Why Do Governments Tax or Subsidize Fossil Fuels?

Paasha Mahdavi, Cesar B. Martinez-Alvarez, and Michael L. Ross

Abstract

Governments have long faced pressure to address the climate crisis by increasing taxes on fossil fuels, which are the source of more than three-quarters of the world's anthropogenic carbon pollution. Since fossil fuel taxes and subsidies are hard to measure, it is unclear how much government policies have changed. Using original high-frequency data on gasoline taxes and subsidies in 157 countries, we establish three findings: despite rising alarm about climate change, from 2003 to 2015 there was little net change in fuel taxes and subsidies at a global level; fuel taxes and subsidies appear to be driven by slow-moving economic factors, primarily income and fossil fuel wealth; and reforms, when they occur, are overwhelmingly associated with country-level political conditions that follow no readily-discernible patterns. These patterns are consistent with a model in which fossil fuel taxes are determined by a country's income and revenue needs, not its environmental commitments.

Keywords: Gasoline taxes, carbon taxes, fossil fuel subsidies, tax reform, climate policy, environmental politics, political economy

JEL: H23, Q35, Q38, Q54, Q5

Center for Global Development
www.cgdev.org

Working Paper 541
August 2020

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Paasha Mahdavi
University of California, Santa Barbara

Cesar B. Martinez-Alvarez
University of California, Los Angeles

Michael L. Ross
University of California, Los Angeles

We thank Thomas Hale, Chad Hazlett, Robert Keohane, Daniel Treisman, and the participants at the February 2020 Balzan Workshop on Climate Change Politics for valuable suggestions. Our data collection efforts were generously supported by the UCLA Burkle Center and the Natural Resources Governance Institute. Earlier versions of this paper were presented at the 2018 meeting of the American Political Science Association, and seminars at University of Wisconsin, University of Colorado, University of Virginia, the UCLA Burkle Center, and the Center for Global Development, and were greatly improved by the suggestions of participants.

Mahdavi, Martinez-Alvarez, and Ross, 2020. "Why Do Governments Tax or Subsidize Fossil Fuels?." CGD Working Paper 541. Washington, DC: Center for Global Development. https://www.cgdev.org/publication/why-do-governments-tax-or-subsidize-fossil-fuels

Center for Global Development
2055 L Street NW
Washington, DC 20036

202.416.4000
(f) 202.416.4050

www.cgdev.org

1 Introduction

We are remarkably ignorant about what governments are doing to address the most important challenge of the 21st century. The gravity of the climate change problem has been widely-acknowledged by most governments since the mid-1990s.[1] Yet, most studies that seek to explain – or even describe – climate change policies are limited to one or several countries. There are relatively few cross-national studies, and most cover the advanced industrialized democracies but not the rest of the world (Bättig and Bernauer, 2009; Bayer and Urpelainen, 2016; Aklin and Urpelainen, 2013; Purdon et al., 2015; Mildenberger, 2020; Ward and Cao, 2012; Finnegan, 2019).

In part, this reflects the challenge of identifying policies that are equally salient in a wide range of settings: the most appropriate policies vary widely, depending on a country's geographic characteristics, economic structure, and level of development. Hence measuring a government's "mitigation efforts" in ways that are comparable across countries and over time has been a major stumbling block for researchers and policy architects alike (O'Neill et al., 2013; Aldy et al., 2016; Bernauer and Böhmelt, 2013). For some scholars, the measurement problem is so intractable that "the quest to find a single cause, or even a common set of drivers, to explain climate leaders or climate laggards is a near-futile exercise" (Christoff and Eckersley, 2011).

Our approach is to focus on policies that encourage or discourage the use of fossil fuels, which since 2000 have been the source of about 78 percent of all anthropogenic greenhouse gas pollution (Clarke and (coord. lead authors), 2015). We concentrate on transportation fuels, which generate about 23 percent of global energy-related emissions (Sims, 2014). All governments have policies that encourage or discourage the consumption of transportation fuels, typically through a complex web of policies that have the effect of taxing or subsidizing the retail price. These varied policies have led to remarkable country-to-country differences in prices: in June 2020, a liter of gasoline sold for \$0.02 in Venezuela and \$2.24 in Hong Kong.[2]

Taxes and subsidies for fossil fuels have profound consequences: they affect fuel consumption (Charap et al., 2013; Fattouh and El-Katiri, 2013), greenhouse gas pollution (Erickson et al.,

[1]Since the mid-1990s, almost all countries have been members of the United Nations Framework Convention on Climate Change (UNFCCC), whose stated objective is to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic interference with the climate system."

[2]Globalpetrolprices.com, accessed June 26, 2020.

2020), investments in renewable energy (Aghion et al., 2016), inequality (Del Granado et al., 2012), and the fiscal health of governments. They also affect political stability: between 2006 and 2019, attempts to raise gasoline prices were followed by protests in at least 24 countries.[3] The 1999 overthrow of Indonesia's Suharto government, Myanmar's 2007 "Saffron Rebellion," and France's 2018-19 "Gilets jaune" movement all began as protests against higher gasoline prices. As Ansolabehere and Konisky (2014, 17) note, "people are acutely aware of energy prices."

There is strong international support for removing subsidies and raising taxes on fossil fuels. The Intergovernmental Panel on Climate Change (IPCC) describes the removal of fossil fuel subsidies as one of the simplest and cheapest ways for countries to curtail carbon pollution (Sims, 2014). Other international institutions – including the World Bank, the International Monetary Fund, the United Nations Environmental Program, and the International Energy Agency – have also urged governments to abolish these subsidies (McFarland and Whitley, 2014). Many governments nominally support fuel price reforms: in September 2009, the G20 heads of state agreed to phase out "inefficient fossil fuel subsidies," while the 21 governments of the Asia Pacific Economic Cooperation group made a similar vow (McFarland and Whitley, 2014). In June 2010, nine additional governments formed the "Friends of Fossil Fuel Subsidy Reform" to support these efforts.

Despite these initiatives, fossil fuel taxes and subsidies can be remarkably hard to change. The federal gasoline tax in the US was last changed in 1994. More recent efforts to reduce subsidies in Angola, Mexico, Nigeria, Indonesia, Sudan, Egypt, Azerbaijan, and Venezuela have all been rolled back or nullified by falling exchange rates or rising inflation. As a result, fossil fuel subsidies remain large: depending on how they are measured, they are worth between $500 billion and $5.2 trillion dollars a year (Kojima and Koplow, 2015; Coady et al., 2017). After falling in 2015 and 2016, they rose in 2017 and 2018, returning to their 2014 levels (Matsumura and Zakia, 2019).

Cross-national research on the politics of fossil fuel taxes and subsidies has been limited, partly because data have been scarce. As a result, previous analyses have been based on either compilations of case studies (e.g., Inchauste and Victor, 2017; Skovgaard and van Asselt, 2018; Clements et al., 2013), or a public data set that measures prices at two-year intervals, and hence

[3] See Appendix Table S3 for a list of countries, dates and sources.

tells us relatively little about the frequency and timing of reforms (Cheon et al., 2013; Wagner, 2013).

We compile an original data set on the monthly value of gasoline taxes and subsidies in 157 countries from 2003 to 2015, totaling 23,550 observations. Using these data we estimate the relationship between fuel taxes and a wide range of potentially-salient economic and political factors.

We find three robust patterns. First, fuel taxes and subsidies are highly resistant to change. Despite thirteen years of rising alarm about greenhouse gas emissions, there was little net change in fuel taxes and subsidies over the 2003-15 period. Fuel taxes rose modestly in 73 countries, fell modestly in 63 countries, and were unchanged in five. On average, countries raised their per-liter gasoline taxes by 2.05 percent per year. Yet this fails to capture the global trend, since consumption fell in high-tax countries but rose in low-tax countries. If we weight each country to reflect its annual gasoline consumption, per-liter gas taxes fell globally by 5.43 percent per year. In short, governments collectively made little progress toward raising taxes on gasoline and diesel fuel.

Second, fuel tax and subsidy levels are strongly associated with the same three factors that drive other types of taxes: income per capita, which is linked to disposable income, the demand for public goods, and the size of government (Ortiz-Ospina and Roser, 2020; Akitoby et al., 2006; Drazen, 2004; Luttmer and Singhal, 2011); government debt, which is associated with higher taxes (Schneider and Heredia, 2003); and oil and gas wealth, which provides an alternative source of government revenues and tends to reduce other types of taxes (Prichard et al., 2018; Brautigam et al., 2008). All three factors change slowly, and may help keep fuel taxes and subsidies in place through what Victor (2009, 7) calls "a political logic that is often difficult to alter."

Finally, the small changes in fuel taxes that did occur were primarily associated with unobserved, time-varying, country-specific factors. This result stands in contrast with prior studies that suggest governments adopt more climate-friendly policies when they are more democratic (Cheon et al., 2013; Midlarsky, 1998; Neumayer, 2002; Bayer and Urpelainen, 2016); when they have more effective bureaucracies, which can compensate the losers from environmental reforms (Kyle, 2018; Cheon et al., 2013; Victor, 2009); or when elections or leadership changes create "windows of opportunity" (Moerenhout, 2018; Harrison and Sundstrom, 2007).

We find no support for these or other arguments about the role of political factors. Instead, our analysis supports recent qualitative research on fuel tax reform that emphasize the importance of each country's unique configurations of actors, events, constraints and opportunities (Clements et al., 2013; Skovgaard and van Asselt, 2018; Inchauste and Victor, 2017; Rabe, 2018).

In sum, our analysis implies that fuel tax policies are determined by slowly-moving macro-level economic conditions, while changes in these policies are largely a function of micro-level political conditions that are highly context-specific. Our results are robust to many alternative specifications and the use of instrumental variables for fossil fuel wealth.

To explain these results, we argue they are consistent with a model in which fuel taxes are first and foremost *taxes*, not instruments of environmental policy. As such, they are jointly driven by a government's demand for revenues and the public's willingness to supply them; these in turn are affected by a country's income, debt, and natural resource endowment. When there is a gap between the fuel taxes that a government seeks to impose and the amount that citizens are willing to pay, the outcome is resolved by country-specific political factors, such as the capacity of citizens to mobilize, and the government's ability to curtail this mobilization.

At the broadest level, our research contributes to the study of climate change politics (Bernauer, 2013; Hughes and Lipscy, 2013; Javeline, 2014). We make three contributions to this literature. First, we offer a significantly improved way to measure the actions that governments are taking to curb greenhouse gas emissions. Unlike other climate policy indicators, our measure of monthly fossil fuel taxes and subsidies does not rely on subjective judgments; it only records implemented policies, not nominal ones; and it allows researchers to make fine-grained comparisons of policies across countries and over time. To the best of our knowledge, our data offers the most accurate and fine-grained measure of an important climate policy for a large number of countries over a significant period of time.

Second, we provide new insights about global progress on taxing carbon fuels. The concept of taxing carbon fuels has received widespread support among policy analysts, yet the success of these efforts has been difficult to measure. Our analysis covers the thirteen-year period leading up to the 2015 Paris Accord, which was characterized by growing alarm about the consequences of global climate change, and heightened international support for both reducing subsidies and raising taxes on fossil fuels. We find that over this period, taxes on one category of fossil fuels – transportation fuels – did not significantly increase, and by one measure, actually decreased. We take this as evidence of how difficult it is for governments to raise the cost of carbon fuels, and how a different political imperative – funding the government while avoiding protests – typically takes precedence. Less contentious emissions-reduction strategies – like making renewable energy cheaper, curtailing fossil fuel use through standards instead of prices, and encouraging subnational political action – may ultimately be more effective.

Finally, we suggest a new perspective on the global politics of fuel taxes: that they are mostly determined by the revenue needs of governments and largely unresponsive to the climate catastrophe. If these patterns hold for other types of carbon policies – a question we do not try to answer here – they may deepen our understanding of the political economy of climate change, and cast light on general patterns, obstacles, and opportunities.

We also bring several innovations to the study of fossil fuel taxes and subsidies.[4] Most research on this topic has been based on in-depth, highly granular, qualitative case studies; quantitative analyses have lagged behind, in part because of limited data. Our analysis is the first to use both monthly and annual data covering a large number of countries and years, to correct for distortions caused by broad-based taxes, to more carefully test alternative arguments, and to address the endogeneity of natural resource wealth. These innovations give us a stronger platform to evaluate the sources of fossil fuel taxes and subsidies.

The next section explains how we measure taxes and subsidies for gasoline and diesel, along with other key variables. Our empirical analysis is in section three. We discuss our results in section four, where we also develop a simple model to show how income, fossil fuel dependence, and local politics can account for the observed patterns. Section five concludes.

[4]Throughout this paper we use the terms "fossil fuel taxes" and "gasoline taxes" to refer to both taxes and subsidies. Subsidies can be characterized as negative taxes.

2 Data

2.1 Gasoline Taxes

To measure taxes and subsidies for gasoline, we collected data on local retail gas prices from January 2003 to June 2015 for 157 countries, representing 97.1% of the world's population and accounting for 98.2% of all greenhouse gas emissions. The countries included all sovereign states with populations over one million in 2012, except for four countries where we failed to obtain reliable data (Cuba, Eritrea, North Korea, and Turkmenistan).[5] Data are missing for 1,067 (4.5 percent) of the 23,550 country-months. Appendix Section 1 explains our method for deriving taxes and subsidies, the full list of countries and months (Table S1), and describes our data sources (Table S2).[6]

There are several ways to define and measure fossil fuel taxes and subsidies. We use a conservative definition and employ the "price gap" method.[7] Since refined petroleum products are traded internationally, it is possible to calculate the international supply cost – that is, the cost of bringing a liter of gasoline or diesel to consumers. Since they are sold on retail markets in virtually all countries, their in-country prices are observable. The difference between the international supply cost and the local retail price is the price gap and constitutes the implicit fuel tax or subsidy (Koplow, 2009).

We also correct for the effects of any general sales taxes, such as value-added taxes (VAT), that are imposed on all goods and services. Because they do not affect the price of gasoline or diesel relative to other goods, general sales taxes cannot cause consumers to switch toward cheaper transportation alternatives. We therefore control for the effects of VAT and other broadly-applied sales taxes with a novel data set created by the International Monetary Fund.[8]

Our measure of fossil fuel taxes and subsidies has three valuable properties. First, it tell us

[5]Over a three-year period, our research team gathered data from a large number of primary and secondary sources, working in ten languages. In 17 countries, we employed local researchers to obtain primary data that were not otherwise accessible.

[6]For the separate analysis of diesel taxes and subsidies, we use the biannual observations from Wagner (2013).

[7]The IMF identifies two classes of petroleum subsidies: "pre-tax subsidies," which represent the difference between the retail price and the international supply cost, and "post-tax subsidies" which are defined as the difference between the retail price and the sum of the supply cost, a basic consumption tax, and a Pigouvian tax that offsets the costs of local pollution, congestion, and carbon emissions (Coady et al., 2017). Post-tax subsidies are, by construction, larger than pre-tax subsidies. We only examine pre-tax subsidies.

[8]While the VAT correction makes our estimates more precise, it does not affect any of our results, which are substantially unchanged when the VAT correction is dropped.

about a policy that is politically costly to adopt. When climate policies are uncontroversial, their adoption tells us relatively little about the depth of the government's policy commitments. But the price of fuel affects many citizens on a daily level, and policies that raise it can be politically risky and lead to protest. This makes it a useful way to gauge a government's capacity to sustain carbon-reducing policies that raise consumer costs.

