INTERNATIONAL MONETARY FUND

The Political Economy of Fossil Fuel Subsidy Removal

Evidence from Bolivia and Mexico

Mariza Montes de Oca, Achim Hagen and Franziska Holz

WP/24/230

2024
NOV

 WP/24/230

IMF Working Paper
Strategy, Policy and Review (SPR)

The Political Economy of Fossil Fuel Subsidy Removal: Evidence from Bolivia and Mexico

Prepared by Mariza Montes de Oca Leon, Achim Hagen and Franziska Holz*

Authorized for distribution by Pritha Mitra
November 2024

ABSTRACT: We study the impact of fossil fuel subsidy removal on presidential popularity using difference-in-difference approaches and a stylized theoretical model. Analyzing macro level data for two subsidy removal events in Mexico and Bolivia in the early 2010s, we find evidence of a negative impact on presidential approval. Our theoretical probabilistic voting model predicts that the decline in popularity is driven by high income groups if subsidies are regressive, and that lack of trust in the government lowers popularity of the removal in all income groups. We confirm these predictions using micro level data for the Mexican subsidy removal event.

JEL Classification Numbers:	D72, H23, Q41, Q48, Q56
Keywords:	Political economy; Fossil fuels; Subsidy removal
Author's E-Mail Address:	mmontesdeoca@imf.org, fholz@diw.de, achim.hagen@hu-berlin.de.

* Montes de Oca, M.: International Monetary Fund; A. Hagen: PECan Research Group, Humboldt-Universität zu Berlin (HU); F. Holz: German Institute for Economic Research (DIW Berlin) and Norwegian University of Science and Technology (NTNU). The authors are grateful to Pritha Mitra, Baoping Shang, Gregor Schwerhoff, Jocelyn Boussard, Klaus Eisenack, Emine Hanedar, David Amaglobeli, Matteo F. Ghilardi, Andresa Lagerborg, Joana Pereira, Juan Yepez, Sergio Cardenas Rossel, Tannous Kass-Hanna, and Dirk Heine for their valuable comments and suggestions. We are also grateful to audiences at the AERE, EAERE, IAEE, and LAGV conferences in 2021, the Humboldt-Universität zu Berlin and the Mercator Research Institute on Global Commons and Climate Change for their helpful comments. Mariza Montes de Oca carried out parts of the research while being a doctoral researcher at DIW Berlin. We gratefully acknowledge funding by the German Federal Ministry of Education and Research (BMBF) under grants 01LA1811C (Achim Hagen), 01UU2205A (Achim Hagen) and 01LA1811B (Franziska Holz and Mariza Montes de Oca). The views expressed in this paper are those of the authors and do not necessarily represent the views of the International Monetary Fund (IMF).

WORKING PAPERS

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Prepared by Mariza Montes de Oca, Achim Hagen, and Franziska Holz[1]

[1] Montes de Oca, M.: International Monetary Fund; A. Hagen: PECan Research Group, Humboldt-Universität zu Berlin (HU); F. Holz: German Institute for Economic Research (DIW Berlin) and Norwegian University of Science and Technology (NTNU). The authors are grateful to Pritha Mitra, Baoping Shang, Gregor Schwerhoff, Jocelyn Boussard, Klaus Eisenack, Emine Hanedar, David Amaglobeli, Matteo F. Ghilardi, Andresa Lagerborg, Joana Pereira, Juan Yepez, Sergio Cardenas Rossel, Tannous Kass-Hanna, and Dirk Heine for their valuable comments and suggestions. We are also grateful to audiences at the AERE, EAERE, IAEE, and LAGV conferences in 2021, the Humboldt-Universität zu Berlin and the Mercator Research Institute on Global Commons and Climate Change for their helpful comments. Mariza Montes de Oca carried out parts of the research while being a doctoral researcher at DIW Berlin. We gratefully acknowledge funding by the German Federal Ministry of Education and Research (BMBF) under grants 01LA1811C (Achim Hagen), 01UU2205A (Achim Hagen) and 01LA1811B (Franziska Holz and Mariza Montes de Oca). The views expressed in this paper are those of the authors and do not necessarily represent the views of the International Monetary Fund (IMF).

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1 Introduction

Is the removal of fuel subsidies as politically costly as many assume? Removing fossil fuel subsidies (FFS) is a compelling measure to fight climate change, as it improves public finances, reduces greenhouse gas emissions, and decreases local air pollutants (Sterner, 2007; Davis, 2014). Despite these benefits, subsidies remain politically stable and entrenched (Strand, 2013). This paradox is manifest in Latin America, where mass protests in Ecuador in 2019 led to a decline in President Lenin Moreno's popularity, and President Evo Morales' approval ratings in Bolivia dropped after announcing a fuel price increase in 2010. Similar experiences in Europe, such as Macron's popularity drop after the yellow vest crisis, suggest that the phenomenon is not unique to Latin America (Douenne and Fabre, 2022). With the energy and cost of living crisis in 2022, fossil fuel subsidies have reached all-time highs and are estimated to be as high as $1 trillion (IEA, 2023b) to $1.3 trillion (Black et al., 2023) in 2022. How significant are the political costs of subsidy removal for elected officials, and which income groups disapprove most of these measures — the wealthy elites or the middle and low-income voters?

To explain this seeming paradox of FFS removal, this paper combines empirical analysis with theoretical modeling to estimate the effect of gasoline subsidy removal on presidential approval ratings in two Latin American cases: Mexico and Bolivia in the early 2010s. Utilizing a Difference-in-Differences (DiD) framework, we analyze macro data for both Mexico and Bolivia and micro data for Mexico. Additionally, we employ a probabilistic voting model à la Lindbeck and Weibull (1987) to analyze the role of trust in the government in stabilizing a political equilibrium of FFS. Latin America, with its predominant presidential regimes and tradition of popularity surveys as well as various subsidy reform experiences, provides a unique setting for this study. We focus on gasoline subsidy removal as it affects a significant portion of the electorate, with gasoline representing 46% of road transport fuel demand in the region (IEA, 2023a). Our results indicate that removal is politically costly, yet the cost seem moderate and short-lived. The negative effect of subsidy removal on approval is stronger and more long-lasting in Bolivia, with an average 19% decrease in presidential approval, compared to Mexico, where pre-trends complicate clear identification of causal effects in the macro data setting. However, a model employing micro level data for Mexico supports our theoretical model predictions and corroborates the inconclusive macro-level results, demonstrating that the of 2% decrease in presidential approval in Mexico is driven by the richest income groups. Trust in the president plays a crucial role in moderating the public response: higher trust can mitigate or even reverse the negative impact of subsidy removal on approval. This underscores the importance of trust in shaping public reactions to subsidy reforms and aligns with previous qualitative research that highlighted the role of government trust in subsidy acceptance.

The relationship between economic policies and political outcomes has been well documented in the literature. Early scholarly contributions highlight the sensitivity of presidential election results to economic and fiscal policy (Alesina and Tabellini, 1990; Lowry et al., 1998; Niemi et al., 1995). Niemi et al. (1995) find that tax increases contribute to votes against the incumbent State governors and their parties. Kone and Winters (1993) examine the effects of sales tax and personal income

tax policies on electoral support, finding a negative impact of sales tax on electoral support. Tribin (2020) employs a probabilistic voting model and empirical data from Colombian municipalities and finds that an incumbent seeking reelection uses different forms of redistribution to target core, swing and opposition municipalities. Focusing on fuel taxation, a variable closely related to fuel subsidies, Finnegan (2023) finds that higher levels of electoral competition are associated with lower gasoline tax rates in high-income democracies.

Because of their dual importance for climate and fiscal balances, a number of recent studies investigate the link between fuel subsidies, economic and electoral incentives, public opinion, and political outcomes. A strand of this literature explains the introduction of subsidies by looking at their demand and supply. On the demand side, FFS can be explained by interest groups seeking rents at the expense of the state budget (Victor, 2009; Inchauste and Victor, 2017; Becker, 1983; Oates and Portney, 2003). On the supply side, governments can choose fossil fuel subsidies as part of a visible and easy to deliver redistribution mechanism and an effective election strategy (Boix, 2003; Overland, 2010; Overland and Kutschera, 2011; Strand, 2013). Thus, governments that provide a salient benefit to their citizens can reap political benefits through political support (List and Sturm, 2006).

A second strand of this literature explores the determinants of subsidy *lock-in*, as opposed to factors that explain the *introduction* of subsidies. The lock-in of FFS can be explained by structural domestic factors, including lack of institutional capacity (Commander, 2012; Cheon et al., 2013; Strand, 2013), reform opposition from actors benefiting from the subsidy *status quo* (Victor, 2009; Inchauste and Victor, 2017; Oates and Portney, 2003), and a policy commitment problem linked to electoral incentives (Pani and Perroni, 2018). Analyzing institutional capacity, Strand (2013) contends that the government's inadequacies in delivering public goods are a key explanatory factor for subsidy entrenchment. In the context of institutional capacities, Alleyne et al. (2013) argue that middle income groups may oppose the removal of fuel subsidies because they are viewed as one of the few concrete benefits they receive from the state. According to the authors, lack of confidence in the government is seen as an important factor behind unsuccessful fuel subsidy reforms in Indonesia in 2003 and 2011. Fairbrother et al. (2019) contribute to this literature by introducing a multilevel model that underscores the significance of trust in shaping attitudes towards subsidies. Their findings indicate that nations with elevated levels of political trust are more likely to endorse high fuel prices than those with higher awareness and concern for climate issues. Along the same lines, Harring et al. (2023) find that the public is more positive towards subsidy removal if the optimal use of the saved fiscal resources is specified.[1]

This paper contributes to the literature on the lock-in of FFS in two ways. First, we undertake a novel empirical analysis to quantify the political costs of removing fuel subsidies. Utilizing a staggered Difference-in-Differences (DiD) framework as proposed by Callaway and Sant'Anna (2021), we estimate the effect of staggered announcements of subsidy removal in Mexico and Bolivia on presidential approval ratings. Our access to presidential approval data significantly complements previous research on political costs, which primarily focus on electoral outcomes, protests, riots,

[1] In the carbon tax context, Carattini et al. (2019) find that revenue use is decisive for public acceptance.

and social unrest (McCulloch et al., 2022; Drabo et al., 2023). Presidential approval ratings, more frequent and temporally proximate to subsidy removal events than electoral results, offer a more immediate and clean measure of political repercussions. Furthermore, unlike indicators of protest, riots, and social unrest, approval ratings are less susceptible to manipulation by interest groups, providing a more authentic reflection of public opinion from a representative sample of the voting-age population. Our findings highlight evidence of a negative yet moderate effect of the subsidy phase-out on political approval. In Bolivia, the effect is clearly identified in the macro data, however, in the Mexico case, pre-trends challenge the identification strategy using macro-level data. The effect is later confirmed in the micro-data examination in the second part of the paper.

In the second part of this paper, we investigate why these reforms, despite their potential benefits, are unpopular and politically challenging for elected representatives, particularly in developing countries like those in Latin America. In these countries, a large portion of the population lives in poverty conditions and the larger share of the fuel subsidy transfer accrues to the richest income groups. Here, the removal of FFS could lead to a more progressive[2] distribution of public resources,[3] benefiting the poorer portion of the electorate. Consequently, a large share of the electorate should in principle be favorable to FFS removal. This paradox is examined using a probabilistic voting model à la Lindbeck and Weibull (1987) that analyzes the role of party preferences and trust in the government in stabilizing a political equilibrium (or lock-in) of FFS. Such models have been used in similar studies, e.g., by Hodler et al. (2015) who investigate the influence of voting costs on democratic participation and government expenditures and by Tribin (2020) who examine the distribution of public resources in Colombia. We theoretically show how phasing out subsidies can result in a loss of political support.

Our model predicts that if FFS are regressive, and trust in the government is equal in all income groups, the overall loss in support is driven by a decline in support from high-income groups, whereas low-income groups increase support. Sufficiently low trust in the government in low income groups can lead to declining political support from these groups in reaction to a subsidy removal. These predictions suggest that mistrust in the government can sustain support for high fuel subsidies, even when these are regressive. We empirically test the predictions of the model focusing on two testable hypotheses using micro-level survey data[4] from Mexico. Our first hypothesis posits that the decline in approval ratings associated with FFS phase-out is predominantly due to diminished support from high-income groups, particularly when FFS are characterized as regressive. The second hypothesis suggests that this adverse effect is exacerbated by a lack of trust in the president. By applying a difference-in-differences (DiD) framework, we are able to substantiate these theoretical predictions within the Mexican context. Our results have significant implications for policy formulation,

[2]While fuel taxes and fuel subsidy removal can be regressive in industrialized countries, there is mounting evidence of their progressivity in developing countries (Van Heerden et al., 2006; Brenner et al., 2007; Datta, 2010; Nurdianto and Resosudarmo, 2016; Dorband et al., 2019; Renner, 2018; Sterner, 2012)

[3]For instance, Jakob et al. (2015) examine the development benefits of redirecting fuel subsidies to public infrastructure spending in 45 countries and find that phasing out fuel subsidies would free up enough funds to finance universal access to water, sanitation and electricity.

[4]Our methodology is unique in its utilization of both macro and micro data for modeling purposes: enabling an evaluation of both national impacts and effects across different income groups. While macro data is utilized for both Mexico and Bolivia, micro data application is limited to Mexico due to data availability.

highlighting the necessity of trust-building measures.

The remainder of this paper is organized as follows. Section 2 presents background information on fossil fuel subsidies and their removal in selected Latin American countries. Section 3 deals with the estimation of the political costs at the national level. Section 4 presents the probabilistic voting model and tests the model predictions on micro-level survey data. Finally, Section 5 concludes.

2 Fossil-fuel subsidies in Latin America

Fossil-fuel subsidies in Latin America are substantial. With more than $360 billion in 2022, Latin America spends more than 5% of GDP on fossil fuel subsidies (Black et al., 2023).[5] Subsidies in the region are large not only in comparison to other regions, but they are substantial relative to the region's own GDP. For the larger part, fossil-fuel subsidies in Latin America are not the result of an intentional subsidy policy, but the indirect result of other policies, e.g. smoothing out price volatility or redistributing natural resource rents. For instance, they often result from the gap between low and stable government controlled domestic prices and high international reference prices (Black et al., 2023; Parry et al., 2021; Ross et al., 2017). This gap occurs either because prices are directly fixed by the government or regulated in ways that are not fully aligned with market price fluctuations. Several price mechanisms have been used in the region, including liberalized prices, fully flexible prices according to a formula, flexible prices with some degree of smoothing according to a formula, ad-hoc prices and fixed prices. In many cases, including gasoline and diesel subsidies, fuel subsidies in the region are economy-wide[6] and reach a variety of economic actors and sectors within the economy.

Mexico is a good example of a country where government-fixed prices, alongside a policy to smooth out volatility via excise taxes, led to a sizable fuel subsidy from 2006-2014. For several decades, the Mexican Ministry of Finance had been in charge of setting fuel prices (until recent reforms to the energy sector changed the gasoline market).[7] A policy to smooth out volatility from international prices via the fuel excise tax led to a stable domestic price. The nominal domestic price of gasoline would only increase alongside inflation. The excise tax varied according to the gap between international and domestic prices (see gray shaded area in Figure 1 during the 1990s). However, amid growing international prices, this policy led to substantive shrinking of the excise tax toward 2004 (see gray shaded area in Figure 1). As international prices rose further during the 2000s, the same policy eventually flipped the gap and led to net subsidies in 2006 (Munoz-Pina et al., 2022). Net subsidies persisted and, in 2008, they represented 1.8% of Mexico's GDP. As shown in Figure 1, the gap between fixed[8] domestic prices and growing international prices of reference (the price at which Mexico imported about 40% of its gasoline) determined either a tax or a subsidy. Since then,

[5] This measure takes into account both implicit and explicit subsidies. Explicit subsidies, which reflect undercharging for supply costs, amount to $56.7 billion in the LAC region. Implicit subsidies, which reflect undercharging for environmental costs and forgone consumption tax revenues, amount to $304.5 billion (Black et al., 2023).

