the country's ETS in depth and breadth. In this regard, the following section provides a description of the main advances and experiences of its implementation.

Characteristics and proposed operation of the national programme for a pilot ETS

In July 2018, a reform to Mexico's General Law on Climate Change was published, establishing the creation of an Emissions Trading System (ETS) that would begin with a 36-month experimental programme. The ETS is designed to promote low-carbon development and meet Mexico's sectoral climate goals. It constitutes a reliable means both for measuring emissions and for providing appropriate tax payment mechanisms in the Mexican context. This would encourage GHG reduction by allowing companies to choose the most cost-effective way to meet established goals. The strategy also promotes technological innovation and efficient energy use in companies, thus strengthening their competitiveness and creating quality jobs. The preliminary bases of the ETS Experimental Programme were published in October 2019.

Participants in the ETS, at least in the pilot stage, comprise companies whose direct emissions (fixed sources from industrial processes and fuel combustion) from their installations have exceeded 100,000 tCO_2 in any year between 2016 and 2019, totalling around 300 installations. These participants come mainly from the industrial and energy sectors, encompassing subsectors such as hydrocarbons and electric power generation, representing about 90% of the emissions reported in the National Emissions Registry (RENE, by its initials in Spanish). Each participant is committed to developing and implementing an emissions monitoring plan in accordance with the requirements of the General Law on Climate Change.

The emissions cap set in the pilot ETS programme was determined using historical data reported in RENE and the country's climate goals. It was published 30 days before the start of the Experimental Programme (Healy et al., 2018). Simultaneously, a quantity of emission allowances (DEM, by its initials in Spanish) equivalent to the cap was allocated and subsequently distributed among the participating installations. Initially, the distribution of the emission allowances was free, with the option for subsequent exchange being possible through an auction market.

The Emission Allowances Monitoring System was created to monitor participants' emissions by keeping records of both their emissions and of the trading of emission allowances. According to Article 94 of the General Law on Climate Change, the Ministry of the Environment and Natural Resources (SEMARNAT, by its initials in Spanish) is in charge of designing, managing, operating, and reviewing the ETS; and of regulating and promoting allowances auctions. The Ministry's work is supported by the National Institute of Ecology and Climate Change in this area.

For the ETS to function properly, participants are required to monitor and report their emissions and verify them with an independent third-party. Once the emission levels are determined, participants must surrender the corresponding allowances to cover them. Failure to meet this obligation results in a deduction of two emission allowances for each one not surrendered in the pilot stage from the allocation for the operational phase of the ETS. Unused emission allowances can be banked between compliance years but cannot be carried over to the operational phase of the ETS. The implementation of the pilot programme concluded in December 2022, so there is still no official record of auctions conducted. The Ministry of Environment and Natural Resources (SEMARNAT) is working on an updated proposal for the operational phase, which is expected to be consolidated between 2024 and 2025.

Advantages as a potential source of revenues to finance the universal social protection system

According to OECD data, in 2021, the estimated potential tax base on carbon emissions for its member countries totalled 15,250,040 kilotons of CO2. Mexico is ranked 6th on this list (684,956) behind Canada (740,531), South Korea (783,474), Germany (844,131), Japan (1,270,916), and the United States (6,097,885). This illustrates that there is a great area of opportunity for future tax revenues that could be allocated to programmes such as the universal social protection system.

For that purpose, it is necessary to consider both the redistributive effects of the IEPS on fuels (the main component of the ECR in the country) and the appropriate development of the ETS. A limitation for the latter is that, in several countries, the adoption and development of ETSs have resulted in auction prices of emission allowances falling below expectations. This is a cause of concern because, from the perspective of ETS participants, a decrease in the cost of emissions may diminish the real incentives to invest in emission reduction efforts. Therefore, it has been proposed to create a hybrid system offering the advantages of an ETS without encountering the pricing irregularities observed in some cases.

An analysis conducted by the SEMARNAT and the German Agency for International Cooperation (GIZ) (Mehling & Dimantchev, 2017) proposes a hybrid system called Overlapping Tax & ETS. The system consists in adding floors or ceilings to the prices involved in the exchange of emission allowances, to align both quantities and prices of auctions with a stable system that promotes emissions reduction. Compared to the original ETS design, the proposed hybrid system could increase tax revenues by MXN 21 billion to MXN 36 billion per year, depending on the auction system implemented. However, the authors also point out that the coexistence of uncoordinated carbon pricing instruments can have adverse effects and significantly undermine both the profitability and the associated environmental benefits.

A combination of pricing strategies can introduce a carbon price floor in an ETS and offer various benefits, such as providing more predictable carbon prices and avoid ineffective investment decisions. It is crucial to bear in mind that the scope of the carbon tax must be at least equal to or greater than that of the ETS in order to avoid emissions leakage between sectors. However, an environmental fiscal policy strategy in this direction must consider the redistributive effects of the IEPS on fuels and the IEPS on carbon so that it does not assume a regressive character.

Given that the ETS has not been fully implemented, and its potential implementation seems to be a medium-term strategy, the remainder of this analysis will focus on quantifying the incidence and distributive impact of the main component of the ECR (IEPS on fuels and IEPS on carbon) and electricity subsidies (an "anti-green" instrument) in order to propose adjustments to the composition of the ECR that could potentially align the country's revenue collection and emissions reduction objectives.

3. Analysis of distributive incidence of green taxes: 2014-2020

This section summarises and analyses the main results of this study. The full set of results can be downloaded as a reference Excel document on the project webpage[2]. We employ a standardised methodology for fiscal and benefit incidence (developed by the Commitment to Equity Institute, CEQI; Lustig 2022). This methodology facilitates comparability in time and space and yields a diverse set of incidence indicators, including effects on the Gini coefficient, and income poverty, using national and international poverty lines (see Scott 2014, 2017, 2022; Scott et al. 2017, and the latest edition of the CEQ comparative database). This allows us to estimate the effect of green taxes in the context of the overall fiscal system.

We will use the seven definitions of pre-fiscal and post-fiscal income listed below. Concerning these concepts, it is important to distinguish the interpretation of non-contributory pensions as deferred market income (without public subsidy) or as public transfers. In most countries, contributory pension systems include contributory financing with public subsidies. In the case of Mexico, the pensions observed in the years studied have a significant public subsidy, not only because they include statutory contributions from the government, but also because with the 1977 reform of the IMSS (and, later, that of the ISSSTE) the government assumed full responsibility for the ongoing pensions of all workers registered with the IMSS until that date.

a) Market income (YM): households' gross earned and unearned income (i.e. before direct taxes), excluding public transfers.
b) Market income with contributory pensions (YM/P): YM + contributory pensions considered as deferred market income.
c) Net market income (YNM): YM (or YM/P) + direct taxes on individuals (personal income tax and social security contributions). We do not consider corporate taxes because the survey used (ENIGH) does not allow for estimating their incidence at the household level.
d) Gross income (YB): YM (or YM/P) + public cash transfers.
e) Disposable income (YD): YNM + public cash transfers.
f) Consumable income (YC): YD + indirect taxes and subsidies.
g) Final income (YF): YC + transfers in-kind

2 https://www.afd.fr/en/carte-des-projets/distributive-impact-green-taxes-mexico

Section 3 described the principal fiscal instruments with environmental effects used in Mexico, as well as their evolution over the past decades (Figure 2). This analysis includes the main green tax used in recent years, the excise tax on fuels (IEPS on fuels), but also the excise tax on carbon (Carbon IEPS), which is much smaller. Since the latter is collected mainly through the fuel consumption, we estimate its distribution along with the tax on fuels, through spending on fuels as reported by households in the National Survey of Household Income and Expenditure (ENIGH, by its initials in Spanish) (INEGI). The IEPS on fuels has represented an average of almost MXN 200 billion annually in 1990-2023 (2023 prices), excluding the years in which it functioned as a subsidy, while the Carbon IEPS has collected an average of MXN 8.1 billion since its introduction (2014-2023). The IEPS on fuels has been equally important during the ten years it functioned as a subsidy (2006-2008, 2010-2014, 2022), representing on average a subsidy of MXN 169 billion.

We also present estimates for the electricity subsidy, considering, as noted above, that 82% of electricity in Mexico is currently generated using fossil fuels. This subsidy represented an average of MXN 168.2 billion in 1995-2023. [3]

The analysis does not include the other taxes/subsidies with environmental impact considered in Figure 2 because the ENIGH does not contain the necessary information for their estimation (ISAN) and/or they were eliminated in the analysis period (LP gas subsidy, eliminated as of 2013) or decentralised (federal vehicle ownership, we do not have complete state data). Fortunately, these represent a marginal fraction of total environmental taxes and subsidies.

The analysis spans the 2014-2022 period. We will use ENIGH data for 2014, 2018, 2020 and 2022, as well as the corresponding tax and spending annual public accounts. This timeframe is significant as it encompasses the transition from a period where fuel subsidies amounted to a total of MXN 1,365 billion (5.7% of GDP) during 2006-2014, to fuel taxes of equivalent sizes. By 2014, the subsidy had almost disappeared (decreasing from MXN 318 billion in 2012 to MXN 12.8 billion in 2014). By 2018 and 2020, revenues from fuel taxes had risen to MXN 187.6 billion (0.8% of GDP) and MXN 299.6 billion (1.2% of GDP), respectively. Finally, in 2022, the fuel subsidy was reintroduced at a level close to MXN 80 billion (0.3% of GDP) (Figure 2).

Besides extending the estimates to include the latest ENIGH surveys available to date (2020 and 2022), this study introduces various methods and scenarios to measure the indirect effects of fossil fuel taxes. These effects are separate from the direct spending on fuels

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[3] Since 2019, the value of the electricity subsidy for residential consumption is no longer published by the CFE, so in this paper we assumed it has remained the same as the last published value, in 2018.

reported by households for private transport. In particular, they include the consumption of fuels in public passenger transport and the commercial transportation of goods and services. This robustness analysis holds particular significance in the context of Mexico, since, as shown below, the indirect effects significantly reduce the progressivity (regressivity) of fuel taxes (subsidies) (Figure 7).

Two different methods were compared to include these indirect effects. The first one, which has been used in previous estimates (Scott 2022), applies factors that represent the share of the fuel tax associated with the three main sources (private fuel purchases, public road transportation, and freight transportation), as published by the Ministry of Finance (SHCP) in its fiscal expenditure estimates. The second one, which is a new contribution of the present study, uses the most recent input-output matrix based on the Mexico's National Accounts System published by the INEGI. To compare them, we adapted a methodology proposed by Jellema & Inchauste (2022). Technical details are presented in Annex 1.

An important complexity in the empirical analysis of fiscal incidence arises from the combination of household income surveys and public fiscal accounts. Most of these surveys include the social cash transfers reported directly to households, but not the direct or indirect taxes borne by these households, nor the cash value of in-kind transfers. Therefore, these fiscal instruments must be allocated according to data on income and expenditure, and on use of public services reported by households. The total value of allocated taxes and benefits is generally based on public accounts. Even direct transfers are often underreported in household income surveys, as are most other sources of income, compared to the equivalent items in the national accounts. In view of this under-reporting, using the value of taxes and benefits as reported in public accounts implies a risk of overestimating the size of these fiscal instruments relative to market income as reported in surveys and, therefore, overestimating the fiscal incidence and redistributive impact of the fiscal system. This problem is especially pertinent in the context of Mexico's ENIGHs, where some of the widest gaps in relation to national accounts in the LAC region (see Sedlac-BM database) can be found. To correct this, the present analysis considers three scenarios:

E1: Only uses data reported in the survey to estimate the distribution and amounts of cash transfers, as reported by households. The distribution of in-kind transfers is derived from the reported use of public educational and health services, and their amount is valued on the cost of provision as reported in the public accounts, at the different educational levels and health institutions (IMSS, SS, Pemex). The distribution of taxes is estimated by applying the relevant tax legislation to the income and expenditure data as reported in the survey (applying specific assumptions to exclude informal income and expenditure).

E2: The same as E1, except that cash transfers are valued according to the amounts reported in the public accounts, and

E3: The same as E2, except that the tax values are first adjusted to ensure consistency with tax revenues reported in the public accounts, and second, these values are adjusted downwards by the factor of income under-reporting from the survey compared to national accounts.

As documented in Excel file available for download on the project page and Figure 13 below, the main qualitative results are robust for all three scenarios. The summary below outlines the results for E2, while results for all three scenarios are included in Excel file.

