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The Legal and Real Incidence of VAT Reforms in Mexico

DISTRIBUTIONAL EFFECTS AND IMPACTS ON POVERTY

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Abstract

This paper studies the price effects of two asymmetric value-added tax (VAT) reforms in Mexico: a 2014 VAT hike and a 2021 VAT cut implemented in the southern border region. Our estimates show that consumers pay for 25 percent of the VAT change in both reforms, but consumer incidence differs across goods. With the price effect estimates (real incidence), we determine the impact of the VAT reforms on income distribution and poverty. We compare these impacts with the full passthrough of the VAT on prices (legal incidence). Depending on the type of price incidence, the VAT is allocated differently along the income distribution. Moreover, the impact on poverty due to the VAT (hike or cut) real incidence is small (less than ±0.5 percent change). In contrast, the VAT cut legal incidence decreases extreme poverty by 8.3 percent.

Keywords: VAT incidence, distributional effects, poverty.

JEL Codes: H22, H23, H27.

Resumen

Este trabajo estudia los efectos sobre los precios de dos reformas asimétricas de la tasa de impuesto al valor agregado (IVA) en México: un aumento de la tasa en 2014 y una disminución de la tasa en 2021. Ambas aplicadas en la región fronteriza sur. Nuestras estimaciones muestran que los consumidores pagan el 25 por ciento del cambio del IVA en ambas reformas, pero la incidencia del consumidor difiere según el tipo de bien. Con las estimaciones del efecto sobre los precios (incidencia real), determinamos el impacto de las reformas del IVA sobre la distribución del ingreso y la pobreza. Comparamos los efectos la incidencia real con los efectos que habría con un pase total del cambio de la tasa de IVA a precios (incidencia legal). Encontramos que, según el tipo de incidencia sobre precios, el IVA se reparte de forma diferente a lo largo de la distribución del ingreso. Además, el impacto sobre la pobreza debido a la incidencia real del IVA es pequeño (menos de ±0.5 por ciento de cambio en pobreza). Por el contrario, la incidencia legal del recorte del IVA disminuye la pobreza extrema en un 8.3 por ciento.

Palabras claves: Incidencia del IVA, efectos distributivos, pobreza.

Código JEL: H22, H23, H27.

The Legal and Real Incidence of VAT Reforms in Mexico: Distributional Effects and Impacts on Poverty[*]

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September 23, 2024

Abstract

This paper studies the price effects of two asymmetric value-added tax (VAT) reforms in Mexico: a 2014 VAT hike and a 2021 VAT cut implemented in the southern border region. Our estimates show that consumers pay for 25 percent of the VAT change in both reforms, but consumer incidence differs across goods. With the price effect estimates (real incidence), we determine the impact of the VAT reforms on income distribution and poverty. We compare these impacts with the full passthrough of the VAT on prices (legal incidence). Depending on the type of price incidence, the VAT is allocated differently along the income distribution. Moreover, the impact on poverty due to the VAT (hike or cut) real incidence is small (less than ± 0.5 percent change). In contrast, the VAT cut legal incidence decreases extreme poverty by 8.3 percent.

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1 Introduction

The consumer incidence of the value-added tax (VAT) is crucial to determining who pays for this tax along the income distribution. It has been established with convincing natural experiments and identification strategies across multiple and varied countries that the VAT is not entirely paid by consumers (Carbonnier, 2008; Benedek et al., 2015; Kosonen, 2015; Harju et al., 2018; Benzarti and Carloni, 2019; Benzarti et al., 2020; Fuest et al., 2021; Wilson et al., 2021; Chávez and Domínguez, 2022). Nonetheless, most literature analyzing the distributional incidence of the VAT assumes that the tax is paid entirely by consumers (Creedy, 2002; Kaplanoglou, 2004; Barrett and Wall, 2006; Garfinkel et al., 2006; Decoster et al., 2007; Lustig et al., 2014; Scott et al., 2017; Gaarder, 2018; Chatterjee et al., 2021; Granger et al., 2022).[1]

Few distributional incidence studies consider that the burden of VAT may not fall entirely on the consumer (Bachas et al., 2023, 2024). However, the criterion these papers use is highly limited as it only applies to developing economies where informal markets are large. Research has established that the burden of the VAT does not fall entirely on consumers in high-income countries either because informality is not the only determinant of VAT consumer incidence; other determinants are market competition, the temporality of the tax, the direction of a rate change, or firm characteristics.

In this research, we analyze the VAT incidence on consumers using two asymmetric VAT reforms happening in the same region at different points over the last decade. This natural experiment allows the implementation of a differences-in-differences (DiD) design to identify the consumer VAT incidence in both reforms. We find that in both the reform that increased the VAT and the reform that decreased it, consumers pay for around 25 percent of the VAT change, on average, across the goods subject to paying the VAT.[2] However, the

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[1]Jellema and Inchauste (2016) describe the Commitment to Equity Institute (CEQ) methodology to allocate the VAT among households. While the methodology recognizes that, for elastic demand goods, the VAT may not be translated entirely to consumers, in most cases, consumers bear fully the VAT. This methodology is applied to CEQ papers that analyze the distributional incidence of taxes and government spending in many countries.

[2]In Mexico, an important set of goods is exempt from paying the VAT. These are mostly basic consumption goods such as food, housing rents, medicines, medical consultations, and education services.

VAT passthrough on prices differs according to the type of good. From the DiD estimates, we get the *real incidence* of the VAT. We use the real incidence to determine the implications of the reforms on income distribution and poverty. We compare this with the implications of the *legal incidence*. The latter incidence refers to the case where consumers pay the entirety of the VAT change.[3]

We calculate that if firms had passed the VAT hike to prices fully (*legal incidence)*, the VAT reform would decrease household disposable by an average of 3.9 percent with respect to observed income. The largest decreases are located in the poorest and the richest deciles. In contrast, using our DiD estimates, we calculate that the VAT hike reduced household disposable income with respect to observed income by 0.8 percent (*real incidence*). The most affected households being at the bottom of the distribution. Thus, the percent change in counterfactual income –with respect to observed income– in the legal incidence case is about five times larger than in the real incidence case.

We find a similar but more pronounced effect for the VAT cut. The legal incidence of the VAT cut would lead counterfactual household disposable income to increase by about 7.1 percent with respect to observed income, on average. For the first decile, the increase would be about 16.5 percent. On the other hand, the real VAT cut incidence leads counterfactual income to increase by 0.5 percent on average (0.9 for the first decile). This is a fourteen-fold difference regarding the real incidence case. Our results highlight the importance of accounting for the real VAT price incidence when determining the distributional incidence of this tax.

Using the counterfactual income measures constructed with the VAT's real and legal price effects, we estimate how poverty would have changed due to the VAT reforms. Both for the VAT hike and the VAT cut, we find that the impact on poverty from the real VAT price effects is relatively small, ranging from ± 0.05 to ± 0.50 percent change concerning observed poverty or extreme poverty. Regarding the legal VAT price effects, the VAT hike would not have led

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[3]Defining the full passthrough to consumers as *legal incidence* is quite literal, as Article 1 of Mexico's Value Added Tax Law states: "The taxpayer shall transfer such tax [the VAT], expressly and separately, to the persons acquiring the goods, using or enjoying them temporarily, or receiving the services" (Congreso de la Unión, 2009).

to important poverty changes (0.20 percent change for poverty and 0.66 percent change for extreme poverty). However, the VAT cut would have led to sizeable poverty changes (-2.82 percent change for poverty and -8.32 percent change for extreme poverty). Thus, our results provide an important lesson for tax distributional incidence literature: assuming that the VAT is entirely paid by consumers can lead to widely different conclusions than those related to actual VAT incidence.

The paper proceeds as follows: Section 2 discusses literature relevant to our paper and relates it to our contributions; Section 3 describes the VAT reforms that we use as a natural experiment; 4 describes the data we use in this research; 5 details our identification strategy and methodology; Section 6 presents the results; Section 7 concludes.

2   Related Literature

Our paper contributes to three main realms of international economic literature and one strand of literature particular to Mexico. First, we build on literature that studies the distributional effects of the VAT. This literature generally finds that indirect taxes, such as the VAT, are regressive. Evidence from developed countries indicates that individuals from the lowest income percentiles end up paying more than individuals at the top of the income distribution. As a consequence, lowering VAT rates can have positive effects in reducing inequality (Creedy, 2002; Kaplanoglou, 2004; Barrett and Wall, 2006; Garfinkel et al., 2006; Decoster et al., 2007; Warren, 2008; Gaarder, 2018).

For developing economies, the evidence is more nuanced (Granger et al., 2022). However, this literature also indicates that the VAT tends to be regressive in these economies. Lustig et al. (2014) investigate the distributional effects of different taxes in Argentina, Bolivia, Brazil, Mexico, Peru, and Uruguay. They find that the VAT tends to offset the poverty-reducing impact of government programs like cash transfers, with the tax being more regressive in some countries (Bolivia, Brazil) than others (Mexico). Scott et al. (2017) find that direct taxes and cash transfers reduce inequality and poverty in Mexico, with the effect being less pronounced in rural and indigenous populations. On the other hand, indi-

rect taxes tend to offset the reduction of poverty and inequality. In other contexts, such as South Africa, Chatterjee et al. (2021) find that the VAT is highly regressive. A reform that increased the VAT rate in the country led to a significant reduction in disposable income among the poorest households.