[6] Economy-wide subsidies are also referred to as blanket subsidies or broad-based subsidies

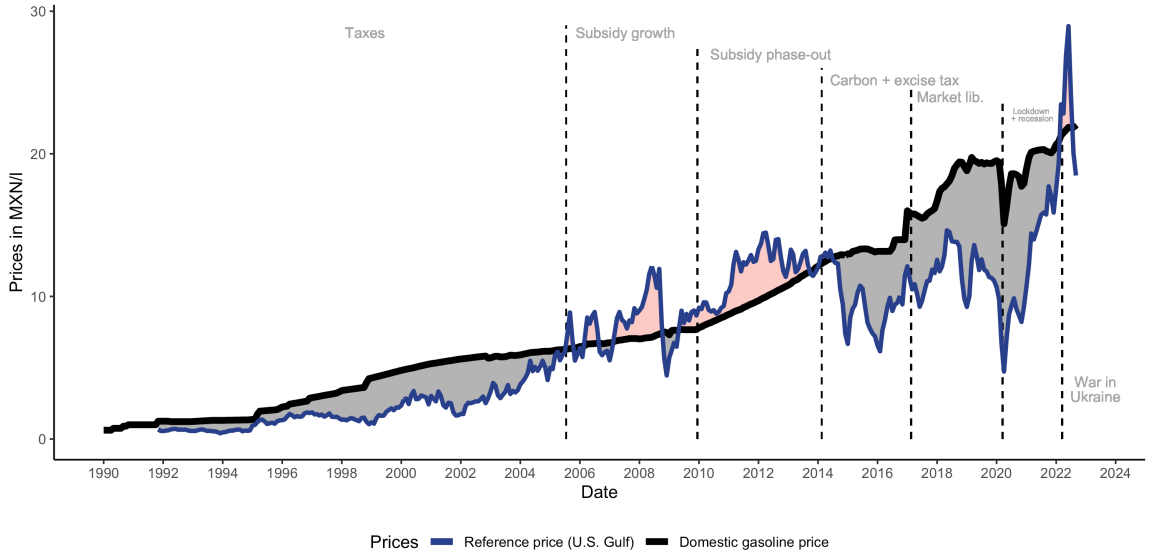
[7] In 2017, Mexico liberalized the gasoline market allowing the private sector, instead of only Pemex and its franchises, to import and retail gasoline.

[8] Prices were fixed in real terms. In other words, they were adjusted to match inflation.

significant changes in Mexico's transportation fuel's market structure, pricing schemes, and excise taxation happened.

In 2010, Mexico started a gradual phase-out of the subsidy via monthly price hikes resulting in a complete phase-out by 2014. In 2016, as a result of the 2014/16 energy reform, all market participants were allowed to import and sell fuels and the country introduced fuel price bands; In 2017, the country implemented a gradual staggered state-wise liberalization of fuel prices starting with the northern states; In 2019, the government introduced a new fuel price smoothing formula by presidential decree, which may lower fuel prices at the pump via an adjustment in the excise rate, whenever the fuel price exceed a shadow price (see IMF (2022) and Munoz-Pina et al. (2022)). Although the new price-smoothing formula can change prices at the pump (and may result in subsidies), it does so by reducing excise taxes only, which is a significant policy change from the previous approach of government administered and fixed fuel prices.

Figure 1: Gasoline subsidies and taxes in Mexico

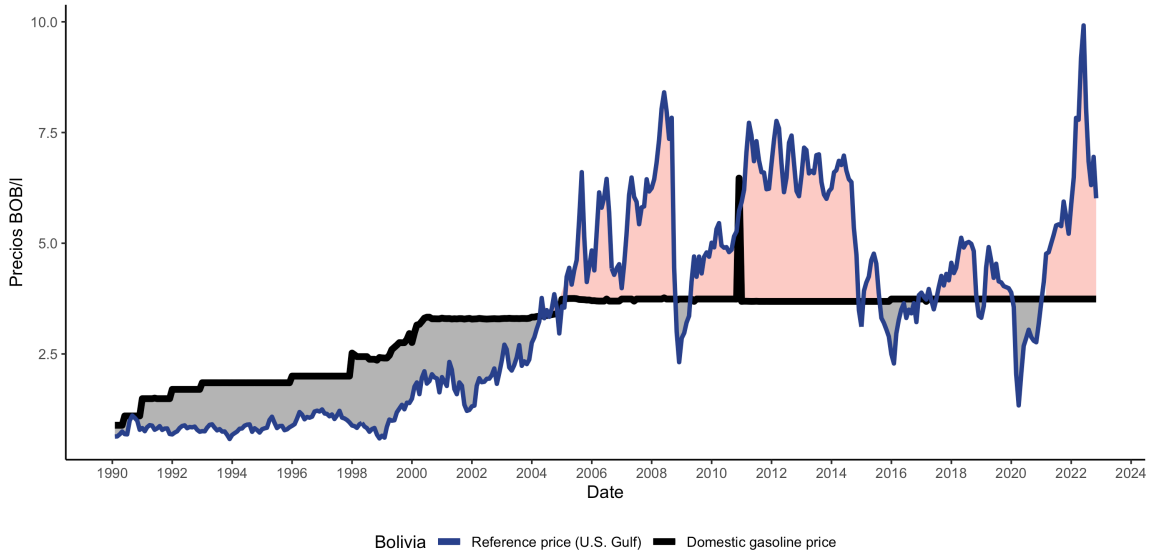


Notes: This plot shows the monthly consumer subsidy per liter for low-octane gasoline in Mexico -the most consumed gasoline grade in the country. Gray areas denote fuel taxes while red areas show fuel subsidies. The subsidy phase-out was announced in Dec. 2009. Despite the price hikes that were intended to phase-out the subsidy, the 2010-2014 shows short periods of an increased subsidy. However, in the absence of the price hikes, the subsidy per liter would have been larger. The international reference price is adjusted to reflect transport and distribution costs.

Bolivia is another example of subsidization of fossil fuels and, more precise, gasoline. Gasoline prices have been fixed by the government for many decades and stayed frozen for years at a time (Kojima, 2013). In Bolivia, the *Agencia Nacional de Hidrocarburos (ANH)* is in charge of publishing maximum retail prices according to the Decree 24.914 (Altomonte and Rogat, 2004). According to data from the Latin American Energy Organization (OLADE, for its acronym in Spanish), nominal gasoline prices in Bolivia have remained unchanged since 2005 at 3.74 bolivianos per liter (OLADE,

2023). In fact, as shown in Figure 2, prices have only marginally increased since 2000, when they were at 3.1 bolivianos per liter.[9] Frozen prices, increased imports, and a rising international price of reference led, just as in the Mexican case, to substantial subsidies. Subsidies were estimated just above 1 percent of GDP in 2006 and they rose together with the increase in international oil prices to 3 percent in GDP in 2013 (Di Bella et al., 2015).

Figure 2: Gasoline subsidies and taxes in Bolivia



Notes: This plot shows the monthly consumer subsidy per liter for low-octane gasoline. Gray areas denote fuel taxes while red areas show implicit fuel subsidies. The subsidy phase-out was announced in Dec. 2010.

Other examples in the region include indirect regulation via a strong government's presence in the executive board of oil companies. This was the case of Brazil where, for several years, the government influenced the fuel prices via Petrobras. The nature of these pricing arrangements has two consequences. First, it indulges consumers with artificially stable prices and accustoms them to little to no change. Second and crucial, it attaches any fuel price change to a government decision. In other words, whenever prices change, citizens link the change to a deliberate government decision (Kyle, 2018). Presumably, citizens hold policymakers accountable for any price changes.

In the region, Argentina, Brazil, Bolivia, Dominican Republic, Ecuador, and Mexico have attempted to remove fuel subsidies (see Table 1). The removal can involve an overhaul of laws and regulations in the fuels markets, or they can simply imply a change of the fixed price by decree. Similarly, the removal can involve a one-off change in fuel prices (to remove the subsidy) or a gradual and constant change in prices to eventually remove the subsidy *de facto* (see fourth column in Table 1).

Importantly, factors exogenous to presidential approval ratings ignite the removal. Rising international fuel prices (and fixed domestic prices), growing fiscal pressure, and influence of international

[9]Other types of fuels in Bolivia, including diesel, have not seen price changes since the 2000s.

organizations are some examples of drivers of these reforms. For instance, rising international prices[10] of oil led to higher implicit subsidies in Mexico in 2006-2010 (see Figure 1) and increased pressure on public finances. Similarly, other, international influences on FFS removal can be considered to be exogenous to presidential approval ratings. For instance, in 2009 at the the Pittsburgh Summit, the G20 leaders agreed to *phase out and rationalize over the medium term inefficient fossil-fuel subsidies while providing targeted support for the poorest.* The subsidy removal in Mexico occurred soon after the call of the G20 to remove subsidies. The G20 call may have exerted some influence on the decision to remove subsidies in Mexico.[11] All these external influences on subsidy removal are important for our econometric approach: we can assume that treatment, i.e. subsidy removal, is determined by these factors and therefore it is as if random or orthogonal to approval ratings. In other words, we argue that there is no selection based on presidential approval ratings.

[10]The developments that lead to FSS removal can be assumed to be exogenous to approval in oil price-taker countries. In other words, they can be assumed to be endogenous to approval only in countries able to influence international oil prices.

[11]There is lack of consensus in the academic literature on the role of G20 (and other international calls) in influencing subsidy removal globally. A few authors support this argument. For instance, Van de Graaf and Blondeel (2018) document an increase in the number of reform efforts since the G20 2009 Pittsburgh Summit. By 2015, the IEA (2015) calculated that without the reforms undertaken since 2009, the value of consumption subsidies would have been 24% higher globally.

Table 1: Gasoline subsidy removal and price-setting in selected Latin American countries: State of subsidies[a] around 2010

Country	Gasoline price setting	Gasoline blanket subsidy	Other info
Argentina	Market based	No subsidy	Natural gas, diesel and LNG tariffs government-fixed; LNG subsidy removal announcements in 2013 and 2016. Electricity subsidy was reduced.
Bolivia	Government administered price	Large subsidy	Diesel, kerosene, LPG, jet fuel and fuel oil prices also administered by the government. Implied subsidies for diesel and natural gas too.
Brazil	Price indirectly influenced via Petrobras.	Likely, but indirectly.	Diesel price also indirectly influenced.
Chile	Fuel price stabilization mechanism.	Little to no subsidy. Chilean 2011-2013 protests coincide with post-phase-out period in Mexico and Bolivia.	
Colombia	Fuel price stabilization mechanism.	Little to no subsidy.	—
Costa Rica	Automatic price mechanism	No subsidy.	—
Dominican Republic	Government administered price (weekly).	Large subsidy	LPG: 2005-Q1 (large users), LPG: 2008-Q3 targeted cash transfers ended universal LPG subsidies. Electricity subsidy removal in 2009.
Ecuador	Government administered prices	Large subsidy.	Diesel and LPG prices also fixed by government. A new subsidy for electricity consumers was established in 2012 Q6.
El Salvador	Market-based prices	No subsidy.	Taxes on fuels, removed for 6 months period in 2011. Targeted subsidies of LPG.
Guatemala	Market-based prices	No subsidy.	—
Honduras	Regulated prices (weekly updates)	No subsidy.	—
Mexico	Government administered price.	Large subsidy.	Diesel prices also regulated by government
Nicaragua	Market-based prices	No subsidy.	—
Panama	Market-based prices	No subsidy.	—
Paraguay	Price controls eliminated in early 2000s.	No subsidy.	Small subsidy for the agricultural sector.
Peru	Market-based prices, stabilization fund via price band.	Little to no subsidy.	Diesel subsidy likely changed in 2008-Q1 (gradual) authorities adjusted price bands to market prices, with most of the change from August 2013.
Uruguay	Regulated prices aligned with international trends	—	—

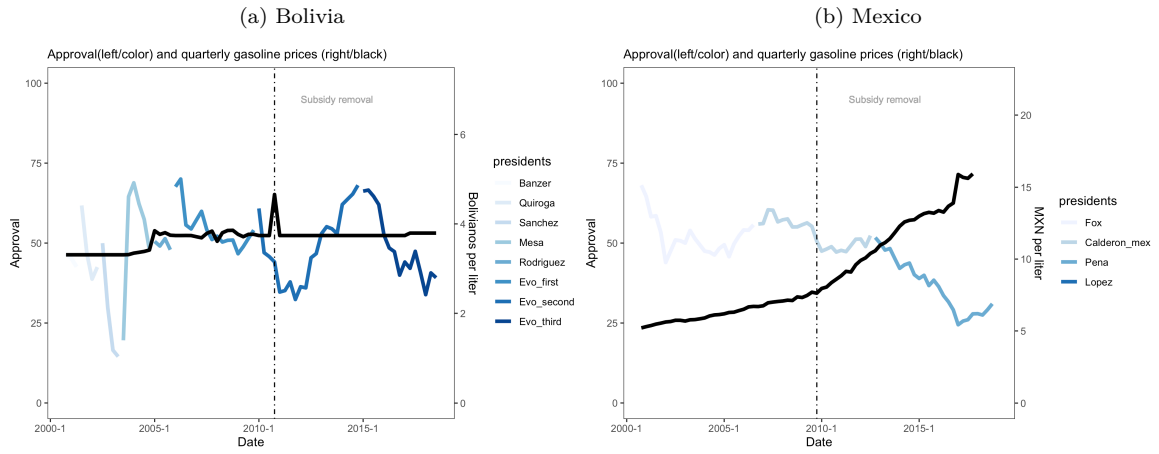
Sources: Di Bella et al. (2015), World Bank (2009), and Vagliasindi (2013)

[a] Estimates of subsidies differ across multiple sources. This table focuses in the period around 2010; it is not intended to be a characterization of recent developments. In other words, the characterization here follows Di Bella et al. (2015), which is temporally close to the treatment period for Bolivia and Mexico. The term *indirect* refers to a situation where there is moral suasion or where the government sits at a Board of an oil company. According to estimates by Di Bella et al. (2015), average fuel subsidies in Colombia in 2011-13 reached only 0.2% of GDP.

3 The political costs of subsidy removal: Empirical evidence at the macro-level

How unpopular and politically costly is it to remove fuel subsidies? Prominent removal events in Latin America motivate this question. In 2019, Ecuador was paralyzed by mass protests demanding a halt to the subsidy removal; President Lenin Moreno's popularity plummeted reaching an all-time low. By the end of 2010, President Evo Morales' approval ratings in Bolivia dropped after the announcement to increase fuel prices sharply (see Figure 3). Similar experiences in Europe, such as Macron's popularity drop after the yellow vest crisis (Douenne and Fabre, 2022), suggest that the phenomenon extends to regions outside Latin America. In contrast, after an initial drop in approval ratings, Mexico's price shifts since the end of 2009 were seemingly unchallenged by the public (see Figure 3).

Figure 3: Subsidy removal and presidential approval



Quarterly price averages and quarterly approval ratings are shown. In Bolivia, the government sets fuel prices via an ad-hoc pricing mechanism. This has meant practically fixed prices for several years at the time. In December 2010, the Vice President announced a reform via a Decree (748) to raise the low-octane gasoline price from 3.74 up to to 6.47 Bolivianos/liter and the high-octane gasoline from 4.79 to 7.41 Bolivianos. Diesel saw a concomitant price increase from 3.72 to 6.80, which is not studied in this paper. The prices presented here are obtained from OLADE (in US-$/bbl). Exchange rate conversions make prices appear more volatile than actual. The government set prices in Mexico via an ad-hoc pricing and taxing mechanism until 2017. From 2000 until 2010, prices in Mexico were raised only to match inflation. In Dec. 2009, the government started with gradual and constant monthly prices hikes of less than US-$0.1/month.