Second, it reveals the taxes and subsidies that were implemented, not merely ones that were publicly announced. Many governments declare ambitious climate policies that they fail to implement; others will adopt costly reforms without announcing them. We only measure policies once they affect prices at the pump.

Finally, our measure captures the size of the net tax or subsidy. A wide range of government policies can affect fossil fuels at different points in the supply chain – taxing or subsidizing the extraction, import, refining, or transportation of fuel – in ways that ultimately affect the retail price. Governments can also change the retail price directly, even without making formal changes to the tax code: state-owned oil companies, for example, can raise or lower gasoline prices by fiat. Our indicator measures the aggregated effects of these policies, producing a more complete picture of the consumption incentives or disincentives maintained by governments. Since some of these price-altering policies cannot be formally classified as taxes or subsidies, we refer to our measure as *net implicit taxes and subsidies.*

2.2 Explanatory variables

To learn about the correlates of fuel tax levels, we take an inductive approach. We begin with a baseline model that includes three economic variables that are widely believed to influence a country's tax structure: fossil fuel endowment, income per capita, and government debt. We then add variables to test alternative arguments about the role of democratic institutions, bureaucratic effectiveness, elections, oil discoveries, and leadership changes. In the Appendix we test additional arguments about the role of national oil companies and car ownership.

2.2.1 Fossil Fuel Wealth

Fossil fuel subsidies are strongly associated with oil and gas wealth, but the latter has not been well-measured. Previous studies of fuel taxes have used OPEC membership as a proxy for oil wealth, yet OPEC members produce less than 40 percent of the world's oil and gas (Cheon et al., 2013, 2015). A country's fossil fuel production may also be endogenous to its fossil fuel taxes, possibly leading to biased estimations.

We use three more fine-grained measures. Our preferred measure is *Fossil Fuel Dependence*, which is the fraction of a country's GDP that comes from oil and gas production and may be the most intuitive way to make comparisons across countries. Our alternative measures focus on oil exports: *Fossil Fuel Exports Dependence*, which expresses oil and gas exports as a fraction of total exports, and *Oil and Gas Exports per capita*, which expresses these exports in per capita terms. Although they are highly correlated, each captures a slightly different dimension of fossil fuel abundance: countries like Chad, with low incomes and modest levels of oil wealth, will have relatively high values of *Fossil Fuel Dependence* and *Fossil Fuel Export Dependence* but relatively low values of *Oil and Gas Exports per capita*; countries like Norway, with more diversified economies but greater per capita oil wealth, will have the opposite. We take our data on oil and gas production and exports from Ross and Mahdavi (2015) and World Bank (2019). To evaluate the impact of oil and gas wealth at the monthly level, we use data on giant oil field discoveries from Arezki et al. (2017).

Since we recognize that all of the oil wealth measures may be endogenous to other variables in our model (such as income and fuel taxes), we instrument for fossil fuel wealth using a country's 1960 oil endowment per capita. For robustness, we also employ an alternative instrument based on the spatial distribution of oil-yielding sedimentary basins (Cassidy, 2018). We assume that, conditional on the revenues generated from oil production, the historical geological endowment of a country's oil is plausibly exogenous from present-day implicit taxes on gasoline. To protect against violations of the exclusion restriction using this instrument, we follow Cassidy (2018) by controlling for potential geographical correlates of geological endowments and fuel price policies, which in our case include latitude, coastal access, and regional indicators.

2.2.2 Other variables

Our main economic measures (*GNI Per Capita* and *Central Government Debt*) are drawn from the World Development Indicators and the International Monetary Fund (World Bank, 2019; IMF, 2019a). Our baseline measure of democracy is the Polity IV score from Marshall et al. (2011), which we convert to the categorical measure *Autocracy*;[9] as alternatives, we also use the *Electoral Democracy* score from the Varieties of Democracy database (Coppedge et al., 2015) and a dichotomous measure of democracy from Boix et al. (2013). The *Government Effectiveness* score comes from the Worldwide Governance Indicators (WGI) and measures both expert and public perceptions of the quality of public services, the civil service, and policy formulation and implementation (World Bank, 2019). To measure the incidence of elections and leadership changes, we use data from the Archigos dataset (Goemans et al., 2009) and the NELDA project (Hyde and Marinov, 2015). Value-added tax data comes from the IMF (2019b).

3 Analysis

Our analysis is exploratory and we do not make strong claims about causal inference. Instead, our goals are to describe changes in fuel taxes from 2003 to 2015, and determine if prior arguments about the causes of fuel tax reform are consistent with our data. We begin with a cross-national analysis to evaluate explanations for fuel tax *levels*, then analyze panel data to evaluate explanations for policy *changes*. We also use biannual data on diesel prices from 2004 to 2014 from Wagner (2013) and ask similar questions about diesel taxes and subsidies.

3.1 Fuel tax levels, 2003-15

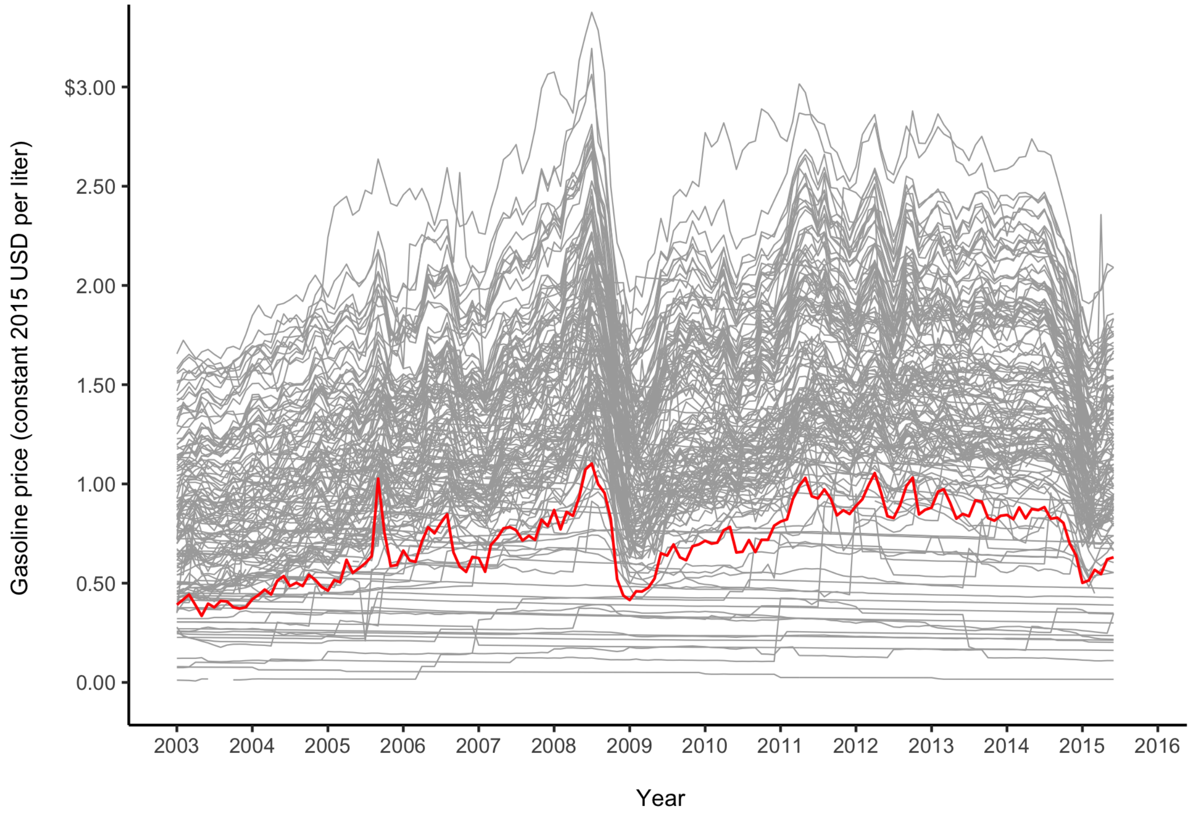
Figure 1 shows gasoline taxes and subsidies for 155 countries over the 2003-15 period.[10] Each gray line represents the retail price in a single country, while the heavy red line displays the "benchmark price," representing the supply cost of a liter of gasoline.[11] States fall into two groups: those above the red benchmark line, whose gasoline prices are greater than the supply cost (indicating they are taxing gas sales), and those below the benchmark line, whose prices are less than the supply cost (indicating they are subsidizing gasoline). Of the 155 countries in our data, 133 (85.8 percent) were net taxers for most of this period, while 22 (14.2 percent)

[9] Specifically, we converted the Polity IV into a binary variable denominated *Autocracy* that takes the value of 1 when the Polity IV score is equal to or lower than -6, and zero otherwise.

[10] Although we have local price data for Myanmar and Somalia, we could not include them because they lacked market exchange rates for their currencies during this period.

[11] For the benchmark price we use the spot price for conventional refined gasoline at the New York Harbor, adjusted to account for distribution costs.

Figure 1: **Gasoline prices by country, 2003-15.** Individual country price trends are shown in gray; the global benchmark price is plotted in bold red. All prices are in constant 2015 US dollars per liter.



were net subsidizers.[12]

Fossil fuel endowments appear to have a strong association with fuel taxes: there is a sizeable gap in tax levels between the oil-importing and oil-exporting countries, and the gap grew during the 2003-15 period (Figure 2). All of the 22 net subsidizers were oil exporters.[13] Among all countries, fossil fuel dependence is negatively correlated with fuel tax levels (Figure 3).

Income per capita also appears to be linked with fuel taxes, although the relationship is conditional on a country's oil endowment: among oil importers there is a U-shaped relationship between income and fuel taxes, while among oil exporters we find a linear relationship (Figure 4).[14] Hence our statistical analysis begins with a baseline model regressing fuel taxes on the log

[12]We define countries as net taxers or subsidizers comparing their median monthly price for the 2003-15 period to the median monthly benchmark price. If it was above the median benchmark price, we classify it as a "net taxer" and if it was below as a "net subsidizer."

[13]This group comprises Algeria, Angola, Azerbaijan, Bahrain, Ecuador, Egypt, Indonesia, Iran, Iraq, Kuwait, Libya, Myanmar, Malaysia, Nigeria, Oman, Qatar, Saudi Arabia, Sudan, Trinidad and Tobago, United Arab Emirates, Venezuela, and Yemen.

[14]In Appendix Figure S2, we demonstrate that the quadratic relationship between income and implicit fuel taxes remains constant over the 2003-15 period.

Figure 2: **Gasoline prices 2003-15, oil exporters versus importers.** Oil exporter and importer group averages are computed monthly using unweighted country taxes and subsidies.

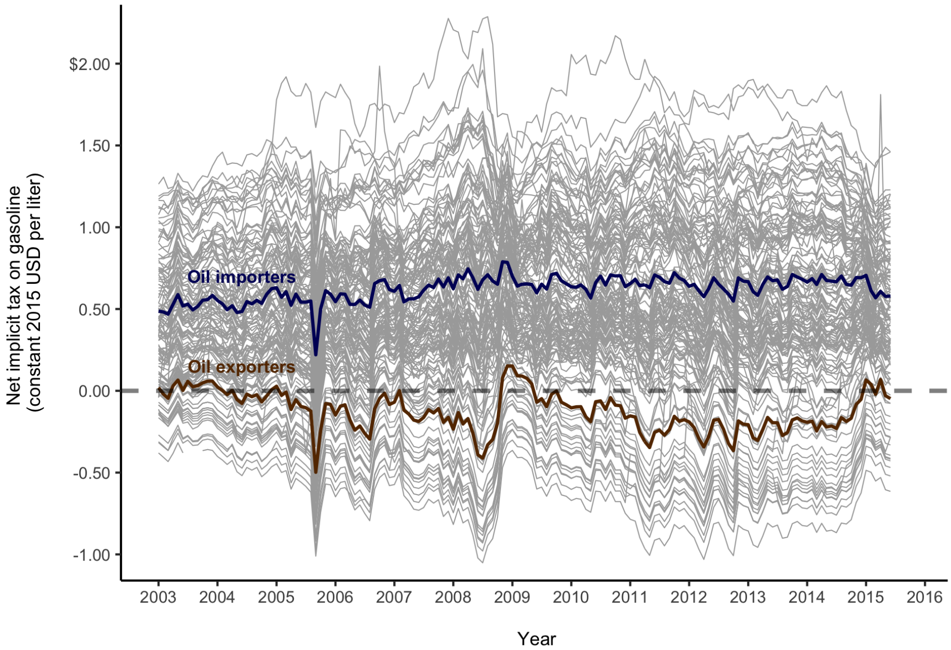


Figure 3: **Fuel dependence and net implicit taxes by country.** Cross-sectional relationship between *net implicit fuel taxes* and *fossil fuel dependence*, both averaged across the 2003-2015 period. Countries above 30% *fossil fuel exports dependence* are labeled to illustrate the high correlation ($\rho = 0.84$) between fuel dependence indicators.

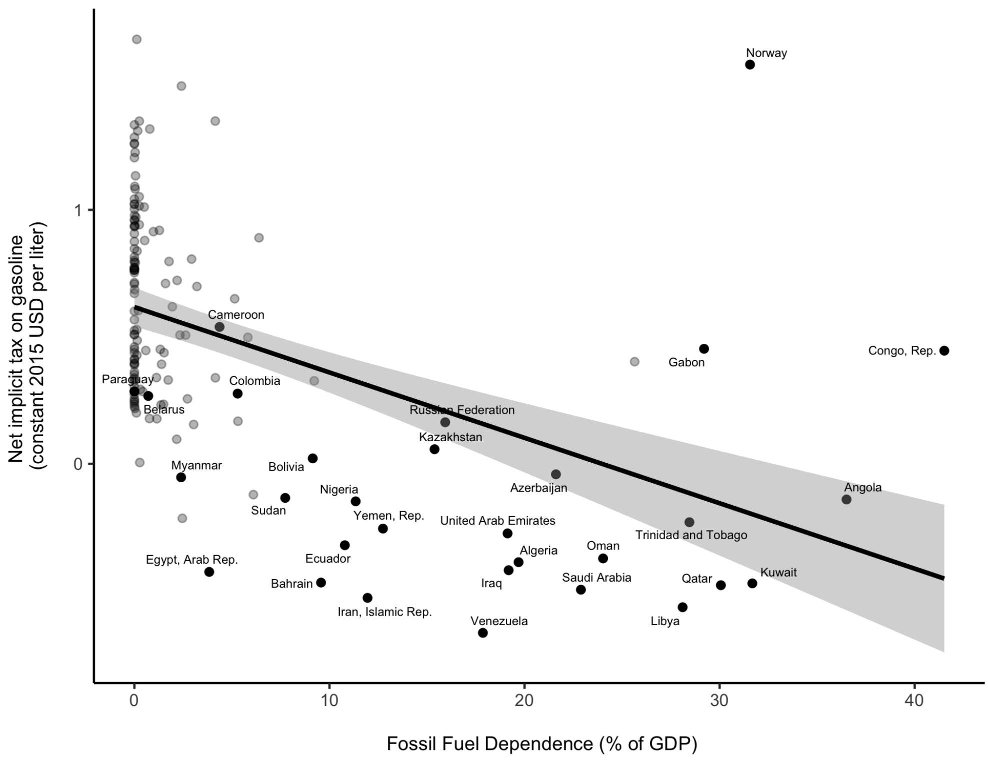


Figure 4: **Income per capita and net implicit taxes by country**. Cross-sectional relationship between *net implicit fuel taxes* and *GNI per capita*, both averaged across the 2003-2015 period, in oil-exporting countries (top panel) and oil-importing countries (bottom panel). A local smoother is shown to illustrate the approximately linear relationship in oil-exporters (the smoother excludes Norway, which is the outlier in the upper right quadrant) versus the U-shaped relationship in oil-importers. Model-based results plotted in Appendix Figure S1.