The papers mentioned above mostly assume that the consumer pays the VAT entirely. However, two papers abandon that assumption by considering informality in developing economies. Bachas et al. (2023) indicate that uniform consumption taxes are progressive in these countries due to the higher share of consumption in informal markets among poor individuals. Bachas et al. (2024) arrive at a similar conclusion but also find that the distributional effects of VAT rate reductions are limited since low-income households' consumption occurs mainly in the informal sector.

Secondly, we contribute to the literature that analyzes the incidence of the VAT. This literature has focused on understanding how the impact of VAT changes is distributed between firms and consumers. These papers show that firms can partly benefit from VAT reductions (Besley and Rosen, 1999; Harju et al., 2018; Kosonen, 2015) and, in some situations, in an uneven way (Benzarti and Carloni, 2019). Changes in VAT rates can affect prices differently depending on the implementation of the change, the market conditions, and the firm's characteristics. The implementation of the change can vary in two dimensions: on the one hand, whether the tax rate increases or is reduced, and on the other hand, whether it is a temporal or permanent change. Increases in VAT tend to have a more significant impact on prices than VAT reductions (Benedek et al., 2015, 2020; Benzarti and Carloni, 2019). Similarly, temporal tax changes have a more substantial effect than permanent changes (Fuest et al., 2021).

Regarding market conditions, the literature highlights the importance of market structure and competition. Competitive environments make it harder for a firm to increase its prices as consumers have more alternatives to choose from (Hindriks and Serse, 2019; Chávez and Domínguez, 2022). Conversely, in less competitive markets like the export market, VAT increases can lead to less competition, and thus, it is less likely that a full passthrough effect occurs (Andrade et al., 2010). Another market condition that determines the size of the

impact of VAT changes is demand price elasticity (Carbonnier, 2007, 2008; Benedek et al., 2015, 2020; Fuest et al., 2021).

Firms' characteristics can also shape the response to VAT rate changes. For example, firms' sizes and managerial differences can lead to different pricing strategies, which leads to different responses to changes in consumption taxes (Kosonen, 2015; Harju et al., 2018). Moreover, the location of prices within the distribution of prices of similar products can lead to different responses to changes in VAT rates within the same firm (Wilson et al., 2021). Thus, this literature indicates that the consumer incidence of the VAT is determined by many factors, such as market competition, the temporality of the tax, the direction of a rate change, or firm characteristics, not just by informality.

Thirdly, our paper relates to the literature on the welfare effects of VAT rate changes. Governments have used VAT rate reductions to milden the impacts of economic crises with varying success, to incentivize economic activity, and as distributional tools (Clemens and Röger, 2022). Moreover, VAT rate reductions have been used in some situations to tackle poverty. Closely related to our work, Warwick et al. (2022) study the effect of consumption tax cuts on inequality and poverty in low and middle-income countries. Using microsimulation models, the authors compare the effectiveness of VAT cuts and targeted social programs to tackle poverty and find that the latter is more effective. Our paper sheds light on establishing a causal relationship between changes in consumption taxes and poverty in a developing economy.

Finally, we contribute to the literature that has exploited exogenous VAT rate changes in Mexico to analyze the causal effects of the VAT. A set of papers study the effect of the 2014 VAT hike that raised the VAT rate from 11 to 16 percent at the northern and southern borders to equalize it with the rest of the country. Aportela and Werner (2002) and Mariscal and Werner (2018) study the effects of VAT hikes on inflation. They find that VAT hikes lead to positive but short-lived inflationary effects. Chávez and Domínguez (2022) study the effects of this reform on prices, employment, wages, and payroll loans. They find that prices increased, but only half the magnitude of a full passthrough effect. Regarding labor markets, employment was unaffected, and wages and payroll loans were negatively affected

by the adjustment of the VAT rate. The authors argue that the high competition firms face on the northern border explains the absence of a full passthrough effect and the negative impact on wages and payroll loans.[4] Davis (2011) indicates that the VAT discount may (moderately) encourage economic activity.

Another line of papers study a set of policies that took place five years later on the country's northern border aimed at incentivizing the local economy and reducing migration to the USA. In 2019, the Mexican government implemented a policy combining fiscal incentives to the income tax rate, a VAT rate reduction, and the minimum wage doubling. Campos-Vazquez and Esquivel (2020) and Calderón et al. (2023) analyze this policy and find that the combined policy led to lower inflation than otherwise would take place; the VAT rate reduction mainly drove the decrease in prices. Lastly, Biu-Cabrera (2024) studies the 2021 southern border decree that mirrored the 2019 northern border decree, except for the minimum wage hike. Biu-Cabrera (2024) finds differentiated price and labor effects among the cities affected by the decree. His findings differ from ours, probably due to the synthetic control strategy he implements.

Our analysis differs from previous research exploiting the border VAT rate changes in several ways. We depart from Chávez and Domínguez (2022) in that the 2021 temporary reform was only implemented on the southern border, a traditionally underdeveloped region with a less dynamic market, and in that the VAT is diminished rather than increased. In addition, we focus on the effect of the VAT cut on the affected products, while Campos-Vazquez and Esquivel (2020) and Calderón et al. (2023) study the impact of the 2019 northern border reform on the general price levels. Moreover, the current policy allows us to identify the net effect of reducing VAT, which is practically the only intervention in this policy. Finally, our paper compares the implications of the real incidence of the reform on consumers versus the legal (full passthrough) incidence. These implications have not been studied in the literature.

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[4]The findings by Chávez and Domínguez (2022) stand in contrast to Núñez Joyo (2017). He finds that the reform had a positive effect on the level of employment, while we find no effect on employment. Chávez and Domínguez (2022) argue that this discrepancy probably comes from two crucial differences in the estimation strategy. Núñez Joyo (2017) does not exclude border municipalities that were largely untreated by the reform or sectors that do not pay the VAT.

3   The VAT Reforms

To study the effect of VAT adjustments on prices in Mexico, we exploit two policy changes that have taken place over the last decade. Introduced in 1980, Mexico's value-added tax (VAT) has since adapted to the economic particularities of border areas. Before 2014, the VAT consisted of a general rate of 16 percent applicable nationally and a reduced rate of 11 percent in a range of approximately 20 kilometers from international borders.[5] This differentiation aimed to recognize and address the specific needs of these regions, particularly the competition for cross-border shoppers (Chávez and Domínguez, 2022). However, after no significant changes in the 2000s, in 2014, the Mexican government equalized the VAT rate of the border municipalities with the rate of the rest of the country. The VAT rate went from 11 to 16 percent. The president in office presented the reform to Congress in September 2013.[6] The reform was approved in October 2013 and came into effect in January 2014, representing a 45 percent increase in the VAT rate in previously discounted areas.[7] Figure 1 shows the southern border cities that were included in the VAT rate discount before the 2014 reform (in red).[8]

In January 2021, the president in office presented the Tax Stimulus Decree for the Southern Border Region, which covered 23 southern border municipalities in four states, with effects scheduled to last until the end of 2024.[9] The decree reduced VAT from 16 to 8 per-

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[5]This discounted rate applied to cities in both the northern and the southern borders. This paper analyzes only the southern cities affected by the reform.

[6]The government's primary justification to introduce the 2013 tax reform was to increase tax collection, as Mexico's tax revenues are low, not only by OECD standards but also compared to Latin American countries.

[7]In addition to the VAT modification, the reform introduced other fiscal measures that impacted the country as a whole. Among these are measures to incorporate informal firms into the formal sector, a special tax on stock exchange transactions, a slight increase in the income tax for the top brackets, and a special tax on mining companies' revenues. Unlike the VAT adjustment that only affected the border regions, all the other measures were applied to the whole country. Thus, they are considered in the identification strategy explained in Section 5.1.

[8]The VAT discount area included all localities situated 20 kilometers or less from the international borders. However, the discount area in some places exceeded the 20 km limit. Some states, as well as some municipalities, were wholly included in the VAT discount area. The exact locations subject to the discount zone are outlined in Congreso de la Unión (2009).

[9]The municipalities affected are Othón P. Blanco in the state of Quintana Roo; Palenque, Ocosingo, Benemérito de las Américas, Marqués de Comillas, Maravilla Tenejapa, Las Margaritas, La Trinitaria, Frontera Comalapa, Amatenango de la Frontera, Mazapa de Madero, Motozintla, Tapachula, Cacahoatán, Unión Juárez, Tuxtla Chico, Metapa, Frontera Hidalgo and Suchiate, in the state of Chiapas; Calakmul and Candelaria in the state of Campeche and, finally, Balancán and Tenosique in the state of Tabasco.