This section explores whether there is a political cost of removal focusing on two subsidy removal efforts: Mexico in 2009 and Bolivia in 2010. Announced in December 2009, Mexico's FFS removal consisted of gradual monthly prices hikes of less than US$0.1 per month. It took the country until 2014 to achieve the full removal of the subsidy. As shown in Figure 1, the strategy first curbed the subsidy growth before curbing the size of the subsidy and eventually removing it. In other words, during the first years of implementation, the subsidy rose, as international prices rose faster than

domestic price hikes. Yet, through the continued pace of the subsidy decrease the domestic price eventually reached and surpassed the international price.

In stark contrast, Bolivia's subsidy reform announcement in December 2010 consisted of a presidential decree mandating a one-off fuel price change in the order of 60-80 percent. For instance, the low-octane gasoline grade was set to increase from 3.7 to 6.5 Bolivianos per liter. The decision was highly unpopular and triggered mass protests, violent demonstrations and union strikes. Subsequent president announcements of compensatory measures included increases in state employees' wages and were arguably aimed at taming the adverse popular reaction (Sdralevich et al., 2014). The strong public reaction led the authorities to reverse the decision after a few days. The measure led to food and transport price increases and, according to the IMF (2011c), to the de-anchoring of inflation expectations, playing a role, alongside higher food commodity prices, in a sharp increase of inflation rates to 7.2 percent in December 2010 and 11 percent in March 2011. Consequently, the episode has been referred to as the "most critical juncture" that the president had experienced while in power (El Pais, 2011). While the FFS removal episode was of short duration, its effect on popularity could have been longer than the episode itself. The next section describes our empirical strategy, including how our empirical approach allows us to obtain insights on the duration of the effect.

The two subsidy reform announcements occurred against the backdrop of sound macroeconomic management in Mexico and Bolivia (IMF, 2011a,b). Both countries' IMF surveillance reports highlighted strong fundamentals and prudent economic policies. In Bolivia, no concurrent fiscal consolidation measures were identified during the fuel subsidy removal attempt (IMF, 2011a). In Mexico, within the context of solid economic policies, the macroeconomic management in 2009 and 2010 was notably different. The year 2009 saw significant fiscal stimulus, while 2010 experienced a reduced fiscal impulse (IMF, 2010, 2011b). Fiscal stimuli and consolidations are correlated with economic output which we control for in our analysis. In Bolivia, the removal of fuel subsidies was a prominent policy in the IMF's key surveillance report for 2011, primarily because it led to a de-anchoring of inflation expectations (IMF, 2011a). Additionally, a pension reform took place earlier, in December 2010, which advanced the retirement age and was largely popular. This concurrent measure could introduce a positive bias in our statistical test, making it more challenging to detect a negative effect of subsidy removal on approval ratings in Bolivia's case.

3.1 Empirical strategy

We estimate the effect of rising gasoline prices, as a consequence of subsidy removal on presidential approval ratings in two prominent cases: Mexico and Bolivia. First, we build a country-quarter panel with policy treatment defined as the announcement of the subsidy removal in Mexico and Bolivia. Then, to study the impact of subsidy removal, we employ the Difference-in-Differences (DiD) framework with multiple treatment periods proposed by Callaway and Sant'Anna (2021), hereafter referred to as *Staggered DiD.*[12] The Staggered DiD method allows us to avoid potential

[12] Also referred to as difference-in-differences with multiple time periods.

bias problems with the two-way fixed effects (TWFE) specification of event studies in a panel setting (Sun and Abraham, 2021).

Staggered DiD is a method allowing to elicit the Average Treatment Effect on the Treated (ATT) in empirical applications that differ from the canonical DiD setup, including in situations where there are multiple (more than two) time periods and variation in treatment timing. In other words, when units are treated at different points in time, this methodology allows us to recover the ATT from Equation 1 without imposing too many restrictions on the data.

$$ATT(g,t) = E[Y_t(g) - Y_t(0)|G_t = 1], \text{ for } t >= g \tag{1}$$

where $ATT(g,t)$ is the causal parameter of interest for a particular group g at time t under a potential outcomes framework. The treatment effect might vary over time. G_t is a binary variable that equals one if a unit is first treated in time t, $Y_t(g)$ is the observed outcome of the treated in time t, $Y_t(0)$ the potential outcome of the treated in time t. In our case, we include two treatment groups[13] for each country, either Mexico or Bolivia.

We formulate our empirical model using an event study framework[14] as suggested by Callaway and Sant'Anna (2021) as shown in Equation 3:

$$approval_{ct} = \Sigma_{l=-L}^{-2}\gamma_l D_{ct}^l + \Sigma_{l=0}^{L}\gamma_l D_{ct}^l + X_{c,t\in[-L,-2]}\alpha + \varepsilon_{ct} \tag{3}$$

where $approval_{ct}$ represents presidential approval ratings, c represents the cohorts of countries that announced the FFS phase out in quarter t, D_{ct}^l is the event study dummy taking value of 1 on the l_{th} period from the event at period 0. γ_l is the effect of the treatment in period l relative to the base period, which in this setting is the year before the start of the treatment. X_{it} is a vector of covariates following presidential approval models, namely socioeconomic conditions (Berlemann and Enkelmann, 2014; Fox and Phillips, 2003), level of corruption and bureaucratic quality (Jung and Oh, 2020; Gómez Vilchis, 2010), internal conflict (Arce, 2003), and the state of law and order (Romero, 2012; Romero et al., 2016). In addition, we include two dummy variables of term length and term length squared to capture the U-shaped cyclical pattern typically found in approval trends (Stimson, 1976; Cabezas and Navia, 2019; Berlemann and Enkelmann, 2014; Berlemann et al., 2015). Stimson (1976) notes that "all presidents begin their terms with great popularity, experience parabolic declines, steadily lose popular support for about three years, and then recover some at

[13] Also called cohorts.

[14] The general DiD approach that we follow is shown in Equation 2.

$$\begin{aligned} \text{approval}_{i,t} &= \alpha_0 + \beta_1 \text{treat}_{i,t} + \beta_2 \text{post}_{i,t} \\ &+ \beta_3 \text{treat} \times \text{post}_{i,t} \\ &+ \mathbf{X}_{i,t}\boldsymbol{\gamma} + \beta_4 \text{length} + \beta_5 \text{length}^2 \\ &+ \epsilon_{i,t} \end{aligned} \tag{2}$$

the ends of their terms." The linear and quadratic terms of term duration in our regression allow us to recover this general U-shaped form of approval.ε_{ct} is the error term that captures uncorrelated noise.

We assume staggered treatment adoption whereby Mexico and Bolivia are each treated successively when the removal policy is announced. Several countries in Latin America have experienced periods of fuel subsidies and some have attempted their removal (see Section 2). With Mexico and Bolivia, we focus on the only two subsidy removal episodes that have the following characteristics: 1) gasoline is subsidized, 2) the subsidy (and consequently its removal) was large and evident to the public, 3) the government's regulation of the price is direct and salient to the public. In presidential democracies such as in Latin America, the government regulation of the gasoline price clearly links a government decision to presidential approval. In other words, indirect price regulation (such as in Brazil and Peru) are unlikely to be observed by the public and, thus, unlikely to have an unambiguous effect on the president's approval.

Bolivia, Ecuador, and Mexico show the three characteristics that we require for employing the staggered DiD approach. However, Ecuador's subsidy was removed only in 2019, one year beyond the availability of presidential approval data. The Dominican Republic also had a salient subsidy which would motivate considering it as treated country. Indeed, the Dominican Republic's LPG subsidy removal was relatively salient. However, this LPG subsidy removal coincided with the Great Recession which will likely bias coefficient estimates. We deem it too difficult to disentangle the treatment effect of each. Therefore, we chose to exclude the Dominican Republic both as a control and as a treated country. Hence, we consider the staggered subsidy removal in Mexico and Bolivia.

Approval is important both for incumbent and challengers, as it affects the political capital, correlates with the intention to vote, and affects the negotiation margin of the president with other political actors (Romero, 2012). Looking at presidential approval data, instead of reelection data, allows us to find a more direct and timely link between the environmental policy, in our case the subsidy removal, and the popularity costs faced by the politician. In sum, it is a proxy for political power and provides information on the events and conditions that could tip the balance of power one way or another. In our main results section, we use the log of approval ratings.

Gasoline is a fuel used by households and firms across the entire economy in Latin America. Unlike in several European countries, gasoline is the most used fuel in transportation in Latin America. Gasoline price changes potentially impact the population not only through its direct use, but also indirectly via public transportation and costs of transported goods, among others. In Mexico and Bolivia, the subsidy was large and salient. Due to the potentially large impact of subsidy removal, the public considers subsidies as relevant in their approval of the president's work.

Callaway and Sant'Anna (2021) require three identification assumptions: 1) Treatment turns on and stays on, 2) there is no treatment anticipation, and 3) the generalized propensity score is bounded away from one. In our setting, the first assumption is plausible when we focus on the presidential term where the subsidy removal occurred and adjacent presidential terms of the same president, i.e. same person is evaluated. In other words, presidents are evaluated based on policy decisions

during their own presidential term. While this may seem obvious, it has important implications for our design, requiring us to restrict the observation period from the second quarter of 2007 until the third quarter of 2012, even though data is available for a longer time period. The starting point is approximately six months after the start of the presidential term of Mexico's President Felipe Calderon who started the subsidy removal. Our observation period ends in the third quarter of 2012 when Calderon's presidential term ended. This date is considered far enough from both treatment dates in Mexico and Bolivia. This same period includes the first and second presidential terms of Bolivian President Evo Morales, with the subsidy removal announcement and potential effects on approval occurring during its second term (2009-2014).

The second assumption of non-treatment anticipation is plausible in our setting. Non-treatment anticipation refers to the lack of prior knowledge, expectation, or awareness of the subsidy removal. In Mexico, this is highly plausible as previous communicated intentions to remove the subsidy in the period 2008-09, where not followed through. Thus, anticipation of future reform efforts is unlikely. In Bolivia, the assumption is highly plausible, too, as this decision took all economic actors by surprise (WEF, 2013). Finally, the third assumption is made to allow regular inference.

An important feature of Callaway and Sant'Anna (2021) is the dynamic definition of the treated and control units. With the staggered roll-out of the treatment we can include all those countries in the control group that are *not yet* treated. For instance, when estimating the average treatment effect of the treated for Mexico, the control units are countries that have not yet removed subsidies. This may include countries without subsidies and countries that have never implemented a subsidy removal. The countries in this group include Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Peru, United States and Uruguay.[15] Callaway and Sant'Anna (2021) allow a menu of two parallel trends assumption (PTA) options, one PTA relying on "never treated" units and one PTA relying on "not-yet treated" units. The estimator that we obtain relies on the conditional PTA based on "not-yet treated" units, which states that, conditional on covariates, the average outcome for the treated unit in a specific period and for the "not-yet treated" group would have followed parallel paths in the absence of treatment. This assumption implies that only countries that had yet to remove gasoline subsidies (or haven't experienced subsidies yet) serve in the control group.

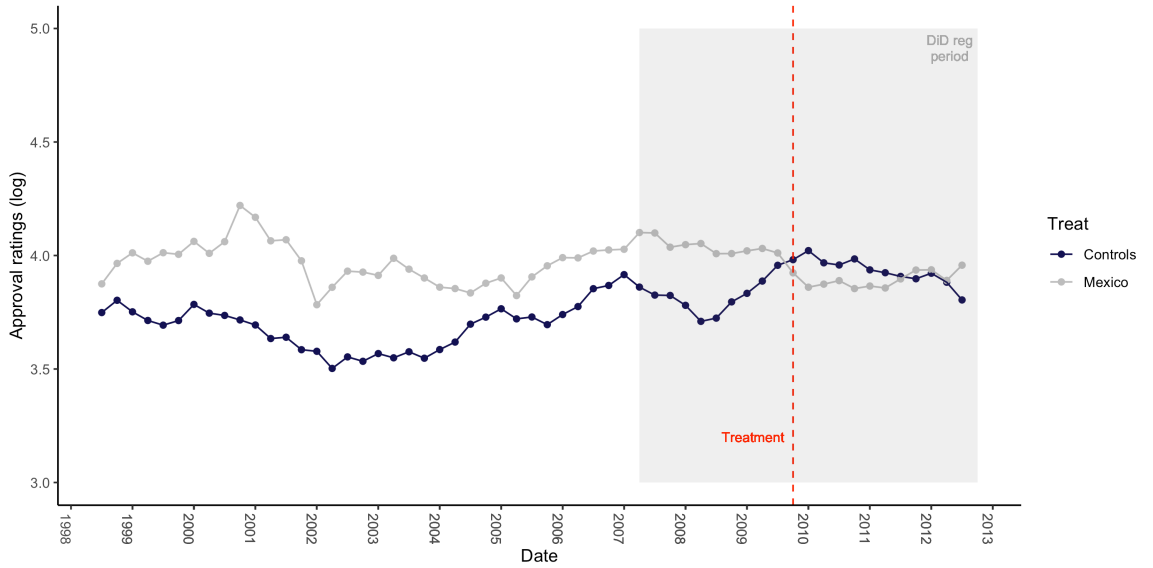
The parallel trends assumption is plausible for Bolivia, with less clarity for Mexico. Figure 4 compares the log of presidential approval ratings in Mexico and the average of the control countries. The two lines approximately follow a parallel trend prior to treatment in the shaded gray area, which represents the study period. We display long time series beyond the gray area to show the plausibility of parallel trends beyond the period of study. Interestingly, after the treatment date in Mexico (Q4 2009), the two lines are no longer parallel. In Appendix 6.2, we show that the raw presidential approval ratings and their rolling means are also consistent with the parallel trends assumption in Mexico and Bolivia.[16] Although the rolling mean transformation of our outcome variable provides

[15]Note that the United States are included as they might be an important control for Mexico given the economic closeness and integration of the two economies.

[16]The rolling mean removes variations that appear as coarseness in the time series. These variations or shocks are often linked to short-lived events (e.g. news about the president's health).

strong evidence of parallel trends, we note that the rolling mean has drawbacks. In particular, (i) it mixes data from different periods that may not be consistent with the underlying data generating process, and (ii) it undermines DiD including the assumption on error terms, and (iii) it contradicts the non-anticipation assumption. Consequently, we do not use this transformation in our main specification. In Figure 6, we show the adjusted trends after controlling for all covariates and we find strong plausibility of parallel trends for Bolivia, while we find evidence of trends for Mexico in the macro-level data context. We note that parallel trends examinations only represent indicative evidence as they rely on the pre-treatment period and not on the potential outcomes after treatment.

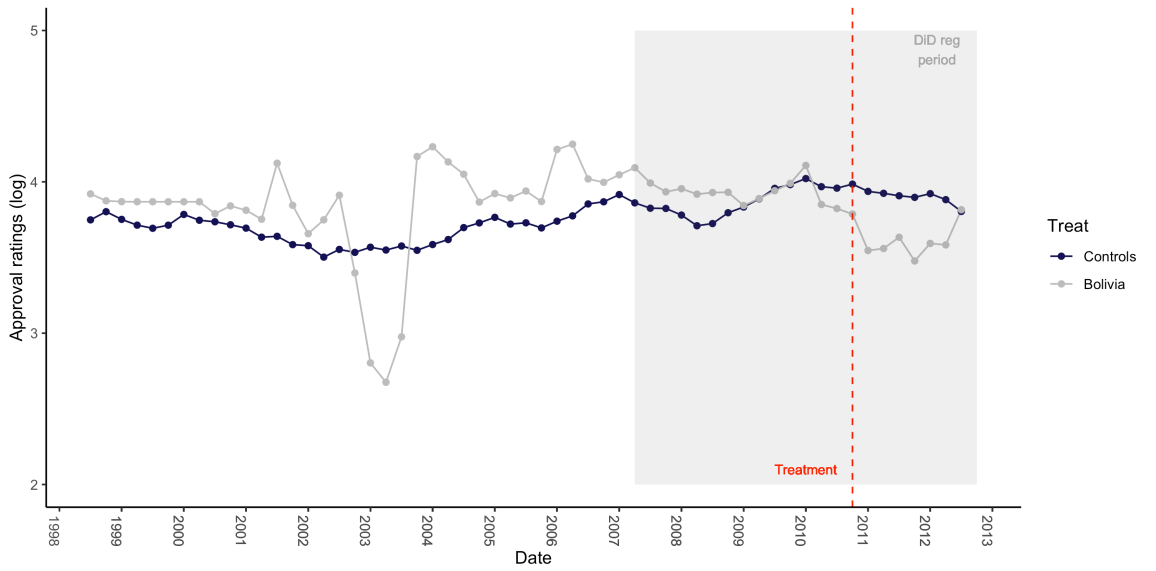
Figure 4: Presidential approval: Parallel trends Mexico and control group (log approval)



Note: Controls represent the average approval ratings for the control countries except Bolivia. The gray shaded area represents the period of study. The vertical dotted line represents treatment announcement.