All incidence estimates presented here, both by deciles and using synthetic measures, are estimated with respect to household market income, including contributory pensions as part of this income. This assumes that most of these pensions are deferred market income. In the case of Mexico, this is a reasonable assumption for future pensions, under the reformed pension systems, with defined contribution and individual account (workers affiliated after 1997 in the case of the IMSS), although not necessarily for current pensions (transitional), which are mostly financed through general taxes. In fact, this subsidy has grown rapidly, mainly due to the transitional but decades-long costs of the reforms, which in 2020, represent 4.1% of GDP. Therefore, we will also illustrate the effect of the opposite assumption, treating these pensions entirely as public transfers, thus considering an upper and lower limit for the net incidence of the fiscal system (Figure 10).

To understand the general context of Mexico's fiscal system, Figure 5 presents the evolution of public revenues by source of income, and Figure 6 presents the evolution of public transfers, which comprise the main items of social spending and other transfers and subsidies, including energy subsidies (fuels, LP gas, and electricity).

We can summarize some of the most relevant facts for this analysis as follows:

a) Historically, Mexico's (non-oil) tax revenues have been low compared to international levels for middle-income countries. They have fluctuated around 10% of GDP over the past three decades, with a significant dependence on oil revenues until the middle of the last decade. However, until recently, even with these revenues, total government revenues have been comparatively modest: about 13% in the 1990s, gradually rising to 14% in the 2000s and 17% in the last decade.

b) This growth is due to tax revenues, which have increased significantly in recent years, almost reaching 15% of GDP in 2016, a level that has remained stable until 2022. This near 50% increase in revenue collection has allowed the federal government to maintain total revenues in a context where oil revenues are declining rapidly.

c) The increase in tax revenue has been achieved both through direct taxes (personal and corporate income) and indirect taxes, including VAT, but the instrument that represents the largest increase in revenue in this period is the IEPS on fuels. The transition from a fuel subsidy of 1.3% of GDP in 2012 to a tax of 1.3% of GDP by 2020 leads to a total increase of 2.6% of GDP in households' net tax burden. Together with the increase in VAT and in corporate income tax for companies (part of which is passed on to consumers through prices), the tax burden on households has evidently increased significantly. Given the regressive incidence of the fuel tax and the VAT (see Figure 9), the impact on the poorest households has been disproportionate.

d) Unfortunately, the increased tax burden on the poor has not been offset in this period by equivalent increases in public transfers to benefit this population. Despite a recent increase in direct cash transfers, they still constitute a relatively small share of total public transfers (Figure 6). Additionally, the recent increase has been the result of a shift from targeted programmes, such as the *Progresa-Oportunidades-Prospera* programme, to universal transfers, mainly the non-contributory pension for the older adults, *Adultos Mayores*. This has implied a decrease in the proportion of direct transfers received by the poorest decile (10% of the population), from 24% in 2018 to 14% in 2022 (Scott 2024, based on ENIGH). Instead, the increase in tax revenues has been used primarily to support increasing subsidies to contributory pension systems during the transition period, benefiting mainly middle- and high- income households. As depicted in Figure 6, this is the social spending item with the highest growth rate, from 0.4% of GDP in 1990 to 4.1% in 2022.

e) At the same time, spending on education, which has historically constituted the main item of social spending and shown a trend of increasing progressivity with advances in coverage, has decreased in recent years, as a proportion of social spending and even of GDP, being surpassed by pension spending as the main component of social spending.

f) Overall, social spending increased in 2018-2022. However, it has only just regained the level it had reached in 2015. It is also important to consider that although the increase in tax revenues has strengthened the fiscal sustainability of this spending, it currently absorbs 90% of total tax revenues.

g) In this context of public spending, the increase in fiscal capacity, via IEPS on fuels, has had and impoverishing net effect (transfers – taxes) (Figures 11, 12).

Figure 7 contrasts the estimates of the incidence of the fuels tax for 2020 considering only the direct effect (DE), and including the indirect effects using the two methods mentioned above, the SHCP factors (EDI-CFH) and the estimates based on the Input - Output Matrix (DEI-MIO). The direct effect is highly progressive, reflecting the distribution of private car use in Mexico. However, once indirect effects are added to this effect, these taxes are found to be slightly (CFH) to highly (MIO) regressive. In the latest estimate, this tax represented 7% of market income for the poorest income decile (in the third scenario, this is reduced to 3.5%). As this final estimate is the most comprehensive and well-supported, derived from the aforementioned input-output analysis, we use it in the following analyses to calculate the incidence of the IEPS on fuels and carbon. As illustrated in Figure 2, the analysis period in this study holds particular significance as it includes two years in which the IEPS on fuels functioned as a subsidy (2014, 2022), and two years in which it functioned as a tax (2018, 2020), the latter nearing its historical peak. Considering its redistributive effects, this entails a broad range of incidences in this period, as shown in Figure 8, ranging from a progressive subsidy (2014, 2018) to an increasingly onerous regressive tax (2018, 2020). For comparison, we include the incidence of VAT in 2020, which is less regressive than the IEPS on fuels. This divergence may reflect the fact that the indirect effects of this tax on the consumption of food (via its transportation), for example, are not exempted, unlike VAT on food itself.

As we can see from Figure 2, these last years are the most representative of the green fiscal policy from 2015 to date, except for the anti-inflationary policy in 2022. Hence, we will use 2020 as a representative year for the analyses of the fiscal system in the following figures.

Considering all taxes together (Figure 9), we see that the burden represented by the IEPS on fuels is similar to that of all VAT (in 2020). Indirect taxes together represent a tax burden equivalent to almost 15% of the market income (plus pensions) of the poorest decile. Also considering direct taxes (personal income tax and social security contributions), the total tax burden on households is progressive but rather flat: it increases from 15% to only 21.5% between the poorest and the richest decile.

Considering the net incidence of the fiscal system as a whole on the monetary (consumable) income of households (Figure 10), including cash transfers and (energy) subsidies, but excluding, for now, in-kind transfers, we see that taxes and contributions significantly reduce the net benefit of direct transfers for the poorest decile, and eliminate these benefits from the second decile onwards. The figure illustrates the two alternative scenarios, assuming that contributory pensions represent deferred market income or public transfers. In the first case, the estimated net tax burden for the richest decile would be 20%, while in the second, it is reduced to 10%.

Finally, Figures 11 and 12 summarize the main effects of the fiscal system on inequality and extreme and total monetary poverty. For this analysis we consider the Gini coefficient and poverty rates using Mexico's official monetary poverty lines, as defined by Coneval. The results for the most commonly-used international lines (1.9, 3.2, and 5.5 USD PPP 2011) are included in the Excel file available for download on the project webpage. Coneval's poverty lines in August 2022 were valued at MXN 137 (13.2 USD PPP) and MXN 98 (9.4 USD PPP) in urban and rural areas, respectively, while those for extreme poverty were MXN 69 (6.6 USD PPP) and MXN 53 (5.1 USD PPP), in urban and rural areas, respectively.

It is clear that inequality and pre-fiscal poverty have diminished significantly in this period, but it is important to note that the 2018-2022 series is not strictly comparable with 2014, since INEGI improved the collection of household income data in the lower part of distribution in the new series.

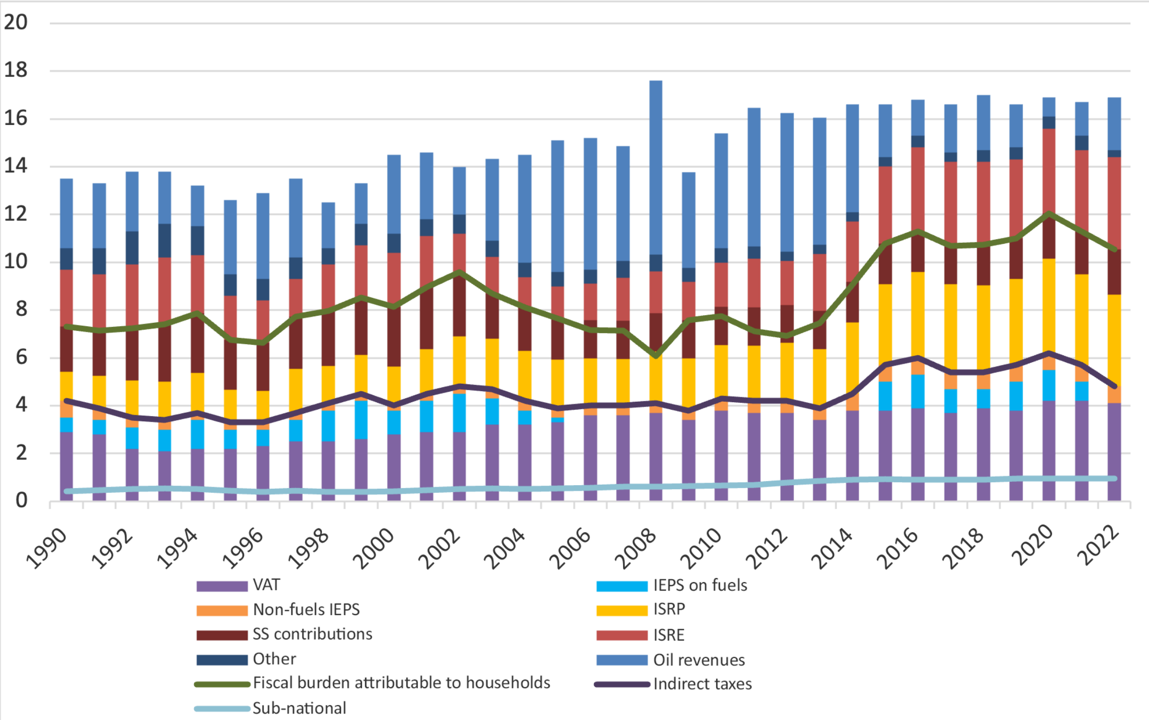
Comparability is largely resolved by analysing the changes in these indicators in percentage points for each post-fiscal income item, with respect to the YM (Figure 12). Among the primary results, the following can be highlighted:

a) The fiscal system reduces inequality in all years, although the monetary effects (before in-kind transfers) are relatively modest, reflecting the relatively small weight of cash transfers in Mexico's GDP. Indirect taxes and subsidies reduce inequality slightly with respect to the YD in all years, except in 2020. This reflects the weight of the IEPS on fuels in this year, which, as we saw, increases the regressivity of indirect taxes.

b) With the increase in the IEPS on fuels between 2014 and 2020, the effect on consumable income in extreme poverty goes from a reduction of 2.3 ppt to an increase of 0.5 ppt. In other words, by 2020, the increase in indirect taxes, due to their impoverishing effect, led to the entire elimination of the poverty-reducing effect of all direct transfers on the extremely poor. The temporary reinstatement of the fuel subsidy in 2022 produced an effect very similar to 2014; however, if we could conduct the analysis for 2023, the result would be very similar to 2018, given a similar weight of the fuel tax in these years.

c) In the case of total poverty, the net effect of the fiscal system on consumable income is impoverishing in all years, but this effect is significantly greater in the years where the fuel tax was in force, 5.8 and 5.4 ppt in 2018 and 2020, respectively (vs. 2.5 and 1.5 ppt in 2014 and 2022, respectively). These impoverishing effects of the fiscal system on consumable income are robust to the different scenarios we have considered, although the magnitude of the effect varies among them (Figure 12).