Figure 1: Treatment and control cities
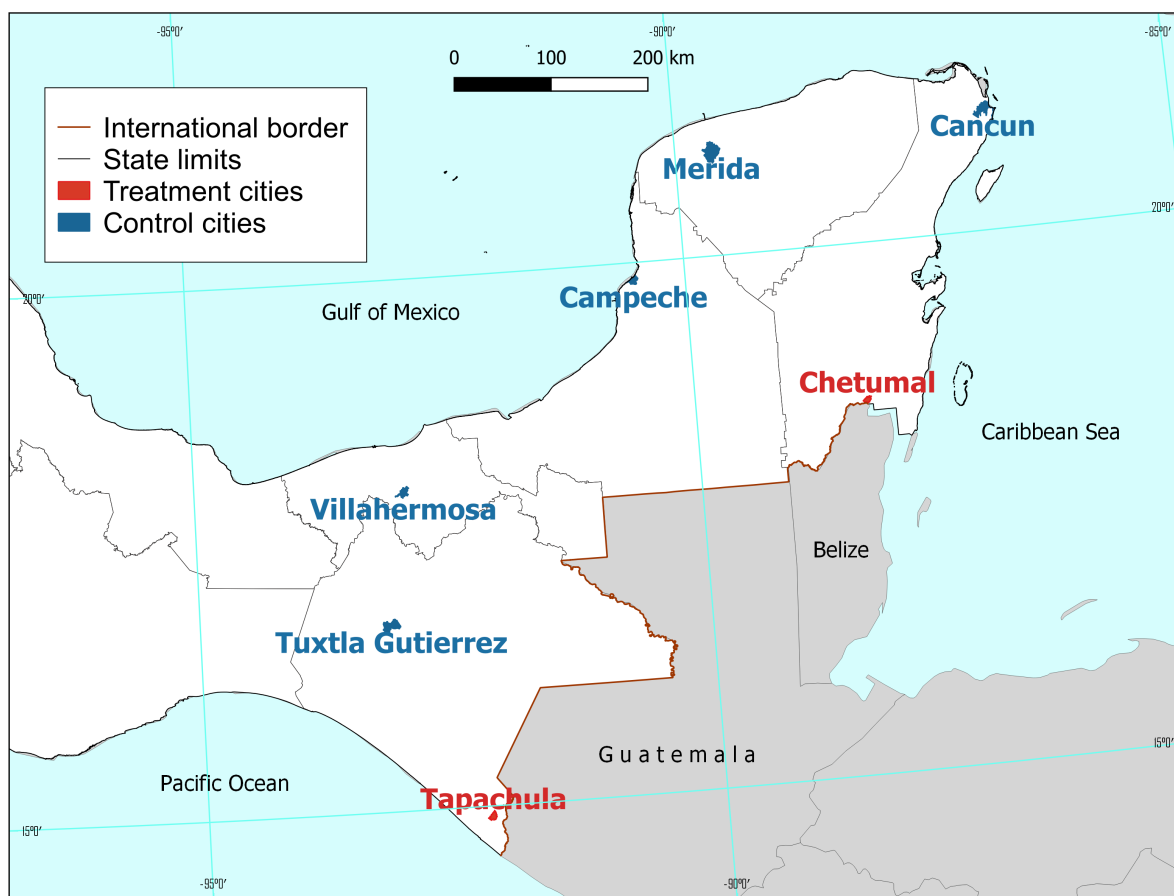
Note: This figure shows the location of treatment and control cities. Treatment cities include Chetumal in the state of Quintana Roo and Tapachula in Chiapas. Control cities are Tuxtla Gutiérrez in Chiapas, Villahermosa in Tabasco, Campeche in Campeche, Mérida in Yucatán, and Cancún in Quintana Roo. Source: authors' elaboration.

cent in all municipalities on the southern border. It affected the same cities that appear in red in Figure 1. Thus creating a favorable natural experiment to examine the effects of asymmetric tax rate changes.[10]

In addition to the VAT reduction, the decree introduced other fiscal measures that only impacted the southern border municipalities: the income tax rate was reduced from 30 to 20

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[10]The 2021 tax decree followed a similar 2019 decree that only affected municipalities at the northern border. However, the northern border decree also doubled the minimum wage, which complicates the identification of the causal VAT effects. The southern border decree did not include changes in the minimum wage. Thus, the adjustment on the southern border represents a clearer natural experiment, as it allows the evaluation of the impact of the VAT on prices without the distortions of wage changes, as documented by Chávez and Domínguez (2022).

percent, a 100 percent tariff exemption on the general import tax (IGI) was implemented, and full credit on the customs processing fee (DTA) for the Chetumal free zone was introduced.[11] However, compared to the impact of the VAT rate, all other fiscal measures are virtually non-existent. The income tax rate reduction constituted only 1.8 and 3.4 percent of total tax waivers between 2021 and 2022. In contrast, the VAT reduction accounted for 98.1 and 96.6 percent of the total tax renunciation of the fiscal stimulus for 2021 and 2022 (SHCP, 2021, 2022). Additionally, the tax waivers implemented in the Chetumal Free Zone had a marginal financial impact. In 2021, the costs associated with IGI and the DTA amounted to only 80,000 pesos, a minimal figure compared to the estimated 26,882 million pesos for the VAT waiver under the decree (SHCP, 2021). This disproportion in fiscal renunciations highlights that the effects on tax collection related to the income tax, IGI, and DTA are insignificant compared to those of the VAT. This is because the VAT discount was applied automatically across the affected municipalities. On the other hand, taxpayers had to submit applications before the federal tax authority to be eligible for the other fiscal advantages. These applications had to be reviewed and approved (or declined) by the federal tax authority, dramatically slowing tax discount roll-out. Therefore, in assessing the 2021 tax decree, we assume that all the price change effects we detect are due to the VAT reduction.

4   Data

We use **price data** from *Índice de Precios al Consumidor* dataset collected by the *Instituto Nacional de Estadística y Geografía* (INEGI). We collected price information for January 2010 to December 2023 for the following cities in southern Mexico: Campeche, Cancún, Chetumal, Mérida, Tapachula, Tuxtla Gutiérrez, and Villahermosa.[12] The dataset provides price information for more than 300 final consumer products and services at the city level.

Household income and consumption data comes from *Encuesta Nacional de Ingresos y Gastos de los Hogares* (ENIGH), the largest household survey in Mexico. It is collected

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[11]The government's argument to justify the decree was to promote the economic development of the region to stimulate and increase consumption and investment, promote productivity and encourage the generation of employment (Presidential Decree, 2020).

[12]Price series for Cancún and Tuxtla Gutiérrez start in August 2018.

bi-annually by INEGI. We use the closest surveys before the 2014 VAT hike and 2021 cut; these surveys were collected in 2012 and 2020. The survey gathers detailed information on household income and expenditure, including the monetary amounts each surveyed individual spends on different goods on a monthly basis (INEGI, 2020). The survey is not representative at the city level, but it is representative at the state level. We focus our household income and expenditure analysis on households living in the states of Chiapas and Quintana Roo, where the treatment cities are located. To ensure comparability with the INPC data, household spending by consumption item was grouped according to the classification used in the INPC.

Finally, we use **poverty measures** constructed by *Consejo Nacional de Evaluación de la Política de Desarrollo Social* (CONEVAL), the federal government agency that evaluates social policy. CONEVAL constructs the poverty measures using ENIGH data. The agency establishes an income poverty threshold (*Línea de Pobreza por Ingresos*) that identifies the households that do not have sufficient monetary income to acquire the basic goods and services they need. This line considers both food and non-food baskets. CONEVAL also defines an extreme income poverty threshold (*Línea de Pobreza Extrema por Ingresos*), which indicates the monetary income. Households falling below this income threshold cannot cover basic nutritional needs even if all their income is destined to buy food (CONEVAL, 2021).

5 Methodology

5.1 Effect of the VAT reforms on prices

To measure the impacts of the 2014 VAT hike and 2021 VAT cut on consumer goods prices, we use a differences-in-differences (DiD) strategy. We use price data for 2010 to 2023. Throughout the period, we observe prices for 300 different goods in two cities that were treated by both the VAT hike and cut: Tapachula in the state of Chiapas, and Chetumal in Quintana Roo. These cities compose our treatment group. They appear in red in Figure 1. The control group comprises the price series of cities not affected by the VAT reforms

located in a similar geographic area as the treated cities. These cities are Campeche, Cancún, Mérida, Tuxtla Gutiérrez, and Villahermosa, shown in blue in Figure 1.

The equation we use to estimate the price effects of the 2014 VAT tax hike and 2021 cut is:

$$Y_{jt} = \alpha + \beta C_j + \gamma D_t + \delta C_j \cdot D_t + \Pi X_j \cdot T_t + \varepsilon_{jt} \tag{1}$$

where Y_{jt} is a log price of a given group of goods at city j and month t. $C = 1$ if the city j is treated, and $C = 0$ if the city j is not treated.

To estimate the effect of the January 2014 VAT hike, we take two years prior and two years after the hike takes place. Thus, $D = 1$ if ($2016 \geq t \geq 2014$), and $D = 0$ if ($2013 \geq t \geq 2010$). Similarly, to estimate the effect of the January 2021 VAT cut, $D = 1$ if ($2023 \geq t \geq 2021$) and $D = 0$ if ($2020 \geq t \geq 2019$). T_t are time dummies and X_j is a set of time-invariant city-level controls.[13] Standard errors ε_{jt} are clustered at the city level. Coefficient δ from eq. (1) provides a point estimate of the effect of the VAT hike or cut on outcome Y. We use δ estimates to study how the VAT reforms affect household consumption.

5.2   Incidence on income and consumption

Using ENIGH data, we construct counterfactual unobserved household expenditures to simulate the extra money households spend due to the VAT reforms (the 2014 hike and the 2021 cut). We construct the unobserved counterfactual in two ways: 1) for the *real counteractual*, we take the household observed spending and adjust it by applying the VAT-induced price changes for the categories of goods with a statistically significant effect from eq. (1); 2) for the *legal counterfactual*, we take the household observed spending and adjust it by applying the VAT-induced price changes, assuming that the VAT change is fully passed to prices. The legal unobserved counterfactual corresponds to the case where the consumers fully pay the VAT. The real unobserved counterfactual corresponds to the price effects we observe with

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[13]City-level control variables are the unemployment rate, the percent of the total workforce employed in the formal sector, and the total number of firms operating in a fixed address (public and private).

the natural experiment explained in Section 5.1.[14]

The following formula expresses counterfactual expenditure:

$$CounterfactualExp_{i,t} = \sum_{k=1}^{K} ObservedExp_{i,k,t} \times (1 + impact_{k,t}) \qquad (2)$$

Where $ObservedExp_{i,k,t}$ is the observed expenditure by household i for product group k in year t. Using ENIGH, we calculate household expenditure for groups of goods coinciding with the categories established in the INCP dataset at the three-digit level.[15] The real and legal counterfactual expenditures differ in the definition of $impact_{k,t}$. For the real counterfactual, $impact_{k,t}$ refers to the effect of the VAT reform on the average log price of goods in group k at year t (the 2014 hike or the 2021 VAT cut) as estimated in eq. (1). For groups of goods that do not display a statistically significant effect, $impact_{k,t} = 0$. For the legal counterfactual, we assume that all goods subject to paying the VAT experience a price change according to the full passthrough on prices.