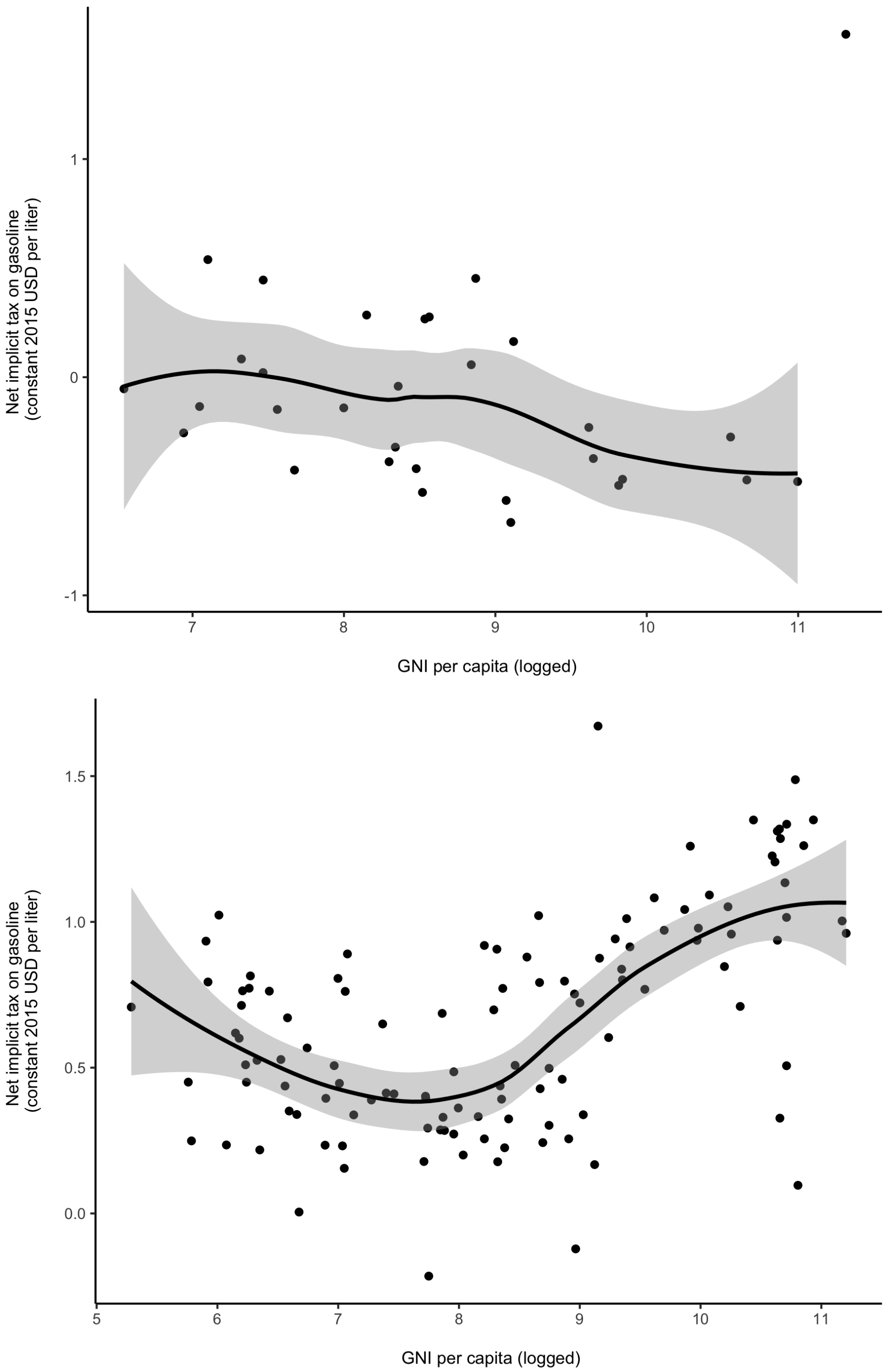


Table 1: Cross-Section / Basic Specification

	Dependent variable:			
	Net Implicit Tax on Gasoline			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	-1.032^{***}	-0.939^{***}	-0.873^{***}	-0.745^{***}
	(0.193)	(0.181)	(0.181)	(0.182)
log(GNI Per Capita Sq)	0.066^{***}	0.061^{***}	0.057^{***}	0.050^{***}
	(0.011)	(0.011)	(0.011)	(0.011)
Fossil Fuel Dependence		-0.016^{***}		
		(0.004)		
log(Oil and Gas Exports PC)			-0.024^{***}	
			(0.005)	
Fossil Fuel Export Dependence				-0.007^{***}
				(0.001)
Central Government Debt	0.003^{***}	0.002^{**}	0.002^{**}	0.002^{**}
	(0.001)	(0.001)	(0.001)	(0.001)
Value-Added Tax Rate	0.049^{***}	0.042^{***}	0.041^{***}	0.035^{***}
	(0.005)	(0.005)	(0.005)	(0.005)
Constant	3.543^{***}	3.328^{***}	2.986^{***}	2.695^{***}
	(0.817)	(0.750)	(0.750)	(0.747)
Observations	140	139	139	136
R^2	0.598	0.673	0.672	0.737
Adjusted R^2	0.586	0.660	0.660	0.727
Note: Robust SE			*p<0.1; **p<0.05; ***p<0.01	

of income per capita and the square of logged income, fossil fuel dependence, and government debt. We also include VAT as a control (Table 1).

The estimates are consistent with the scatterplots: there is a quadratic relationship between *GNI per capita* and fuel taxes, (Table 1, column 1; see also Appendix Figure S1), a negative relationship between *Fossil Fuel Dependence* and fuel taxes (Table 1, column 2), as well as a positive relationship between *Central Government Debt* and fuel taxes. When we measure fossil fuel endowments in alternative ways (Table 1, columns 3 and 4), the R-squared term is similar or larger. The R-squared terms in columns 2-4 suggest these variables account for between 67% and 74% of the variation in fuel taxes.[15]

In Table 2 we evaluate two political factors: *Autocracy* and *Government Effectiveness.* We also include an interaction term for *Fossil Fuel Dependence* and the *Autocracy* dummy, to investigate the claim that oil-rich autocracies are unusually reliant on fossil fuel subsidies, which

[15] Without the VAT-adjustment, *GNI per capita* and *Fossil Fuel Dependence* account for between 42% and 57% of the variation; the F-statistic for models with and without VAT is 97.4, indicative of the need for VAT-adjustment.

Table 2: Cross-Section / Additional Controls

	Dependent variable:			
	Net Implicit Tax on Gasoline			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	-0.939^{***}	-0.957^{***}	-0.957^{***}	-0.519^{**}
	(0.181)	(0.194)	(0.194)	(0.207)
log(GNI Per Capita Sq)	0.061^{***}	0.061^{***}	0.061^{***}	0.036^{***}
	(0.011)	(0.012)	(0.012)	(0.013)
Fossil Fuel Dependence	-0.016^{***}	-0.015^{***}	-0.015^{***}	-0.016^{***}
	(0.004)	(0.005)	(0.005)	(0.005)
Central Government Debt	0.002^{**}	0.002^{**}	0.002^{**}	0.001^{*}
	(0.001)	(0.001)	(0.001)	(0.001)
Autocracy (Polity IV)		-0.108	-0.108	-0.032
		(0.102)	(0.102)	(0.103)
Fossil Fuel Dependence * Autocracy		0.001	0.001	0.002
		(0.008)	(0.008)	(0.006)
Government Effectiveness		0.045	0.045	0.013
		(0.078)	(0.078)	(0.080)
European Union				-0.092
				(0.122)
Latitude				0.001
				(0.001)
Landlocked				0.003
				(0.054)
Asia + Pacific				-0.064
				(0.104)
Europe + North America				0.039
				(0.171)
Former USSR				-0.333^{**}
				(0.139)
Latin America + Caribbean				-0.248^{***}
				(0.089)
Middle East				-0.369^{***}
				(0.121)
Value-Added Tax Rate	0.042^{***}	0.042^{***}	0.042^{***}	0.038^{***}
	(0.005)	(0.005)	(0.005)	(0.008)
Constant	3.328^{***}	3.485^{***}	3.485^{***}	1.770^{**}
	(0.750)	(0.771)	(0.771)	(0.831)
Observations	139	134	134	134
R^2	0.673	0.709	0.709	0.766
Adjusted R^2	0.660	0.690	0.690	0.735
Note: Robust SE				*p<0.1; **p<0.05; ***p<0.01

they use to maintain popular support (Ross, 2012; Fails, 2019). We show in Appendix Table S4 that there is an unconditional, bivariate correlation between each of the "democracy" measures and fuel taxes. But when we place each of the measures in the full model, none are statistically correlated with fuel taxes and their inclusion has little effect on the baseline results.[16] Adding

[16] The failure to find heterogeneous effects is illustrated in Appendix Figure S3.

a series of regional controls to the model, plus measures of geography (latitude and coastal access), raises the R-squared and reduces the size of the *GNI per capita* and *GNI per capita squared* coefficients but otherwise does not change these results (column 4).

In the Appendix, we show that these results are unchanged when we use alternative measures for democracy (Tables S5–S6) and regional categories (Table S7); when we control for the presence of national oil companies (Table S8), a factor highlighted by Cheon et al. (2015); and when we control for the number of cars per capita (Table S9), which plausibly represents the size of the constituency benefiting directly from fuel subsidies.

These results could be biased by the endogeneity of *Fossil Fuel Dependence* to both our outcome and several of the other right-hand side variables (*GNI per capita*, *Autocracy*, and *Government Effectiveness*).[17] In Table 3, we show results from two-stage least squares models in which we use a country's 1960 oil endowment per capita to instrument for *Fossil Fuel Dependence*. The data comes from Tsui (2011), cited by Cassidy (2018). See Table S11 for results from first-stage models.

The instrument produces no change in the statistical significance of *Fossil Fuel Dependence* or the other right-hand side variables, although it causes the instrumented *Fossil Fuel Dependence* coefficients to roughly double in size, implying an attenuation bias in the naïve model using the endogenous regressor. To further check our results, we use an alternative instrument for *Fossil Fuel Dependence*, based on the spatial distribution of oil-yielding sedimentary basins and taken from Cassidy (2018) (Table S10). While the instrument is less efficient—the first stage F statistic is 17 compared to an F of 283 for the endowment instrument (Table S11)—the results are substantively similar.

[17] On the problem of endogeneity in the political effects of oil wealth, see, for example, Haber and Menaldo (2011).

Table 3: Instrumental Variables Approach

	Dependent variable:			
	Net Implicit Tax on Gasoline			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	-0.869^{***}	-1.041^{***}	-1.041^{***}	-0.519^{**}
	(0.205)	(0.212)	(0.212)	(0.235)
log(GNI Per Capita Sq)	0.058^{***}	0.072^{***}	0.072^{***}	0.044^{***}
	(0.012)	(0.014)	(0.014)	(0.015)
Fossil Fuel Dependence	-0.032^{***}	-0.033^{***}	-0.033^{***}	-0.033^{***}
	(0.005)	(0.006)	(0.006)	(0.007)
Central Government Debt	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Autocracy (Polity IV)		-0.165	-0.165	-0.080
		(0.148)	(0.148)	(0.145)
Fossil Fuel Dependence * Autocracy		0.010	0.010	0.009
		(0.009)	(0.009)	(0.008)
Government Effectiveness		-0.122	-0.122	-0.150^{*}
		(0.086)	(0.086)	(0.088)
European Union				-0.168
				(0.115)
Latitude				0.002
				(0.002)
Landlocked				-0.026
				(0.068)
Asia + Pacific				-0.133
				(0.104)
Europe + North America				-0.113
				(0.172)
Former USSR				-0.467^{***}
				(0.167)
Latin America + Caribbean				-0.374^{***}
				(0.105)
Middle East				-0.411^{***}
				(0.129)
Value-Added Tax Rate	0.034^{***}	0.040^{***}	0.040^{***}	0.041^{***}
	(0.005)	(0.005)	(0.005)	(0.006)
Constant	3.230^{***}	3.527^{***}	3.527^{***}	1.383
	(0.852)	(0.842)	(0.842)	(0.957)
Observations	137	132	132	132
Adjusted R^2	0.587	0.633	0.633	0.684
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01			

3.2 Changes in Fuel Taxes

How much did fuel taxes change from 2003 to 2015? What caused the changes?

In Figure 5 we display how fuel taxes changed for the 141 countries with relatively complete data for both 2003 and 2015. The x-axis shows the implicit tax or subsidy in the first six months of 2003, while the y-axis shows the implicit tax or subsidy for the first half of 2015. Over these 13 years, taxes rose modestly in 73 countries (51.8 percent), fell modestly in 63 countries (44.7 percent), and were unchanged in five (3.5 percent). Countries were almost as likely to reduce taxes as to raise them.[18]

If we weight all countries equally, the median gasoline tax rose from \$0.29 per liter to \$0.37 per liter between 2003 and 2015; this is equivalent to an annual increase of 2.05 percent, adjusted for inflation. We can alternatively weight each country's price by its gasoline consumption in the same year, giving high-consuming countries more weight than low-consuming countries. The median consumption-weighted tax fell from \$0.12 to \$0.06 per liter – a drop of 48.8 percent, equivalent to an annual decline of 5.43 percent.The downward trend in the consumption-weighted price reflects a global shift: while consumption fell among the high-tax countries (which were generally high-income, oil-importing states), it rose among low-tax countries (which were predominantly middle-income and oil-exporting states).

We report a similar pattern for diesel fuel: from 2004 to 2014, the unweighted median diesel tax rose from \$0.22 per liter to \$0.25 per liter, a total-period increase of 12.0 percent and an annual increase of just 0.95 percent.[19] Diesel taxes rose in 62 countries and fell in 66 countries.

For many issues, the absence of global policy change might be unremarkable. But the absence of change in fossil fuel taxes and subsidies from 2003 to 2015 is surprising, since this was a period of rapidly-growing attention to both the hazards of climate change and the benefits of taxing carbon emissions.