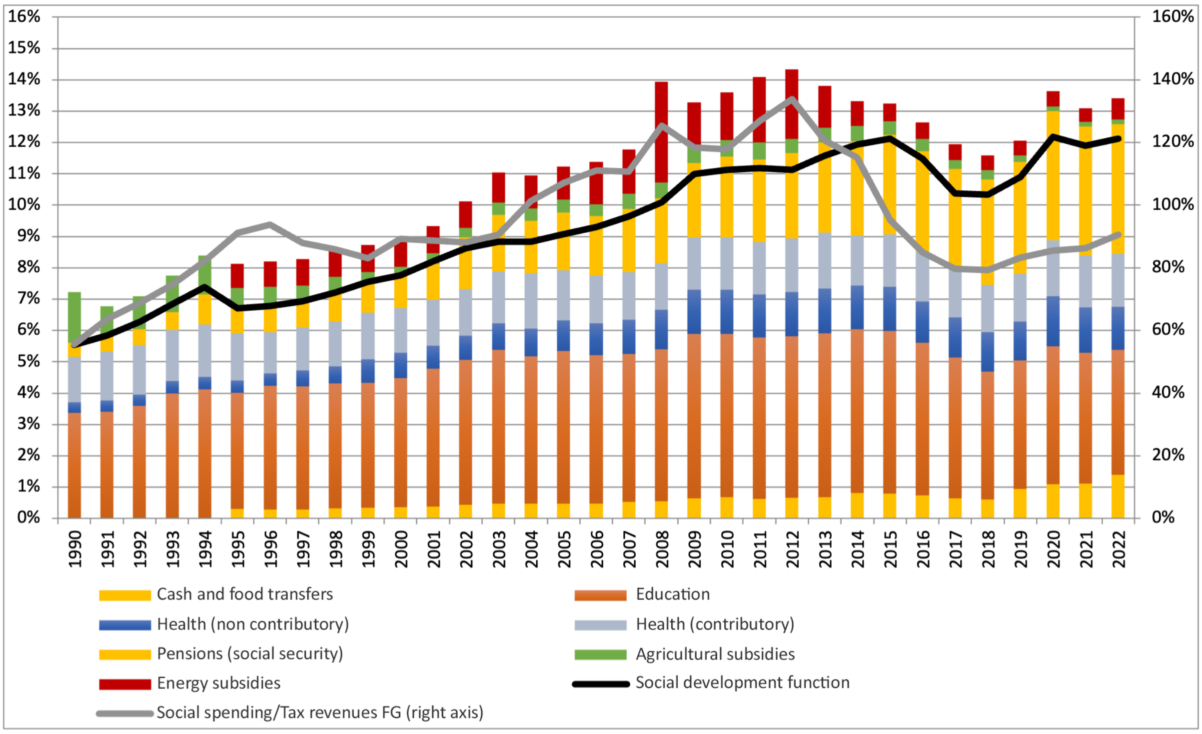
Figure 5. Evolution of Tax and Oil Revenues
(Federal Government, Social Security and Sub-national Governments)
1990-2021 (% of GDP)



Source: Authors' own compilation based on data from the SHCP (Mexican Ministry of Finance), *Estadísticas oportunas de las finanzas públicas de México* and the SENER (Mexican Ministry of Energy), *Sistema de Información Energética*, PEMEX.

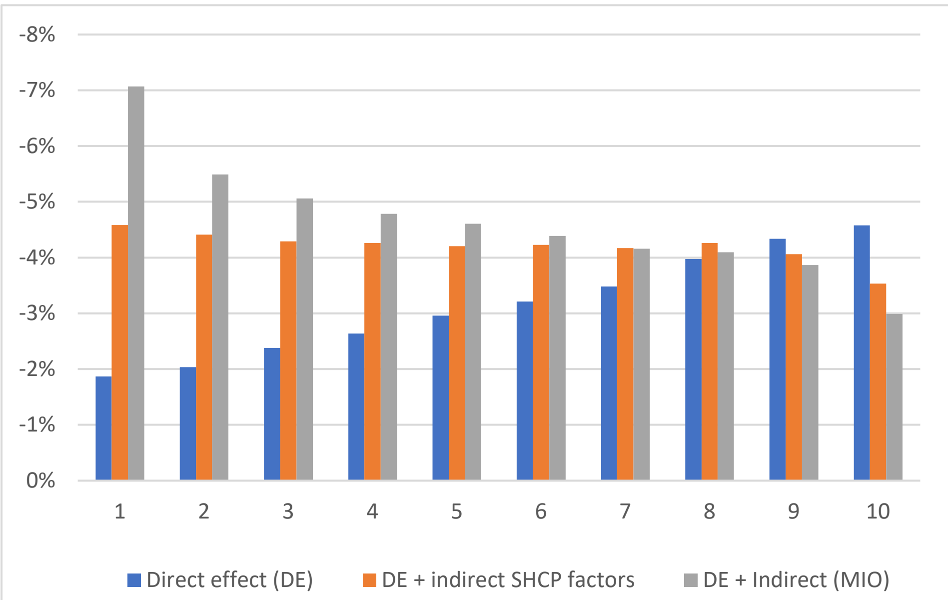
Figure 6. Evolution of social spending and transfers/subsidies 1990-2020

(% of GDP: left axis; % revenue collection: right axis)



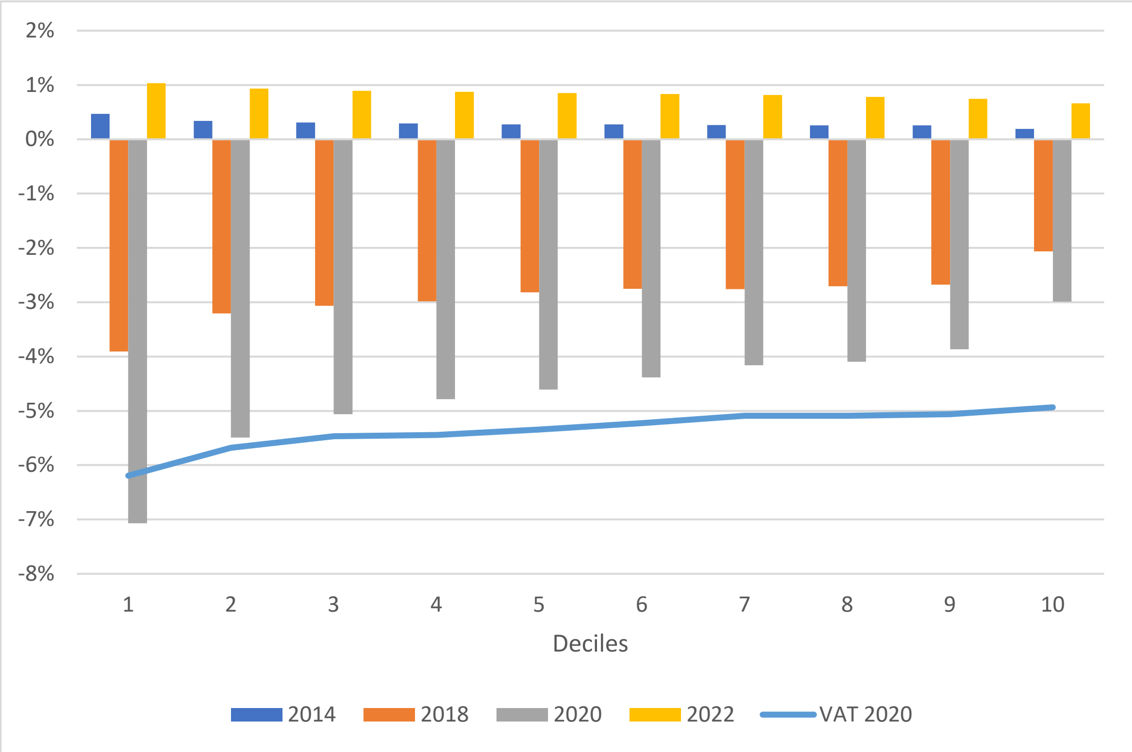
Source: Authors' own calculations based on data from *Cuenta Pública* (SHCP).

Figure 7. Incidence of IEPS on Fuels and Carbon, direct effect and total 2020



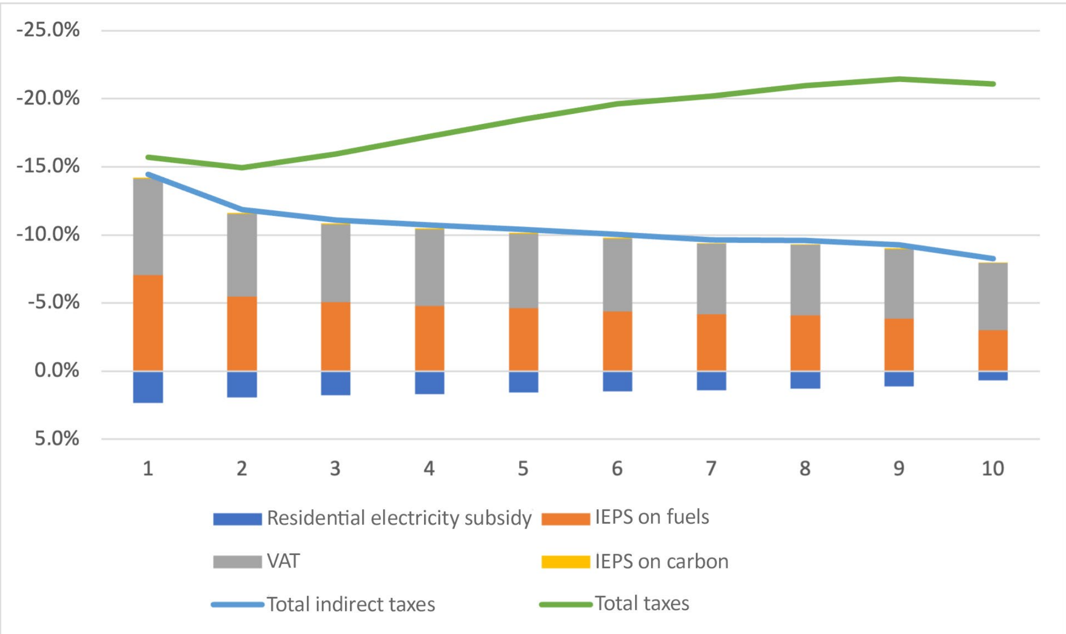
Source: Authors' own compilation based on ENIGH 2020 (National Survey of Household Income and Expenditure) and *Cuenta Pública*.

Figure 8. Incidence of IEPS on Fuels and Carbon by income deciles, 2014, 2018, 2020, 2022
(% YM/P)



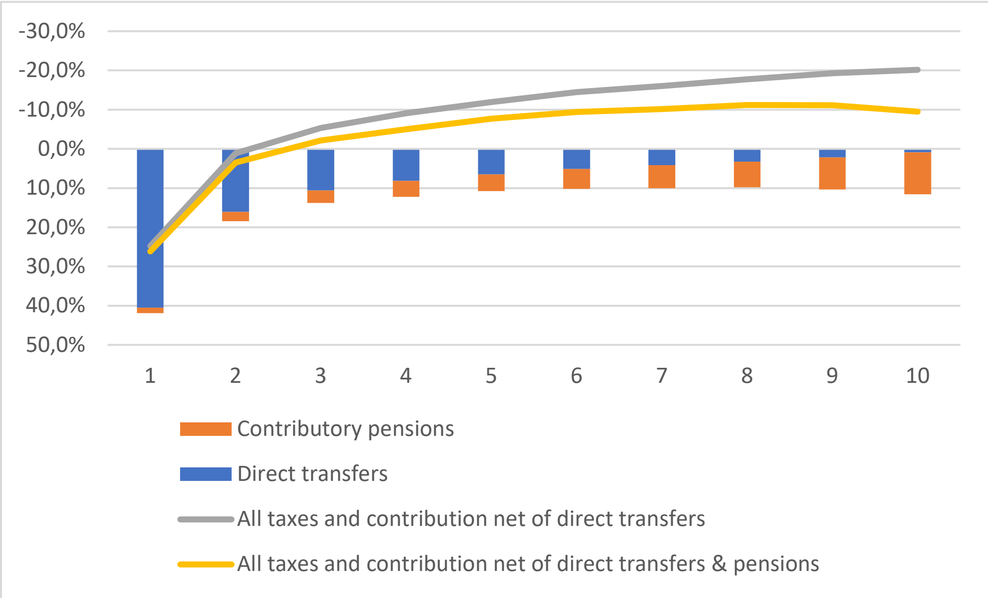
Source: Authors' own calculations based on ENIGH 2018 and 2020 (National Survey of Household Income and Expenditure) and *Cuenta Pública*

Figure 9. Fiscal incidence (% of market income, including pensions), 2020
Green taxes, electricity subsidy