Then, we construct a counterfactual unobserved income. This measure simulates how the VAT reforms may affect household disposable income. It is calculated by adding the difference between observed and counterfactual expenditures to the observed household income from ENIGH. This difference quantifies what households would have 'spent' in 2014 or 'saved' in 2021 due to the VAT reform, thus incorporating 'spending' or 'saving' into the observed income to derive a counterfactual non-observed income that captures the price effects of the VAT reforms. We construct two different counterfactual incomes: 1) the *real*

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[14]We use all households located in the states of Chiapas and Quintana Roo as these are the states where Tapachula and Chetumal –the treatment cities–, are located. We do not restrict our analysis to only households located at Tapachula or Chetumal due to the lack of ENIGH representativeness at the city level. This approach bears some bias if consumption in the treated cities is, on average, different than consumption in the treated states. We use information from the ENIGH surveys before the VAT reforms. These are ENIGH 2012 and 2020.

[15]The exhaustive three-digit list is: 1.1.1. Bread, tortillas, and cereals, 1.1.2. Meat, 1.1.3. Fish and seafood, 1.1.4. Milk, milk derivatives, and eggs, 1.1.5. Oils and edible fats, 1.1.6. Fruits and vegetables, 1.1.7. Sugar, coffee, and sodas, 1.1.8. Other foods, 1.2.1. Alcoholic beverages, 1.2.2. Tobacco, 2.1.1. Men's clothing, 2.1.2. Women's clothing, 2.1.3. Children and baby clothing, 2.1.4. Coats and school uniforms, 2.2.1. Footwear, 2.3.1. Clothing accessories, 3.1.1. Housing costs, 3.2.1. Electricity and fuels, 3.3.1. Other housing services, 4.1.1. Furniture, 4.1.2. Appliances, 4.2.1. Utensils and home-living accessories, 4.2.2. Detergents and cleaning products, 5.1.1. Medicines and health equipment, 5.1.2. Medical services, 5.2.1. Personal care services, 5.2.2. Hygiene products, 6.1.1. Urban public transport, 6.1.2. Long distance public transport, 6.2.1. Vehicle acquisition, 6.2.2. Vehicle use, 7.1.1. Private education, 7.1.2. Education articles, 7.2.1. Recreation services, 7.2.2. Recreation products, 8.1.1. Other services.

counterfactual income coming from the real counterfactual expenditure, and 2) the *legal counterfactual income* coming from the legal counterfactual expenditure.

To obtain the two counterfactual incomes, we use the following equation:

$$CounterfactualInc_{i,t} = ObservedInc_{i,t} + ObservedExp_{i,t} - CounterfactualExp_{i,t} \quad (3)$$

Where $CounterfactualInc_{i,t}$ denotes the hypothetical unobserved income that household i would have after applying the price effects of VAT changes in year t. $ObservedIncome_{i,t}$ is the household income recorded in ENIGH.

We use the unobserved income defined in eq. (3) to assess the impact of the VAT changes on the number of people living in poverty or extreme poverty. We use the poverty thresholds defined by CONEVAL explained in Section 4.[16] We compare households below the poverty and extreme poverty thresholds in 2014 and 2020 under the observed income and unobserved real and legal counterfactual incomes to estimate the number of households that move above or below the poverty line due to the VAT reforms.

6   Results

Let us start by showing the effects of the VAT reforms on prices. Panel (a) of Figure 2 shows graphical evidence of this effect for the January 2014 VAT hike and the January 2021 VAT cut. The figure shows the percent change in the average price of goods that pay the VAT from period t to period $t = Dec2013$.[17] The figure clearly shows that the parallel trend assumption of the difference in differences methodology holds in the natural experiment we study, as the percent change series among the treatment and control cities match very closely for most of the 2012-2022 period, except for the dates after the reforms take place.

Panel (b) shows a close-up of the series around the 2014 VAT hike. The figure shows

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[16]We use the thresholds defined for August 2014 and 2020 because ENIGH data collection occurred in these months.
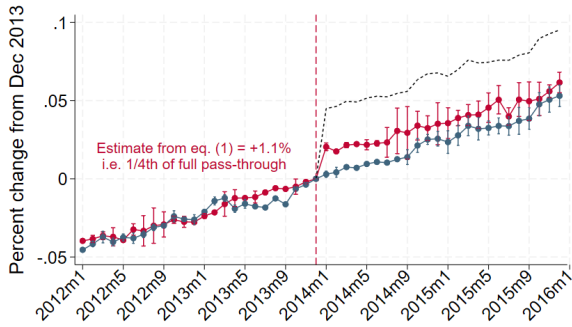
[17]In Mexico, the law exempts many goods from paying the VAT (Congreso de la Unión, 2009). These are primarily essential goods. These exemptions make the VAT in Mexico less regressive than the VAT in other Latin American countries (Lustig et al., 2014).

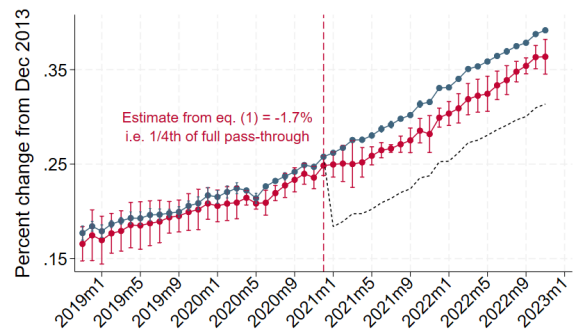## Figure 2: Effect of the 2014 and 2015 VAT reforms on prices

(a) 2014 and 2021 VAT reforms
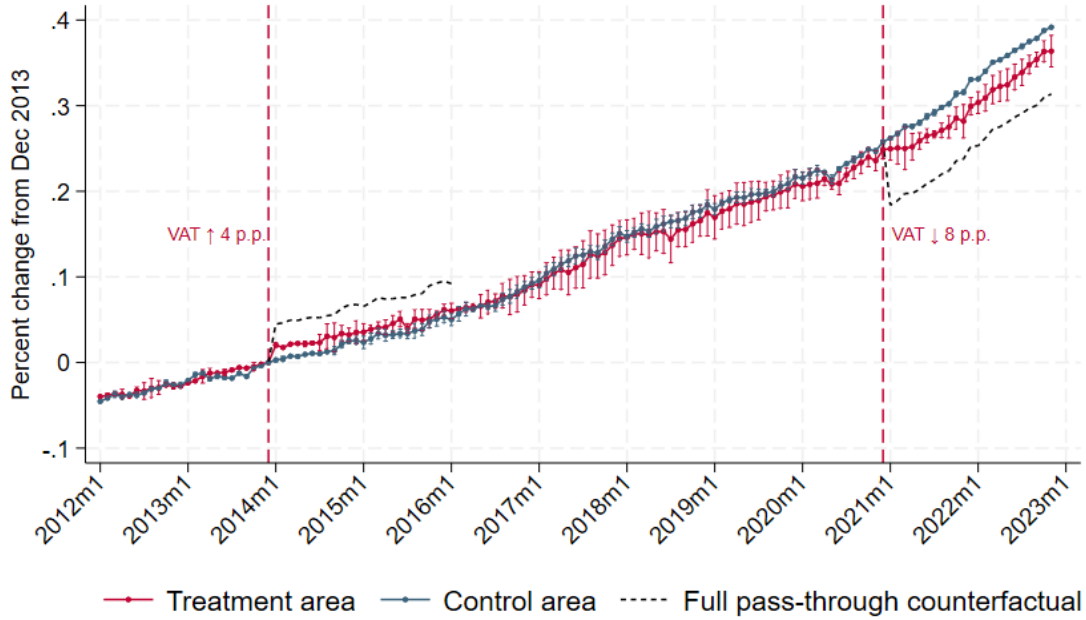
(b) 2014 VAT hike

(c) 2021 VAT cut

Note: This figure shows the effect of the 2014 and 2021 VAT reforms on prices. Panel (a) depicts the time of the reforms and the nominal price VAT hikes and cuts. Panel (b) shows the 2014 VAT hike and the estimated 1.1% passthrough on prices. Panel (c) shows the 2021 VAT cut and the estimated -1.7% passthrough on prices. Sources: authors' calculations using price data from INEGI.

similar growth in the average price series among the treatment and control groups before the reform occurs. Then, after the 2014 VAT hike, prices in the treatment group increase more than in the control group, but by a smaller amount than the full passthrough of the VAT hike to prices. The point estimate for the VAT hike effect from eq. (1) is 1.1 percent. This is about one-fourth of the full passthrough counterfactual.[18] I.e., consumers bear a relatively

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[18]Take y as the price including VAT and x as the non-VAT price. Take $t+1$ as the period after the VAT change and t as the period before the change. Then $y_t = 1.11x$ and $t_{t+1} = 1.16x$. The percent change in y from period t to $t+1$ is $\Delta\%y = \frac{y_{t+1}-y_t}{y_t} \times 100 = \frac{1.16x-1.11x}{1.11x} \times 100 \approx 4.5$.

minor part of the VAT hike. Furthermore, Panel (b) indicates that the effect of the VAT hike was short-lived, lasting around one year, as the series converge afterward.