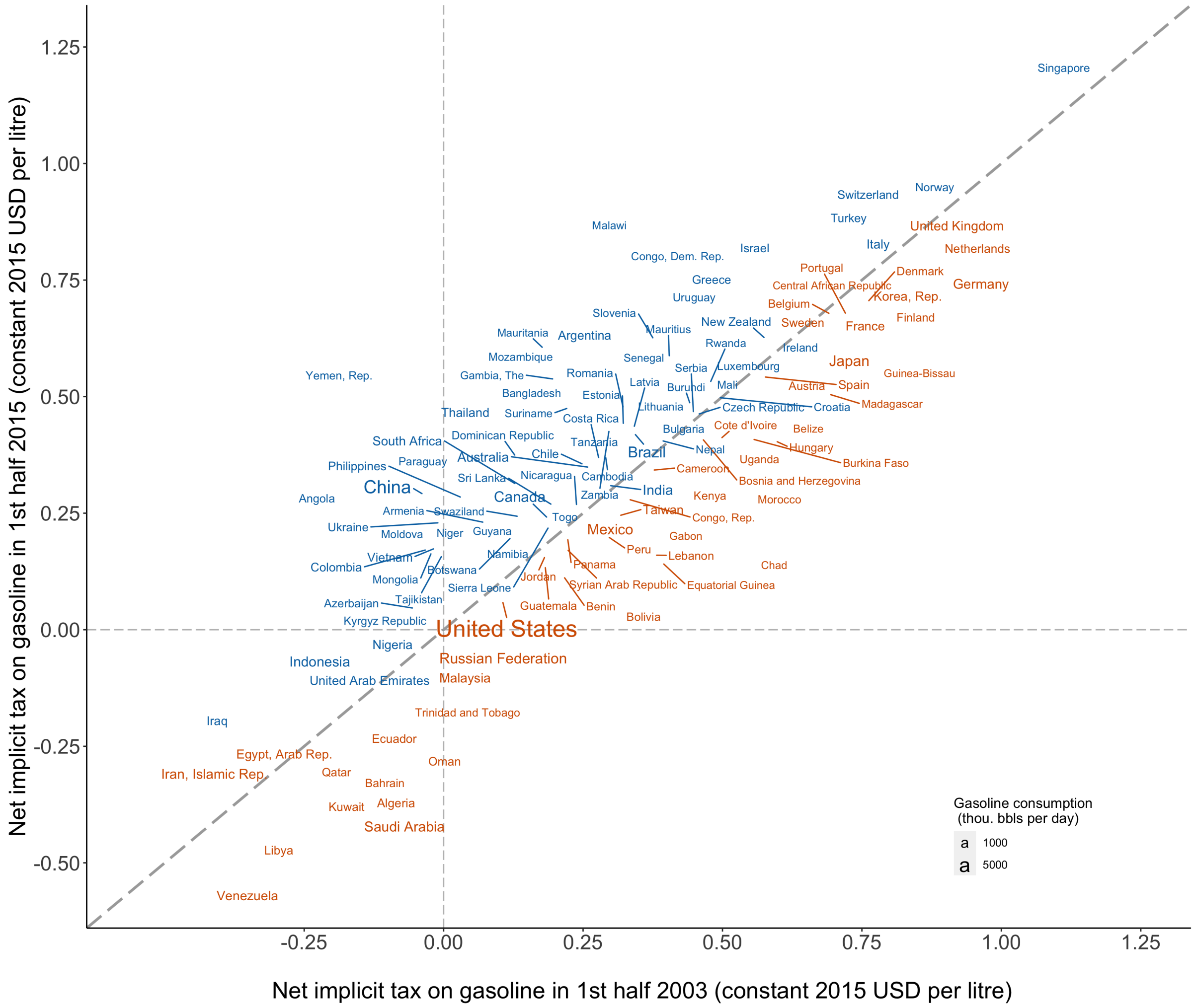
Table 4 displays the results from a fixed-effects model with our monthly fuel tax data aggregated into annual observations.[20] As with the cross-country results, *Fossil Fuel Dependence*

[18]These trends are not sensitive to the choice of beginning and end dates: when we use the second half of 2003 and the second half of 2014 as alternative beginning and end periods, the trends are similar.

[19]We are unable to perform a consumption-weighted calculation for diesel given the lack of time-series data on country-level diesel consumption.

[20]Note we choose the fixed-effects specification as we are interested in within-country changes over time. In Appendix Tables S12–S15, we also show the results from a pooled model without fixed effects.

Figure 5: **Gasoline taxes by country in 2003 and 2015.** This figure compares the average per-liter tax or subsidy for countries in the first six months of 2003 to the first six months of 2015. Taxes or subsidies are net of each country's value-added tax rate; this is calculated as $Price_{it} * (1 - VAT_{it}) - Benchmark_t$. Countries with the same level of taxes or subsidies in both periods will fall along the 45-degree dashed line. Countries with higher taxes (or lower subsidies) in 2015 than in 2003 are colored in blue; those with lower taxes (or higher subsidies) are colored in dark orange. See also Appendix Figures S4–S5.



is negatively associated with fuel taxes, even after accounting for country and year fixed effects. Both *Central Government Debt* and *VAT* remain statistically correlated with fuel taxes, but *GNI per capita* does not. *Government Effectiveness* continues to be uncorrelated with fuel taxes. *Autocracy* is statistically associated with fuel taxes at the 10% level, but the sign on the coefficient is reversed from the model in Table 2. Further, there remains no evidence of a differential effect of fuel dependence on taxes between autocracies and democracies.

A model with *only* country-fixed effects and no other covariates gives an adjusted R^2 of 0.915, indicating that the overwhelming majority of the variation in our data is cross-sectional,

Table 4: Cross-section Time-series: Annual Panel

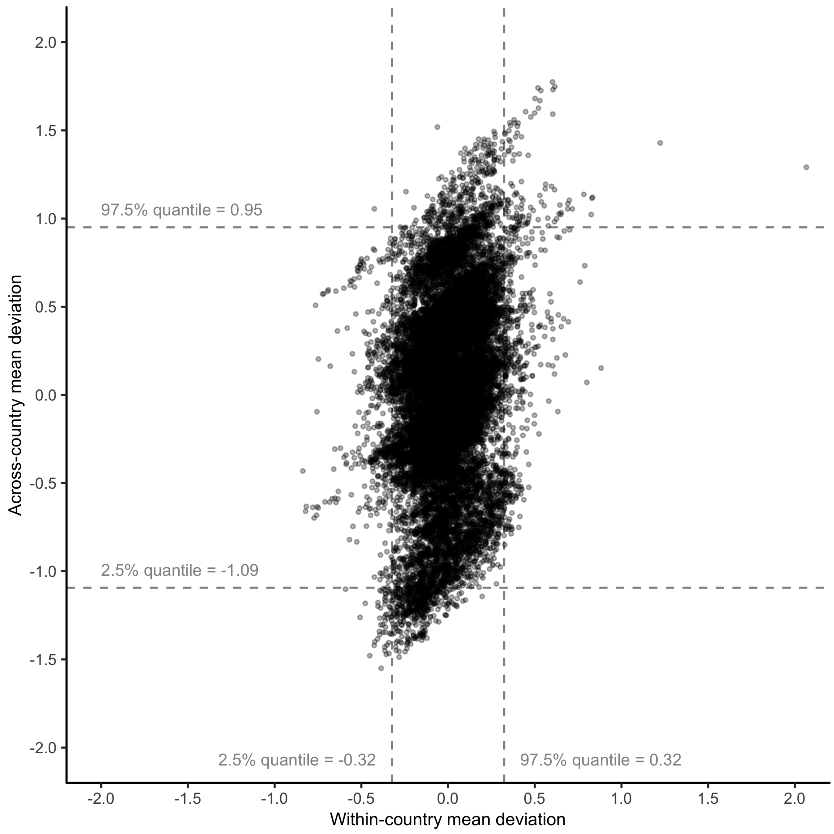
	Dependent variable:
	Net Implicit Tax on Gasoline
log(GNI Per Capita)	−0.020
	(0.097)
log(GNI Per Capita Sq)	0.004
	(0.006)
Fossil Fuel Dependence	-0.006^{***}
	(0.002)
Central Government Debt	0.001^{***}
	(0.0003)
Autocracy (Polity IV)	0.096^{*}
	(0.054)
Fossil Fuel Dependence * Autocracy	−0.005
	(0.003)
Government Effectiveness	0.026
	(0.031)
Value-Added Tax Rate	0.018^{***}
	(0.004)
Constant	0.147
	(0.400)
Observations	1,522
Country and Year FE	Y
Adjusted R^2	0.931
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01

not intertemporal (Figure 6).[21] Our baseline model—including income, fossil fuel dependence, debt, and VAT—accounts for about 20% of the remaining intertemporal variation (0.017/0.085 in the annual panel regressions and 0.025/0.126 in the monthly panel regressions), while the remaining 80% is accounted for by unobserved, time-varying, country-specific factors.

Our monthly data allows us to estimate the role of three types of infra-annual events: the discovery of giant oil fields, elections, and leadership turnover. Our dependent variable is now the monthly measure of *Net Implicit Tax on Gasoline*. In Table 5 we enter each measure with leads and lags by quarters. There appears to be no statistical relationship between fuel taxes and the timing of elections or changes in political leadership. The month of an oil discovery and the following two quarters are associated with *higher* fuel taxes at the p=*.05* and p=*.10* levels, albeit with a small substantive effect; this is not consistent with the notion that fossil fuel wealth leads to reduced fuel taxes, and we cannot rule out the possibility that this result

[21] Adding year-fixed effects only marginally improves the fit of the model: an adjusted R-squared increase to 0.922, and an F-statistic of only 13.2 ($p < 0.0001$).

Figure 6: **Deviation from within-country versus across-country average net implicit tax on gasoline.** Each point in the graph represents the difference between a country-month-year tax and the overall country mean (x-axis) and the overall monthly mean (y-axis). The 95% quantile range of across-country deviations is roughly 3 times larger than the within-country deviation range; a sample with balanced across-country and within-country variation would have roughly equal ranges.



is an artifact of the oil discoveries dataset, making us reluctant to draw inferences.

For each variable we tried a range of other specifications, including leads and lags to cover events one to twelve months before, and one to twelve months following, each type of event. The results were substantively unchanged.[22]

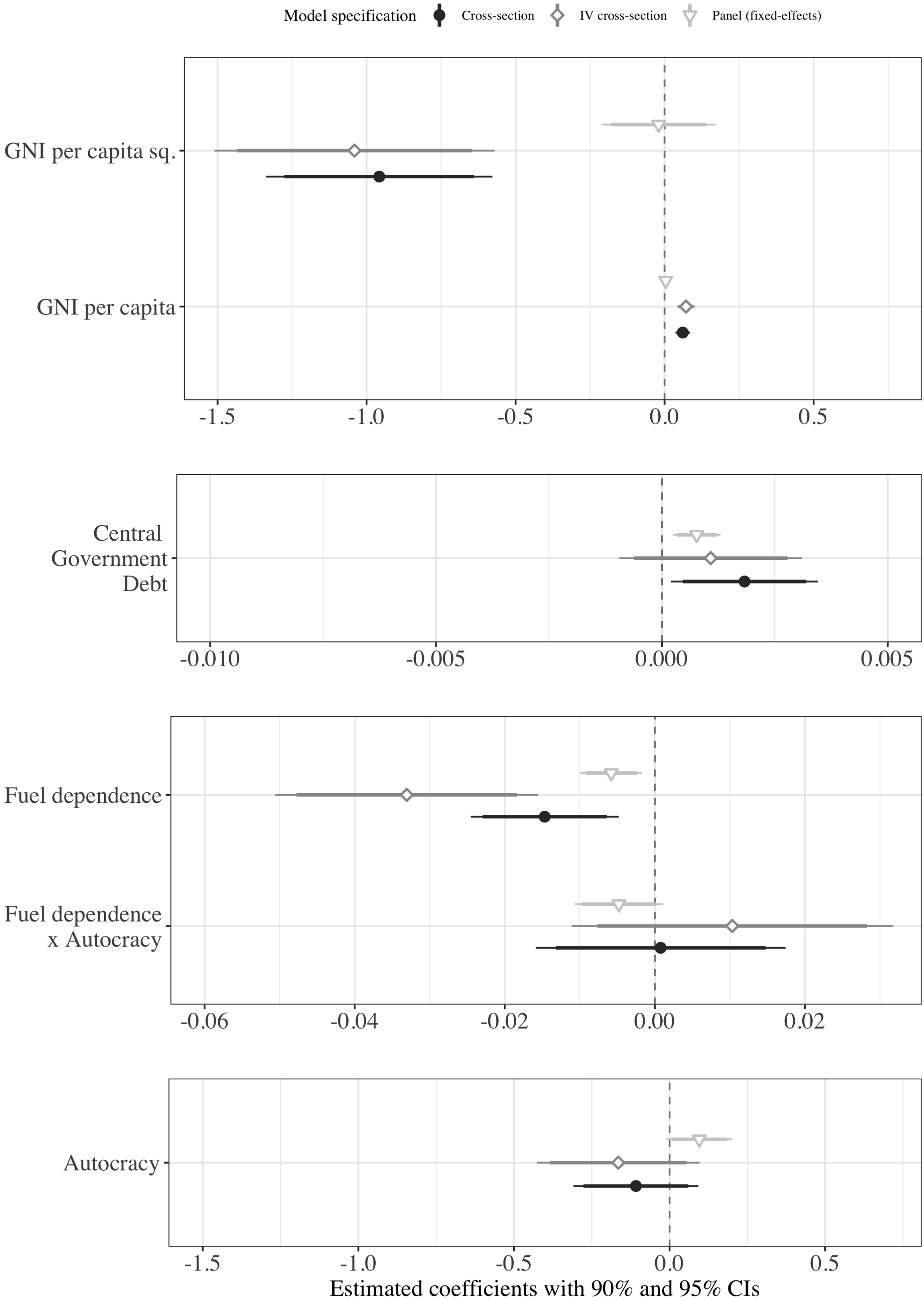
The results across these three model specifications – cross-sectional, instrumental variables analysis, and fixed-effects panel – are plotted in Figure 7 for four of our variables of interest: *GNI per capita*, *Fossil Fuel Dependence*, *Central Government Debt*, and *Autocracy*.

[22] In the Appendix, we show the results of a pooled model with monthly data (Table S16).

Table 5: Cross-section Time-series: Monthly Panel

	Dependent variable:
	Net Implicit Tax on Gasoline
1 Qr Before Elections	0.001
	(0.009)
2 Qr Before Elections	0.004
	(0.010)
3 Qr Before Elections	0.001
	(0.009)
4 Qr Before Elections	0.001
	(0.010)
1 Qr After Elections	0.002
	(0.009)
2 Qr After Elections	−0.003
	(0.009)
3 Qr After Elections	−0.007
	(0.010)
4 Qr After Elections	−0.011
	(0.009)
1 Qr After Leader Turnover	0.010
	(0.015)
2 Qr After Leader Turnover	0.013
	(0.014)
3 Qr After Leader Turnover	0.017
	(0.014)
4 Qr After Leader Turnover	0.008
	(0.014)
Oil Discovery Month	0.041**
	(0.017)
1 Qr After Discovery Month	0.033**
	(0.016)
2 Qr After Discovery Month	0.026*
	(0.015)
3 Qr After Discovery Month	0.016
	(0.015)
4 Qr After Discovery Month	0.023
	(0.016)
Constant	0.218***
	(0.015)
Observations	22,124
Country FE	Y
Adjusted R^2	0.898
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01

Figure 7: **Model results across three specifications for income, fuel dependence, autocracy, and government debt.** Note the differing scales of the estimated coefficients across all covariates. See Appendix Figure S3 for fuel-autocracy interaction marginal effects plot.



4 Discussion

In our data analysis, three patterns stand out: the powerful role of core economic factors, particularly income per capita and fossil fuel wealth; the lack of any consistent effect from political factors, including democracy, elections, leadership, and government effectiveness; and the importance of unobserved, country-specific factors in explaining policy changes. These patterns are robust to multiple specifications and the use of instruments for the endogenous *Fossil Fuel Dependence* variable. In the Appendix, we show that the same three patterns apply to taxes on diesel fuel (Tables S17–S20).

4.1 Economic Factors

Gasoline taxes appear to be largely a function of three macro-level economic factors: income, fossil fuel wealth, and government debt. Depending on how we measure fossil fuel wealth, together they account for between 42% and 57% of the country-to-country variation.[23]

The substantive effect of income appears to be large, though it is difficult to estimate with much precision—partly because the effects of income and fossil fuel wealth are confounded, partly because the effects of income vary by a country's natural resource endowment, and partly because among oil-importing countries, the impact of income on fuel taxes is U-shaped (Figure 4 and Appendix Figures S1–S2). Still, it is consistent with the performances of many countries: we observe the highest fuel taxes in very rich countries (like Singapore and Switzerland) and very poor ones (like Burundi and Malawi), which suggests the U-shaped relationship; and we see fast-growing middle-income countries like China and Bangladesh enacting large increases in fuel taxes.