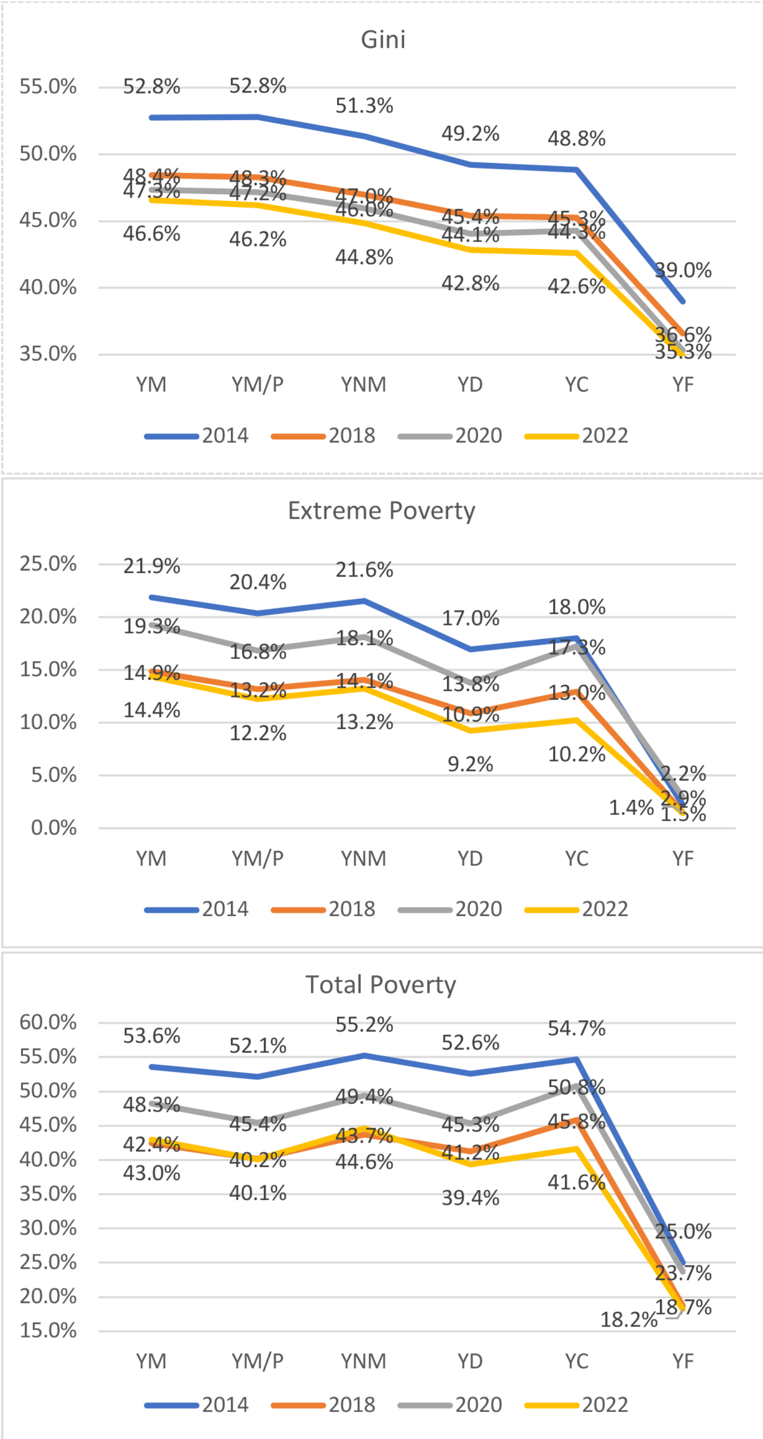
Source: Authors' own calculations based on ENIGH 2020 (National Survey of Household Income and Expenditure) and *Cuenta Pública*

Figure 10. Fiscal incidence (% of market income, including pensions), 2020
Cash transfers, contributory pensions, and net taxes



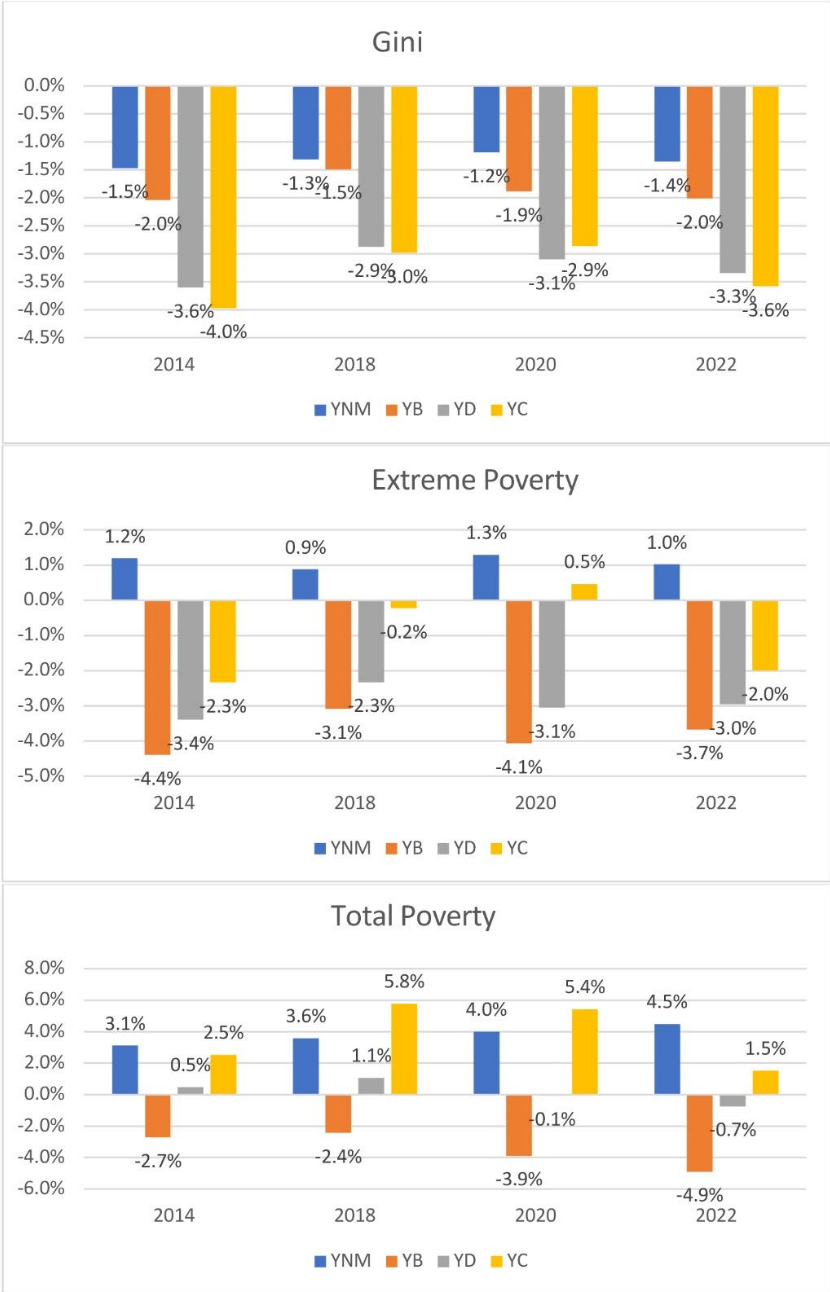
Source: Authors' own calculations based on ENIGH 2020 (National Survey of Household Income and Expenditure) and *Cuenta Pública*

Figure 11. Effects of the fiscal system on inequality and poverty, 2014, 2018, 2020, 2022



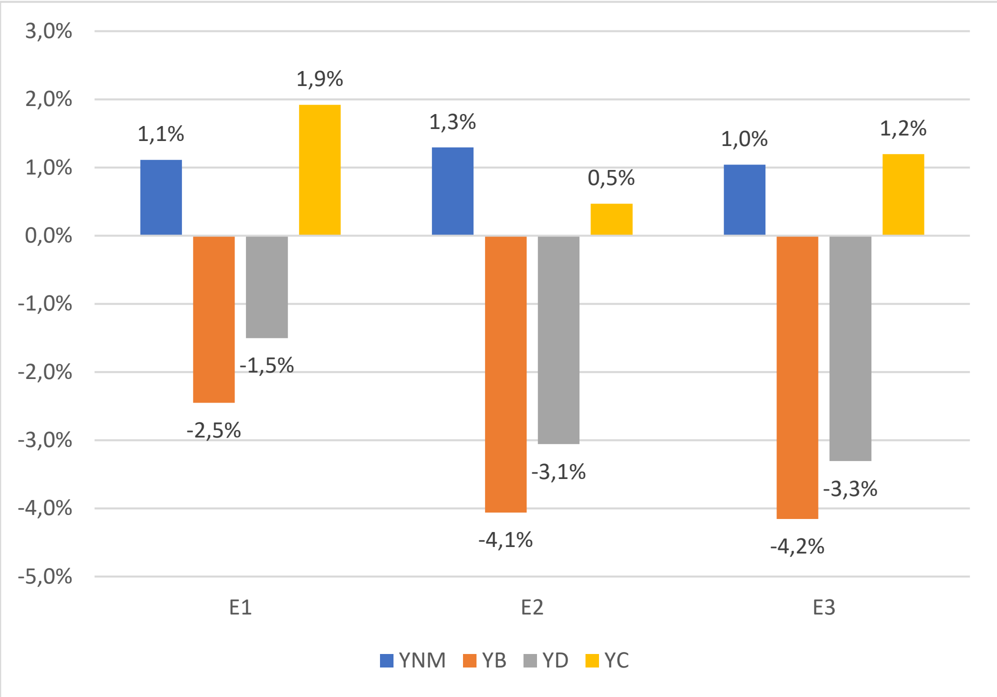
Source: Authors' own calculations based on ENIGH 2014, 2018 and 2020 (National Survey of Household Income and Expenditure) and *Cuenta Pública*

Figure 12. Change in inequality and poverty because of the fiscal system (with respect to YM/P, ppt): 2014, 2018, 2020, 2022



Source: Authors' own calculations based on ENIGH 2014, 2018 and 2020 (National Survey of Household Income and Expenditure) and *Cuenta Pública*

Figure 13. Change in extreme poverty because of the fiscal system (with respect to YM/P, ppt), 2020: three scenarios



Source: Authors' own calculations based on ENIGH 2020 (National Survey of Household Income and Expenditure) and *Cuenta Pública*

Interpretation of the results

In the current context of the fiscal system in Mexico, there is potential conflict between environmental and redistributive objectives due to the impoverishing effects associated with the rise of green taxes. However, these effects are not unavoidable, and they do not necessarily need to be eliminated, let alone converted back into subsidies, as was the case in 2022. Conversely, green taxes potentially constitute an efficient source of tax revenue, both in terms of their environmental impact and of their collection efficiency, at least in the short and medium term. This is particularly true in the case of Mexico, given the country's historically low non-oil tax productivity, which has limited the government's ability to promote inclusive economic development over the past four decades through public investment and universal social protection.

The above results rather reflect the following characteristics of Mexico's current tax and transfer system that limit its redistributive impact and social protection, besides diminishing the country's economic growth potential:

a) The collection productivity of the fiscal system is low, largely as a result of tax waivers or tax expenditures motivated, in many cases, in the name of equity, but which turn out to be ineffective as redistributive instruments and actually reduce the fiscal resources available for more effective spending instruments. The reduction in taxes (or subsidies) on fuels benefits households in the highest decile by 15 pesos for every peso transferred to households in the poorest decile. Other examples include the zero VAT rate on food and medicines, which implies benefits in similar proportions (15:1) between the 10th and the 1st decile; and the exemption from income tax on pensions, which benefits mostly formal pensioners with medium- and high- incomes.