The trends of approval ratings in Bolivia and in the group of controls are approximately parallel from 2007 until late 2009 (Figure 5). The 2003-2004 slump in Bolivia is explained by the "Guerra del Gas", a social conflict originating from the public disapproval of President Sánchez de Lozada's decision to export Tarija's natural gas reserves before supplying the domestic natural gas demand. President Sanchez de Lozada resigned and President Mesa's term started in the third quarter of 2003. Similarly, the spike in approval ratings in 2010 coincides with the start of Evo Morales' second term. The sharp increase in approval can be explained by his *honeymoon* period, a spell of high popularity enjoyed by a new president in office. Hence, we consider the parallel trends assumption for Bolivia and its control group plausible.

Figure 5: Presidential approval: Parallel trends Bolivia and control group (log approval)



Note: Controls represent the average approval ratings for the control countries except Mexico. The gray shaded area represents the period of study.The vertical dotted line represents treatment announcement.

3.2 Data

We construct a unique, balanced quarterly panel data set for 16 Latin American countries[17] and the United States by collecting data from multiple sources. The dataset covers the period Q3 1998 to Q3 2018, but we restrict the observation period from the second quarter of 2007 to the third quarter of 2012 to fit the presidential terms as explained in Section 3.1.

We use presidential approval rating data from the Executive Approval Project (EAP), which provides quarterly data from 1980 to 2018 for more than 50 countries based on data from several hundred of public opinion polls (EAP, 2023). Approval ratings indicate which percentage of the population approves the job of the president. This number is calculated from survey data in which a representative sample of voting-age citizens are regularly asked: "Do you approve or disapprove of the way [President's name] is handling his job as a president?". The EAD employs an algorithm to combine different surveys' results into three different quarterly approval series by country: 1) approval, which denotes the percentage of positive responses, 2) net approval, which refers to the percentage of positive minus the percentage of negative responses, and 3) relative approval, which refers to the percentage of positive divided by the total number of (positive and negative) responses. We use the approval series, which provides the percentage (ranging from 0-100%) of positive ratings that citizens provide about the president at the national level, noting that the three measures are highly correlated.

[17] Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay.

Socio-economic and governance country variables are obtained from the International Country Risk Guide (ICRG) rating of the PRS Group, which provides monthly political, financial, and economic country level indicators from 1984 to 2023.[18] The ICRG publishes risk indicators based on quantitative indicators. The higher the index rating, the lower the risk. Employing this dataset allows us to control for variables that are otherwise hardly available at the quarterly level, including corruption, internal conflict, law and order and bureaucracy quality. To form the *Corruption* index, the PRS group uses data on corruption within the political system, including excessive patronage, nepotism, job reservation, secret party funding, and suspiciously close ties between politics and business. *Law and order* is composed of two parts: the *Law* element assesses the impartiality and strength of the legal system, while the *Order* element assesses the observance of the law and indicates whether the law is routinely ignored without effective sanction. *Bureaucracy Quality* measures the strength of institutions and quality of bureaucracy to govern autonomous from political pressure. Finally, the *Socioeconomic conditions* index from ICRG is a variable summarizes the most important economic determinants of approval, namely: unemployment, consumer confidence and poverty. Finally, we construct a variable of the length of the presidential term using country records.

Treatment dummies take the value of one following the announcement of the FFS phase-out in Mexico and Bolivia and zero otherwise. In other words, treatment is assumed to start in the quarter when the subsidy removal policy is announced. In Mexico, the policy of gradual price hikes (Política de desliz gradual del precio de las gasolinas) was announced by the Ministry of Finance in December 2009 (El Economista, 2009), so we assume treatment to start in Q4 2009. In Boliva, in December 2010, the government decided to stop the policy that had controlled and frozen prices over 6 years (BBC News Mundo, 2010), so we assume treatment starts in Q4 2010 for Bolivia.

Table 2 shows descriptive statistics of our pooled data before their log transformation. The mean approval in the sample is 51%, meaning that, on average, 51% of the citizens approved the work of the president in 2007-2012. The minimum approval rate reported in any quarter and country is 13%, while the max approval rate reported reaches 84%. The values of presidential approval outcomes and predictors of both treated countries, Mexico and Bolivia, lie within the convex hull spanned by the control countries' values. More concretely, Bolivia's mean approval during this period is 47%, while Mexico's is 53%, both within the range determined by the control country group (13-84%) and close to the mean of 51%. However, the presidential term duration is longer in Mexico than in the control countries. We, therefore, control for presidential term duration in our specification. Table 3 shows that the Bolivian President's mean approval decreased considerably in the post-treatment period while it hardly changed in the control group. A similar observation can be made for Mexico with the peculiarity that the approval in the control group for Mexico slightly increase.

[18] See a short description of this commercial dataset by the Political Risk Services (PRS) Group on their website: `https://www.prsgroup.com/explore-our-products/icrg/`

Table 3: Means comparison: Presidential approval

Countries	Presidential approval (pre-treatment)	Presidential approval (post-treatment)
Bolivia	51.22	36.83
Controls (Bolivia)	51.10	51.27
Mexico	56.37	49.06
Controls (Mexico)	49.09	53.21

The treatment date for Bolivia and Mexico differs. Accordingly, the mean of the controls is different as it is calculated across different periods.

3.3 Results

This section explores the impact of fuel subsidy removal in Mexico and Bolivia, specifically addressing the questions whether it carries political implications. We present the results of a staggered DiD estimation as proposed by Callaway and Sant'Anna (2021) where the response variable is the log of the presidential approval ratings and the treatment is determined by the announcement date of a subsidy phase-out. The results of our main specification are shown in Figure 6 where point estimates (i.e., coefficients) and confidence intervals are plotted before and after treatment for each of the two countries, Mexico and Bolivia.

We find evidence of a political cost linked to the announcement of FFS removal: approval ratings exhibit a decline for a period of up to five quarters following the announcement. We observe a more pronounced effect (higher point estimates in absolute value) in Bolivia than in Mexico. We find point estimates of up to -0.27 for Bolivia and -0.19 for Mexico across different quarters. The negative effect persists for up to five quarters following the announcement in Bolivia, while the effect lasts only for a couple of quarters in Mexico. For Mexico, we find an average ATT of -0.15 over two quarters. For Bolivia, we find an average ATT of -0.19 over five quarters. Overall, the effect of subsidy removal on disapproval appears stronger and more long-lasting in Bolivia than in Mexico.

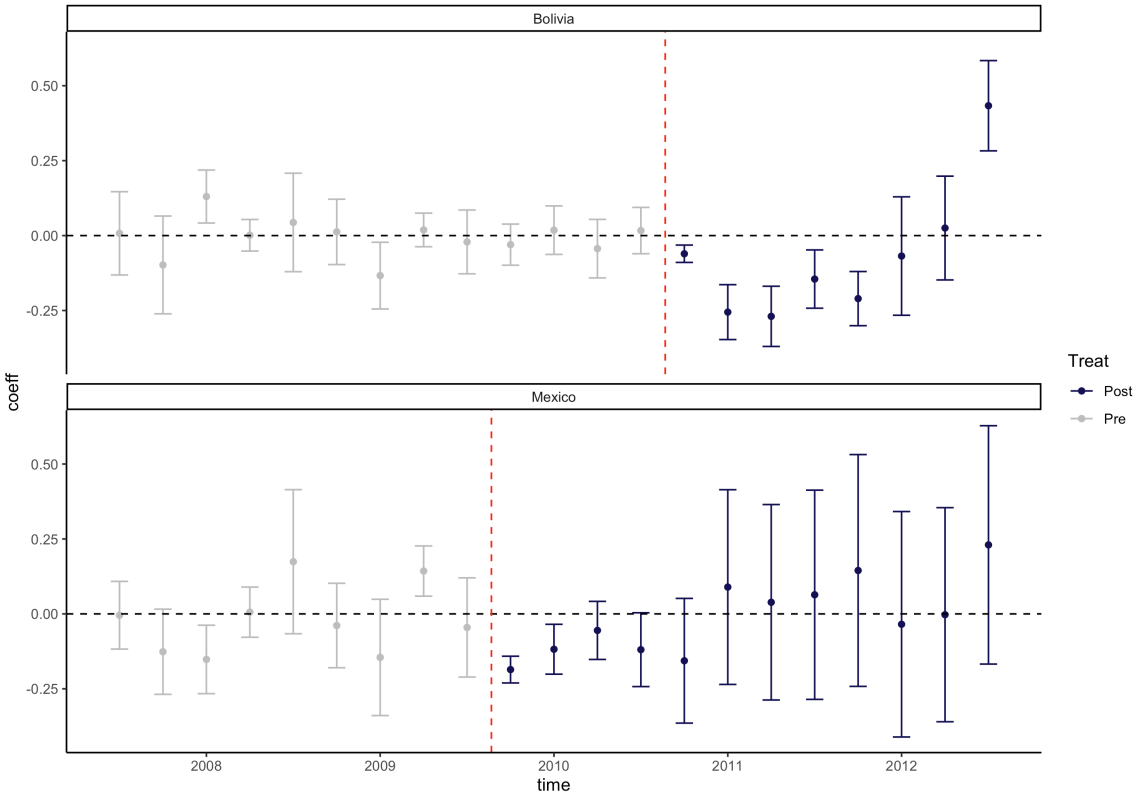
Bolivia shows a positive coefficient in the last quarter of the post-treatment period (2012 Q3) that is likely explained by a prominent political event orthogonal to treatment, namely the widespread popularity of the marriage of the vice president.[19] According to IPSOS (2020), this event led to a spike in presidential approval in Bolivia.

Coefficients are less precisely estimated for Mexico than for Bolivia, as evidenced by the presence of larger standard errors, particularly in the post-treatment period. In the staggered DiD setting, confidence intervals that cover the zero line in the pre-treatment period are a reassurance of the plausibility of the parallel trends assumption. We can confirm the plausibility of the parallel trends for Bolivia.[20] However, the same cannot be argued with full confidence for Mexico because of the visible difference in pre-treatment trends between Mexico and its control group, e.g., with a

[19]This marriage garnered significant attention from the media due to its incorporation of indigenous rituals and the participation of Nobel Prize laureates (La Republica, 2012).

[20]We note two borderline cases in 2008 Q1 and 2009 Q2, that are sufficiently far away from treatment.

Figure 6: Time-event plot: Effect of subsidy removal on presidential approval (variables in logs)



Note:The Y-axis shows the the DiD estimated effect of removal on presidential approval ratings for each country and period. The X-axis represents time, or in our case, quarters of a year. For each quarter, the DiD estimate is depicted as dot; values below the zero line denote a negative effect of subsidy removal on presidential approval. Bars denote 95% confidence intervals; bars touching the zero y-axis denote insignificant effects. Treatment in Bolivia and Mexico are indicated by the vertical red dotted line in Q4 2010 and Q4 2009, respectively. Zero effects in the pre-treatment period are another indicative evidence of the parallel trends assumption.

significant approval increase in Mexico during the second quarter of 2009 (Figure 4). Hence, the impact of the removal on approval ratings in Mexico is less evident in this macro-level setting.

We attribute the absence of a discernible effect to statistical limitations because our dataset comprises macro-level data - i.e., national average of citizen's approval ratings - which inherently involve a relatively modest sample size. We do not attribute the absence of effect in Mexico to the gradual nature of the reform in the country, as we do observe some sizable negative point estimates following the policy announcement.

In sum, the negative effect (point estimates) of subsidy removal on approval appears stronger and more long-lasting in Bolivia than in Mexico. However, we are only able identify causal effects for Bolivia, due to the lack of evidence of parallel trends for Mexico. On average, Bolivia experiences a 19% decrease in presidential approval compared to the control group, all else equal. In Section 4, we present a more extensive analysis for Mexico using micro survey data, which confirms a statistically significant effect. The survey data increases our sample size allowing us to test the effect on approval

with larger statistical power. Combined, the two sections point to a negative effect of subsidy removal on presidential approval in both countries.

To underscore the robustness of our findings, we conduct a series of placebo tests. This involves simulating treatment in non-treated countries to evaluate the potential for false positives (see Annex 6.2). For most countries, except the United States, the absence of parallel trends is notable. For the United States, the assumption of parallel trends could be reasonable; yet, we find no statistical evidence of a treatment effect. The placebo test results support the robustness of our findings, as we detect no statistical evidence of treatment effects.

The results remain robust across different model specifications, as illustrated in Figure 10 in Appendix 6.3. Specifically, results in our main specification, as presented above, align with those using a raw approval model, where all variables are incorporated in their original, untransformed values (i.e., without applying logarithms). We find a small to negligible effect in Mexico where coefficients are estimated with some uncertainty. For Bolivia, we find a substantial negative and statistically significant effect. Here again, parallel trends are plausible for Bolivia, but not for Mexico. In a third model specification, we transform all variables by calculating their rolling means with a parameter of k=3. Our results are also robust to this model specification. Rolling means mitigate the impact of short-term approval fluctuations that we cannot capture in our main specification due to data limitations. As shown in Figure 11 in the Appendix, the assumption of parallel trends appears to be reasonable in this specification, with other results being consistent with our main specification.

The results are also robust to the use of alternative methods. While the staggered DiD as presented above is our preferred specification, it is designed to control for time-invariant unobservables. In other words, it assumes that there is no time-variant country-specific unobservables. Alternatively, we use the Synthetic Control (SC) method which accounts for time-varying effects on unobservables. Our macro setting and the nature of a "large" reform affecting all the economy makes it a good candidate for using the SCM, as proposed by Abadie and Gardeazabal (2003, 2010) and Abadie et al. (2015). The SC reconstructs the outcome of a counterfactual using a combination of countries with similar outcome trajectories that did not select into treatment, hence replicating the unobserved heterogeneity and allowing the method to be employed when time-varying unobservables are present. In this setting, the effect of subsidy removal on presidential approval is given by outcome differences between the treated country after the removal and its "synthetic" counterfactual without the subsidy removal. Here, too, the parameter of interest is the ATT. The results of the SCM are consistent but of larger magnitude than our main results (see Appendix 6). We find that subsidy removal leads to 7-21% lower approval ratings. The ATT are 7% and 21% for Mexico and Bolivia, respectively (Figure 12 in the Appendix). In other words, we find that Bolivia's phase-out leads to, on average, 21% lower approval ratings, while Mexico's phase-out leads to 7% lower approval ratings. We test the statistical significance of the SCM results by using placebo tests (Figure 13 in the Appendix). Overall, the staggered DiD results are our preferred estimation as they are more conservative estimates. However, the direction of the result is generally consistent across specifications and methods.