We see a similar story for the 2021 VAT cut but in the opposite direction. The growth in the series among the treatment and control groups is similar before the reform. When the reform takes place, the series diverge. The effect is not as immediate as in the 2014 VAT hike. However, it is more lasting, as the growth pace is smaller in the treatment than in the control area for the two years that follow the reform. The estimate from eq. (1) is -1.7 percent. This is about 25 percent of the full passthrough on prices.[19] Thus, on both VAT reforms, firms do not pass the VAT completely to prices on average.

This is solid evidence that in the natural experiment that we analyze –spanning around ten years–, consumers do not bear the complete weight of the VAT. Indeed, they appear to pay for a relatively small part.[20] These findings are, in some aspects, similar to previous research that has analyzed the VAT incidence in a causal DiD setting (Carbonnier, 2008; Kosonen, 2015; Harju et al., 2018; Benzarti and Carloni, 2019; Fuest et al., 2021; Chávez and Domínguez, 2022). The papers conclude that the real price incidence and the legal (full passthrough) price incidence of the VAT differ. However, our research differs from previous studies regarding asymmetric effects. Previous studies mostly find that VAT hikes tend to be fully passed on to consumers, while VAT cuts are not (Benzarti et al., 2020). We find that the VAT is not fully passed to consumers in both cases. This may be due to the context of the reforms we study. The reforms took place at an international border, where firms may be shy of passing the VAT hike fully to consumers due to fears of losing consumption to cross-border shopping (Chávez and Domínguez, 2022).

The effects we present in Figure 2 are averaged across all products subject to paying the VAT. This average masks large differences across different types of products. To address this, we calculate the effect of the 2014 VAT hike and the 2021 VAT cut for different types

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[19]The percent change in y from period t to $t+1$ is $\Delta\%y = \frac{y_{t+1}-y_t}{y_t} \times 100 = \frac{1.08x-1.16x}{1.16x} \times 100 \approx -6.9$.

[20]A placebo estimation is shown in Figure A1. The figure shows the effect of the VAT reforms on products that pay the VAT and those that do not. The figure plots the estimated DiD coefficients from 1. For products that pay the VAT, the coefficients are positive (negative) for the VAT hike (VAT cut) and statistically different from zero. For products not subject to paying the VAT, the coefficients are not different from zero, both for the VAT hike and the VAT cut.

Figure 3: Price effects on products that pay the VAT

(a) 2014 VAT hike
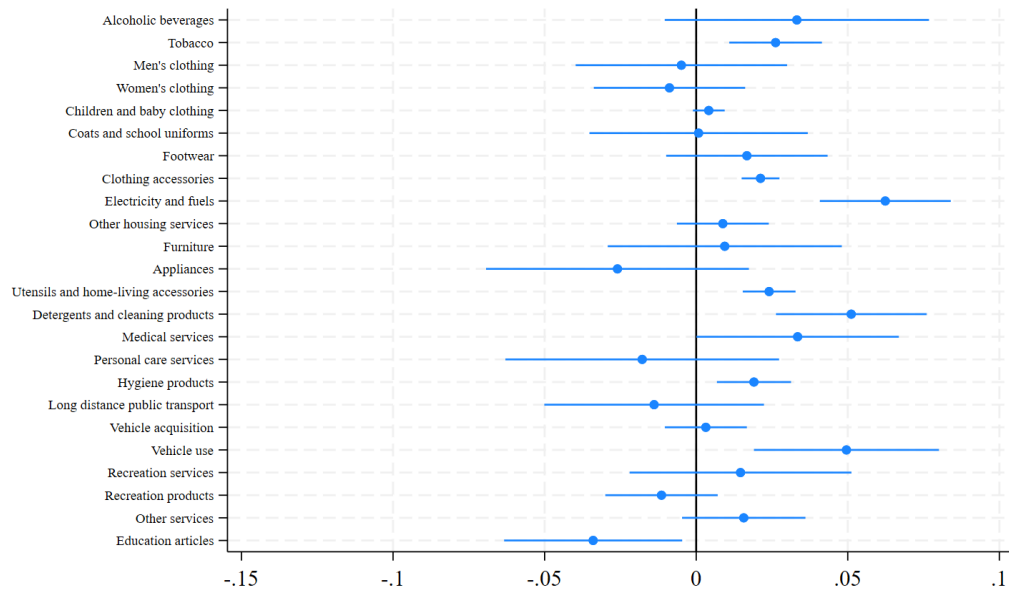
(b) 2021 VAT cut
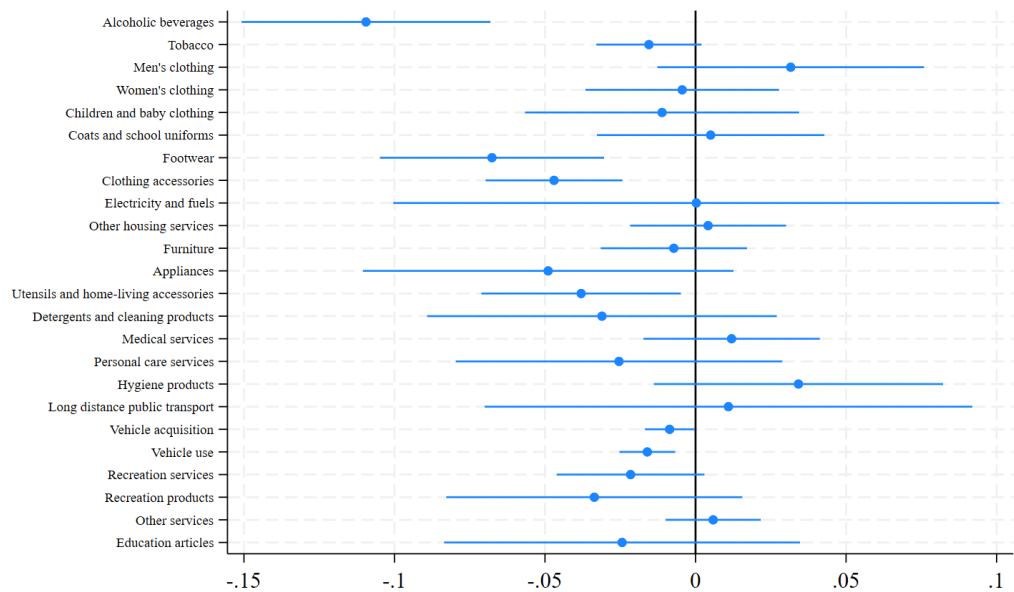
Note: This figure shows the estimated coefficients on δ using equation 1 for various goods according to the three-digit level classification of the INPC. Panel (a) shows the coefficients for the 2014 price hike. Products that experience a statistically significant price increase due to the VAT hike are in the following categories: Tobacco, clothing accessories, electricity and fuels, utensils and home-living accessories, hygiene products, and vehicle use. Panel (b) shows the coefficients for the 2021 price cut. Products experiencing a statistically significant price decrease due to the VAT cut are alcoholic beverages, footwear, clothing accessories, utensils and home-living accessories, and vehicle use. Sources: authors' calculations using price data from INEGI.

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of goods that pay the VAT. To estimate these effects, we use the classification of the INPC dataset at the three-digit level.[21] We present the estimated coefficients from eq. (1) in Figure 3. The figure indicates that not all goods that pay the VAT experience a statistically significant price effect due to the reforms. Tobacco, fuels, clothing, vehicles, and hygiene products present a statistically significant effect due to the VAT hike (Panel a). Similarly, for the VAT cut, products experiencing a statistically significant price decrease are alcoholic beverages, clothing, footwear, home accessories, and vehicles (Panel b).[22]

With the estimated coefficients in Figure 3, we calculate the household *unobserved real counterfactual expenditure* following eq. (2). The term $impact_{k,t}$ differs from zero for the groups of goods k that display a statistically significant price effect. On the other hand, the household *unobserved legal counterfactual expenditure* assumes that all VAT-paying goods experience a full VAT on prices. I.e., all prices of products subject to the VAT increase by 4.5 percent for the VAT hike and decrease by 6.9 percent for the VAT cut.

Next, we construct the household unobserved (real and legal) counterfactual incomes outlined in eq. (3). Figure 4 shows the percent change of the unobserved counterfactual real and legal income with respect to the observed household income, by average income decile. In Panel (a), the observed income is obtained from ENIGH 2012. In Panel (b), the observed income is obtained from ENIGH 2020.

Panel (a) indicates that the VAT hike would have led household disposable to decrease by an average of 3.9 percent with respect to observed income if firms had passed the VAT hike to prices fully (*legal incidence*). The shape of the bars follows an inverse U-shape (except for the fifth decile), where the poorest deciles and the richest deciles experience the largest

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[21]The exhaustive three-digit list is: 1.1.1. Bread, tortillas, and cereals, 1.1.2. Meat, 1.1.3. Fish and seafood, 1.1.4. Milk, milk derivatives, and eggs, 1.1.5. Oils and edible fats, 1.1.6. Fruits and vegetables, 1.1.7. Sugar, coffee, and sodas, 1.1.8. Other foods, 1.2.1. Alcoholic beverages, 1.2.2. Tobacco, 2.1.1. Men's clothing, 2.1.2. Women's clothing, 2.1.3. Children and baby clothing, 2.1.4. Coats and school uniforms, 2.2.1. Footwear, 2.3.1. Clothing accessories, 3.1.1. Housing costs, 3.2.1. Electricity and fuels, 3.3.1. Other housing services, 4.1.1. Furniture, 4.1.2. Appliances, 4.2.1. Utensils and home-living accessories, 4.2.2. Detergents and cleaning products, 5.1.1. Medicines and health equipment, 5.1.2. Medical services, 5.2.1. Personal care services, 5.2.2. Hygiene products, 6.1.1. Urban public transport, 6.1.2. Long distance public transport, 6.2.1. Vehicle acquisition, 6.2.2. Vehicle use, 7.1.1. Private education, 7.1.2. Education articles, 7.2.1. Recreation services, 7.2.2. Recreation products, 8.1.1. Other services.