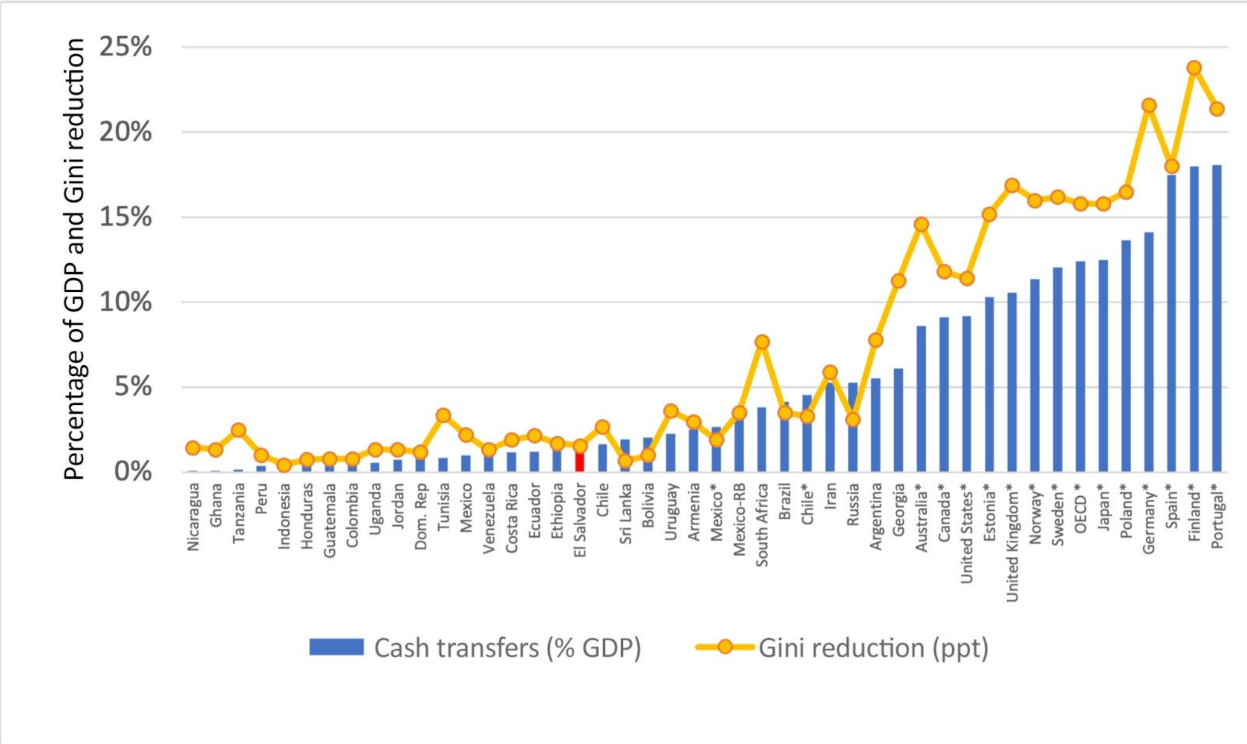
b) The above implies that eliminating these tax waivers to increase transfers would increase the redistributive impact of the fiscal system, even if carried out through universal transfers, such as non-contributory pensions for older adults, and even more so if they are targeted.

c) Despite the recent growth of cash transfers in Mexico (to 1.4% of GDP in 2022), as we have shown, these are still modest in relation to the fiscal burden borne by poor households. What distinguishes OECD countries with highly redistributive fiscal systems, with (accounting) reductions in the Gini of disposable income compared to market income between 15 and 25 ppt, from Mexico and other middle-income countries, is not the progressivity of their taxes or transfers, but the size of these transfers as a proportion of GDP (between 10-20%) (Figure 13).

d) On the other hand, as we have documented, the fastest-growing item within social spending is also the most regressive: subsidies to contributory pension systems, primarily associated with the payment of pensions for the "transition" generation of the IMSS and ISSSTE, assumed by the government. This spending will continue to increase throughout this decade, possibly reaching 6% of GDP, and will gradually decrease at least until the middle of this century.

e) Finally, it is important to consider the redistributive effect of in-kind transfers in the YF, which, due to their budgetary weight and the strongly progressive distribution of some of their main components (basic and upper secondary education; non-contributory health services), have a high redistributive potential. If we include these transfers in the previous analysis, valued at the cost of provision, the estimated net effect of the fiscal system on the poorest decile in 2020 increases from 26%, considering only cash transfers (Figure 10), to 207% (in the full set of results in the Excel file). Unfortunately, with these services being universally accessible, their progressivity partly reveals their low quality, which reduces demand by households as their income increases.

Figure 14. Cash transfers (% of GDP) and reduction of inequality (disposable income-market income, Gini coefficient ppt), in middle/low and high-income countries



Source: Authors' own elaboration based on databases from the Commitment to Equity (CEQ) Institute (https://commitmentoequity.org/datacenter/) and OECD Income Distribution Database (IDD), OECD Social Expenditure Database.

4. Conclusion and avenues for possible reforms

We can identify a wide range of possible reforms that could serve to minimize the conflict between the environmental and social agendas in the design of the fiscal system, and, instead, align public policies —both fiscal and regulatory— to maximize their impacts in both dimensions.

4.1. Eliminating energy subsidies and strengthening and "shielding" the IEPS on fuels and carbon

As we have documented, the IEPS on fuels has served as the main green fiscal instrument in Mexico in terms of its estimated incidence on the ECR in the country. It is also clear in the context of a fiscal system with historically limited collection productivity that in recent years (except for 2022), the IEPS on fuels has represented a significant source of fiscal resources. We have also mentioned that the IEPS, when it has functioned as a subsidy, in combination with a long history of subsidies for electricity consumption, it has represented a clearly anti-green fiscal policy. However, any reform of energy prices must be strictly conditioned to include compensatory instruments to avoid impoverishing effects associated with the elimination of these subsidies and the strengthening of energy taxes, and ideally transforming them into significant social benefits, net of taxes, for lower-income strata. This can be achieved in various ways, as described below (3,4).

4.2. Reducing dependence on fuel taxes

As we have seen, and as is the case in most countries (Figure 3), fuel taxes for road transport represent by far the main green fiscal policy instrument in Mexico, despite nearly 78% of GHG emissions originating from other sources. Although this is not the focus of the present study, two avenues of reform need to be considered to reduce this dependency. On one hand, introducing and strengthening taxes that impact these other sources, such as industry (22%) and electricity generation (17%), which is precisely the aim of the carbon tax. However, this tax is currently too low, and it has lower rates (coal, petroleum coke) or completely exempts (LPG, aviation fuel) significant sources of GHGs. On the other hand, it is important to introduce more efficient market instruments with lower incidence on households as final consumers (vs industry), such as ETSs, partially replacing energy taxes. In the case of electricity, it is necessary to move toward clean generation sources, such as solar and wind, and this transition should occur naturally due to the rapidly decreasing costs of these technologies.

More generally, there are certainly many possible regulatory and fiscal policies to accelerate the transition to cleaner technologies in the medium and long term, from subsidies for hybrid and electric vehicles to the construction of bike lanes.

4.3. Reducing the regressivity of energy taxes

The regressivity of energy taxes stems from the greater share of spending that lower-income households use on energy consumption as a proportion of their income. This is particularly the case with the indirect effect of fuel taxes, which disproportionately affects the poorest, through public transport and goods transportation, especially food. In contrast, we have seen that the direct spending component on fuel for private transport is progressive, and its relatively modest effect on the poorest deciles implies a less pronounced impoverishing effect (Figure 7). One way to reduce regressivity is by separating these two effects. Rather than differentiated tariffs, which could lead to black markets for fuels, these effects could, for example, be partially neutralised through subsidies for public transport. Of course, this would have additional environmental benefits by discouraging private fuel consumption. Additionally, taxes could be targeted on private fuel consumption through taxes on new vehicles, increasing in proportion to their average consumption level. Although the new cars tax, ISAN, has grown in recent years, even at its historical peak in 2023, it represents only 7% of federal green taxes.

In the case of electricity consumption subsidy, Mexico employs a complex tariff structure aimed at increasing its progressiveness, particularly through increasing rates based on consumption and the complete elimination of subsidies for high domestic consumption (see Komives et al. 2009). While the subsidy is progressive in relative terms (relative to household market income), it is highly regressive in absolute terms: for every peso of benefit to the poorest decile, the subsidy grants 10 pesos to the richest decile. This makes it evidently ineffective as a redistributive tool or social protection measure, and it incentivises electricity consumption among higher-income strata. One way to enhance progressiveness, as implemented in some countries, would be to geographically target the subsidy based on the average social stratum of each locality or urban block.

4.4. Ensuring compensatory use of the funds raised

Finally, as demonstrated above, the most feasible and efficient way to ensure compatibility between environmental and social objectives in the fiscal system is to eliminate anti-green subsidies and strengthen green taxes (or their equivalents such as the ETS), and use the fiscal resources produced at least to compensate for the increased tax burden on lower-income strata, and ideally to build broader social protection systems.

To illustrate the redistributive potential of green taxes, we estimated the incidence of a set of possible reforms based on alternative uses of the IEPS on fuels collected in 2020. We chose 2020 because, unlike the temporary subsidy in 2022, it is representative of the average IEPS from 2015 to 2023 (excluding 2022), amounting to 1% of GDP. This revenue collection represented 1.2% of GDP in 2020. We also considered the elimination of the residential electricity subsidy, which would free up another 0.75% of GDP. We analysed three contrasting uses of these fiscal resources, as follows:

a) **Contributory pensions.** We assume that the collected resources are used entirely to finance increasing subsidies for contributory pension systems. As documented earlier, this has been the fastest-growing item within social spending in recent years. During the decade of transition from fuel subsidies to taxes (2013-2023), it increased by 1.3 percentage points of GDP, while the most progressive social spending items, cash transfers excluding non-contributory pensions, and in-kind transfers for health and education, decreased by 0.1%, 0.2%, and 1.2% of GDP, respectively (Figure 15).

b) **Universal Transfer (UT).** We assume that the resources are used to finance a pure universal transfer, with a relative participation of 10% for each decile. This is the simplest form of transfer possible, in design and implementation, with an equal per capita unconditional amount for the entire population. This is often associated with the idea of a Universal Basic Income, which has been extensively analysed in recent literature (Gentilini 2020). Scott (2017) discusses the advantages and limitations of such an instrument for Mexico. It also corresponds to the second fastest-growing item in recent years, the non-contributory pension for older adults, which represented 1% of GDP in 2023. In-kind transfers as a whole are also distributed in Mexico approximately as a universal transfer. Finally, UT can be interpreted as not only a simple cash transfer but as a multi-dimensional package of universal social protection (USP) (Anton et al. 2012 have analysed the financing of a USP system through green taxes, among other possible sources). Here, the objective is much more modest: just to illustrate the effect of a non-targeted transfer, to contrast with the other two cases.

c) **Targeted transfer.** Finally, we consider distributing the resources through a targeted transfer with the same degree of progressivity as the Prospera programme in 2018, its last year of operation, as reported by its beneficiaries in that year's ENIGH. This programme was able to channel 50% of its resources to the population in extreme poverty (30% to the first decile, 20% to the second) and 85% to the population in poverty.

Table 1 shows the net incidence that these three transfers funded by the IEPS on fuels would have in 2020 by income deciles, i.e., the average benefit for households in each decile, net of the tax burden corresponding to the IEPS, as a percentage of their market income. We consider two scenarios: a) the IEPS is collected as estimated in this study, including both direct and indirect effects, and b) we assume that the IEPS is exclusively collected on private fuel consumption, without affecting public transport and freight, but with the same total revenue collection as observed. Finally, Table 2 presents the same analysis as Table 1, but includes the fiscal resources freed up by the elimination of the residential electricity tax, in addition to the resources from the IEPS on fuels.

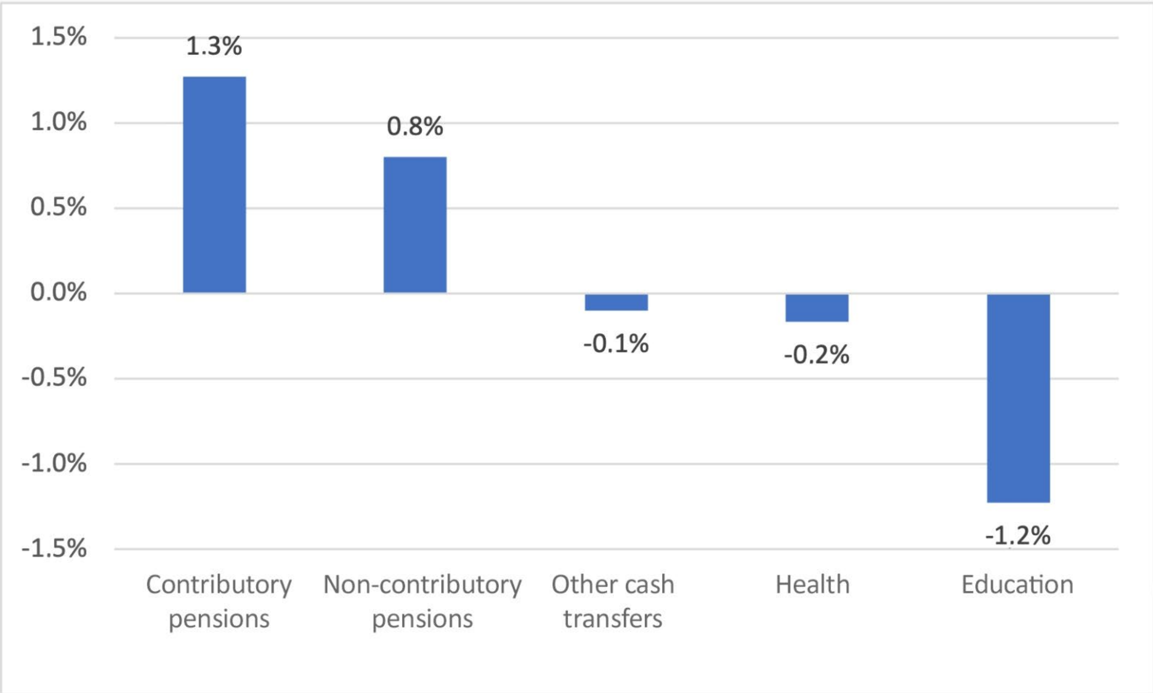
We found that the distributive effects vary dramatically. In the worst-case scenario, which is unfortunately the one closest to the current situation, the poorest strata bear a disproportionate tax burden (relative to their market incomes) due to the IEPS on fuels, but do not receive compensatory benefits as they are excluded from contributory pension subsidies, making them the biggest net losers. All deciles lose out, except for the wealthiest 20% of the population. This outcome is reversed if the resources are redistributed through a UT: the first decile gains a net benefit ranging from 18% (IEPS only, without exemption) to 28% (IEPS with exemption + elimination of electricity subsidy). Only the top three deciles end up being net contributors. Finally, in the targeted scenario, the net benefits for the poor and especially the extremely poor increase significantly, ranging from 70% to 96.7% for the first decile.