The substantive effect of fossil fuel wealth, however, is more straightforward and unambiguously large. In our baseline estimation (Table 1, column 2), a one standard deviation increase in *Fossil Fuel Dependence* is associated with a 16 cent decrease in the fuel tax. For example, as a country's fuel dependence increases from the levels in Malaysia (6.1%) to Qatar (30.1%), the fuel tax decreases by 43 cents, or 20% of the total range of the variable. Our results are similar when we use alternative measures of oil wealth (Table 1, columns 3 and 4), and roughly doubles in size when we use petroleum endowment in 1960 as an instrument (Table 3). We observe a

[23] This is based on running the models in Table 1 without controlling for VAT.

similar relationship in the panel data: increases in *Fossil Fuel Dependence* are associated with declines in fuel taxes, even after accounting for two-way fixed effects (Table 4). This matches our observations of countries like Chad, Bolivia, and Equatorial Guinea, which had fast-growing fossil fuel exports and some of the biggest drops in fuel taxes.

Central Government Debt has a statistical effect that is smaller: a one standard deviation increase in debt (31 percentage points) is correlated with a 6 cent increase in the fuel tax (Table 1, columns 2-4; Table 4, columns 1-3). A dramatic shift in debt, for example, from Luxembourg in 2005 (0.8% of GDP) to Greece in 2005 (108% of GDP) would be associated with a $0.19 per liter increase in fuel taxes, akin to a change of 8% of the total range of the dependent variable. This seems to match the experience of countries like Yemen and Sudan, where sudden changes in fiscal pressures between 2003 and 2015 led to the removal of large fuel subsidies.[24]

4.2 Political Factors

We find no consistent association between fuel taxes and democratic rule, elections, leadership changes, or government effectiveness. Although fuel taxes tend to be higher in democracies than autocracies, this is because regime type is confounded with *GNI per capita*, *Central Government Debt*, and *Fossil Fuel Dependence*. The same holds true for *Government Effectiveness*: its naïve correlation with fuel taxes appears to be spurious. Our result is consistent with Bernauer and Bōhmelt's conclusion that "Most studies are not able to identify a robust significant effect" of national-level political factors on fossil-fuel taxation (Bernauer and Böhmelt, 2013, 434-435).

If democratic rule led to higher fuel taxes, then countries that democratized between 2003 and 2015 period should have raised their gasoline tax, while countries that grew less democratic should have reduced it. We find no such pattern in the data: the countries that moved farthest towards democracy over the period had on average the same gasoline taxes at the end as they did at the beginning. The same is true for countries that moved the farthest toward autocracy (see Appendix Figure S5).

The absence of any effect from elections or leadership change might at first look surprising, since several case studies imply that these events can create "windows of opportunity" for reform. For example, Egypt's experience in 2014-15 seems to suggest that elections matter:

[24]For an in-depth look at the impact of fiscal pressures on fuel taxes, see Vagliasindi (2012) and Inchauste and Victor (2017).

after General El-Sisi won the 2014 presidential election in a landslide (following an earlier coup), he began the first of two rounds of politically-unpopular fiscal reforms, removing long-standing subsidies for gasoline, diesel, kerosene, and liquified natural gas (Moerenhout, 2018). Moerenhout's careful case study (Moerenhout, 2018, 268) describes Egypt as "a good example of opportunistic reform," and observes that "Many subsidy reforms in countries with traditionally low prices happen in shocks and during windows of opportunity, most often at the time of an observable fiscal crisis or after an election."

Yet the longer-term effects of these reforms – and hence of the Egyptian election – are unclear. By 2017, the real price of Egyptian gasoline had dropped well below the 2014 pre-reform price, due in part to a devaluation of the Egyptian pound. El-Sisi's post-election reforms had much less impact than first appeared.

The 2018 Presidential election in Mexico was also surprisingly inconsequential. In December 2017, the Mexican government unveiled large gasoline price increases, which led to riots across the country (Grunstein, 2017). During the 2018 presidential campaign, the candidate who eventually won—Andrés Manuel López Obrador—harshly criticized the fuel price increases and said he would roll them back. Yet after taking office in December 2018, the current administration has left the gasoline price policy mostly unchanged.

4.3 Unobserved factors

Our analysis implies that changes in fuel tax policies are predominantly a function of complex, time-varying, country-specific factors. While variations in fuel taxes over time are relatively small, 80% of these intertemporal changes are *not* associated with any of the variables in our models. Unobserved factors at the country level may be the most important drivers of changing fuel prices.

While this result may look perplexing, it is consistent with the sizable case study literature on fuel taxes, which emphasizes the causal impact of distinctive juxtapositions of actors and events, idiosyncratic local conditions, and fleeting opportunities for reform (Clements et al., 2013; Skovgaard and van Asselt, 2018; Rabe, 2018; Inchauste and Victor, 2017). The impact and complexity of fluctuating local conditions may help explain why, after a decade of research from the World Bank and IMF, there is no straightforward formula for subsidy reform. Our analysis echos the conclusion in Inchauste and Victor (2017, 3) that, “local details matter enormously and vary by country, by market, by fuel type, and by the political organization of the relevant interest groups. The factors relevant in political economy are highly complex and difficult to study without detailed case study analysis.”

4.4 A Model of the Supply and Demand of Fossil Fuel Taxes

How do these four factors – income per capita, fossil fuel dependence, government debt, and local politics – jointly determine fuel taxes? Here we develop a simple model to illustrate how they could produce some of the patterns we observe in the data.

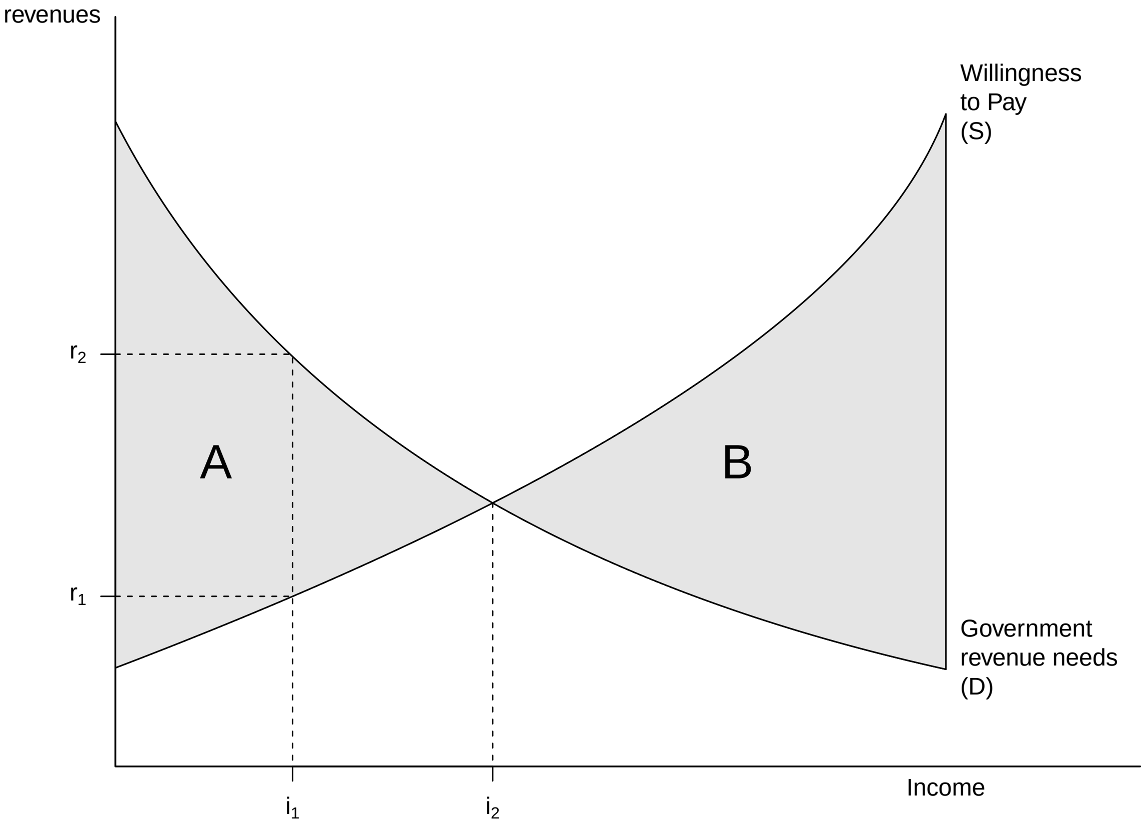
Our approach is to treat fuel taxes as *taxes*, not instruments of environmental policy. We hence assume they are influenced by the same broad factors that affect all tax policies, including a government’s demand for revenues and the population’s willingness to supply them. These factors include a country’s income level, natural resource wealth, and debt burden.

Our model incorporates longstanding ideas about the determinants of tax policies: that higher incomes lead to more government spending as a fraction of the economy, and hence higher taxes (Ortiz-Ospina and Roser, 2020; Akitoby et al., 2006; Drazen, 2004); that the governments of low-income countries are dependent on easy-to-collect taxes, including trade taxes and taxes on commodities for which demand is inelastic (Slemrod, 1990; Besley and Persson, 2014); and that as incomes rise, governments become less reliant on trade and commodity taxes and more reliant on taxes on income, profits, and capital gains (Joshi et al., 2014; Besley and Persson, 2014). These suggest that among low-income countries, taxes on fossil fuels should be relatively high, since transportation fuels are both commodities and (in our baseline example) imported. They also imply that as incomes rise, the government’s demand for fossil fuel tax revenues should *decline*, as it increasingly relies on taxes on income, profits, and capital gains.

Rising incomes should also affect the population’s willingness to pay fuel taxes: more wealth creates both more disposable income and a greater demand for public goods (Luttmer and Singhal, 2011; Greenstone and Jack, 2015). This implies that rising incomes should be associated with an increased willingness to pay fuel taxes.

In our model, fuel taxes are jointly determined by governments that demand tax revenues and citizens who must supply them. Countries are divided into fossil fuel importers and exporters.

Figure 8: **Supply and Demand of Revenue from Fossil Fuel Taxes.** Consumer willingness to pay fuel taxes (supply, S) and government demand for fuel tax revenues (demand, D), plotted by national income (x-axis) and fuel tax revenues (y-axis). Shaded regions (A and B) represent the divergence between government and citizen preferences. Points r_1 and r_2 represent the potential range of gasoline tax revenues when country income is relatively low at i_1. Point i_2 marks the income threshold after which willingness to pay exceeds government need for revenues.



Consider first the oil importers (Figure 8). When country incomes are low, governments are highly dependent on fuel tax revenues and wish to keep rates high. As countries become wealthier, governments grow more reliant on other, more broadly-based tax instruments, causing the government's demand for fuel tax revenue to slope downward. At the same time, when incomes rise citizens grow more willing to pay high fuel taxes, producing an upward-sloping supply curve.

When country income is low (i_1), the government will attempt to set the gasoline tax at r_2 even though the median citizen is only willing to pay r_1 in taxes. The larger the gap between r_1 and r_2, the greater the dissatisfaction of citizens and the higher the likelihood that the government's preferred tax level will spark protests. Since the preferences of governments and citizens diverge in Area A, there is no equilibrium fuel tax. The tax will hence be determined by political factors that reflect the relative bargaining power of the two parties, such as the capacity of citizens to organize protests, and the capacity of the government to deter them.

Once incomes pass a certain threshold (i_2), the public's willingness to pay exceeds the government's need for fuel taxes, making the government's revenue needs less salient.[25] Further increases in income will lead to more disposable income and a greater willingness to fund public goods, and hence pay fuel taxes; since the government's demand function is no longer relevant, this is sufficient to cause the price to rise. If we allow for heterogeneity in the willingness of citizens to pay for public goods, we may still observe conflicts in Area B over the price. Local political conditions will determine which groups are more influential and hence what the tax will be.

Now consider a country with significant hydrocarbon wealth. Hydrocarbon wealth typically produces large government revenues, even in low-income countries; this tends to reduce the government's need for revenues from other sources, including fuel taxes (Ross, 2012). In an oil-exporting country, the demand curve should hence be relatively flat and closer to zero.

The supply curve should also become flatter. In most oil-exporting countries, citizens believe oil wealth belongs to the nation and confers on them a right to purchase fuel without paying more than the marginal supply cost, even when their disposable incomes rise (Beblawi and Luciani, 1990; Hertog and Woertz, 2013; El-Katiri, 2014; Krane, 2018). Hence in oil-exporting countries, the fuel tax should be relatively low, since both curves are closer to zero. It should also remain constant as incomes rise.[26]

The model suggests a way to account for some of the key features of the data, including the impact of incomes on fuel taxes, and why it may vary between oil-importing and oil-exporting states; the relationship between fossil fuel endowments and fuel taxes; the salience of local conditions; and the conflicts that break out over fuel prices, particularly in low and middle income countries.

[25] That is, the government finds it easier to raise revenues with other types of taxes, making fuel taxes a relatively unimportant source of revenue.

[26] When the retail price is below the international supply cost—e.g., the price of imported fuel—the difference is defined as a subsidy.

5 Conclusion

We believe this is the most comprehensive and accurate analysis to date of an important climate-related policy across a large number of countries and years. Our findings are worrisome: from 2003 to 2015, taxes and subsidies for transportation fuels showed little change, with increases in some countries offset by declines in others. Our analysis is consistent with a model in which fuel taxes are determined by a country's income and revenue needs rather than its environmental commitments. There is little or no evidence that governments changed their fuel tax policies in response to the climate emergency.

We also find no support for prior claims about political factors that influence either climate policies in general or fuel taxes in particular. Taxes and subsidies were not associated with democratic accountability, elections, bureaucratic effectiveness, oil discoveries, automobile ownership, or state-owned enterprises.

Instead, policies were associated with a combination of macro-level economic conditions—income levels, fossil fuel endowments, and government debt—and micro-level, country-specific political conditions that follow no readily-discernible patterns. The latter finding is consistent with the conclusions of several collections of qualitative case studies that emphasize the critical role of contextual factors in the reform of fossil fuel taxes and subsidies (Inchauste and Victor, 2017; Clements et al., 2013; Vagliasindi, 2012; Skovgaard and van Asselt, 2018).

Our findings may cast light on a broader class of politically-costly climate policies, particularly ones that entail carbon pricing. Although carbon taxes are championed by many economists and policy analysts for their efficiency, it is unclear whether governments are adopting them. Several reports suggest their use is spreading and note the rising number of jurisdictions that have implemented them or are considering doing so (Klenert et al., 2018). We find that one type of carbon tax, on transportation fuels, made little progress between 2003 and 2015. This probably reflects the "breadth and ferocity of political opposition" to carbon-pricing proposals across many jurisdictions (Rabe, 2018, xvi).

Still, our findings also suggest there may be opportunities to raise fossil fuel taxes in countries where the fundamental determinants of tax policies – income levels, debt, and fossil fuel dependence – are changing in the right directions. In China, quickly-rising incomes probably made it politically feasible for the government to hike fuel taxes; in Norway and Indonesia, declining fossil fuel dependence created political conditions that ultimately opened the door to higher gasoline taxes. Over the next decade, incomes in quickly-growing countries like India and Vietnam may move them past the inflection point on the U-curve when countries typically raise their fuel taxes. If our model is correct, this makes them good candidates for significant increases in fuel taxes, despite the expected gains in car ownership.