Table 2: Descriptive statistics

Country	Variable*	Mean	Variance	Min	Max
Bolivia	Presidential approval	46.64	66.82	32.36	60.84
	Term duration	8.50	17.02	1.00	16.00
	Corruption	1.96	0.02	1.50	2.00
	Socioeconomic conditions	4.50	0.00	4.50	4.50
	Internal conflict	9.10	0.78	6.50	9.50
	Law and Order	2.74	0.06	2.50	3.00
	Bureaucracy Quality	2.00	0.00	2.00	2.00
Mexico	Presidential approval	52.72	18.97	47.19	60.41
	Term duration	13.50	42.17	3.00	24.00
	Corruption	2.20	0.06	2.00	2.50
	Socioeconomic conditions	7.42	0.63	6.50	8.50
	Internal conflict	8.78	0.23	8.50	10.00
	Law and Order	2.27	0.28	1.50	3.17
	Bureaucracy Quality	3.00	0.00	3.00	3.00
Controls	Presidential approval	51.15	231.86	13.23	84.06
	Term duration	8.87	26.33	1.00	20.00
	Corruption	2.60	0.69	1.00	4.50
	Socioeconomic conditions	5.21	3.00	2.00	9.00
	Internal conflict	9.21	1.69	5.50	11.00
	Law and Order	2.74	1.19	1.00	5.00
	Bureaucracy Quality	2.13	0.52	1.00	4.00

**Presidential approval* is expressed in percentages, *Term duration* is shown in quarters, all other variables in index values.

4 Subsidies, voters and trust

4.1 A simple probabilistic voting model of redistributive fossil fuel subsidies

In the previous section, we show that there are political costs from phasing out FFS. However, this might seem counter-intuitive if these subsidies are regressive, and their removal potentially benefits large poorer parts of the electorate. There are, of course, many more factors influencing presidential approval by voters than FFS. In the following, we provide a simple model à la Lindbeck and Weibull (1987) that shows how the distribution of party preferences and trust in the government in the electorate can stabilize a political equilibrium with positive regressive FFS. In turn, this implies that a deviation from this equilibrium leads to a decrease in average approval even if some of the poorest do not benefit from FFS directly because they often do not own vehicles. With the following model, we provide intuition why removing FFS is difficult even in low- and medium-income countries. In Section 4.2, we test the predicted channels empirically.

4.1.1 Voter utility and preferred subsidy levels

We assume that the electorate consists of voters who differ in their income. There are $j \in J$ income groups. The whole electorate has size N with n^j voters in each income group. We denote the population share of group j with $\sigma^j = \frac{n^j}{N}$ and individual income with y^i. The overall income distribution is characterized by the cumulative distribution function $F(\cdot)$ with the average (expected value) $\mathbf{E}(y^i) = y$. We assume that all individual income group members of group j receive the same income $y^{ij} = y^j \ \forall j \in J$ and $F(\cdot)$ is thus a step function. Each voter i derives quasi-linear utility

$$W^i = c^i + \mu^j H(g) \tag{4}$$

where c^i is private consumption, g is a per-capita provided public good (this is the aggregate of all public goods and services other than FFS), and μ^j is an income-group specific weight of utility $H(g)$ from the public goods with $H'(g) > 0$ and $H''(g) < 0$.[21] In the following, we interpret the weight μ^j as a measure of trust in the government, i.e. as a measure of how convinced people are that they benefit from public goods and services provided by the government. A low μ^j indicates high mistrust in the government, as members of the income group do not perceive the public goods as accessible. According to Alleyne et al. (2013), even where the public recognizes the magnitude and shortcomings of energy subsidies, it often has little confidence that the government will use savings from subsidy reform wisely.[22]

[21] With these assumptions, we closely follow the model of public finance used by Persson and Tabellini (2002) who, however, assume that $\mu^j = 1 \ \forall j \in J$, i.e. they do not include this parameter.

[22] Following Strand (2013), two alternative interpretations of a low μ^j are possible. First, a low μ^j can reflect a low probability (or low perceived likelihood) of public good delivery, for example because of corruption, low quality, low institutional capacity, or a large distance of the income member of group j to the nearest populated area where

The government taxes income with an exogenously given tax rate τ. The government decides about the share α of its budget that is redistributed to voters via the fossil fuel subsidy. The rest, $(1-\alpha)$, is used to provide the aggregate of other public goods and services g. The government budget is thus given by

$$g + s = y\tau$$

so that $g = (1-\alpha)y\tau$ and $s = \alpha y\tau$. Here, s is the average amount of money that a voter receives via FFS. We assume that the amount of FFS that a voter receives is determined by its fuel consumption behavior and differs between income groups but is assumed to be the same for all voters of one income group. We thus have s^j. This amount is assumed to be exogenous as we abstract from elastic fuel demand. In this model, we implicitly assume a balanced budget, and thus we abstract from fiscal imbalances and public debt. We denote the share of the total FFS that an income group receives with $a^j = \frac{s^j n^j}{sN}$ and therefore $s^j = \frac{a^j sN}{n^j} = \frac{a^j}{\sigma^j} s$. We can now write the welfare of a household in income group j

$$W^j(\alpha) = (1-\tau)y^j + \frac{a^j}{\sigma^j}(\alpha y\tau) + \mu^j H\left((1-\alpha)y\tau\right). \tag{5}$$

The preferred FFS policy of a voter in group j, α^j, is given by

$$\alpha^j = 1 - \left(\frac{H'^{-1}\left(\frac{a^j}{\mu^j \sigma^j}\right)}{y\tau} \right). \tag{6}$$

We can see from (6) that the preferred FFS policy of a voter (α^j) increases with the share of FFS that her income group j receives relative to its population share ($\frac{a^j}{\sigma^j}$) as H'^{-1} decreases in $\frac{a^j}{\sigma^j}$. Inspection of (6) further shows that the higher the mistrust in the government is for a voter in group j, i.e. the lower μ^j, the higher her preferred FFS.

4.1.2 The political environment

We use a probabilistic voting model (Lindbeck and Weibull, 1987; Persson and Tabellini, 2002; Hodler et al., 2015) with two parties $P = A, B$, one of which represents the presidential party in power, and the other the most promising challenger. Each party proposes a policy platform consisting of a share α_P of the government budget, that it commits to spending on FFS if it is elected (in case of the party in power, this share is directly implemented through the choice of the subsidy level s) and a number of other party-specific positions that cannot credibly be adjusted. Voters differ in their preferences about these other positions ("ideologies") both within and between income groups. Additionally, the relative popularity of the two parties can be different due to factors that are external to the model. We assume that the overall relative popularity of party B in the electorate is measured by δ, which can be either positive or negative and is uniformly distributed on $[-\frac{1}{2\psi}, \frac{1}{2\psi}]$. In addition,

most public goods are provided (a common feature of rural households). Second, a low μ^j can reflect that members of income group j assign little value to public goods because of their own preferences or lack of use (e.g. public transport if they instead use a private car).

each individual has an "ideological" preference bias towards one of the parties. This is measured by the parameter ξ^{ij}, with $\xi^{ij} = 0$ for ideologically neutral voters, $\xi^{ij} < 0$ for voters that prefer party A and $\xi^{ij} > 0$ for voters that prefer party B. We assume that ξ^{ij} is drawn from a distribution $B^j(\cdot)$ that is specific for each income group, common knowledge, and has the unimodal probability density $b^j(\cdot)$. A voter i in group j prefers party A if

$$W^j(\alpha_A) > W^j(\alpha_B) + \xi^{ij} + \delta. \tag{7}$$

Parties are purely office motivated and set their party platforms to maximize their probability of winning the majority of votes. The sequential game has the following stages: (i) the parties announce (or implement) their policy platforms, *i.e.* their chosen FFS. (ii) The relative popularity of the two parties is realized. (iii) Elections take place and (iv) the elected party implements the announced platform. We solve for the subgame perfect Nash equilibrium by backward induction. We assume that parties can credibly commit to the announced FFS (in case of the party in power they are directly implemented) and do not change their ideological positions. Therefore, voters know which policy will be implemented by the elected party when the elections take place. To solve this stage, let us first identify for each income group the voter which is indifferent between the two parties.This voter is influenced by its ideological preferences and characterized by

$$\xi^j(\alpha_A, \alpha_B) = W^j(\alpha_A) - W^j(\alpha_B) - \delta. \tag{8}$$

All voters in this income group that have ideological preferences $\xi^{ij} \leq \xi^j$ are better off if party A is elected and, thus, vote for it. Party A's vote share for a given realization of δ is thus given by

$$\pi_A = \sum_{j \in J} \sigma^j B^J \left(\xi^j(\alpha_a, \alpha_B) \right), \tag{9}$$

its probability of winning by

$$p_A = \Pr\left[\pi_a \geq \frac{1}{2} \right] = \Pr\left[\sum_{j \in J} \sigma^j B^j \left(W^j(\alpha_A) - W^j(\alpha_B) - \delta \right) \geq \frac{1}{2} \right], \tag{10}$$

and the probability that party B wins the elections is $(1 - p_A)$. Maximizing the probability of winning, both parties announce the same FFS ($\frac{\partial p_a}{\partial \alpha_A} = -\frac{\partial p_a}{\partial \alpha_B}$ and $p_B = (1 - p_A)$). We can show that this resulting equilibrium fossil fuel subsidy is given by

$$\alpha_A^\circ = \alpha_B^\circ = 1 - \left(\frac{H'^{-1}\left(\frac{\sum_{j \in J} \sigma^j b^j(\xi^{j\circ}) \frac{a^j}{\mu^j \sigma^j}}{\sum_{j \in J} \sigma^j b^j(\xi^{j\circ})} \right)}{y\tau} \right) \tag{11}$$

with the circle indicating the equilibrium.

In all income groups, trust in the government (μ^j) leads to a lower preferred level of FFS. In turn, the

equilibrium subsidy level is high if trust in the government is low in the population. Our theoretical results imply three predictions for a downward deviation from the equilibrium subsidy, i.e. a FFS removal:

Result 1 *(i) Removing FFS results in a loss of political support. (ii) If FFS are regressive, and mistrust in the government is equal in all income groups, the overall loss in support is driven by a decline in support from high income groups, whereas low income groups increase support. (iii) Sufficiently low trust in the government by low income groups can lead to declining political support from these groups, too, in reaction to a subsidy removal.*

These effects of subsidy removal occur if the party in power reduces the level of FFS by deviation from the political equilibrium that was chosen to maximize their probability of winning. Low trust in the government increases the preferred level of FFS and can lead to reduced political support from low income groups in reaction to a subsidy removal even if FFS are regressive[23], if these groups have very low trust in the government. The loss in political support from a removal of equilibrium subsidies - or (i) above- is in line with our findings in Section 3 for the cases of Mexico and Bolivia. To empirically investigate the role of specific income groups we use survey data including information on ideological preferences and trust in the government in different income groups in the following.

4.2 Empirical evidence: Fuel expenditure, trust, and presidential approval across income groups

The theoretical results imply that a deviation from the equilibrium subsidy leads to a loss in presidential popularity with those income groups that accrue the largest share of the subsidy. In addition, higher mistrust in the president can be associated with a higher preference for fuel subsidies as these do not need to be transferred through the usual administrative channels (e.g. social programs and policies that may or may not reach the population). In this section, we use granular micro data to test empirically for heterogeneous effects by income groups. We explore the hypotheses that the negative effect of subsidy phase-out on presidential approval ratings

(ii) is driven by a decline in support by high income groups if FFS are regressive.

(iii) can be amplified by low trust in the president.[24]

4.2.1 Data and methodology

We use data from Mexico to test our model predictions. Data availability precludes us from testing our model predictions in Bolivia.[25] We employ a standard DiD regression with survey data to

[23] In this paper, we do not cover other general equilibrium effects that may influence how progressive or regressive fuel subsidy removal is.

[24] In Section 3.3, we focus on showing prediction (i) that removing FFS leads to a loss of political support. Therefore, we focus on (ii) and (iii) here.

[25] LAPOP surveys are bi-annual. Bolivia's removal announcement was in December 2010. However, the 2010 survey was carried out between February and March 2010. The next survey round in 2012 was considerably further away

explore heterogeneous effects by income group and obtain insights on predictions (ii) and (iii). We rely on survey data from the *Americas Barometer* of the Latin America Public Opinion Project (LAPOP),[26] as well as from the Mexican National Survey of Household Income and Expenditure (ENIGH, for its acronym in Spanish)[27] and subsidy data from Munoz-Pina et al. (2022). LAPOP provides bi-annual voting-age adults' public opinion survey data between 2004-2019 from more than 20 countries and with over 40,000 interviews per round. We use the three survey rounds between 2008-2012 for Mexico and Colombia because we focus on the time period around the FFS reform in Mexico in late 2009 and use Colombia as control.We focus on the survey questions on presidential approval, socio-economic characteristics, political attitudes, and democratic values. The ENIGH allows us to obtain fuel expenditures (absolute and relative to income) across income groups and obtain insights on (ii). By merging the ENIGH with fuel price and subsidy data from Munoz-Pina et al. (2022), we obtain fuel consumption and the subsidy received by each income group.

The LAPOP survey data allows us to explore heterogeneous effects by income group while controlling for crucial socioeconomic and political covariates. The availability of socioeconomic variables is a key factor for why we focus for a limited time period 2008-2012. For instance, the variable of the role of the government in improving safety is not available before 2008. Safety is, however, a crucial and salient topic and determinant of approval in Mexico. We choose Colombia as a control because we find plausible evidence for assuming parallel trends. Colombia and Mexico's raw presidential approval data show roughly parallel trends both for the pooled data and the income groups. The parallel trends plots confirm that Colombia is a control country that approximates the travelling path of the treatment country Mexico, *i.e.*, there are no time-variant country-specific unobservables. Figure 8 shows that excepting the first income quartile, all income groups show parallel trends in the raw approval ratings data. Note that although treatment starts in 2010, we draw the treatment line in 2008 as the survey data is obtained every second year, which means that 2008 is the last untreated data point.

To obtain the DiD estimate, we create an indicator variable *treat* equal to 1 for a citizen in the treatment country Mexico. We interact this variable with an indicator of the time *post* equaling 1 for survey waves after 2009. The OLS representation of this relationship is:

$$\begin{aligned} \text{approval}_{i,t} = \alpha_0 &+ \beta_1 \text{treat}_{i,t} + \beta_2 \text{post}_{i,t} \\ &+ \beta_3 \text{treat} \times \text{post}_{i,t} \\ &+ \mathbf{X}_{i,t}\boldsymbol{\gamma} + \epsilon_{i,t} \end{aligned} \tag{12}$$

where t indexes years and i indexes voters. The outcome variable, *approval*, is the log of presidential

from the treatment, so too late to be able to identify an effect. In Mexico, the opposite was true: the FFS removal was announced in late 2009 and then the 2010 survey took place shortly thereafter.

[26]The *Americas Barometer* is a series of public opinion surveys conducted by the Latin America Public Opinion Project, also referred to as LAPOP, a lab hosted at Vanderbilt University.

[27]ENIGH is a bi-annual survey on household income and expenditure (INEGI, 2022). It provides detailed data on the amount, source and distribution of income and expenditures. In addition, it provides information on the occupational and socio-demographic characteristics of the household member.

approval ratings. To avoid an omitted variable bias, we control for a large set of economic and political factors in $\boldsymbol{X_{it}}$ including the perceived economic situation of the country, the prevalence of corruption among public servants, the role of the government in improving safety (reducing crime), trust in the president, and the ideology of the citizen on the left-right political spectrum. All variables are in logs in our main specification and are taken from the LAPOP dataset.

High-income households in Mexico exhibit larger gasoline consumption and expenditures than low-income households (Figure 7). Both absolute and relative expenditures (as a share of income) show that same pattern.[28] Consequently, the third and fourth income quartiles accrue a larger share of the subsidy than lower income quartiles (Figure 7D) and their economic loss due to a subsidy removal is larger. This observation is consistent with a growing body of research finding that energy taxes, carbon taxes and fossil fuel subsidy removal improve income progressivity[29] in developing countries (Van Heerden et al., 2006; Brenner et al., 2007; Datta, 2010; Nurdianto and Resosudarmo, 2016; Dorband et al., 2019; Renner, 2018; Del Granado et al., 2012). For instance, Dorband et al. (2019) finds that, because richer, urban households have more energy intensive lifestyles, carbon pricing policies are progressive in low- and middle-income countries. For Mexico and Bolivia, Dorband et al. (2019) find that a carbon tax of \$30 per tCO_2 would lead to a neutral impact in Mexican households and a progressive impact on Bolivian households. Hallegate et al. (2024) analyze existing research and identify a progressive outcome for Mexico, while their findings for Bolivia are either neutral or regressive. Renner (2018) finds moderate to high progressivity of a number of alternative carbon tax settings (different than the current carbon tax design). Black et al. (2021) finds moderate regressivity to high progressivity for Mexico across various carbon tax schemes, both before and after revenue recycling. Although the impacts of FFS reform and a carbon tax may differ, i.a., because a carbon tax is applied on multiple fuels and different consumption patterns, they share many similarities.