Comparing the scenarios with and without exemptions to the IEPS, we see that the differences in net benefits between the two alternative instruments (universal and targeted) are not as significant. In other words, it is much more important for the progressivity of the net benefits to ensure the progressivity of the transfers than that of the tax.

To illustrate the effects on inequality and poverty, we estimated the effects in the most conservative alternative scenario: only IEPS on fuels, without exemptions, distributed through a UT. Figures 16 and 17 compare the redistributive effect of the observed fiscal system against this scenario. The fiscal reduction in inequality would increase from 2.9 to 4.7 Gini ppt, extreme poverty would decrease by 4 ppt (instead of increasing by 0.5 ppt in the SQ), and the overall impoverishing effect would nearly disappear, decreasing from 5.4 to 1.7 ppt. This demonstrates that even a universal transfer financed through a regressive green tax could be highly redistributive.

Of course, as previous estimates show, the use of effective targeted instruments could significantly increase these redistributive effects. Beyond its fiscal distributive benefits, a reform of this kind applied to a transition from the unequal and inefficient social security system we have towards a USP system would imply three important benefits: effective reductions in GHG, an improvement in the efficiency and productivity of the fiscal system, and a contribution to financing an equitable and efficient social protection system (Levy and Cruces, 2021, UNDP 2021, Scott 2022, Levy and Scott 2024).

Figure 15. Change in social public spending (% of GDP) 2013-2022



Source: Authors' own calculations based on ENIGH 2020 and *Cuenta Pública*. Deciles 1-2 correspond approximately to the population living in extreme poverty (on income), 3-5 to those in moderate poverty.

Table 1. Net incidence of transfers financed with the IEPS on fuels: with and without exemptions to public transport and freight 2020
(market income %)

Deciles	Without exemptions (direct + indirect effect)			With exemptions (direct effect)		
	Contributory pensions	Universal	Targeted (Prospera)	Contributory pensions	Universal	Targeted (Prospera)
1	-6.4%	18.0%	69.8%	-1.2%	23.2%	75.0%
2	-4.3%	7.9%	21.3%	-0.8%	11.4%	24.8%
3	-3.4%	5.0%	9.7%	-0.7%	7.7%	12.4%
4	-2.6%	3.2%	3.8%	-0.5%	5.4%	5.9%
5	-2.4%	1.9%	1.1%	-0.7%	3.6%	2.7%
6	-1.7%	1.0%	-0.9%	-0.5%	2.2%	0.3%
7	-1.1%	0.2%	-2.3%	-0.4%	0.9%	-1.7%
8	-0.6%	-0.6%	-3.0%	-0.5%	-0.5%	-2.9%
9	0.5%	-1.3%	-3.6%	0.1%	-1.8%	-4.1%
10	2.8%	-1.9%	-2.9%	1.2%	-3.5%	-4.5%

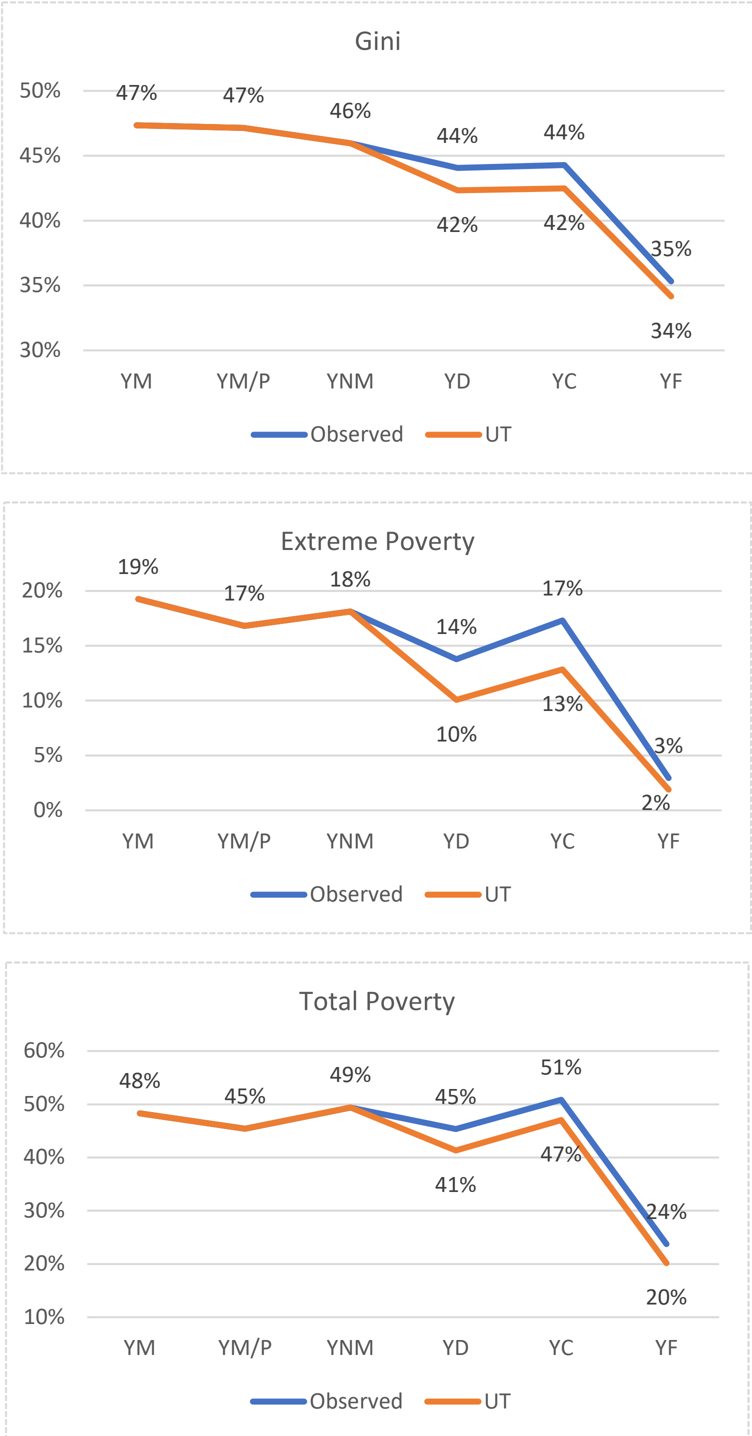
Source: Authors' own calculations based on ENIGH 2020 and *Cuenta Pública*. Deciles 1-2 correspond approximately to the population living in extreme poverty (on income), 3-5 to those in moderate poverty.

Table 2. Net incidence of transfers financed with the IEPS on fuels and the removal of residential electricity subsidies: with and without exemptions to public transport and freight, 2020
(market income %)

Deciles	Without exemptions (direct + indirect effect)			With exemptions (direct effect)		
	Contributory pensions	Universal	Targeted (Prospera)	Contributory pensions	Universal	Targeted (Prospera)
1	-8.5%	23.5%	91.5%	-3.3%	28.7%	96.7%
2	-5.8%	10.2%	27.8%	-2.4%	13.7%	31.2%
3	-4.6%	6.3%	12.6%	-1.9%	9.0%	15.3%
4	-3.6%	4.0%	4.8%	-1.5%	6.2%	6.9%
5	-3.2%	2.4%	1.3%	-1.6%	4.0%	2.9%
6	-2.4%	1.2%	-1.3%	-1.2%	2.4%	-0.1%
7	-1.5%	0.2%	-3.2%	-0.8%	0.9%	-2.5%
8	-0.8%	-0.9%	-3.9%	-0.7%	-0.7%	-3.8%
9	0.8%	-1.7%	-4.6%	0.3%	-2.1%	-5.1%
10	3.9%	-2.2%	-3.6%	2.3%	-3.8%	-5.2%

Figure 16. Change in inequality, extreme poverty and total poverty because of the fiscal system (with respect to YM/P, ppt), 2020

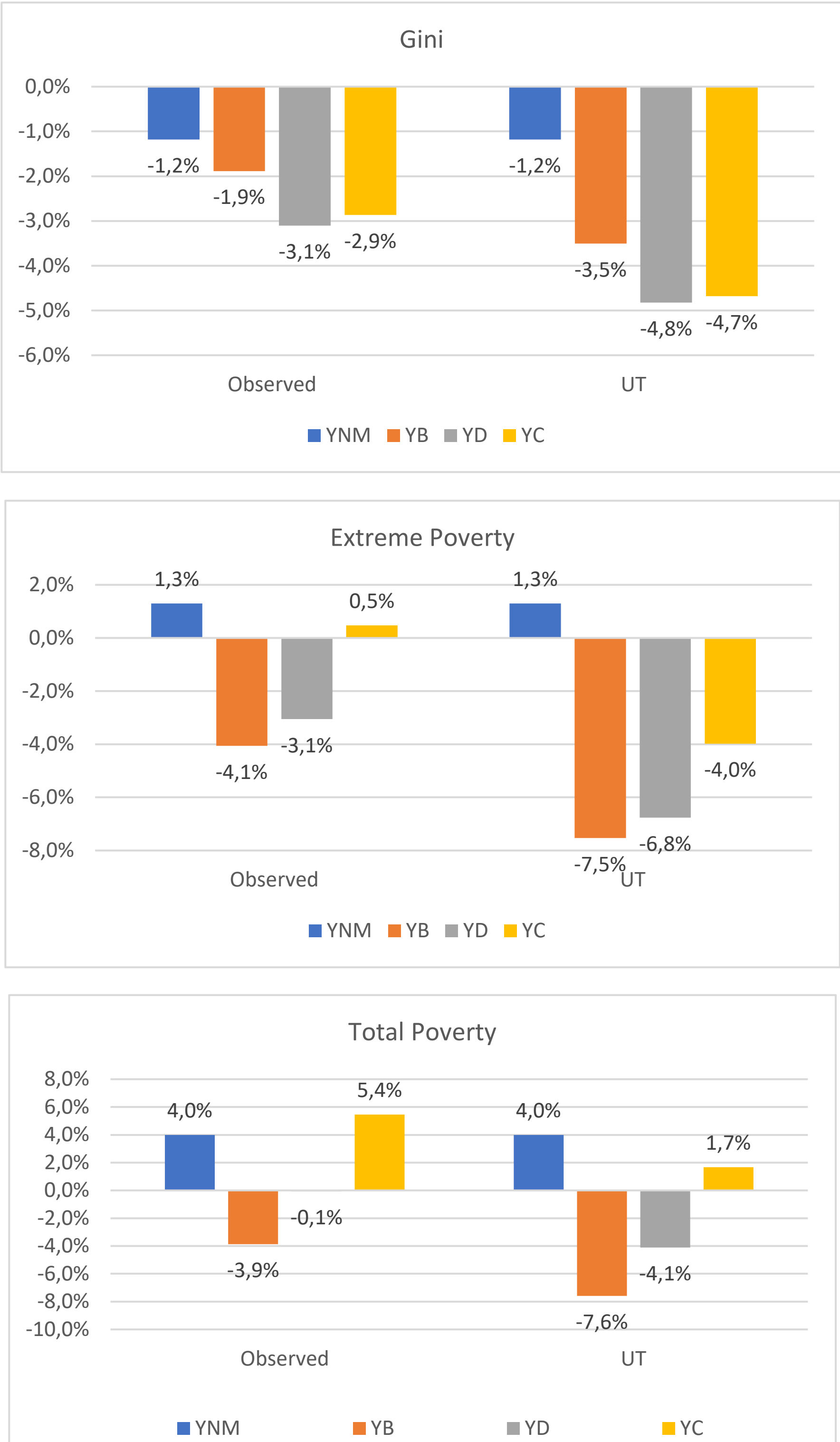
Observed vs UT financed through the IEPS on fuels



Source: Authors' own calculations based on ENIGH 2014, 2018, and 2020 (National Survey of Household Income and Expenditure) and *Cuenta Pública*

Figure 17. Change in inequality, extreme poverty and total poverty because of the fiscal system (with respect to YM/P, ppt), 2020

Observed vs UT financed through the IEPS on fuels



Source: Authors' own calculations based on ENIGH 2020 (National Survey of Household Income and Expenditure) and *Cuenta Pública*

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Annex 1. Methodology

TREATMENT OF TRANSFERS AND TAXES BY SCENARIOS

- Treatment of **direct government transfers**

  Scenario 1

  The amounts **are maintained** as the respondents **report in the ENIGH**.