Fortunately, there are many ways governments can discourage fossil fuel consumption without imposing new taxes on consumer products: instead of making gasoline and diesel more expensive, they can make green alternatives cheaper, for example, by investing in mass transit and subsidizing electric vehicles. They can also use regulations instead of prices by raising fuel efficiency standards, and in the electricity sector, adopting renewable portfolio standards and shutting down coal plants.

Fossil fuel taxes are not a lost cause, but they are much harder to advance than many recognize. Other carbon-reducing policies may ultimately be politically easier to implement.

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Supporting Information

Why Do Governments Tax or Subsidize Fossil Fuels?

To be published as Online Appendix

Contents

1 Supplementary Data Description

1.1 Data collection methods

1.1.1 Selection of dates and grades

For countries with data reported more frequently than monthly intervals (daily, weekly or bi-weekly), we used the price from the first day or week of the month as the monthly price. When data on multiple gasoline grades were available we use regular-graded gasoline (typically between 87 and 90 octane) to reflect the type most likely to be purchased by the average consumer. In countries where the availability of grades changes over time we selected the grade with the longest coverage. When data were available for different parts of a country we selected the region that includes the capital city.

1.1.2 Converting local currencies

To convert local currencies to US dollars we use monthly exchange rates from the IMF International Financial Statistics. For converting from nominal to real 2015 US dollars we use monthly inflation rates from the US Federal Reserve Economic Database (FRED) Consumer Price Index for All Urban Consumers: All Items Less Food and Energy (CPILFESL) series. In countries that experienced currency changes or revaluations—for example, Romania (July 2005), Turkey (January 2005), Ghana (August 2007)—all prices have been back-converted to the more recent currency price. For example, the Turkish lira was revalued in January 2005 by dividing by 1,000,000 to usher in the 'Second Turkish lira'. All pre-2005 prices are thus divided by 1,000,000 to be in Second Turkish lira per litre.

1.1.3 Benchmark prices

To estimate implicit net taxes and subsidies we compute the gap between the local price and the international benchmark price, less a small adjustment to account for distribution costs. To simplify our analysis we assume local distribution costs are fixed for all countries and years at 10 US cents per litre in constant 2015 US dollars; this estimate is drawn from ref. 19, which uses a similar figure for the cost of bringing refined gasoline to retailers. Though distribution and other local costs may vary by location, we expect those unobserved differences to change slowly, and thus may affect cross-country comparisons but not within-country comparisons over time.

For our benchmark we use the spot price for conventional refined gasoline at the New York Harbor as reported by the US Energy Information Administration. For oil-importing countries, the benchmark price represents the marginal cost of supplying gasoline to consumers. For oil-producing countries, who in many cases can supply gasoline to their citizens at a lower cost, the difference between the retail price and the benchmark represents the opportunity cost to the government: if it sets a retail price below the international benchmark, it is forgoing revenue it would otherwise accrue by selling its gasoline at a market price. In both cases we treat the difference between the retail price and the benchmark as the net implicit tax or subsidy.

1.1.4 Start and end dates

Six-month averages for 2003 ('first half 2003') and 2015 ('first half 2015') are computed using prices for January through June, where available. In countries where one or several of these months are missing, we instead use the average price for the non-missing months.

1.1.5 Consumption weighting

We weight implicit net taxes and subsidies by consumption using data on annual motor gasoline consumption from the US Energy Information Agency International Energy Statistics. A weight wit is given by a country's consumption share, calculated as the total consumption by each country i divided by total global consumption in month t (assuming constant consumption share across all 12 months in a given year). A global consumption-weighted mean implicit net tax isthen given by

$$tax_t = (\sum_{i=1}^{N} w_{it} price_{it}) - benchmark_t$$

at each month t. The most recent Energy Information Administration data on motorgasoline consumption are from 2012; we extrapolate consumption shares up to 2015 by assuming that shares (but not consumption) remain fixed across the 2012–2015 period.

1.2 Sample, variable descriptions, and protest data

Table S1: **List of countries and monthly observations used in the analysis.**

Country	Start Date	End Date	Monthly Obs.
Afghanistan	Mar 2004	Jun 2015	126
Albania	Jul 2008	Jun 2015	79
Algeria	Jan 2003	Jun 2015	150
Angola	Jan 2003	Jun 2015	150
Argentina	Jan 2003	Jun 2015	150
Armenia	Jan 2003	Mar 2015	138
Australia	Jan 2003	Jun 2015	150
Austria	Jan 2003	Jun 2015	150
Azerbaijan	Jan 2003	Jun 2015	150
Bahrain	Jan 2003	Jun 2015	150
Bangladesh	Jan 2003	Jun 2015	150
Belarus	Sep 2006	Jun 2015	106
Belgium	Jan 2003	Jun 2015	150
Belize	Jan 2003	Feb 2015	146
Benin	Jan 2003	Jun 2015	138
Bolivia	Jan 2003	Jun 2015	150
Bosnia and Herzegovina	Jan 2003	Jun 2015	150
Botswana	Jan 2003	Jun 2015	150
Brazil	Jan 2003	Jun 2015	150
Bulgaria	Jan 2003	Jun 2015	150
Burkina Faso	Jan 2003	Jun 2015	150
Burundi	Jan 2003	Jun 2015	140
Cambodia	Jan 2003	Mar 2015	146
Cameroon	Jan 2003	Jun 2015	132
Canada	Jan 2003	Jun 2015	150
Central African Republic	Jan 2003	Jun 2015	130
Chad	Jan 2003	Jun 2015	150
Chile	Jan 2003	Jun 2015	150
China	Jan 2003	Jun 2015	150
Colombia	Jan 2003	Jun 2015	150
Congo	Jan 2003	Jun 2015	146
Congo, Dem Rep	Jan 2003	Jun 2015	150
Costa Rica	Jan 2003	Jun 2015	150
Cote d'Ivoire	Jan 2003	Jun 2015	137
Croatia	Jan 2003	Jun 2015	150
Cyprus	May 2004	Jun 2015	134
Czech Republic	Jan 2003	Jun 2015	150
Denmark	Jan 2003	Jun 2015	150

Country	Start Date	End Date	Monthly Obs.
Dominican Republic	Jan 2003	Jun 2015	143
Ecuador	Jan 2003	Jun 2015	150
Egypt	Jan 2003	Jun 2015	150
El Salvador	Jan 2004	Jun 2015	138
Equatorial Guinea	Jan 2003	Jun 2015	150
Estonia	Jan 2003	Jun 2015	150
Ethiopia	Jan 2003	Jun 2015	150
Finland	Jan 2003	Jun 2015	150
France	Jan 2003	Jun 2015	150
Gabon	Jan 2003	Jun 2015	150
Gambia	Jan 2003	Jun 2015	144
Georgia	Jul 2008	Jun 2015	84
Germany	Jan 2003	Jun 2015	150
Ghana	Jan 2003	Jun 2015	149
Greece	Jan 2003	Jun 2015	150
Guatemala	Jan 2003	Jun 2015	150
Guinea	Jan 2005	Jun 2015	126
Guinea-Bissau	Jan 2003	Apr 2015	86
Guyana	Jan 2003	Jun 2015	150
Haiti	Jan 2003	Jun 2015	150
Honduras	Jan 2003	Jun 2015	150
Hungary	Jan 2003	Jun 2015	146
India	Jan 2003	Jun 2015	150
Indonesia	Jan 2003	Jun 2015	150
Iran	Jan 2003	Jun 2015	150
Iraq	Jan 2003	Jun 2015	150
Ireland	Jan 2003	Jun 2015	150
Israel	Jan 2003	Jun 2015	150
Italy	Jan 2003	Jun 2015	150
Jamaica	Feb 2004	Jun 2015	134
Japan	Jan 2003	Jun 2015	150
Jordan	Jan 2003	Jun 2015	150
Kazakhstan	Jul 2009	Jun 2015	72
Kenya	Jan 2003	Jun 2015	150
Kuwait	Jan 2003	Jun 2015	150
Kyrgyzstan	Jan 2003	Jun 2015	150
Laos	Jan 2003	Jun 2015	150
Latvia	Jan 2003	Jun 2015	150
Lebanon	Jan 2003	Jun 2015	150
Lesotho	Jan 2004	Jun 2015	136
Liberia	Jul 2008	Mar 2015	74
Libya	Jan 2003	Jun 2015	150
Lithuania	Jan 2003	Jun 2015	150

Country	Start Date	End Date	Monthly Obs.
Luxembourg	Jan 2003	Jun 2015	150
Macedonia	Apr 2006	Jun 2015	111
Madagascar	Jan 2003	Jun 2015	150
Malawi	Jan 2003	Jun 2015	150
Malaysia	Jan 2003	Jun 2015	150
Mali	Jan 2003	Jun 2015	149
Malta	Jun 2004	Jun 2015	133
Mauritania	Jan 2003	Jun 2015	142
Mauritius	Jan 2003	Jun 2015	150
Mexico	Jan 2003	Jun 2015	150
Moldova	Jan 2003	Jun 2015	150
Mongolia	Jan 2003	Jun 2015	150
Montenegro	Jul 2006	Jun 2015	108
Morocco	Jan 2003	Jun 2015	150
Mozambique	Feb 2003	Jun 2015	149
Myanmar	Jan 2003	Jul 2014	139
Namibia	Jan 2003	Jun 2015	146
Nepal	Jan 2003	Jun 2015	150
Netherlands	Jan 2003	Jun 2015	150
New Zealand	Jan 2003	Jun 2015	150
Nicaragua	Jan 2003	Jun 2015	150
Niger	Jan 2003	Jun 2015	150
Nigeria	Jan 2003	Jun 2015	150
Norway	Jan 2003	Jun 2015	150
Oman	Jan 2003	Jun 2015	150
Pakistan	May 2006	Jun 2015	109
Panama	Jan 2003	Jun 2015	150
Papua New Guinea	Jan 2003	Apr 2015	112
Paraguay	Jan 2003	Jun 2015	150
Peru	Jan 2003	Jun 2015	150
Philippines	Jan 2003	Jun 2015	150
Poland	May 2004	Jun 2015	134
Portugal	Jan 2003	Jun 2015	150
Qatar	Jan 2003	Jun 2015	150
Romania	Jan 2003	Jun 2015	150
Russia	Jan 2003	Jun 2015	150
Rwanda	Jan 2003	Jun 2015	150
Saudi Arabia	Jan 2003	Jun 2015	150
Senegal	Jan 2003	Jun 2015	144
Serbia	Jan 2003	Jun 2015	150
Sierra Leone	Jan 2003	Jun 2015	144
Singapore	Jan 2003	Jun 2015	150
Slovakia	Jun 2004	Jun 2015	133

Country	Start Date	End Date	Monthly Obs.
Slovenia	Jan 2003	Jun 2015	150
Somalia	Jan 2003	Jun 2015	146
South Africa	Jan 2003	Jun 2015	150
South Korea	Jan 2003	Jun 2015	150
Spain	Jan 2003	Jun 2015	150
Sri Lanka	Jan 2003	Jun 2015	150
Sudan	Jan 2003	Jun 2015	150
Suriname	Jan 2003	Jun 2015	150
Swaziland	Jan 2003	Jun 2015	150
Sweden	Jan 2003	Jun 2015	150
Switzerland	Jan 2003	Jun 2015	150
Syria	Jan 2003	Jun 2015	150
Taiwan	Jan 2003	Jun 2015	150
Tajikistan	Jan 2003	Jun 2015	150
Tanzania	Jan 2003	Jun 2015	150
Thailand	Jan 2003	Jun 2015	150
Timor-Leste	Jan 2003	Jun 2015	150
Togo	Jan 2003	Jun 2015	150
Trinidad & Tobago	Jan 2003	Jun 2015	150
Tunisia	Jul 2005	Jun 2015	112
Turkey	Jan 2003	Jun 2015	150
UAE	Jan 2003	Jun 2015	150
Uganda	Jan 2003	Jun 2015	141
Ukraine	Mar 2003	Jun 2015	148
United Kingdom	Jan 2003	Jun 2015	150
United States	Jan 2003	Jun 2015	150
Uruguay	Jan 2003	Jun 2015	150
Uzbekistan	Oct 2008	Jun 2015	81
Venezuela	Jan 2003	Jun 2015	150
Viet Nam	Jan 2003	Jun 2015	150
Yemen	Jan 2003	Jun 2015	150
Zambia	Jan 2003	Jun 2015	150
Zimbabwe	Feb 2009	Jun 2015	76

Table S2: **Variable list, descriptions, and data sources.**

Variable	Description	Source
Gasoline Tax	Net implicit tax estimated using the "gap" approach, which is the difference between the local price and the benchmark	Ross et al. (2017)
Fuel Exports Dependence	Exports of mineral fuels as percentage of total merchandise	World Bank (2019)
Oil and Gas Income Dependence	Total oil and gas income as percentage of GDP	Ross (2013), World Bank (2019)
GNI Per Capita (Atlas)	Gross national income per capita converted to U.S. dollars using the Atlas method	World Bank (2019)
GDP Per Capita PPP	Gross domestic product per capita based on purchashing power parity	World Bank (2019)
Electoral Democracy	Index including information on freedom of association, clean elections, freedom of expression, elected officials, and suffrage	Coppedge et al. (2015)
Polity IV	Polity IV Score from a -10 to 10 range	Marshall et al. (2011)
Democracy	Dichotomous measure of democracy based on Robert Dahl's elements of contestation and participation	Boix et al. (2013)
NOC	Presence of an upstream national oil company	Mahdavi (2020)
Influential NOC	Presence of an upstream national oil company completely owned by the state and with production capacity	Mahdavi (2020)
Central Gov Debt	Total stock of debt liabilities issued by a country's central government as a percent of gross national product	IMF (2019a)
Car Ownership	Number of motor vehicles per capita	World Bank (2019)
VAT	Value-added Tax Rate	IMF (2019b)
Region World Bank	Regional categories as defined by the World Bank	World Bank (2019)
Fuel Exports Per Capita	Value of total oil and gas exports per capita in USD	Ross (2013)
Oil Endowment	Natural log of the total endowment of oil in millions of barrels divided by the population in 1960	Tsui (2011) cited by Cassidy (2018)
Convergent C-C mechanical area	Natural log of the total sovereign area covered by convergent C-C mechanical basin	Cassidy (2018)
Time Before/After Elections	1-4 quarters before and after executive-level elections	Hyde and Marinov (2015)
Time Before/After Leader Turnover	1-4 quarters before and after the regular turnover of executive leaders (excludes any irregular mechanisms such as coups)	Goemans et al. (2009)
Time Before/After Oil Discoveries	1-4 quarters before and after the discovery of major oil fields	Arezki et al. (2017)
Diesel Prices	Pump price for diesel fuel in USD per liter	World Bank (2019)
Diesel Benchmark Price	Spot price for Ultra Low Sulfur CARB Diesel at the Los Angeles port in USD per liter	EIA (2019c)
Global Oil Price	Cushing OK WTI Spot Price FOB Annual in USD per barrel	EIA (2019a)
Gasoline Benchmark Price	Spot price for conventional refined gasoline at the New York City port (Brent crude blend) in USD per liter	EIA (2019b)

Table S3: **Country list of states experiencing protests over fuel prices, 2007–2019.**