In line with the literature, we find that the richest households, the third and fourth quartiles, receive the lion's share of the total subsidy. In the next section, we explore whether this group indeed exhibits higher disapproval of the president compared to other income groups when the subsidy is removed.

4.2.2 DiD results from micro data: Heterogeneous effects by income level

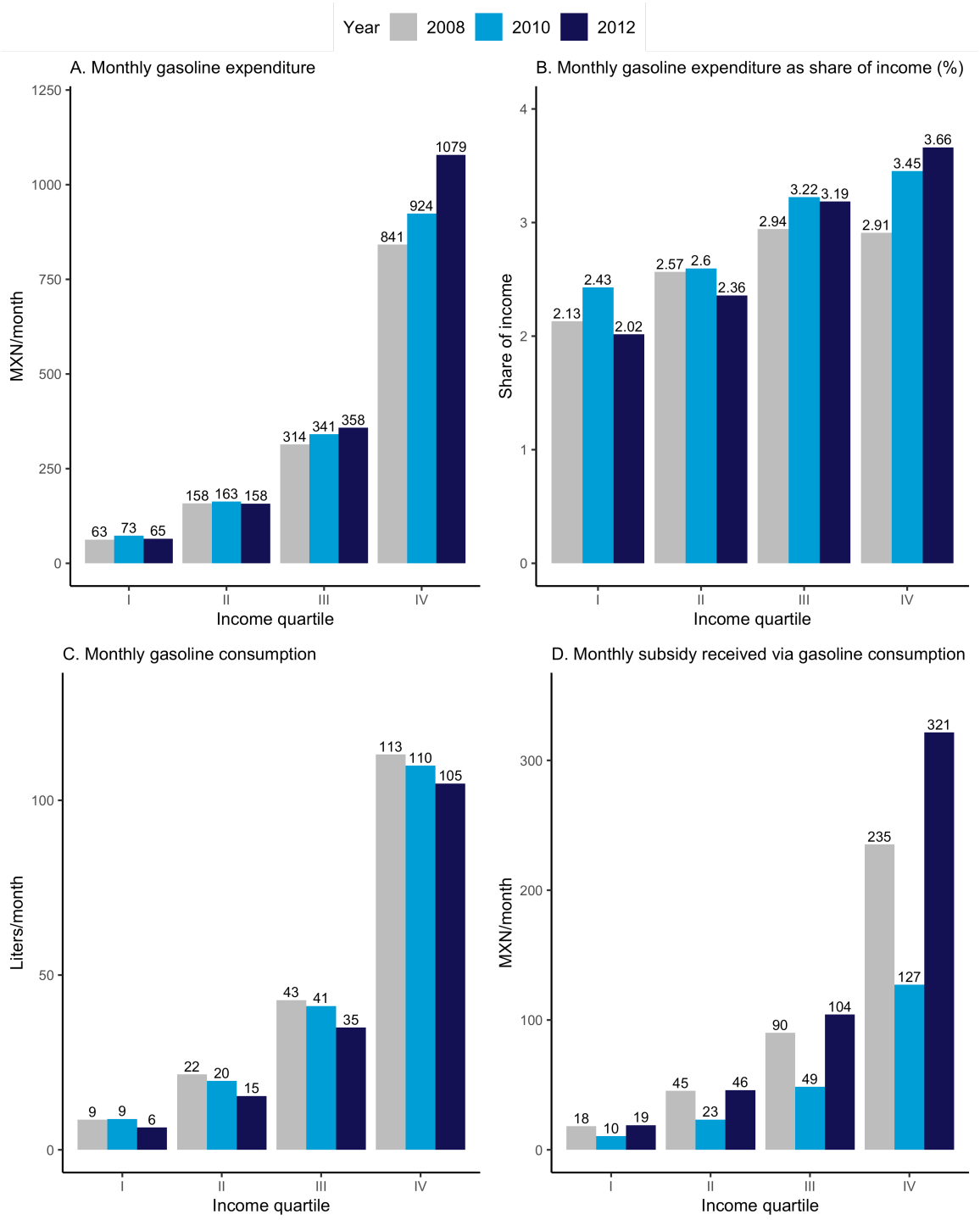
The DiD results support the predictions of our theoretical model. We find that the loss in presidential approval after FFS removal stems from the richest income groups. Table 4 reports the coefficient estimates for the DiD estimator across income groups and the pooled dataset. We find that the DiD estimator for the third and fourth income quartiles (3Q and 4Q) is negative and in both cases significant at conventional significance levels. In contrast, low income quartiles (1Q and 2Q) are generally less responsive to the subsidy removal and show a positive coefficient sign. These results confirm prediction (ii) and are robust to alternative specifications.[30]

[28] Note that this effect seems to start reversing in the fourth quartile. A potential reason for this are higher efficiency automobiles.

[29] Note that Figure 7 focuses only on regressivity for consumers and does not incorporate general equilibrium effects.

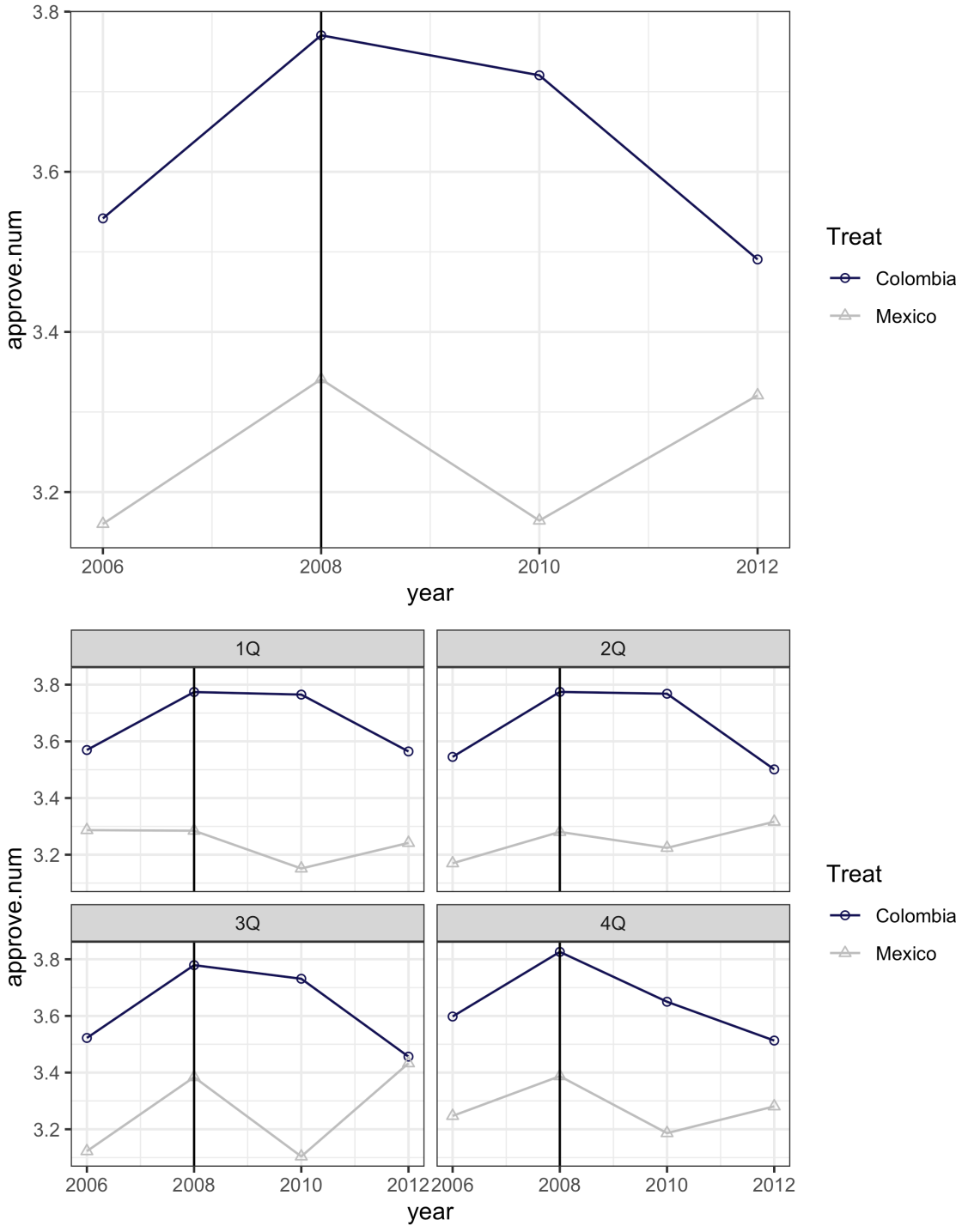
[30] In Appendix 6, we show alternative specifications where we use the outcome variable in its raw form and its demeaned form. In both cases, the sign and direction of the DiD estimator are consistent with our main specification.

Figure 7: Subsidy regressivity in Mexico: Evidence from consumption and expenditures



Source: Own elaboration with data from the National Survey of Household Income and Expenditure (2008-2012) from the Mexican National Institute of Statistics and Geography (INEGI) and subsidy data from Munoz-Pina et al. (2022)

Figure 8: Parallel trends: Raw presidential approval in Mexico and Colombia, total and across income-quartiles



Our results can also be interpreted as a confirmation of prediction (i) in the case of Mexico. Specifically, we observe that approval ratings decrease by approximately 2.3% due to the subsidy removal in Mexico, as shown in the pooled column in Table 4. In Section 3.3, we identify a negative effect of 15%, yet with some concerns about the validity of the parallel trends assumption. In this setting, we confirm with micro-level survey data that the effect, although smaller, is negative and statistically significant. The difference in estimate magnitudes between the macro setting in Section 3.3 and the micro setting here can be explained by the latter's use of biannual survey data, possibly failing to capture the full range of immediate reactions following the policy treatment.

Our results also support prediction (iii) from the theoretical model: We find that, across income groups, the higher the trust in the president the higher the approval. This result is in line with the literature that highlighted qualitative evidence on how mistrust in the government may increase opposition to subsidy reform (Alleyne et al., 2013). More importantly, we interact the DiD coefficient (*Treat*×*Post*) with the variable of *Trust in the president* to find if trust modifies the effect of subsidy removal on approval. The three-way coefficient of *Treat*×*Post*×*Trust in president* denotes how the effect of the DiD estimator is modified by trust, when trust is different than zero. For the richest income quartiles, we find a positive coefficient of the three-way interaction, which implies that the negative effect of subsidy removal on presidential approval ratings found in high-income quartiles is watered down as trust increases. For the second quartile (Q2) after treatment, we find that the negative DiD estimator of removal on approval is watered down by the three-way interaction effect so much as to reverse the sign.

To underscore the robustness of our findings, we conduct a series of placebo tests, which support the robustness of our findings, as we detect no statistical evidence of treatment effects (see Annex 6.8). Excepting Nicaragua, the absence of parallel trends in the pre-treatment period is notable. For Nicaragua, parallel trends appear plausible. However, we find no statistical evidence of robust negative treatment effect in the placebo test performed on Nicaragua. The aggregate effect across all income quartiles and the pooled sample suggest a positive effect of treatment and standard errors are large.

Table 4: Summary of DiD results: Effect of the subsidy removal on approval ratings across income quartiles in Mexico

	Income quartiles									
Predictor	1Q	1Q*	2Q	2Q*	3Q	3Q*	4Q	4Q*	Pooled	Pooled*
Treat×Post	0.033	0.028	0.03	-0.174	-0.042	-0.163	-0.093	-0.659	-0.023	-0.234
	(0.002)	(0.01)	(0.004)	(0.005)	(0.002)	(0.003)	(0.001)	(0.007)	(0.001)	(0.006)
Treat	-0.083	-0.117	-0.093	0.025	-0.043	0.057	-0.006	0.5	-0.052	0.129
	(0.008)	(0.003)	(0.009)	(0.008)	(0.001)	(0)	(0.007)	(0.002)	(0)	(0.006)
Post	-0.051	-0.222	-0.026	0.112	-0.013	0.037	0.034	0.378	-0.006	0.099
	(0.001)	(0.004)	(0.005)	(0.005)	(0.001)	(0.002)	(0.006)	(0.004)	(0)	(0.005)
Trust in president	0.204	0.119	0.144	0.196	0.181	0.21	0.249	0.447	0.186	0.247
	(0.002)	(0.007)	(0.001)	(0.009)	(0.017)	(0.012)	(0.031)	(0.008)	(0.019)	(0.006)
Treat×Trust in president		0.008		-0.078		-0.072		-0.342		-0.124
		(0.002)		(0.001)		(0.002)		(0.001)		(0.003)
Post×Trust in president		0.108		-0.091		-0.032		-0.226		-0.068
		(0.002)		(0.001)		(0.001)		(0.003)		(0.002)
Treat×Post×Trust in president		0.024		0.14		0.087		0.387		0.146
		(0.007)		(0.002)		(0.002)		(0.002)		(0.003)
Ideology	0.016	0.013	0.034	0.033	0.033	0.032	0.064	0.063	0.04	0.04
	(0.005)	(0.007)	(0.002)	(0.002)	(0.029)	(0.028)	(0.002)	(0.005)	(0.008)	(0.006)
Gov. improves safety	0.072	0.077	0.108	0.112	0.118	0.119	0.147	0.152	0.116	0.118
	(0.002)	(0)	(0.016)	(0.013)	(0.009)	(0.011)	(0.003)	(0.007)	(0.011)	(0.012)
Econ. sit. country	0.119	0.114	0.044	0.042	0.109	0.109	0.125	0.123	0.101	0.1
	(0.049)	(0.041)	(0.021)	(0.024)	(0.006)	(0.006)	(0.021)	(0.024)	(0.005)	(0.006)
Corruption	-0.053	-0.053	-0.041	-0.042	-0.012	-0.011	0.007	0.001	-0.011	-0.014
	(0.015)	(0.001)	(0.016)	(0.013)	(0.037)	(0.036)	(0.023)	(0.028)	(0.022)	(0.021)
Intercept	0.784	0.925	0.869	0.785	0.714	0.667	0.442	0.14	0.681	0.588
	(0.071)	(0.041)	(0.032)	(0.019)	(0.013)	(0.004)	(0.091)	(0.065)	(0.019)	(0.002)
Obs.	560	560	914	914	1114	1114	603	603	3603	3603

Note: Columns 1Q through 4Q denote the model for each income quartiles. Columns 1Q* through 4Q* denote the model with a three-way interaction. Clustered standard errors are shown in parenthesis. We assume that treatment starts in Mexico when the price hikes are announced, Dec 2009. A log-log model is run and coefficients can be interpreted as elasticities.

5 Conclusions

Fossil fuel subsidies have a surprising political stability. Despite a climate imperative for their removal, subsidies remain difficult to remove. To better understand the political challenge, we provide the first estimation of the political cost of removing them and disentangle why politicians are affected when deviating from the equilibrium subsidy. Using a difference-in-differences framework, we identify and estimate the effect of FFS removal on presidential approval ratings in Mexico and Bolivia during the early 2010s.