[22]Figure A2 shows the DiD estimates for the effect of the VAT reforms on groups of goods that do not pay the VAT. The figure shows that all the groups of goods that do not pay the VAT do not experience a statistically significant effect on the reforms.

income decrease (around -4.3 percent) with respect to observed income. In contrast, the reduction of counterfactual household disposable income with respect to observed income, when considering the actual effects of the VAT hike on prices (*real incidence*), is 0.8 percent. The most affected households are at the bottom of the distribution (-1.31 percent for the first decile). Thus, for the VAT hike, the effect on household disposable income of the legal incidence is about five times as large as the effect of real incidence. Moreover, the most affected households in the real incidence case are in the poorest deciles, while the least affected are in the richest deciles. Although, the difference between the least and most affected is not as large as in the legal incidence case.

We find a more pronounced story for the VAT cut (Panel b). If the price of VAT-paying products had decreased by the full passthrough (6.9 percent), the unobserved counterfactual household disposable income would have increased by about 7.1 percent, on average, with respect to the income observed in ENIGH 2020. The disparity between the poorest and richest households is larger in this case. The income for the first decile would have increased by about 16.5 percent, while the income for the other deciles would have increased from 7.1 to 5.5 percent, with the poorest deciles being the most benefited.

On the other hand, the real incidence effect of the VAT cut leads counterfactual income to increase by 0.5 percent (0.9 for the first decile). The difference between the percent change of the legal counterfactual and the real counterfactual is fourteen-fold. This is much larger than the real and counterfactual difference in the VAT hike. This is partly because the VAT cut was bigger than the VAT hike (six percentage points versus four percentage points), leading to a larger difference between observed and non-observed counterfactual incomes if we take a legal incidence (because all the VAT change is passed to prices). In contrast, if we consider the fact that firms only pass a small part of the VAT change to prices (real incidence), we get a similar difference between observed and non-observed counterfactual income for the VAT hike and the VAT cut.[23]

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[23]A robustness test is presented in Figure A3. The figure presents the same calculations as Figure 4, but the observed incomes are taken from the closest ENIGHs *after the reforms*. These are ENIGH 2014 for the VAT hike and ENIGH 2022 for the VAT cut. The figure shows similar results to the case where we take the closest ENIGHs before the VAT reforms occur. For the VAT hike, the size of the effect on real and legal household disposable income is similar compared to the case when we take the observed income from

Figure 4: Simulated percent change on household income due to the 2014 VAT hike and the 2021 VAT cut
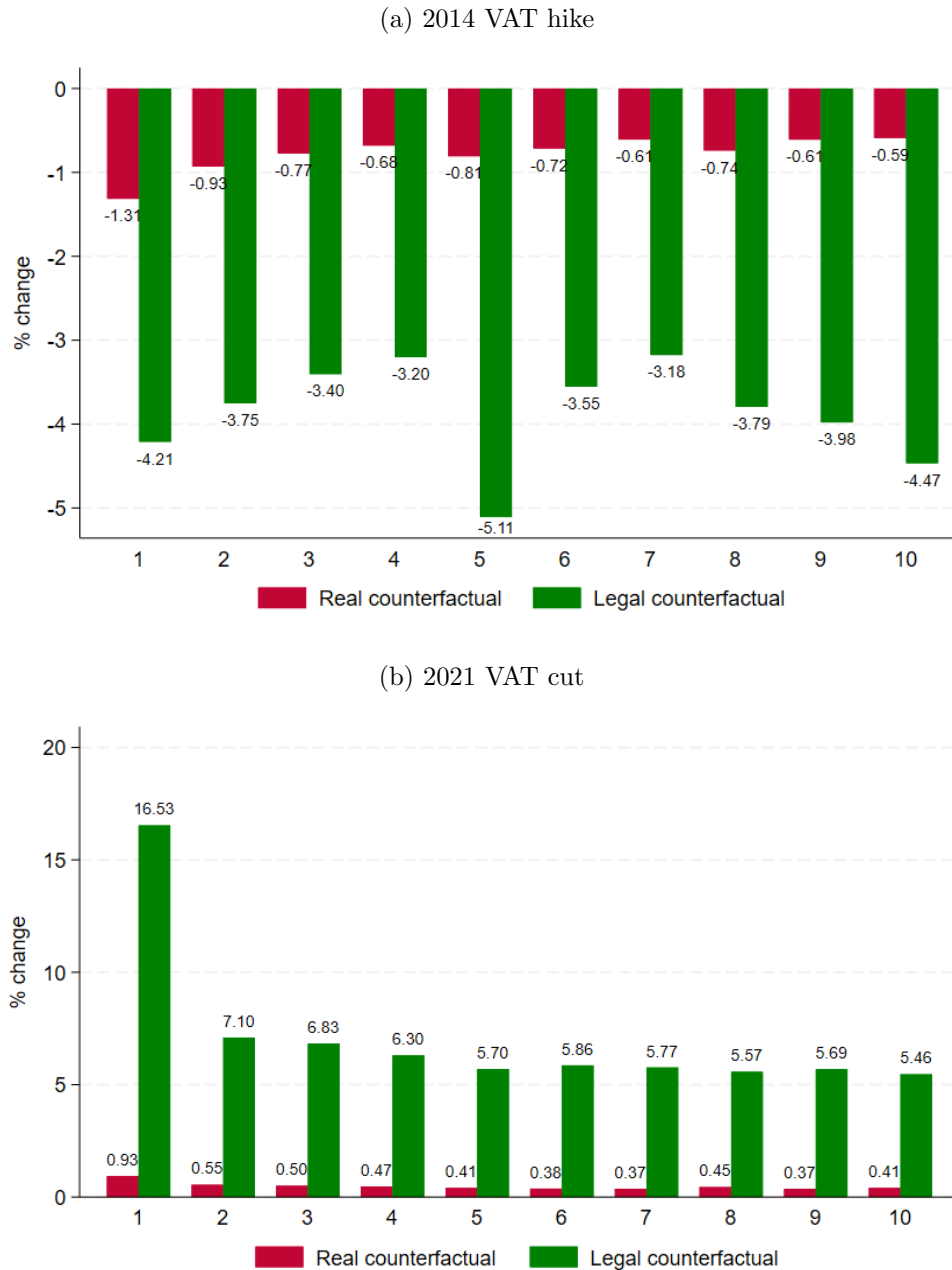
(a) 2014 VAT hike

(b) 2021 VAT cut

Note: This figure shows the simulated effect on household income due to the 2014 and 2021 VAT reforms along the income distribution. Simulated income is calculated by adding the difference between observed and counterfactual expenditures to the observed household income, as explained in section 5.2. Red bars show the estimated counterfactual income using the estimates from figure 3. Green bars show the estimated counterfactual income under full passthrough. Panel (a) shows the simulated percentage change in income due to the 2014 VAT hike. The 2014 VAT hike decreases income along the income distribution, with larger effects for lower and higher deciles. Panel (b) shows the simulated percentage change in income due to the 2021 VAT cut. The 2021 VAT cut increases income along the income distribution with larger effects for lower deciles. Sources: authors' calculations using ENIGH data collected by INEGI.

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Figure 5: Simulated percent change on poverty and extreme poverty due to the 2014 VAT hike and the 2021 VAT cut

(a) 2014 VAT hike

(b) 2021 VAT cut

Note: This figure shows the estimated effects of the VAT reforms on poverty. Poverty incidence is calculated according to CONEVAL's methodology, the official method for computing poverty statistics at the national level, after accounting for the price changes induced by the VAT reforms. Panel (a) shows the increases in poverty due to the 2014 VAT hike. Panel (b) shows the decrease in poverty due to the 2021 VAT cut. Sources: authors' calculations using ENGIH data collected by INEGI.

These results highlight the importance of accounting for the real incidence when determining the VAT distributional incidence. In the context that we study, we established with solid evidence that the VAT is only partly passed to consumers; this leads to an effect on household disposable income that is much smaller and, in some cases, distributed differently than the case where the consumer fully pays the VAT. As mentioned in Sections 1 and 2, most papers that analyze the distributional incidence of taxes and government spending assume that the VAT is fully passed to the consumer. Our findings indicate that the results such literature gets are most likely biased due to the full consumer incidence assumption.

With the unobserved counterfactual income measures obtained with eq. (3), we estimate how poverty would have changed due to the VAT reforms. The effects are presented in Figure 5. In the case of the VAT hike (Panel a), the real VAT incidence would lead poverty to increase by 0.06 percent and extreme poverty to increase by 0.32 percent. These are small, virtually non-existent increases. On the other hand, the legal VAT incidence would increase poverty by 0.19 percent and extreme poverty by 0.65 percent. In the case of the VAT hike, firms not passing the VAT fully to prices did not make much difference in households falling below the poverty lines.