Country	Date	Source.
Bolivia	Dec 2010	Ortiz et al. (2013)
Brazil	May 2018	The Guardian (2019)
Burkina Faso	Feb 2008	Ortiz et al. (2013)
Burkina Faso	Nov 2018	Africa News (2018)
Cameroon	Feb 2008	Ortiz et al. (2013)
Cameroon	Dec 2008	The New York Times (2008)
China	Apr 2011	Ortiz et al. (2013)
Cote d'Ivoire	Apr 2008	Ortiz et al. (2013)
Chile	Dec 2010	Ortiz et al. (2013)
Chile	Aug 2011	Ortiz et al. (2013)
Ecuador	Oct 2019	The New York Times (2019a)
France	Nov 2018	The New York Times (2018)
India	Jun 2010	Ortiz et al. (2013)
India	May 2012	Ortiz et al. (2013)
India	Sep 2012	Ortiz et al. (2013)
India	Jun 2013	Ortiz et al. (2013)
Indonesia	May 2008	Ortiz et al. (2013)
Indonesia	Apr 2012	Ortiz et al. (2013)
Iran	Nov 2019	The New York Times (2019b)
Jordan	Nov 2012	Ortiz et al. (2013)
Jordan	March 2013	The Jordan Times (2013a)
Mexico	Jan 2017	The Washington Post (2008)
Mozambique	Feb 2008	Ortiz et al. (2013)
Mozambique	Sep 2010	Ortiz et al. (2013)
Myanmar	Aug 2007	Asia Times (2007)
Nigeria	Jan 2012	Ortiz et al. (2013)
Sudan	Sep 2013	The Jordan Times (2013b)
Uganda	Apr 2011	Ortiz et al. (2013)
Yemen	Aug 2014	Al-Jazeera (2014)

2 Supplementary Tables: Gasoline models

2.1 Cross-Sectional models

Table S4: **Bivariate relationships between Regime Type and Fossil Fuel Taxes.**

	Dependent variable:				
	Net Implicit Tax on Gasoline				
	(1)	(2)	(3)	(4)	(5)
Polity IV (continuous)	0.044^{***}				
	(0.005)				
Autocracy (Polity IV)		-0.537^{***}			
		(0.097)			
Democracy (Polity IV)			0.449^{***}		
			(0.070)		
Electoral Democracy (V-DEM)				1.119^{***}	
				(0.123)	
Democracy (Boix et al.)					0.487^{***}
					(0.076)
Constant	0.312^{***}	0.547^{***}	0.238^{***}	-0.123	0.198^{***}
	(0.039)	(0.040)	(0.052)	(0.075)	(0.058)
Observations	153	153	153	153	150
R^2	0.294	0.123	0.214	0.340	0.228
Adjusted R^2	0.290	0.117	0.209	0.335	0.223

Note: Robust SE *p<0.1; **p<0.05; ***p<0.01

Table S5: **Cross-sectional models: Alternative measures of regime type.** Here we use the Boix-Miller-Rosato measure of democracy instead of the Polity IV measure used in the main text. Compare to results in main text Table 2. See Table S2 for variable descriptions.

	Dependent variable:			
	Net Implicit Tax on Gasoline			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	-0.939^{***}	-0.994^{***}	-0.994^{***}	-0.550^{***}
	(0.181)	(0.198)	(0.198)	(0.195)
log(GNI Per Capita Sq)	0.061^{***}	0.063^{***}	0.063^{***}	0.038^{***}
	(0.011)	(0.013)	(0.013)	(0.012)
Fossil Fuel Dependence	-0.016^{***}	-0.013^{**}	-0.013^{**}	-0.014^{***}
	(0.004)	(0.005)	(0.005)	(0.004)
Central Government Debt	0.002^{**}	0.002^{**}	0.002^{**}	0.002^{*}
	(0.001)	(0.001)	(0.001)	(0.001)
BMR Democracy		0.083	0.083	0.027
		(0.074)	(0.074)	(0.089)
Fossil Fuel Dependence		−0.004	−0.004	−0.003
* BMR Democracy		(0.010)	(0.010)	(0.010)
Government Effectiveness		0.045	0.045	0.019
		(0.077)	(0.077)	(0.078)
European Union				−0.080
				(0.125)
Latitude				0.002
				(0.002)
Landlocked				0.005
				(0.053)
Asia + Pacific				−0.075
				(0.102)
Europe + North America				−0.001
				(0.170)
Former USSR				-0.358^{***}
				(0.136)
Latin America + Caribbean				-0.227^{**}
				(0.106)
Middle East				-0.384^{***}
				(0.123)
Value-Added Tax Rate	0.042^{***}	0.042^{***}	0.042^{***}	0.038^{***}
	(0.005)	(0.005)	(0.005)	(0.008)
Observations	139	135	135	135
Adjusted R^2	0.660	0.686	0.686	0.727
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01			

Table S6: **Cross-sectional models: Alternative measures of regime type.** Here we use the V-DEM measure of electoral democracy instead of the Polity IV measure used in the main text. Compare to results in main text Table 2. See Table S2 for variable descriptions.

	Dependent variable:			
	Net Implicit Tax on Gasoline			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	-0.939^{***}	-0.965^{***}	-0.965^{***}	-0.547^{***}
	(0.181)	(0.194)	(0.194)	(0.198)
log(GNI Per Capita Sq)	0.061^{***}	0.061^{***}	0.061^{***}	0.038^{***}
	(0.011)	(0.012)	(0.012)	(0.012)
Fossil Fuel Dependence	-0.016^{***}	-0.013	-0.013	-0.013^{*}
	(0.004)	(0.008)	(0.008)	(0.007)
Central Government Debt	0.002^{**}	0.002^{**}	0.002^{**}	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Electoral Democracy		0.156	0.156	0.072
		(0.197)	(0.197)	(0.254)
Fossil Fuel Dependence		-0.003	-0.003	-0.005
* Electoral Democracy		(0.017)	(0.017)	(0.016)
Government Effectiveness		0.035	0.035	0.012
		(0.082)	(0.082)	(0.081)
European Union				-0.112
				(0.124)
Latitude				0.001
				(0.002)
Landlocked				-0.001
				(0.051)
Asia + Pacific				-0.053
				(0.104)
Europe + North America				0.052
				(0.163)
Former USSR				-0.326^{**}
				(0.140)
Latin America + Caribbean				-0.245^{***}
				(0.091)
Middle East				-0.359^{***}
				(0.136)
Value-Added Tax Rate	0.042^{***}	0.042^{***}	0.042^{***}	0.038^{***}
	(0.005)	(0.005)	(0.005)	(0.008)
Observations	139	134	134	134
Adjusted R^2	0.660	0.686	0.686	0.735

Note: Robust SE *p<0.1; **p<0.05; ***p<0.01

Table S7: **Cross-sectional models: Alternative measure of region.** Here we use the World Bank measure of regional categories instead of the measure used in the main text. Compare to results in main text Table 2. See Table S2 for variable descriptions.

	Dependent variable:			
	Net Implicit Tax on Gasoline			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	-0.939^{***}	-0.957^{***}	-0.957^{***}	-0.694^{***}
	(0.181)	(0.194)	(0.194)	(0.217)
log(GNI Per Capita Sq)	0.061^{***}	0.061^{***}	0.061^{***}	0.048^{***}
	(0.011)	(0.012)	(0.012)	(0.014)
Fossil Fuel Dependence	-0.016^{***}	-0.015^{***}	-0.015^{***}	-0.015^{***}
	(0.004)	(0.005)	(0.005)	(0.005)
Central Government Debt	0.002^{**}	0.002^{**}	0.002^{**}	0.002^{**}
	(0.001)	(0.001)	(0.001)	(0.001)
Autocracy (Polity IV)		−0.108	−0.108	−0.074
		(0.102)	(0.102)	(0.153)
Fossil Fuel Dependence		0.001	0.001	−0.001
* Autocracy (Polity IV)		(0.008)	(0.008)	(0.008)
Government Effectiveness		0.045	0.045	0.039
		(0.078)	(0.078)	(0.087)
European Union				−0.081
				(0.128)
Latitude				0.001
				(0.002)
Landlocked				−0.015
				(0.062)
Europe + Central Asia				0.031
				(0.182)
Latin America + Caribbean				−0.137
				(0.132)
Middle East + North Africa				-0.289^{**}
				(0.120)
North America				-0.442^{***}
				(0.152)
South Asia				−0.007
				(0.126)
Sub-Saharan Africa				0.123
				(0.141)
Value-Added Tax Rate	0.042^{***}	0.042^{***}	0.042^{***}	0.033^{***}
	(0.005)	(0.005)	(0.005)	(0.007)
Observations	139	134	134	134
Adjusted R^2	0.660	0.690	0.690	0.716

Note: Robust SE *p<0.1; **p<0.05; ***p<0.01

Table S8: **Cross-sectional models: National oil companies.** Here we add measures to control for the presence of national oil companies. Compare to results in main text Table 2. See Table S2 for variable descriptions.

	Dependent variable:		
	Net Implicit Tax on Gasoline		
	(1)	(2)	(3)
log(GNI Per Capita)	-0.879^{***}	-0.843^{***}	-0.879^{***}
	(0.201)	(0.173)	(0.197)
log(GNI Per Capita Sq)	0.055^{***}	0.054^{***}	0.056^{***}
	(0.013)	(0.011)	(0.013)
Fossil Fuel Dependence	-0.011^{**}	-0.009^{*}	-0.012^{**}
	(0.005)	(0.005)	(0.005)
Central Government Debt	0.002^{**}	0.002^{**}	0.002^{**}
	(0.001)	(0.001)	(0.001)
Autocracy (Polity IV)	-0.057	-0.024	-0.060
	(0.095)	(0.085)	(0.100)
Fossil Fuel Dependence * Autocracy	-0.001	-0.003	-0.001
	(0.008)	(0.007)	(0.008)
Government Effectiveness	0.067	0.053	0.052
	(0.078)	(0.069)	(0.077)
National Oil Company (Mahdavi)	-0.108^{*}		
	(0.059)		
Influential National Oil Company (Mahdavi)		-0.252^{***}	
		(0.088)	
National Oil Company (Cheon et al.)			-0.108
			(0.066)
Value-Added Tax Rate	0.041^{***}	0.039^{***}	0.041^{***}
	(0.005)	(0.005)	(0.005)
Observations	132	132	134
Adjusted R^2	0.700	0.720	0.695
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01		

Table S9: **Cross-sectional models: Motorization rate.** Here we add a measure to control for the number of cars per capita, which plausibly represents the size of the constituency benefiting directly from fuel subsidies. Compare to results in main text Table 2. See Table S2 for variable descriptions.

	Dependent variable:			
	Net Implicit Tax on Gasoline			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	−1.046***	−1.064***	−1.064***	−0.741***
	(0.204)	(0.218)	(0.218)	(0.248)
log(GNI Per Capita Sq)	0.071***	0.070***	0.070***	0.054***
	(0.013)	(0.015)	(0.015)	(0.017)
Fossil Fuel Dependence	−0.026***	−0.022***	−0.022***	−0.023***
	(0.005)	(0.007)	(0.007)	(0.006)
Central Government Debt	0.001*	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Autocracy (Polity IV)		−0.105	−0.105	−0.072
		(0.093)	(0.093)	(0.116)
Fossil Fuel Dependence * Autocracy		−0.001	−0.001	0.001
		(0.008)	(0.008)	(0.007)
Government Effectiveness		0.057	0.057	0.013
		(0.082)	(0.082)	(0.093)
Motorization Rate	−0.315	−0.372	−0.372	−0.597
	(0.292)	(0.311)	(0.311)	(0.417)
European Union				−0.068
				(0.126)
Latitude				0.001
				(0.002)
Landlocked				−0.006
				(0.062)
Asia + Pacific				−0.054
				(0.108)
Europe + North America				0.089
				(0.202)
Former USSR				−0.199
				(0.186)
Latin America + Caribbean				−0.223**
				(0.100)
Middle East				−0.266**
				(0.129)
Value-Added Tax Rate	0.042***	0.041***	0.041***	0.037***
	(0.005)	(0.005)	(0.005)	(0.007)
Observations	117	113	113	113
Adjusted R^2	0.762	0.769	0.769	0.790
Note: Robust SE				*p<0.1; **p<0.05; ***p<0.01

2.2 Instrumental Variables models

Table S10: **Instrumental Variables models: Alternative instrument.** Here we use the spatial distribution of oil-yielding sedimentary basins, following Cassidy 2018, as an instrument for fossil fuel dependence instead of the oil endowment per capita instrument. Compare to results in main text Table 3. See Table S2 for variable descriptions and Table S11 for first-stage results.

	Dependent variable:		
	Net Implicit Tax on Gasoline		
	(1)	(2)	(3)
log(GNI Per Capita))	−0.316	−0.358	-0.971^{***}
	(0.392)	(1.074)	(0.362)
log(GNI Per Capita Sq)	0.030	0.096	0.084^{**}
	(0.021)	(0.094)	(0.040)
Fossil Fuel Dependence	-0.060^{**}	−0.183	−0.082
	(0.025)	(0.291)	(0.094)
Central Government Debt	−0.0001	−0.007	−0.001
	(0.002)	(0.016)	(0.004)
Autocracy (Polity IV)		−0.677	−0.259
		(1.128)	(0.364)
Fossil Fuel Dependence * Autocracy		0.059	0.023
		(0.116)	(0.045)
Government Effectiveness		−1.550	−0.524
		(2.780)	(0.812)
log(Land Area PC)	0.045	0.077	0.072
	(0.055)	(0.192)	(0.113)
log(Coastline PC)	0.008	0.052	0.010
	(0.016)	(0.107)	(0.031)
log(Mountainous Area PC)	0.007	0.033	−0.001
	(0.015)	(0.067)	(0.018)
log(Good Soil PC)	-0.053^{*}	−0.144	−0.073
	(0.030)	(0.230)	(0.082)
log(Tropical Area PC)	0.016	0.051	0.022
	(0.016)	(0.074)	(0.027)
Europe/Northern America/Oceania	−0.250	−1.128	
	(0.243)	(2.059)	
Asia	−0.223	−0.497	
	(0.171)	(0.869)	
Latin America/Caribbean	-0.364^{**}	−1.324	
	(0.183)	(2.060)	
Value-Added Tax Rate	0.033^{***}	0.064	0.044^{***}
	(0.009)	(0.047)	(0.011)
Observations	135	131	131
Adjusted R^2	0.357	−2.920	0.040
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01		

Table S11: **Instrumental Variables models: First-stage results.** Results from the first stage of two-stage least squares models, using the oil endowment per capita and oil-yielding sedimentary basins instruments. See Table S2 for variable descriptions.

	Dependent variable:	
	Fossil Fuel Dependence	
	(1)	(2)
Oil Endowment PC 1960	2.357^{***}	
	(0.214)	
Basin Type Area PC 1960		0.660^{**}
		(0.277)
Constant	28.289^{***}	10.110^{***}
	(2.422)	(2.412)
Observations	152	152
R^2	0.558	0.049
Adjusted R^2	0.555	0.043
F Statistic (df = 1; 150)	189.210^{***}	7.725^{***}
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01	

2.3 Cross-Sectional Time Series models

A Hausman test comparing the pooled OLS model to a country-year fixed effects model gives an F statistic of 34.9 (p-value < 0.0001), which suggests the fixed effects model may be a better choice over the pooled model. (A second Hausman test gives a χ^2 of 99.97 (p-value < 0.0001), indicating that a random effects model should be rejected in favor of a fixed effects model.) In a pooled model, *GNI per capita, GNI per capita sq, Fossil Fuel Dependence*, and *Central Government Debt* have the same relationships to *Net Implicit Tax on Gasoline* as they do in the cross-section results in the main text (Tables 1-3). We also find that *Autocracy* is statistically associated with *Net Implicit Tax on Gasoline* in the direction hypothesized by prior studies, while *Government Effectiveness* is not. The *Fossil Fuel Dependence*Autocracy* interaction term remains not statistically significant, implying that fossil fuel dependence has similar effects in democracies and autocracies. Note that, as discussed in the main text, once country and year fixed effects are added to the model, most of the variables lose statistical significance at the $p = 0.05$ level (although *Autocracy* remains significant at the $p = 0.10$ level). The exceptions are *Fossil Fuel Dependence*, *VAT*, and *Central Government Debt*, which remain significant in both specifications.