Our results suggest that removal is politically costly. Yet, these costs seem moderate and short-lived. We analyze what explains these political costs by using a probabilistic voting model. Our theoretical results suggest that high-income groups drive the loss in political support in low-income countries where subsidies are regressive. Our model incorporates trust in the president, which explains why other income groups, particularly low-income groups may prefer subsidies as a distribution mechanism. Using micro-level survey data for Mexico, a difference-in-differences model confirms our theoretical predictions, namely that high income groups' approval of the president decreases as a result of the subsidy removal and that low trust in the president by low income groups can cause a decrease of approval in reaction to the removal in these groups as well.

Our study offers insights for shaping effective policies. If reelection incentives of politicians lead to the lock-in of FFS that are regressive and environmentally harmful, feasible political strategies for a phase-out have to account for this challenge. Higher trust in the president is key to increase acceptance of a removal of regressive subsidies across all income groups. Trust moderates the negative effect of subsidy removal on popularity, and it can, in some cases, even revert the negative impact.

While this study provides insights into effective strategies to remove subsidies, it is crucial to highlight its limitations. First, constrained by data availability, mainly by presidential approval records, the analysis is restricted to two prominent cases, which limits its external validity. Similarly, while fuel subsidy removal is an important element of the total carbon pricing signals (Agnolucci et al., 2023), the results cannot be generalized to other forms of direct and indirect carbon prices, such as carbon taxes or fuel excise taxes that typically cover larger groups of fossil fuels. The dynamics of positive and negative carbon prices may differ due to both economic and behavioral factors. For instance, subsidising fossil fuels can be related to a sense of national endowment with these fuels, but we know that people attach higher value to items to which they feel entitled (Marzilli Ericson and Fuster, 2014).

Second, our analysis abstracts from the influence of government revenue uses on the (un) popularity of the subsidy removal which can be decisive for public acceptance (Harring et al., 2023; Clarke and Stewart, 1994). The two cases that we analyze in this paper are examples of subsidy reform where no simultaneous compensation scheme was implemented. Notwithstanding these limits, our results demonstrate the importance of considering the political economy of climate protection policies in their design and implementation. Future research might consider evaluating the presence of heterogeneous effects by type of carbon pricing instruments.

6 Appendix

6.1 Data and descriptives

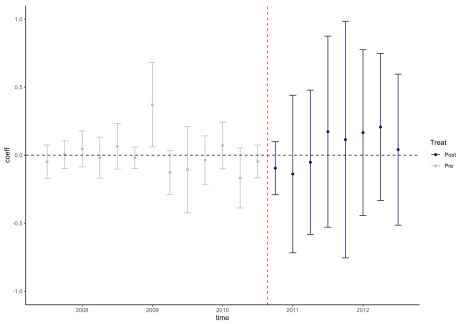
Table 5: Description and construction of variables

Variable (periodicity)	Description	Construction	Used in	Source
Presidential approval ratings (quarterly)	Percentage of the population that approves the job of the president.	Presidential approval is logged for most regressions.	Sections 2-3	Executive Approval Project (EAP)
Term duration (quarterly)	Length of the presidential term: number of quarters.	Presidents can have more than one presidential term, as it was the case for Bolivia during the period studied.	Sections 2-3	Own derivation from official country records.
Corruption (quarterly)	Risk rating measure with a maximum score of 6 points and a minimum score of 0 points. A higher score indicates lower risk.	The measure is mainly concerned with actual or potential corruption in the form of excessive patronage, nepotism, job reservations, favor-for favors, secret funding, and suspiciously close ties between politics and business. In addition, it includes financial corruption in the form of special payments and bribes connected with export licenses, exchange controls, tax assessment, police protection or loans.	Sections 2-3	International Country Risk Guide (ICRG) rating of the PRS Group
Socioeconomic conditions (quarterly)	Risk rating measure that assesses the socioeconomic pressures that could constrain government action or fuel social dissatisfaction. The rating ranges from 0-12. The higher the index rating, the lower the risk.	The rating is obtained as the sum of three subcomponents: unemployment, consumer confidence and poverty. Each of these components ranges from 0-4, where 4 equates to a very low risk and 0 to a very high risk.	Sections 2-3	ICRG
Internal conflict (quarterly)	Risk rating measure assessing the political violence and its actual or potential impact on governance. The rating ranges from 0-12. A rating of 12 equates to no armed or civil opposition, and where the government does not indulge in arbitrary violence against its own people. A rating of 0 equates to ongoing civil war.	The rating is obtained as the sum of three subcomponents: 1) Civil War/Coup Threat, 2) Terrorism/Political violence and 3) Civil Disorder. Each of these components ranges from 0-4, where 4 equates to a very low risk and 0 to a very high risk.	Sections 2-3	ICRG
Law and order (quarterly)	Risk rating ranging from 0-6 points.	It is composed by two sub-elements. The law element assesses the strength and impartiality of the legal system. The order element assesses the popular observance of the law.	Sections 2-3	ICRG
Presidential approval (bi-annual)	Presidential approval of a representative sample of citizens above voting age.	Respondents are asked "Generally speaking regarding the current government, ¿Would you say that the job the president [Name] is?" 1) Very good, 2) Good, 3)Neither good, nor bad (regular), 4) Bad, 5) Very bad. The variable has been recoded so that the higher the number, the higher the approval.	Section 4	LAPOP/Americas Barometer
Trust in the president (bi-annual)	Trust in the president of a representative sample of citizens above voting age.	Respondents are asked "To what extent do you trust in the President?". Answers range from 1-7, where 1=no trust, 7=high trust.	Section 4	LAPOP/Americas Barometer
Ideology (bi-annual)	Political ideology of a representative sample of citizens above voting age.	Respondents are asked to place themselves in a scale of 1-10, where 1 represents the political "left" and 10 represents the political "right".	Section 4	LAPOP/Americas Barometer
Government improves safety (bi-annual)	Opinion of a representative sample of citizens on the extent to which the government improves citizen's safety.	Using a scale from 1-7, where 1 represents "nothing" and 7 represents "very much", respondents are asked "To which extend would you agree with the statement that the current administration improves citizen's safety?".	Section 4	LAPOP/Americas Barometer
Economic situation (bi-annual)	Opinion of a representative sample of citizens on the country's economic situation.	Respondents are asked "How would you judge the economic situation of the country" 1) Very good, 2) Good, 3)Neither good, nor bad (regular), 4) Bad, 5) Very bad. The variable has been recoded so that the higher the number, the better the economic situation .	Section 4	LAPOP/Americas Barometer
Corruption (bi-annual)	Opinion of a representative sample of citizens the corruption among public servants in the country.	Respondents are asked "Taking into consideration your own experience or what you have heard, the corruption of the public servants in the country is" 1) Very widespread, 2) Somewhat widespread, 3) Little widespread, 4) Not at all widespread. The variable has been recoded so that the higher the number, the higher (more generalized) the corruption.	Section 4	LAPOP/Americas Barometer

6.2 Placebo tests: Empirical evidence at the macro level

The robustness of our results are supported by a series of placebo tests. First, we artificially assign treatment by simulating treatment across all countries in our sample. Specifically, each country replaces Bolivia in the staggered treatment assignment with Mexico. For most countries, except the United States, the absence of parallel trends is notable. For the United States, the assumption of parallel trends could be reasonable yet we find no statistical evidence of a treatment effect.

Figure 9: Placebo: United States with no significant treatment effect



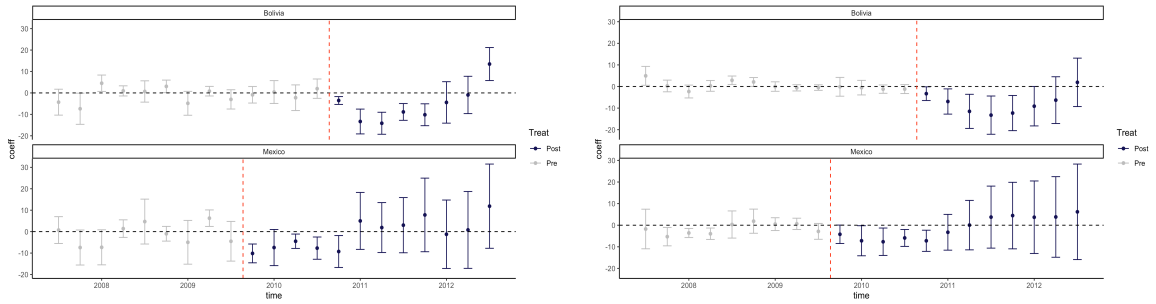
Note:The Y-axis shows the the DiD estimated effect of removal on presidential approval ratings. The X-axis represents time, or in our case, quarters of a year. For each quarter, the DiD estimate is depicted as dot; values below the zero line denote a negative effect of subsidy removal on presidential approval. Bars denote 95% confidence intervals; bars touching the zero y-axis denote insignificant effects.

6.3 Robustness: Empirical evidence at the macro level

Figure 10: Robustness to the choice of the outcome variables: DiD results for Bolivia and Mexico

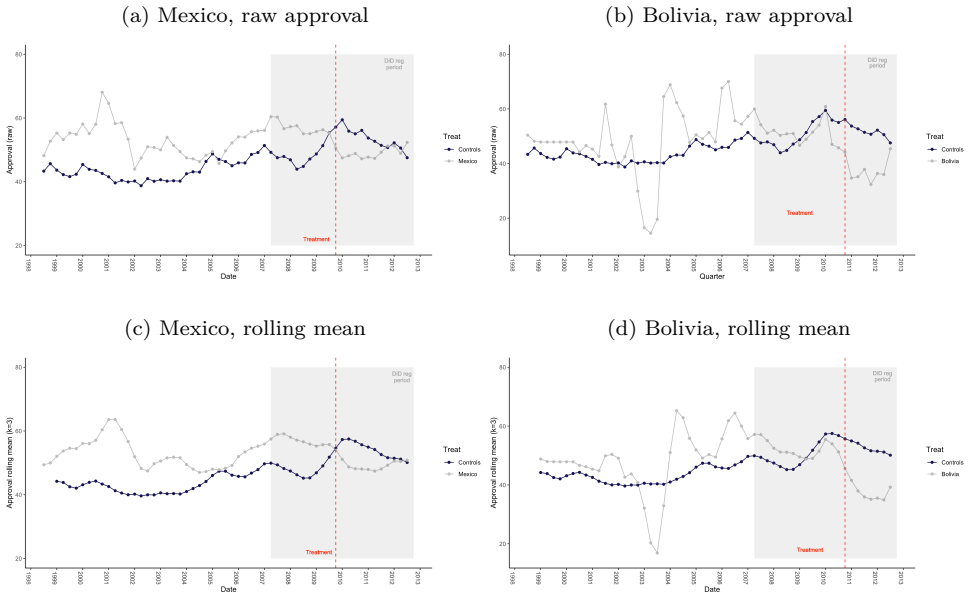
(a) Raw approval model

(b) Rolling mean approval model



Note: Treatment in Bolivia and Mexico denoted by the vertical red dotted line in Q4 2010 and Q4 2009 respectively. Point estimates and confidence intervals are represented by dots and bars respectively. Bars denote 95% confidence intervals.

Figure 11: Presidential approval: Parallel trends



Note: Controls represent the average approval ratings for the control countries.

6.4 Synthetic control estimation as robustness

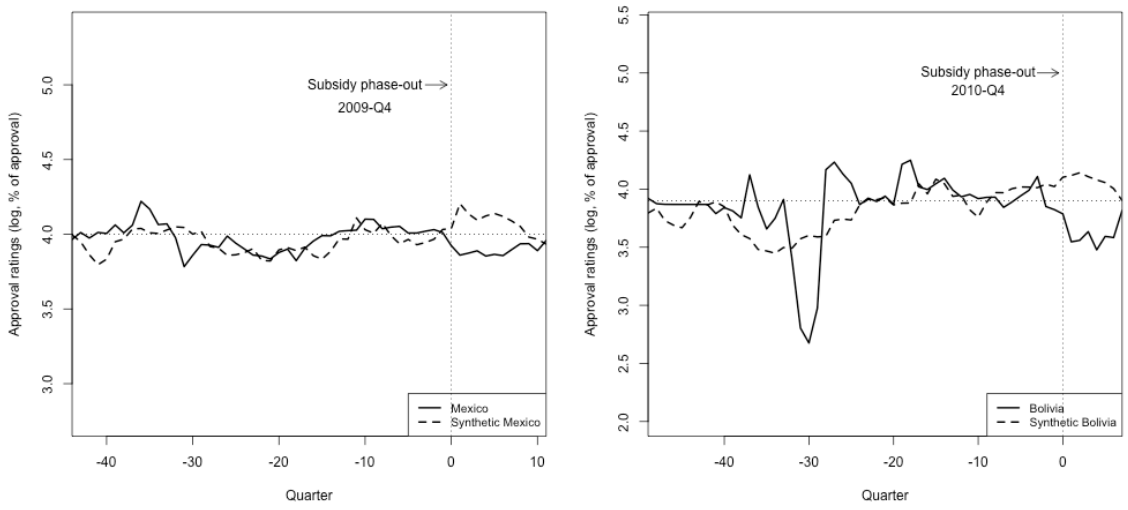
We perform a synthetic control (SC) analysis as robustness check of the difference-in-differences (DiD) estimation in Section 3. In the SC, the average treatment effect on the treated (ATT) is computed as the post-treatment average difference between approval ratings of Mexico and a "synthetic Mexico" (or Bolivia and a "synthetic Bolivia"), following Abadie and Gardeazabal (2010). The counterfactual outcome of Mexico (or Bolivia), called the synthetic control, is endogenously constructed by weighting units in the control group (or donor pool) before the removal to resemble the treated unit (Mexico or Bolivia) in all outcome-relevant variables and pre-treatment outcomes. Put simply, the method uses country and covariate weights to predict the treated unit's presidential approval before and after the removal. We assume that the removal is accurately fitted in the pre-treatment period, so that the post-treatment differences can only be due to the subsidy removal.

We apply the SC method for Mexico and Bolivia separately. For each case, we reconstruct the post-treatment period's presidential approval had the country not removed subsidies. We use the same set of variables and treatment timing dummies as in the DiD in Section 3 (see Table 2). The donor pool includes the same set of control countries as in the main regression in section 3.3.[31] However, we use a longer pre-treatment period from 2001 Q1 to 2012 Q2 because the SC method relies on longer pre-treatment periods (see (Abadie, 2021) for a discussion). While this may limit comparability with the DiD results, it is crucial for the SC method to provide meaningful results. The results of the SCM are consistent, yet of larger magnitude than our main results.

[31] Except that we remove Bolivia from the donor pool of Mexico and viceversa.

Figure 12: Results of the synthetic control approach

(a) Mexico (b) Bolivia



Note: SCM path plot assumes treatment starts at 0, when the price hikes are announced in Mexico and Bolivia on Dec 2009 and Dec 2010 respectively. Treatment is denoted with the vertical dotted line.

Synthetic Mexico is constructed as a weighted average of five countries, with Honduras, Ecuador, and El Salvador showing the highest weights (see Table 8). Ecuador,Paraguay and Argentina have a higher weight in constructing Synthetic Bolivia (see table 9). This data-driven construction of the counterfactual is one advantage of the SC method over other methods that rely on the researcher's call for an appropriate comparison.

Following standard SCM procedures, we run placebo tests in-time and in-space. Figure 13 illustrates a placebo in-time, where we artificially move the treatment timing to an earlier quarter than actual. Here, we show the artificial or placebo treatment at -10 quarters before treatment (i.e., 2007 Q2), which results in no negative treatment effect.