The story is different for the VAT cut (Panel b). The real VAT incidence would decrease poverty by 0.07 percent and extreme poverty by 0.49 percent, a minimal decrease. However, the legal VAT incidence would have created an enormous poverty effect. Poverty would decrease by 2.82 percent and extreme poverty by 8.32 percent. Thus, in the VAT cut case, firms not passing the cut entirely to prices prevents many households from rising above the poverty line.[24] This is another crucial lesson for literature that studies the distributional effects of the VAT: assuming that the burden of the VAT falls entirely on the consumer

ENIGH 2012. However, the poorest deciles tend to be somewhat more affected using ENIGH 2014 compared to ENIGH 2012. For the VAT cut, the size and distribution of the effect on the real household disposable income are similar compared to the case when we take the observed income from ENIGH 2020. However, the effect on the legal household disposable income is somewhat larger using ENIGH 2020 compared to ENIGH 2022, especially for the poorest decile.

[24]A robustness test is presented in Figure A4. The figure presents the same calculations as Figure 5, but the observed incomes are taken from the closest ENIGHs *after the reforms occur*. ENIGH 2014 for the VAT hike and ENIGH 2022 for the VAT cut. Regarding the VAT hike, the effects on poverty are similar to when observed income is taken from ENIGH 2012. However, the effect is larger with ENIGH 2024, especially for the effect on extreme poverty with legal incidence. As for the VAT cut, the effects are similar but somewhat smaller when the observed income is taken from ENIGH 2022.

can lead to conclusions that are vastly different (and sometimes more optimistic) than when consumer incidence is obtained through a causal natural experiment.

7   Conclusion

Although the literature on the incidence of taxation has convincingly shown that the legal and real incidence of taxes differs due to several factors, the distributional effects of taxes are most often calculated assuming the legal incidence equals the real incidence. We show pretty different distributional and poverty implications from assuming real versus legal tax incidence. We recognize that assuming that the consumer pays the VAT fully facilitates calculations to determine tax burdens across the distribution. However, from our findings, we argue that the full VAT consumer incidence approach is not the right way to go.

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Appendix

A   Additional Graphs

Figure A1: Effect of the VAT hike by VAT payment eligibility
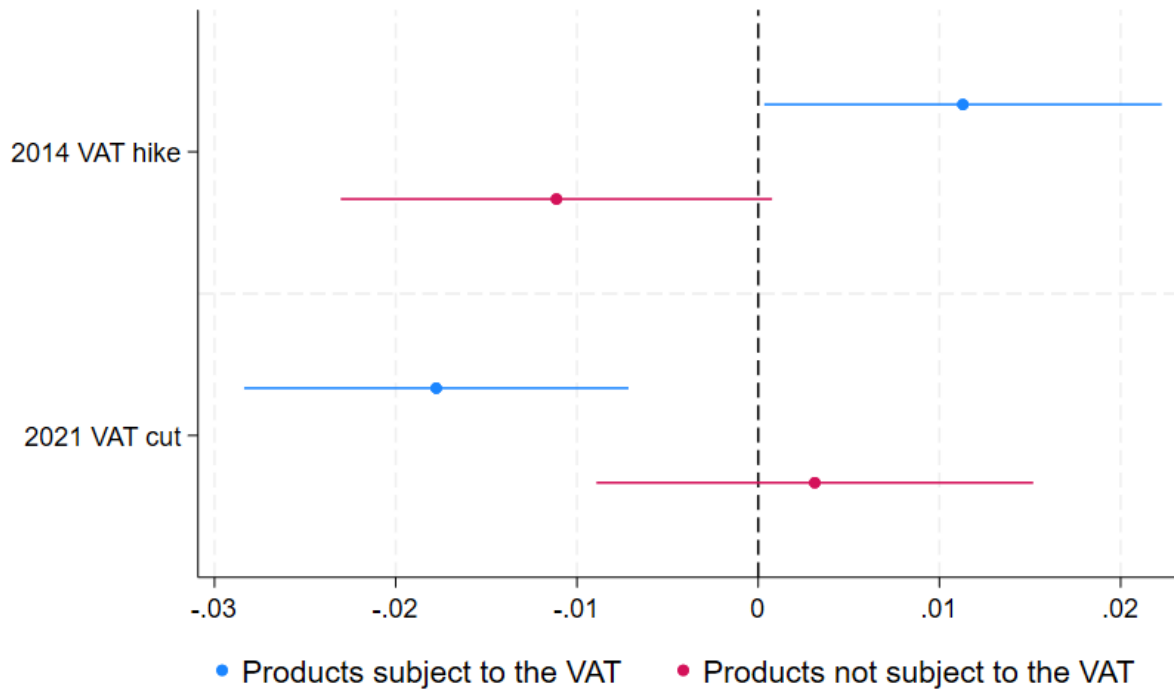
Note: This figure shows the effect on prices of the VAT reforms, using equation (1), for products that are subject to the VAT and products that do not pay the VAT. For products that pay the VAT, the coefficients are positive for the VAT hike, negative for the VAT cut, and statistically different from zero in both cases. For products that do not pay the VAT, the coefficients are not statistically different from zero, both for the VAT hike and the VAT cut. Sources: authors' calculation using data from INEGI.
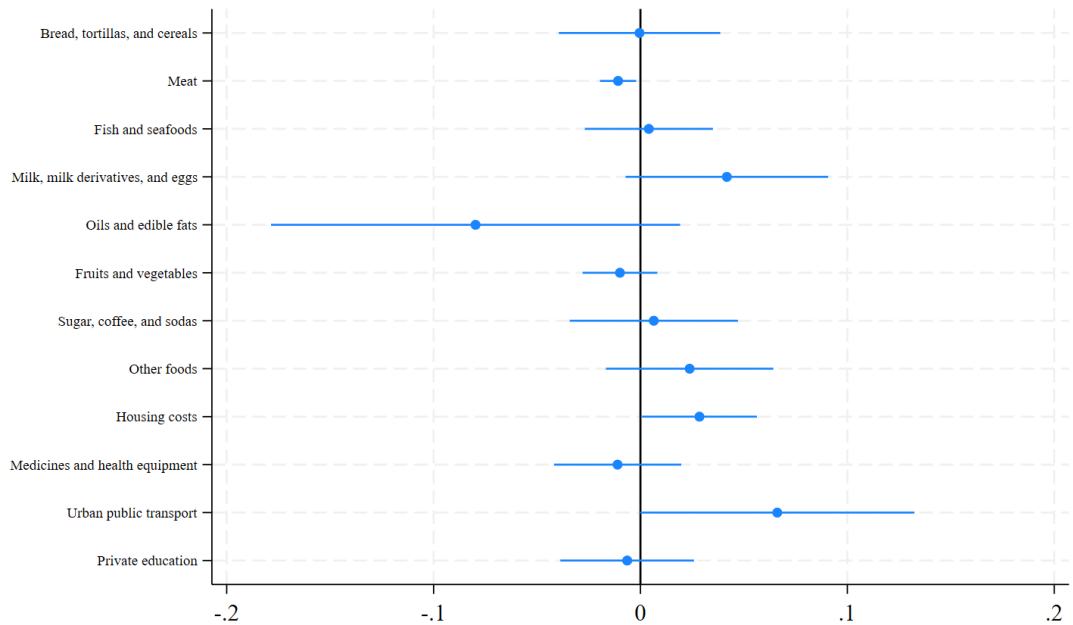
Figure A2: Price effects on goods that do not pay the VAT
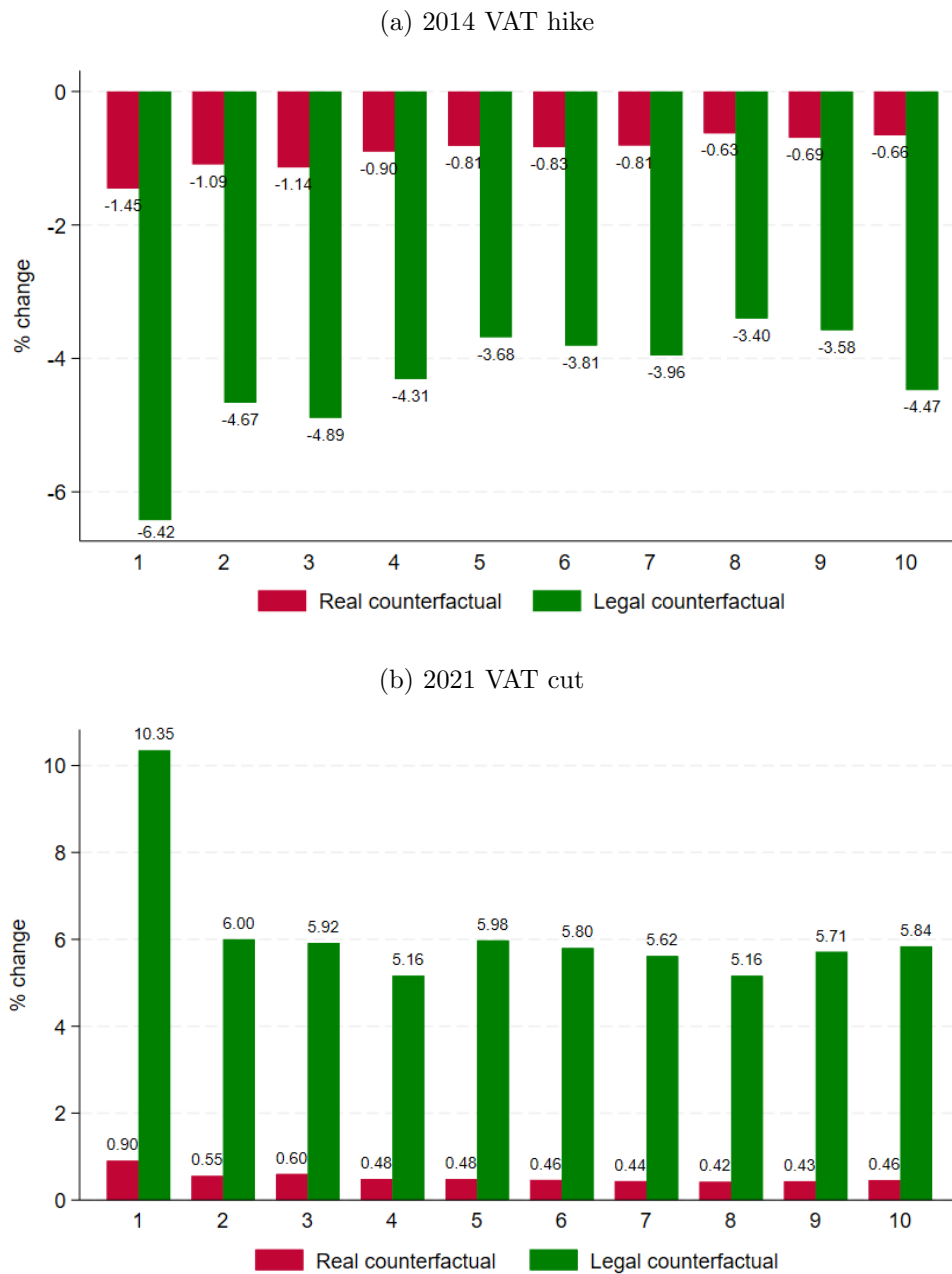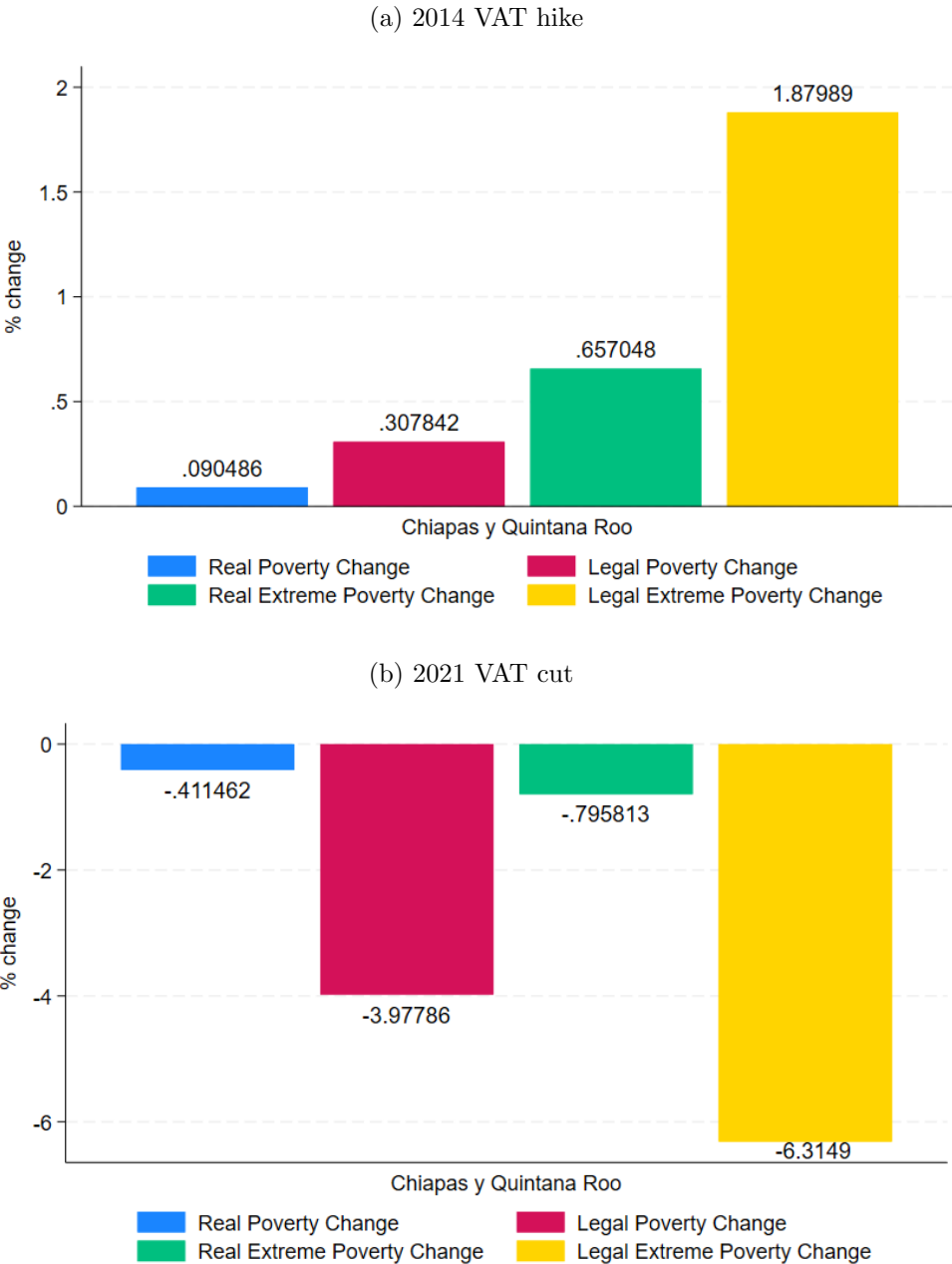
(a) 2014 VAT hike
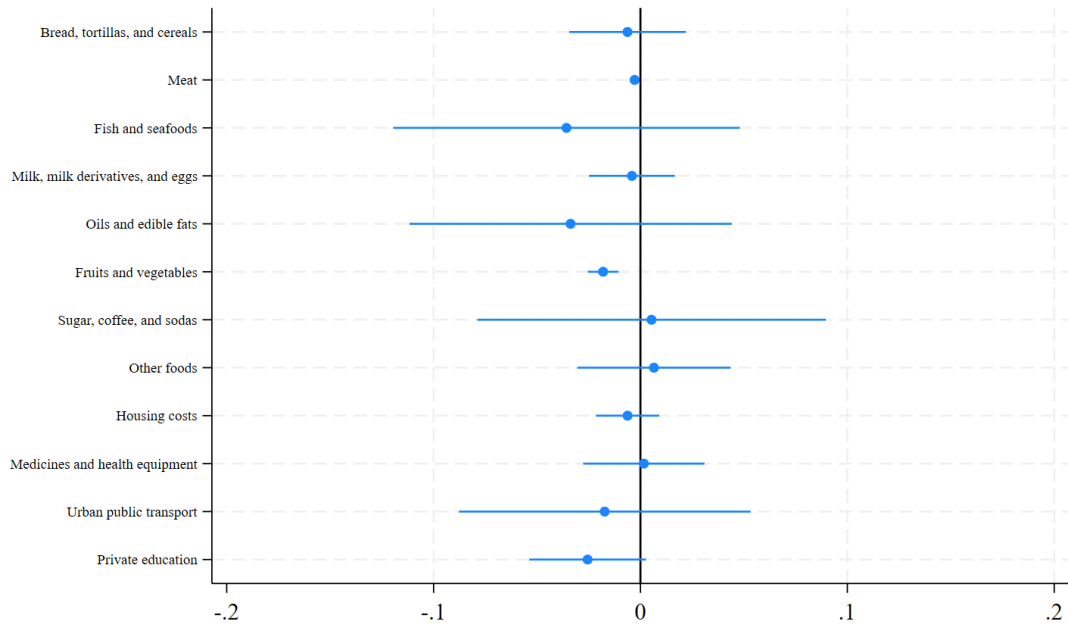
(b) 2021 VAT cut