  Scenarios 2 and 3

  The amounts reported in national accounts are **distributed among those who** claim to be beneficiaries of the program.

  - Individual **support programs,** such as scholarships and assistance to older adults, are charged **by apportioning the amount into national accounts equitably** among individuals who report being beneficiaries considering the factor of expansion.

  - **Home support programmes** such as procampo or prosper are allocated **by apportioning the amounts proportionately** among the households of which they claim to receive relative to the total and then estimating the per capita value among the number of household members.

- Treatment of **indirect transfers** (in kind) equal in all scenarios

  Scenarios 1, 2 and 3

  Transfers in kind are **simulated by distributing national accounts expenditure by educational level or social security institution to potential beneficiaries**

  - Education - Population at different educational levels

  - Health Services - Persons according to the health service to which they are affiliated

- Treatment of **indirect taxes**

<u>Scenarios 1 and 2</u>

They are estimated based on household spending on taxable assets **under tax laws. Only in the** case of IEPS to gasoline, the estimated tax value is in line with that reported in national accounts.

<u>Scenario 3</u>

The **amount reported in national accounts is considered and adjusted for the factor of under-revenue** of the survey with respect to national accounts, which is distributed favorably to the tax estimated according to tax laws among households.

- Treatment of **direct taxes**

<u>Scenarios 1 and 2</u>

According to the **Income Law of the Federation**, personal deductions are estimated based on the expense of property deductible according to the rules and the rates corresponding to the annual period are applied, to calculate SRIs of formal persons.

<u>Scenario 3</u>

The **amount reported in national accounts is considered and adjusted for the factor of under-revenue** of the survey with respect to national accounts, which is distributed favorably to the tax estimated according to the LIF as in scenarios 1 and 2.

METHODOLOGICAL DESCRIPTION

We use the methodology developed by The Commitment to Equity (CEQ) Institute, in which tax incidence rates are estimated, inequality, poverty and population concentration considering the different income concepts constructed from information at the micro-data level (obtained from the ENIGH national household income and expenditure survey).

The different income concepts are constructed from the National Household Income and Expenditure Survey 2014, 2018, 2020 and 2022; as of 2018 the surveys are designed to be comparable among them.

We assume that the information reported in the ENIGH refers to net tax revenues. So, first estimate the *Net Market Income (NLY)* per capita for each individual, adding the non-working income per household, this concept includes:

- Work income
- Capital income
- Non-governmental transfers, including pensions and pensions.
- Rental estimate
- Self-consumption
- Other income

Information on monetary income in the survey is reported individually, thus aggregating individual household income for each item and calculating per capita income[4] by dividing the household income concept by the number of individuals in the household. Guests or service personnel are not considered part of the household.

Labour income includes wages and salaries, commissions, incentives, bonuses, bonuses, remuneration in kind and business income. As well as capital income, that is, investment income, property income and profits or profits. The direct non-governmental transfers correspond to pensions or pensions and money received by private institutions or other households, such as private scholarships, donations, remittances, etc. The rental estimate is the opportunity cost of the property used as housing. The self-consumption from 2018 is reported in the income questionnaires for independent workers who have businesses and other nongovernmental monetary current income not considered in the previous items.

To this net market income are added the monetary transfers of government from social programs, to obtain the *Disposable Income (YD).*

In Scenario 1, the amounts of these monetary transfers are taken directly from what was reported by the respondents. However, in scenarios 2 and 3, the existence of a sub-report of these values is considered, so the[5] amounts reported in national accounts that allow comparing and homogenizing the information are imputed.

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4 All estimates are made with per capita values, which consider the entire population by adding the amounts (income, expenses, monetary and in-kind) per household and then dividing them by the number of household members.

5 In all imputations the factor of expansion is considered.

The allocation of money transfers is made by distributing the total amounts reported by the SHCP among the beneficiaries of the program, which can be granted to households or directly to individuals, in both cases the per capita benefit is calculated.

The *consumable income* (*YC*) considers subsidies and indirect taxes; to the disposable income is added the electric subsidy and the subsidy to gasoline (for the years 2014 and 2022) and deducted from it value-added tax and excise duties including the IEPS on tobacco, alcoholic beverages, beer, communications, energy drinks, flavoured beverages, high-calorie foods, gambling and sweepstakes and pesticides, plus excise tax on gasoline (for 2018 and 2020) and carbon tax.

Electric Subsidy

In Mexico, the government subsidizes the consumption of domestic electricity depending on an assigned tariff (by regions and temperature at certain periods of the year) and the level of consumption of kilowatts. Each rate type indicates a cost per kilowatt, for the first 150 KW bimonthly, another higher cost for the next 130 and another cost for more than 280, as shown in table A.1

The federal electricity commission publishes the monthly staggered rates according to the temperature by region, since the ENIGH rises between June and September takes an average of the rates between these four months.

Table A.1. Staggered rates for estimating the elective allowance

		Staggered rates (price per KW)			
	Range of consumption in KW (bimonthly)	2014	2018	2020	2022
Basic consumption	0 - 150	$ 0.812	$ 0.793	$0.844	$ 0.917
Intermediate consumption	150- 280	$ 0.983	$ 0.956	$1,019	$1,118
Surplus consumption	More than 280	$ 2,876	$2,802	$ 2,987	$3,267

Source: Own compilation with data published by CFE.

From the monetary expenditure on electricity reported in the ENIGH, consumption is estimated in kilowatts before tax (VAT) per household. The subsidy is obtained from the difference between what the household pays and what it should have paid for the same level of consumption without the staggered rate, in this case it is considered price per KW equal to the surplus consumption, but if the household consumes more than 500 KW no subsidy is allocated.

Gasoline

For 2014 and 2022, gasoline consumption is considered to be subsidized by the government by exempting fossil fuels from the IEPS in order to stabilize prices. However, for 2018 and 2020 if excise tax is applied to gasoline.

Three methods are used to estimate the effect of IEPS on gasoline from consumption per household: considering only direct effects (ED), also considering indirect effects but distributed according to the factors published by SHCP (EDI-CFH) and considering direct and indirect effects from the intersectoral relationship shown in the input product matrix (EDI-MIO) the latter allows estimating the effect of the carbon tax. For scenarios 1 and 2 this tax is adjusted to what is reported in national accounts, and for scenario 3 the amount reported in national accounts is affected by a factor of sub-declaration of income from the survey with respect to national accounts.

Direct Effects Method (ED)

By not considering indirect effects, the value is imputed to each household by distributing the total amount of tax or subsidy reported in national accounts among those who report consuming gasoline by octane level and proportional to the expenditure of each household such products, to reduce due to the income underreporting problem this tax is adjusted to disposable income in the same way as all taxes and subsidies (for more detail see example in IEPS imputation).

Method Direct and Indirect Effects with SHCP Factors (EDI CFH)

It is considered that 46.2% of the tax or subsidy comes from direct expenditure on fuels, while 31.9% of the use of public transport and 21.8% of the transport of goods and services. Monetary expenditure per household is estimated for petrol, public transport and goods and services. The amount reported in national accounts is distributed according to the above percentages, proportional to the share of each household in the total expenditure. Thus, 46.2% of the reported amount is distributed proportionally to the expenditure on fuels (gasoline and diesel).

Direct and Indirect Effects Method with Input-Output Matrix (EDI MIO)

Indirect effect of green taxes

The IEPS on gasoline consumption is the green tax that has the most weight in Mexico, this tax is paid by final consumers based on their level of consumption.

The indirect effect of taxes or subsidies is calculated[6] through the impact on prices of inputs used to produce the taxed goods.

It is assumed that consumers end up paying all the tax (or benefiting from the subsidy), through higher (or lower) prices. So, the tax is calculated from consumer information in the survey. The current tax rate applies to the reported consumption per household for each imputed good or service (for each type of fuel).

However, the tax applies for both final goods and intermediate goods or inputs, so it is necessary to use the input product matrix to capture the change in the prices of these intermediate goods (inputs).

Direct effect

To capture the direct impact of indirect taxes affecting the sales prices of taxed products, in this case the public price of fuels, inelastic demand and homothetic preferences are assumed. This allows that in a prefiscal scenario, the amounts demanded are lower in the same proportion as the tax rate; if the rate is 10%, the consumption expenditure of the taxed asset would be less than 10%.

Based on the gasoline consumption expenditure records per household$Gasto_Comb_{HH}$, a tax value is imputed to fuels by distributing the amount reported in national accountsMR_{CN} (187 billion for 2018) proportional to the share of each household in total spending.

$$Impuesto\_Comb_{HH} = \frac{Gasto\_Comb_{HH}}{\sum Gasto\_Comb_{HH}} * MR_{CN}$$

[6] Indirect taxes and subsidies have the same treatment, but with contrary signs to capture the sense of the effect.

Table A.2. Sectoral analysis from the Product Input Matrix (IO matrix) for 2018

Ingresos - Consumo intermedio del subsector 324 (vector renglón matriz IO)			
Subsectores		*% producción (UPIPB=DI+DF)*	*% demanda intermedia*
485---Transporte terrestre de pasajeros, excepto por ferrocarril	$ 121,616.41	12.57%	20.98%
221---Generación, transmisión y distribución de energía eléctrica	$ 82,207.43	8.50%	14.18%
484---Autotransporte de carga	$ 63,581.12	6.57%	10.97%
325---Industria química	$ 40,812.76	4.22%	7.04%
481---Transporte aéreo	$ 34,193.42	3.53%	5.90%
213---Servicios relacionados con la minería	$ 18,780.91	1.94%	3.24%
461---Comercio al por menor de abarrotes, alimentos, bebidas, hielo y tabaco	$ 17,887.64	1.85%	3.09%
212---Minería de minerales metálicos y no metálicos, excepto petróleo y gas	$ 15,942.21	1.65%	2.75%
211---Extracción de petróleo y gas	$ 14,455.79	1.49%	2.49%
431---Comercio al por mayor de abarrotes, alimentos, bebidas, hielo y tabaco	$ 12,501.48	1.29%	2.16%
931---Actividades legislativas, gubernamentales y de impartición de justicia	$ 12,401.27	1.28%	2.14%
236---Edificación	$ 11,706.77	1.21%	2.02%
237---Construcción de obras de ingeniería civil	$ 10,957.19	1.13%	1.89%
111---Agricultura	$ 10,669.16	1.10%	1.84%
DF---Demanda final|CPrv---Consumo privado	$ 307,104.99	31.75%	
DI---Demanda intermedia|Total	$ 579,552.34		
DF---Demanda final|Total	$ 387,734.13		
UPIPB---Utilización de la producción interna a precios básicos	$ 967,286.47		

Source: Own elaboration with data from the Input-Output 2013 matrix for the Mexican economy published by INEGI.

Direct and indirect effect

The direct effect is easy to estimate based on the consumption data in the surveys, however, the indirect effect on the prices of intermediate goods requires knowing the intersectoral structure of the country's economy.

We assume that producers pass on the tax burden to final consumers, through the price-shifting model (Price-shifting), which quantifies the magnitude of sectoral changes in intermediate and final prices due to exogenous changes (in this case of fiscal policy).

The cross-sectoral structure of the total economy is reflected in the input-output matrix, which describes the value of inputs used in production in all sectors and the uses or destinations of all sectoral products at one point of time (static). The matrix input product 2013 is used, except for 2022 in whose estimates the matrix input product 2018 last published by INEGI is used.

The model considers the following assumptions: exogenous changes in prices, constant returns at scale in production, perfect competition and fixed factors of production throughout the economy, that is, fixed participation of inputs and technological coefficients.

Three types of sectors are considered:

- Cost-push, cost-push sectors if the price of inputs or intermediate goods used for production increases, also increases the price of the product generated ;

- Controlled, fixed price sectors controlled by the government ;

- Negotiated, sectors that do not push costs, production prices do not move by changes in input prices, perhaps because they are linked to global market prices.

Since the tax policy applied affects the price of fuels, the sector producing these taxed goods is considered a controlled sector. The 913 sector of legislative and governmental activities is also considered controlled. It is also assumed that no sector is negotiated, so most receive a cost-pusch treatment.