Table 6: Outcome predictor means and weights: Mexico

Covariates	Mexico	Synthetic Mexico	Donor pool	Covariate weights
Socio-econ. conditions	1.98	1.21	1.52	0.00
Corruption	0.79	0.90	0.94	0.07
Law and order	0.87	0.81	0.99	0.16
Bureacracy quality	1.10	0.70	0.71	0.01
Duration	12.33	7.84	9.10	0.00
Duration squared	202.73	88.18	113.38	0.00
Internal conflict	2.19	2.20	2.18	0.00
Special predictor -33	4.07	4.03	3.64	0.34
Special predictor -23	3.86	3.90	3.59	0.12
Special predictor -15	3.99	3.83	3.74	0.06
Special predictor -10	4.10	4.03	3.86	0.06
Special predictor -1	4.01	4.03	3.96	0.17

Table 7: Outcome predictor means and weights: Bolivia

Covariates	Bolivia	Synthetic Bolivia	Donor pool	Covariate weights
Socio-econ. conditions	1.64	1.51	1.53	0.06
Corruption	0.80	0.81	0.94	0.35
Law and order	1.08	1.02	0.99	0.08
Bureacracy quality	0.69	0.68	0.71	0.16
Duration	5.50	7.27	9.01	0.01
Duration squared	47.14	77.95	111.88	0.01
Internal conflict	2.11	2.13	2.19	0.12
Special predictor -16	4.00	3.96	3.87	0.09
Special predictor -22	3.89	3.91	3.72	0.12
Special predictor -26	4.13	3.74	3.62	0.01

Table 8: Synthetic Mexico: Donor pool weights

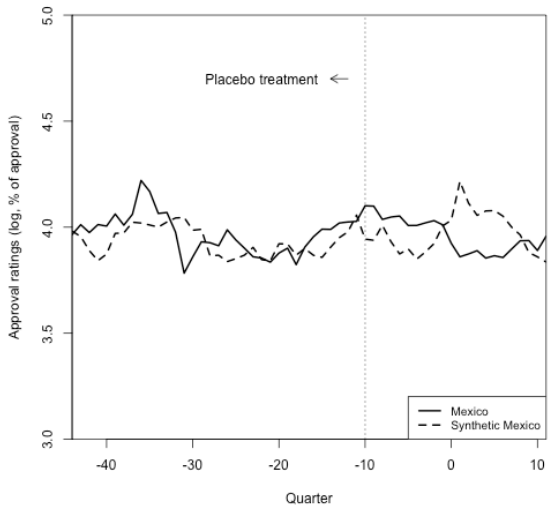
Country	Country weight
Honduras	0.35
Ecuador	0.33
ElSalvador	0.22
Panama	0.09
Argentina	0.01
Chile	0.00
Brazil	0.00
Colombia	0.00
Costa Rica	0.00
Guatemala	0.00
Nicaragua	0.00
Paraguay	0.00
Peru	0.00
United States	0.00
Uruguay	0.00

Table 9: Synthetic Bolivia: Donor pool weights

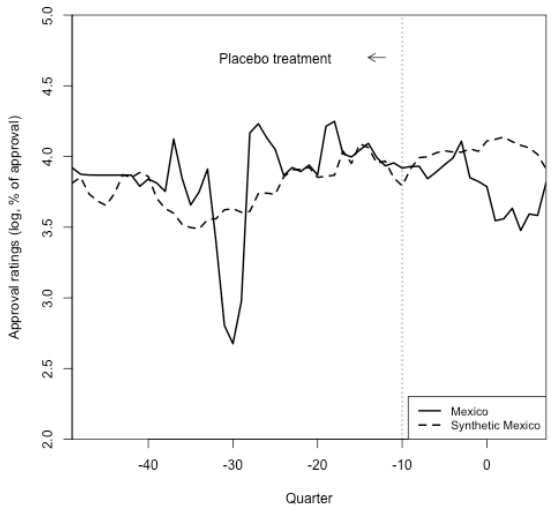
Country	Country weight
Ecuador	0.40
Paraguay	0.20
Argentina	0.19
Panama	0.15
United States	0.05
Colombia	0.02
Brazil	0.00
Chile	0.00
Costa Rica	0.00
ElSalvador	0.00
Guatemala	0.00
Honduras	0.00
Nicaragua	0.00
Peru	0.00
Uruguay	0.00

Figure 13: Synthetic control: Placebos

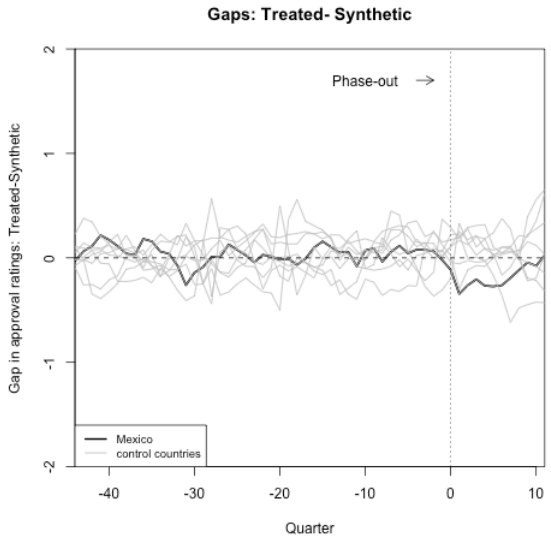
(a) Mexico: Placebo in time



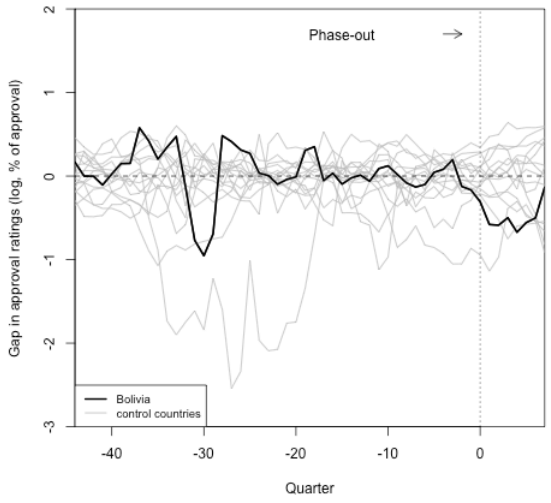
(b) Bolivia: Placebo in time



(c) Mexico: Placebo in space



(d) Bolivia: Placebo in space



Note: Placebos in time assume treatment starts at -10, a placebo treatment. Placebos in space compare the outcome gap of the treated vs. artificially (placebo) treated countries from the donor pool using the actual treatment date.

6.5 Derivation of Equation (11)

Define $G(\alpha_A, \alpha_B, \delta) := \sum_{j\in J} \sigma^j B^j \left(W^j(\alpha_A) - W^j(\alpha_B) - \delta\right)$. We see that $G_{\alpha_A} = \sum_{j\in J} \sigma^j b^j(\xi^j) W^j_{\alpha_A}(\alpha_A)$ and $G_\delta = -\sum_{j\in J} \sigma^j b^j(\xi^j) \leq 0$. It is clear that there exists $\hat{\delta}(\alpha_A, \alpha_B)$ which is implicitly defined by

$$G(\alpha_A, \alpha_B, \hat{\delta}) = \frac{1}{2}. \tag{13}$$

The probability of winning is then given by

$$\Pr\left[\hat{\delta} \geq \delta\right] = \psi\hat{\delta} + \frac{1}{2} \tag{14}$$

Taking the policy platform of party B as given, implicit differentiation of (13) yields

$$\frac{\mathrm{d}\hat{\delta}}{\mathrm{d}\alpha_A} = -\frac{G_{\alpha_A}}{G_\delta} = \frac{\sum_{j\in J} \sigma^j b^j(\xi^j) W^j_{\alpha_A}(\alpha_A)}{\sum_{j\in J} \sigma^j b^j(\xi^j)}. \tag{15}$$

Party A thus chooses α_A to maximize (14). Substituting (15) into the F.O.C. yields

$$\frac{\psi}{\sum_{j\in J} \sigma^j b^j(\xi^j)} \left(\sum_{j\in J} \sigma^j b^j(\xi^j) \left(\frac{a^j}{\sigma^j} y\tau - \mu^j H'\left((1-\alpha)\, y\tau\right) y\tau \right) \right) = 0. \tag{16}$$

Solving for α yields (11).

6.6 Proof of Result 1

(i) Follows directly from the fact that the equilibrium level of FFS results from a maximization of the expected probability of winning. All deviations from this equilibrium will therefore reduce the expected political support. To show (ii) and (iii), recall that the vote share for party A from group j, π^j_A for a given realization of δ is

$$\pi^j_A = \sigma^j B^J \left(\xi^j(\alpha_a, \alpha_B)\right) = \sigma^j B^j \left(W^j(\alpha_A) - W^j(\alpha_B) - \delta\right),$$

and thus

$$\frac{\partial \pi^j_A}{\partial \alpha_A} = \sigma^j b^j(\xi^j) W^j_{\alpha_A}(\alpha_A).$$

From (6) we know that $W^j(\alpha_A)$ has a global maximum at α^j (income group j's bliss point), so that

$$\sigma^j b^j(\xi^j) W^j_{\alpha_A}(\alpha_A) \gtreqless 0 \Longleftrightarrow \alpha_A \lesseqgtr \alpha^j.$$

Comparing (6) and (11), (ii) follows. (iii) follows from

$$\frac{\partial \alpha^j}{\partial \mu^j} < 0$$

which implies that if μ^j is sufficiently low, $\alpha^j > \alpha_A^\circ$ and thus $\frac{\partial \pi_A^j}{\partial \alpha_A} > 0$.

6.7 Robustness: Empirical evidence at the micro level

Table 10: DiD Robustness: Outcome variable in raw levels

Predictor	1Q	2Q	3Q	4Q	Pooled
Treat×Post	0.044	0.154	-0.059	-0.176	-0.027
	(0.002)	(0.001)	(0.002)	(0.012)	(0.005)
Trust in president	0.171	0.146	0.165	0.238	0.174
	(0.004)	(0.01)	(0.007)	(0.032)	(0.017)
Treat	-0.269	-0.305	-0.177	-0.127	-0.195
	(0.017)	(0.001)	(0.004)	(0.016)	(0.005)
Post	-0.081	-0.112	-0.051	0.062	-0.026
	(0.003)	(0.001)	(0.002)	(0.018)	(0.003)
Ideology	0	0.013	0.025	0.041	0.023
	(0.006)	(0.004)	(0.018)	(0.004)	(0.006)
Gov. improves safety	0.054	0.089	0.104	0.125	0.095
	(0.005)	(0.011)	(0)	(0.016)	(0.008)
Econ. sit. country	0.145	0.068	0.144	0.142	0.133
	(0.072)	(0.007)	(0.013)	(0.013)	(0.005)
Corruption	-0.042	-0.033	-0.019	0.011	-0.005
	(0.019)	(0.019)	(0.031)	(0.009)	(0.016)
Intercept	2.297	2.433	1.99	1.294	1.912
	(0.241)	(0.056)	(0.009)	(0.185)	(0.053)
Obs.	560	914	1114	603	3603

Note: Columns 1Q through 4Q denote the model for each income quartiles. The outcome variable is the presidential approval rating in its raw levels. Clustered standard errors are shown in parenthesis. We assume that treatment starts in Mexico when the price hikes are announced, Dec 2009.

Table 11: DiD Robustness: Outcome variable demeaned

Predictor	1Q	2Q	3Q	4Q	Pooled
Treat×Post	0.104	0.028	-0.059	-0.05	-0.006
	(0.004)	(0.005)	(0.01)	(0.001)	(0.006)
Trust in president	0.334	0.2	0.279	0.372	0.28
	(0.051)	(0.001)	(0.057)	(0.065)	(0.049)
Treat	0.058	0.014	0.092	0.141	0.073
	(0.017)	(0.013)	(0.016)	(0.04)	(0.014)
Post	-0.137	-0.029	-0.027	-0.024	-0.039
	(0.006)	(0.006)	(0.008)	(0.03)	(0.007)
Ideology	0.043	0.05	0.037	0.12	0.066
	(0.015)	(0)	(0.042)	(0.038)	(0.003)
Govt. improves safety	0.116	0.165	0.17	0.23	0.179
	(0.028)	(0.013)	(0.005)	(0.03)	(0.005)
Econ. sit. country	0.199	0.06	0.166	0.25	0.154
	(0.031)	(0.051)	(0.035)	(0.13)	(0.011)
Corruption	-0.115	-0.069	0.015	0.065	-0.011
	(0.069)	(0.005)	(0.075)	(0.088)	(0.034)
Intercept	0.127	0.369	0.071	-0.48	0.028
	(0.046)	(0.065)	(0.137)	(0.461)	(0.141)
Obs.	560	913	1112	600	3594

Note: Columns 1Q through 4Q denote the model for each income quartiles. The outcome variable is the demeaned presidential approval. Clustered standard errors are shown in parenthesis. We assume that treatment in Mexico starts when the price hikes are announced, i.e. in Dec 2009.

6.8 Placebo tests: Empirical evidence at the micro level

Table 12: DiD results Placebo Nicaragua

Predictor	1Q	1Q*	2Q	2Q*	3Q	3Q*	4Q	4Q*	Pooled	Pooled*
Treat×Post	0.206	0.194	0.086	-0.044	0.056	0.089	0.028	-0.26	0.072	0.027
	(0.028)	(0.003)	(0.04)	(0.042)	(0.023)	(0.007)	(0.008)	(0.014)	(0.022)	(0.016)
Treat	-0.24	-0.306	-0.156	-0.12	-0.102	-0.117	-0.08	0.226	-0.116	-0.08
	(0.034)	(0.015)	(0.035)	(0.066)	(0.01)	(0.03)	(0.031)	(0.034)	(0.008)	(0.035)
Post	-0.028	-0.056	-0.004	0.127	0	0.004	0.007	0.307	-0.003	0.067
	(0.001)	(0.014)	(0.008)	(0.023)	(0.004)	(0.001)	(0.002)	(0.012)	(0.003)	(0.006)
Trust in president	0.183	0.137	0.159	0.193	0.212	0.214	0.231	0.419	0.2	0.233
	(0.004)	(0.03)	(0.017)	(0.015)	(0.014)	(0.003)	(0.051)	(0.006)	(0.025)	(0.011)
Treat×Trust in president		0.035		-0.013		0.02		-0.211		-0.016
		(0.002)		(0.034)		(0.016)		(0.034)		(0.022)
Post×Trust in president		0.015		-0.086		-0.002		-0.197		-0.046
		(0.006)		(0.01)		(0.003)		(0.004)		(0.001)
Treat×Post×Trust in president		0.02		0.08		-0.036		0.191		0.021
		(0.009)		(0.008)		(0.012)		(0.004)		(0.004)
Ideology	-0.032	-0.03	-0.039	-0.035	-0.033	-0.035	-0.044	-0.053	-0.033	-0.033
	(0.015)	(0.016)	(0.036)	(0.039)	(0.039)	(0.042)	(0.053)	(0.051)	(0.039)	(0.041)
Gov. improves safety	0.13	0.129	0.154	0.154	0.128	0.128	0.196	0.202	0.15	0.151
	(0.038)	(0.038)	(0.052)	(0.051)	(0.015)	(0.015)	(0.035)	(0.03)	(0.034)	(0.033)
Econ sit. country	0.14	0.139	0.12	0.119	0.142	0.143	0.197	0.197	0.157	0.158
	(0.093)	(0.093)	(0.082)	(0.083)	(0.036)	(0.037)	(0.005)	(0.004)	(0.046)	(0.046)
Corruption	-0.023	-0.021	-0.022	-0.023	-0.012	-0.014	0.01	0.007	-0.009	-0.011
	(0.003)	(0.004)	(0.008)	(0.008)	(0.003)	(0.005)	(0.024)	(0.024)	(0.011)	(0.012)
Intercept	0.774	0.847	0.796	0.738	0.714	0.714	0.514	0.238	0.678	0.628
	(0.108)	(0.064)	(0.063)	(0.059)	(0.03)	(0.02)	(0.143)	(0.066)	(0.02)	(0.008)
Obs	970	970	1572	1572	2372	2372	1485	1485	6900	6900

Note: Columns 1Q through 4Q denote the model for each income quartiles. Columns 1Q* through 4Q* denote the model with a three-way interaction. Clustered standard errors are shown in parenthesis. We assume that treatment starts in Nicaragua on Dec 2009. A log-log model is run and coefficients can be interpreted as elasticities.

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