Note: This figure shows the estimated coefficients on δ using equation 1 for various goods that do not pay VAT, according to the three-digit level classification of the INPC. Panel (a) shows the coefficients for the 2014 price hike. Panel (b) shows the coefficients for the 2021 price cut. Most coefficients are not statistically different from zero. Sources: authors' calculations using price data from INEGI.

Figure A3: Simulated percent change on household income due to the 2014 VAT hike and the 2021 VAT cut - robustness

(a) 2014 VAT hike

(b) 2021 VAT cut

Note: This figure shows the simulated effect on household income due to the 2014 and 2021 VAT reforms, along the income distribution. Simulated income is calculated by adding the difference between observed and counterfactual expenditures to the observed household income, as explained in section 5.2. Red bars show the estimated counterfactual income using the estimates from Figure 3. Green bars show the estimated counterfactual income under full passthrough. Panel (a) shows the simulated percentage change in income due to the 2014 VAT hike. Panel (b) shows the simulated percentage change in income due to the 2021 VAT cut. The observed income is taken from ENIGH 2014 for the VAT hike and ENIGH 2022 for the VAT cut. Sources: authors' calculations using ENIGH data collected by INEGI.

Figure A4: Simulated percent change on poverty and extreme poverty due to the 2014 VAT hike and the 2021 VAT cut - robustness

(a) 2014 VAT hike

(b) 2021 VAT cut

Note: This figure shows the estimated effects of the VAT reforms on poverty. Poverty incidence is calculated according to CONEVAL's methodology, the official method for computing poverty statistics at the national level, after accounting for the price changes induced by the VAT reforms. Panel (a) shows the increases in poverty due to the 2014 VAT hike. Panel (b) shows the decrease in poverty due to the 2021 VAT cut. The observed income is taken from ENIGH 2014 for the VAT hike and ENIGH 2022 for the VAT cut. Sources: authors' calculations using ENGIH data collected by INEGI.

Appendix p.4