The indirect effect captures the indirect change in price resulting from exogenous shocks multiplied by matrix A and K.

$$\Delta p^C = [\ \Delta t^C \propto AK\ ] + [\Delta\tilde{p}(1-\propto)AK]$$

$$K = (1-\propto * A)^{-1}$$

Where A is the matrix of technical coefficients,Δt^C is the tax rate,$\Delta\tilde{p}$ the change in production price level,$\propto$ is the dimensional identity matrix corresponding to the 79 subsectors (or 82 if we disaggregate subsector 324 into branches)with zero on the diagonals for controlled sectors, andnxn is the Leontief matrix for cost-push sectors, which captures the combined effect (direct and indirect) of spending the sector i used to produce an expenditure unit that affects the input cost of the cost sectors-push j to controlled sectors. Note that the first term considers the impact on cost-push sectors when using alpha and the second considers sectors with fixed or controlled prices.K

The change that pushes the cost in the selling price (cost-push retail prices) depends on the previous effect plus the direct effect Δt^C on the sector producing petroleum products.

$$\Delta q^C = \Delta t^C + [\ \Delta t^C \propto AK\ ] + [\Delta \tilde{p}(1-\propto)AK]$$

The following table (A.3) shows the direct and indirect effect of a tax rate of 21.5% on the price of fuels corresponding to the estimate for 2018, generating an exogenous shock on the branch 324110 - Oil refining of subsector 324 - Manufacture of petroleum and coal products.

Prices in the 485 passenger transport sector, for example, would increase by 4.7%. The goods most affected are the sectors of air transport, tourist transport and generation and transmission of electric distribution.

Table A.3. Direct and indirect effect of the branch 324110 on the other sectors of the Mexican economy

SIAN code	Subsector or Branch	Effect
324110	Manufacture of petroleum and coal products - Oil refining	22.0%
481	Air transport	7.3 %
487	Tourist transport	6.2 %
221	Power generation, transmission and distribution	5.2 %
485	Inland passenger transport, except by rail	4.7%
114	Fishing, hunting and catching	4.5%
482	Rail transport	4.5%
492	Courier and parcel services	3.5%
213	Services related to mining	2.6 %
484	Freight transport	2.0 %
212	Mining of metallic and non-metallic minerals, other than oil and gas	1.7 %
115	Services related to agricultural and forestry activities	1.7 %
222	Piped water and gas supply to the final consumer	1.5 %
325	Chemical industry	1.4 %
327	Manufacture of non-metallic mineral products	1.2 %
813	Associations and organizations	1.2 %
493	Storage services	1.1 %
483	Water transport	1.0%
321	Wood industry	1.0%
811	Repair and maintenance services	0.9 %
331	Basic metal industries	0.9 %
562	Waste management and remediation services	0.8 %
111	Agriculture	0.8 %

Source: Own production.

Prices in the 485 passenger transport sector, for example, would increase by 4.7%. The goods most affected are the air transport and tourism sectors, as well as the generation and transmission of elective distribution.

The tax rates used per year are presented in table A.4, these are weighted average rates for the market share of gasoline types with respect to total fuel consumption, gasoline with octane below 91 represents 85% of the market.

Excise duties are quotas applied to the price per liter of gasoline per octane level, these quotas are published annually by the SHCP in the DOF. However, gasoline wrecks are free floating given the movement of international prices in addition to fluctuating depending on the geographical area or distributor, Therefore, to estimate a generalized tax rate we consider the monthly average prices published by the CRE. Since these are net of tax, the tax rate is calculated as the percentage that the monthly fee represents with respect to the price.

Table A.4. Estimated rates for calculating indirect effects

	Tax rate	
Year	**IEPS Gasoline**	**Carbon tax**
2014	2.27	NA
2018	21.52 %	2.26%
2020	26.90%	2.51 %
2022	-19.80	2.89 %

Source: Own processing with CRE and SHCP data.

In the case of 2022, taxes became subsidies because the net effect of giving greater tax stimuli is negative.

To apply the effect of these price changes per subsector, a mapping is made between the expenditure keys per product used in ENIGH and the subsectors that produce them. The labelling process uses the SIAN 2018 classification as the basis.

Table A.5. Example mapping of expenditure keys and subsectors

Key ENIGH	Product	Key Subsector
A001	Grain corn	111
A002	Corn flour, cornstarch, nixtamalized for tortillas	111
A157	Mango	111
A158	Apple and peron	111
A159	Melon	111
F007	Magna Gasoline	324
F008	Premium gasoline	324
F009	Diesel and gas	324
F010	Oils, lubricants and additives	324
G009	Liquefied petroleum gas	324
G010	Petroleum	324
G011	Diesel	324
R001	Electrical energy	221
...		
T913	Recreational goods	711

Fuels such as petrol, diesel, liquefied gas, etc. relate to sector 32 subsector 324 Manufacture of petroleum and coal products. All expenditure keys are assigned a subsector; table A.5 shows some of these relationships, for example, cereals, fruits and vegetables are associated with subsector 111 of Agriculture, while electricity expenditure under subsector 221 corresponds to the generation, transmission and distribution of electricity.

Once it is identified that consumer goods and services are related to each subsector, the household tax expense is calculated as if it were a direct indirect tax effect. Calculating the amount of tax that each household indirectly pays for the goods and services consumed by multiplying the effects by the expense on each property and adding them per household.

It is adjusted according to disposable income from the proportion of tax calculated with respect to household expenditure.

$$IEPS_{HH_A} = \frac{Impuesto_{HH}}{Gasto_{HH}} * Y_D$$

Imputation of VAT

For scenarios 1 and 2

It is adjusted according to disposable income from the proportion of tax calculated with respect to household expenditure.

$$IVA_{HH\_A} = \frac{IVA_{HH}}{Gasto_{HH}} * Y_D$$

WhereIVA_{HH} it is the imputed tax from the annual expenditure on monetary goods, that is, excluding self-consumption, gifts or transfers in kind; also excluding purchases in informal places such as markets, tianguis, street vendors, inns or individuals, regardless of whether they are in rural or urban areas. A rate of 16% of integrated VAT is charged, that is, a factor of $\frac{1}{1+0.16}0.16 = 0.137931034$ over-expenditure on taxable goods.

Durable goods taxes are not included. To consider informal markets (which do not pay taxes, mainly VAT) it is assumed that households in rural areas buy products without taxes, also do not consider products sold in informal markets.

$Gasto_{HH}$ is the annual spending of the monetary and non-monetary household, minus expenditures on nondurable goods andY_D disposable household income.

For stage 3

The imputed values are inflated as in scenarios 1 and 2 (IVA_{HH_A}) according to their share in the tax sum, in such a way that it is recalibrated according to the following formula:

$$IVA_{HH\_A2} = MT * fa_{na} * \frac{IVA_{HH\_A}}{SUM(IVA_{HH\_A})}$$

Where MT is the total amount reported in national accountsfa_{na} that is adjusted for the national factor of sub-declaration ([7]) due to the net disposable income in national accounts, for example, for 2018 is total collected by the SHCP is 922,238.28 million pesos and the factor is 0.4555, so 420,079.5 million are distributed proportionally to the tax estimated in the same way as in scenarios 1 and 2.

Imputation of IEPS

For scenarios 1 and 2

It is adjusted according to disposable income from the proportion of tax calculated with respect to household expenditure.

$$IEPS_{HH\_A} = \frac{IEPS_{HH}}{Gasto_{HH}} * Y_D$$

Where$IEPS_{HH}$ is the imputed excise tax. For this, the annual expenses in goods or services per household are identified and the corresponding tax is calculated according to the tax rate of the tax (before VAT). For example, for drinks with more than 20 degrees of alcohol a rate of 53% is applied.

$$IEPS_{HH} = Gasto_{ALCOHOL} * \left(\frac{1}{1+0.16}\right) * \left(\frac{1}{1+0.53}\right) * 0.53$$

Where$Gasto_{HH}$ is the annual spending of the monetary and non-monetary household, minus expenditures on nondurable goods. Except the quota tax on flavoring drinks, for which is estimated a price per unit (expense/quantity) less VAT plus the fee. The excise duty on foods with high caloric density applies after VAT.

[7] Institutional Sector Accounts : B.6n - Net disposable income -- S.14 - Households : yd-transfers.

For stage 3

The values of$IEPS_{HH}$ (estimated as in scenarios 1 and 2) are inflated by allocating an adjusted amount according to their share in the total tax, in such a way that it is re-adjusted according to the following formula:

$$IEPS_{HH\_A} = MT * fa_{na} * \frac{IEPS_{HH}}{SUM(IEPS_{HH})}$$

Where MT is the total amount reporting in national quanta, for example, for 2018 the amount collected for tax on beverages with high alcohol content is 5,958.3 Million pesos, considering the national subdeclaration factor of 0.4555 are distributed 2,714 million in proportion to household tax.

The *Final Entry (YF*) also includes transfers in kind. Which mainly consider the economic benefits of education and social security. To estimate and impute these amounts, we first identify the potential population that benefits, for example, children who attend public primary school, and then they are allocated government spending per child at this educational level as reported by the government for the different levels (primary, secondary, upper and upper middle), finally the benefit per capita is estimated, in such a way that the households with more members studying get more benefits.

The estimated transfers in kind by social security are charged in the same way, the amounts are distributed in national accounts, only that the population to which the benefit is assigned depends on access to the various institutes that offer social security in Mexico (IMSS, ISSSTE, Seguro Popular, SEDENA and Pemex). The treatment of non-monetary transfers is the same for the three scenarios.

Market Income + Pensions (Y_p*) is obtained by adding direct taxes to net market income* (Y_{MN}), it is considered that theY_{MN} income reported in the ENIGH is net so it is necessary to calculate income tax (ISR) and social security contributions, which are estimated taking into account applicable tax rules and laws.

To obtain *Market Income* (Y_M), we subtract contributory pensions from market income + pensions and reinstate pension contributions to both IMSS and ISSSTE.

SRI estimate

The concepts of income considered as SRI subjects are described below, as well as the assumptions of formality used.

- From the subordinate labor income are excluded: bonuses, profits, overtime, holiday incentives and bonuses as indicated by the Federation Income Law (LIF) and are considered wages, wages, piece work, commissions and tips, bonuses and bonuses for principal and secondary jobs of those who report being registered as workers to an IMSS security institution, ISSSTE or PEMEX, have an income greater than zero and work more than 0 hours) or have SAR or AFORE benefits and are registered as workers.

- Income from Independent Work Paying Taxes (SRI) are considered soils and wages from core work in household businesses or secondary work income from cooperatives, societies and companies merging as corporations, and ISR pays those who report being affiliated *to IMSS, ISSSTE or PEMEX or* have *AFORE* and have a salary or receive payments by card, deposit or electronic transfer**.**

- From formal business income in business and professional activities, to identify formal businesses are considered those who report payments other than cash, carry an accounting system or have an accountant.

- Income from rental of property and interest and income from invested capital are also considered.

The taxable base(bg) is equal to the gross income of taxable ISR items (described above) minus personal deductions(ib) (ded).

$$bg = ib - ded$$

From which the ISR is estimated by applying the annual ISR table published by the SHCP for each year that shows a fixed quota (cf) and a tax rate (r) by income ranges (LI: lower limit and LS: upper limit) in terms of taxable base.

$$ISR = cf + r(bg - LI)$$

The tax rate applies only to the difference between the tax base and the corresponding lower limit.

It is assumed that the different income concepts reported by households in the ENIGH are net income, so what was reported in the survey (e) includes the SRI.

$$e = ib - ISR$$

And since gross income would be the taxable base plus deductions

$$ib = bg + ded$$

We have to

$$e = bg + ded - [cf + r(bg - LI)]$$

To estimate the taxable base in terms of the information available in the surveybg we cleared.

$$bg = \frac{e - ded + cf - r(LI)}{(1 - r)}$$

While the fixed fee, the fee and the lower cap depend on the same taxable base, one is calculatedbg for each possible option and only the value between the limits is kept. Personal deductions (ded) are estimated from reported expenses on ISR-deductible assets under the LIF. Educational deductions are considered for funeral services and medical and hospital health services.

Once the tax base is calculated for each individual, the value of the corresponding ISR is estimated according to their quota, rate and corresponding limit.

$$ISR = cf + r(bg_0 - LI)$$

It should be mentioned that per capita values are calculated for all income, transfers, subsidies and taxes, by dividing the estimated, imputed or calculated amounts per household among the members of each household.

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