Table S12: **Cross-sectional Time-series: with and without fixed effects**. Compare to Table 4 in the main text. See Table S2 for variable descriptions.

	Dependent variable:	
	Net Implicit Tax on Gasoline	
	(1)	(2)
log(GNI Per Capita)	−0.843***	−0.020
	(0.058)	(0.097)
log(GNI Per Capita Sq)	0.055***	0.004
	(0.004)	(0.006)
Oil and Gas Income Dependence	−0.014***	−0.006***
	(0.001)	(0.002)
Central Government Debt	0.001***	0.001***
	(0.0003)	(0.0003)
Autocracy (Polity IV)	−0.149***	0.096*
	(0.040)	(0.054)
Oil and Gas Income Dependence * Autocracy	−0.0001	−0.005
	(0.003)	(0.003)
Government Effectiveness	0.033	0.026
	(0.021)	(0.031)
Value-Added Tax Rate	0.040***	0.018***
	(0.002)	(0.004)
Constant	3.000***	0.147
	(0.237)	(0.400)
Observations	1,522	1,522
Country and Year FE	N	Y
R^2	0.645	0.938
Adjusted R^2	0.643	0.931
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01	

Table S13: **Cross-sectional time-series models: Alternative measures of regime type.** Here we use the Boix-Miller-Rosato measure of democracy instead of the Polity IV measure used in the main text. Compare to results in main text Table 4. See Table S2 for variable descriptions.

	Dependent variable:	
	Net Implicit Tax on Gasoline	
	(1)	(2)
log(GNI Per Capita)	-0.848^{***}	-0.033
	(0.061)	(0.096)
log(GNI Per Capita Sq)	0.055^{***}	0.005
	(0.004)	(0.006)
Fossil Fuel Dependence	-0.014^{***}	-0.010^{***}
	(0.002)	(0.002)
Central Government Debt	0.001^{***}	0.001^{***}
	(0.0003)	(0.0003)
Democracy	0.065^{***}	0.009
	(0.023)	(0.033)
Fossil Fuel Dependence * Democracy	-0.002	0.008^{**}
	(0.003)	(0.004)
Government Effectiveness	0.035^{*}	0.045
	(0.021)	(0.030)
Value-Added Tax Rate	0.042^{***}	0.017^{***}
	(0.002)	(0.004)
Constant	2.971^{***}	0.247
	(0.246)	(0.393)
Observations	1,547	1,547
Country and Year FE	N	Y
R^2	0.636	0.937
Adjusted R^2	0.634	0.930
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01	

Table S14: **Cross-sectional time-series models: Alternative measures of regime type.** Here we use the V-Dem measure of electoral democracy instead of the Polity IV measure used in the main text. Compare to results in main text Table 4. See Table S2 for variable descriptions.

	Dependent variable:	
	Net Implicit Tax on Gasoline	
	(1)	(2)
log(GNI Per Capita)	-0.850^{***}	-0.059
	(0.059)	(0.099)
log(GNI Per Capita Sq)	0.055^{***}	0.006
	(0.004)	(0.006)
Fossil Fuel Dependence	-0.014^{***}	-0.011^{***}
	(0.003)	(0.003)
Central Government Debt	0.001^{***}	0.001^{***}
	(0.0003)	(0.0003)
Electoral Democracy	0.167^{***}	0.052
	(0.060)	(0.078)
Fossil Fuel Dependence * Electoral Democracy	-0.002	0.008
	(0.005)	(0.007)
Government Effectiveness	0.023	0.045
	(0.021)	(0.030)
Value-Added Tax Rate	0.041^{***}	0.017^{***}
	(0.002)	(0.004)
Constant	2.960^{***}	0.346
	(0.240)	(0.400)
Observations	1,537	1,537
Country and Year FE	N	Y
R^2	0.640	0.937
Adjusted R^2	0.638	0.930
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01	

Table S15: **Cross-sectional time-series models: Motorization rate.** Here we add a measure to control for the number of cars per capita, which plausibly represents the size of the constituency benefiting directly from fuel subsidies. Compare to results in main text Table 2. See Table S2 for variable descriptions.

	Dependent variable:	
	Net Implicit Tax on Gasoline	
	(1)	(2)
log(GNI Per Capita)	-0.967^{***}	-0.233^{*}
	(0.073)	(0.137)
log(GNI Per Capita Sq)	0.062^{***}	0.015^{*}
	(0.005)	(0.008)
Fossil Fuel Dependence	-0.020^{***}	-0.001
	(0.002)	(0.002)
Central Government Debt	0.001^{**}	0.001^{***}
	(0.0003)	(0.0004)
Autocracy (Polity IV)	-0.195^{***}	0.147^{**}
	(0.044)	(0.059)
Fossil Fuel Dependence * Autocracy	0.004	-0.002
	(0.003)	(0.003)
Government Effectiveness	0.086^{***}	-0.007
	(0.026)	(0.037)
Motorization Rate	-0.222^{**}	0.450^{*}
	(0.103)	(0.238)
Value-Added Tax Rate	0.043^{***}	0.014^{***}
	(0.002)	(0.004)
Constant	3.548^{***}	0.988^{*}
	(0.285)	(0.550)
Observations	1,093	1,093
Country and Year FE	N	Y
R^2	0.738	0.961
Adjusted R^2	0.736	0.956
Note: Robust SE	$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$	

Table S16: **Cross-Sectional Time Series (Monthly) with and without fixed effects.** A Hausman test comparing the pooled OLS model to a country-fixed effects model for the monthly panel suggests that the fixed effects model is a better choice ($F = 1,249$). In column 2 we show that included country and year fixed effects causes the R-squared figure to rise from 0.008 to 0.898. We observe a negative relationship between *Oil Discoveries* and *Net Implicit Tax on Gasoline*, rather than the small positive relationship in the pooled model. The inconsistency of these results leads us to be cautious about drawing inferences about the role of oil discoveries.

	Dependent variable:	
	Net Implicit Tax on Gasoline	
	(1)	(2)
1 Qr Before Elections	−0.018	0.001
	(0.027)	(0.009)
2 Qr Before Elections	−0.007	0.004
	(0.027)	(0.010)
3 Qr Before Elections	−0.010	0.001
	(0.028)	(0.009)
4 Qr Before Elections	−0.006	0.001
	(0.028)	(0.010)
1 Qr After Elections	−0.005	0.002
	(0.027)	(0.009)
2 Qr After Elections	−0.014	−0.003
	(0.026)	(0.009)
3 Qr After Elections	−0.017	−0.007
	(0.027)	(0.010)
4 Qr After Elections	−0.019	−0.011
	(0.027)	(0.009)
1 Qr After Leader Turnover	0.044	0.010
	(0.047)	(0.015)
2 Qr After Leader Turnover	0.025	0.013
	(0.047)	(0.014)
3 Qr After Leader Turnover	0.032	0.017
	(0.047)	(0.014)
4 Qr After Leader Turnover	0.037	0.008
	(0.048)	(0.014)
Oil Discovery Month	−0.249***	0.041**
	(0.054)	(0.017)
1 Qr After Discovery Month	−0.259***	0.033**
	(0.055)	(0.016)
2 Qr After Discovery Month	−0.293***	0.026*
	(0.054)	(0.015)
3 Qr After Discovery Month	−0.282***	0.016
	(0.055)	(0.015)
4 Qr After Discovery Month	−0.278***	0.023
	(0.057)	(0.016)
Constant	0.503***	0.218***
	(0.004)	(0.015)
Observations	22,124	22,124
Country FE	N	Y
Adjusted R^2	0.008	0.898
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01	

3 Supplementary Tables: Diesel models

We additionally run all specifications in the main text for models with taxes on diesel fuel instead of gasoline. The same core patterns hold for diesel: a consistent statistical relationship between fuel taxes and income, and between fuel taxes and fossil fuel dependence; the lack of a consistent relationship with political factors; and the importance of unobserved, country-specific factors in the annual panel. Note that we do not run monthly panels here given the lack of infra-annual data on diesel prices.

3.1 Cross-Sectional models

Table S17: **Diesel analysis: cross-sectional base specification.** Compare to results in main text Table 1. See Table S2 for variable descriptions.

	Dependent variable:			
	Net Implicit Tax on Diesel			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	-0.899^{***}	-0.820^{***}	-0.780^{***}	-0.664^{***}
	(0.163)	(0.150)	(0.145)	(0.146)
log(GNI Per Capita Sq)	0.057^{***}	0.053^{***}	0.050^{***}	0.044^{***}
	(0.010)	(0.009)	(0.009)	(0.009)
Fossil Fuel Dependence		-0.015^{***}		
		(0.003)		
log(Oil and Gas Exports PC)			-0.019^{***}	
			(0.004)	
Fossil Fuel Export Dependence				-0.006^{***}
				(0.001)
Central Government Debt	0.001^{**}	0.001	0.001	0.0005
	(0.001)	(0.001)	(0.001)	(0.001)
Value-Added Tax Rate	0.042^{***}	0.034^{***}	0.035^{***}	0.030^{***}
	(0.004)	(0.004)	(0.004)	(0.004)
Constant	3.101^{***}	2.953^{***}	2.692^{***}	2.433^{***}
	(0.676)	(0.606)	(0.597)	(0.594)
Observations	138	137	137	135
R^2	0.587	0.666	0.656	0.722
Adjusted R^2	0.575	0.653	0.643	0.711

Note: Robust SE *p<0.1; **p<0.05; ***p<0.01

Table S18: **Diesel analysis: cross-sectional full specification.** Compare to results in main text Table 2. See Table S2 for variable descriptions.

	Dependent variable:			
	Net Implicit Tax on Diesel			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	-0.820^{***}	-0.904^{***}	-0.904^{***}	-0.420^{***}
	(0.150)	(0.158)	(0.158)	(0.159)
log(GNI Per Capita Sq)	0.053^{***}	0.059^{***}	0.059^{***}	0.031^{***}
	(0.009)	(0.010)	(0.010)	(0.010)
Fossil Fuel Dependence	-0.015^{***}	-0.016^{***}	-0.016^{***}	-0.016^{***}
	(0.003)	(0.004)	(0.004)	(0.004)
Central Government Debt	0.001	0.001	0.001	0.0005
	(0.001)	(0.001)	(0.001)	(0.001)
Autocracy (Polity IV)		-0.147^{*}	-0.147^{*}	-0.115
		(0.079)	(0.079)	(0.081)
Fossil Fuel Dependence * Autocracy		-0.002	-0.002	0.001
		(0.006)	(0.006)	(0.005)
Government Effectiveness		-0.025	-0.025	-0.027
		(0.067)	(0.067)	(0.066)
European Union				-0.033
				(0.099)
Latitude				0.002
				(0.001)
Landlocked				0.070^{*}
				(0.041)
Asia + Pacific				-0.171^{**}
				(0.073)
Europe + North America				-0.002
				(0.129)
Former USSR				-0.279^{**}
				(0.110)
Latin America + Caribbean				-0.243^{***}
				(0.065)
Middle East				-0.336^{***}
				(0.112)
Value-Added Tax Rate	0.034^{***}	0.034^{***}	0.034^{***}	0.026^{***}
	(0.004)	(0.004)	(0.004)	(0.006)
Constant	2.953^{***}	3.226^{***}	3.226^{***}	1.433^{**}
	(0.606)	(0.620)	(0.620)	(0.619)
Observations	137	132	132	132
R^2	0.666	0.725	0.725	0.793
Adjusted R^2	0.653	0.707	0.707	0.765
Note: Robust SE				*p<0.1; **p<0.05; ***p<0.01

3.2 Instrumental Variables models

Table S19: **Diesel analysis: instrumental variable specification.** Fossil fuel dependence is instrumented using the oil endowment per capita measure from 1960. Compare to results in main text Table 3.

	Dependent variable:			
	Net Implicit Tax on Diesel			
	(1)	(2)	(3)	(4)
log(GNI Per Capita)	-0.795^{***}	-0.962^{***}	-0.962^{***}	-0.411^{**}
	(0.166)	(0.164)	(0.164)	(0.181)
log(GNI Per Capita Sq)	0.052^{***}	0.066^{***}	0.066^{***}	0.035^{***}
	(0.010)	(0.011)	(0.011)	(0.011)
Fossil Fuel Dependence	-0.025^{***}	-0.025^{***}	-0.025^{***}	-0.026^{***}
	(0.004)	(0.005)	(0.005)	(0.005)
Central Government Debt	-0.00004	0.0002	0.0002	0.00001
	(0.001)	(0.001)	(0.001)	(0.001)
Autocracy (Polity IV)		-0.178	-0.178	-0.148
		(0.116)	(0.116)	(0.111)
Fossil Fuel Dependence * Autocracy		0.003	0.003	0.006
		(0.007)	(0.007)	(0.007)
Government Effectiveness		-0.114^{*}	-0.114^{*}	-0.126^{*}
		(0.066)	(0.066)	(0.069)
European Union				-0.076
				(0.088)
Latitude				0.002
				(0.001)
Landlocked				0.052
				(0.052)
Asia + Pacific				-0.213^{***}
				(0.080)
Europe + North America				-0.099
				(0.132)
Former USSR				-0.367^{***}
				(0.131)
Latin America + Caribbean				-0.323^{***}
				(0.082)
Middle East				-0.373^{***}
				(0.103)
Value-Added Tax Rate	0.029^{***}	0.032^{***}	0.032^{***}	0.027^{***}
	(0.004)	(0.004)	(0.004)	(0.005)
Constant	2.974^{***}	3.307^{***}	3.307^{***}	1.157
	(0.695)	(0.656)	(0.656)	(0.750)
Observations	135	130	130	130
R^2	0.627	0.705	0.705	0.771
Adjusted R^2	0.612	0.686	0.686	0.739
Note: Robust SE				*p<0.1; **p<0.05; ***p<0.01

3.3 Cross-Sectional Time Series models

Table S20: **Diesel analysis: cross-sectional time-series specification.** Compare to results in main text Table 4. See Table S2 for variable descriptions.

	Dependent variable:	
	Net Implicit Tax on Diesel	
	(1)	(2)
log(GNI Per Capita)	-0.796^{***}	-0.208
	(0.069)	(0.132)
log(GNI Per Capita Sq)	0.052^{***}	0.012
	(0.004)	(0.008)
Oil and Gas Income Dependence	-0.015^{***}	-0.005^{*}
	(0.002)	(0.003)
Autocracy (Polity IV)	-0.159^{***}	0.065
	(0.041)	(0.067)
Government Effectiveness	-0.004	0.058
	(0.029)	(0.045)
Central Government Debt	0.0001	0.0004
	(0.0003)	(0.0004)
Oil and Gas Income Dependence * Autocracy	-0.001	0.0004
	(0.003)	(0.005)
Value-Added Tax Rate	0.035^{***}	0.011^{**}
	(0.002)	(0.006)
Constant	2.807^{***}	1.247^{**}
	(0.273)	(0.549)
Observations	734	734
Country and Year FE	N	Y
R^2	0.657	0.930
Adjusted R^2	0.653	0.913
Note: Robust SE	*p<0.1; **p<0.05; ***p<0.01	

4 Supplementary Figures

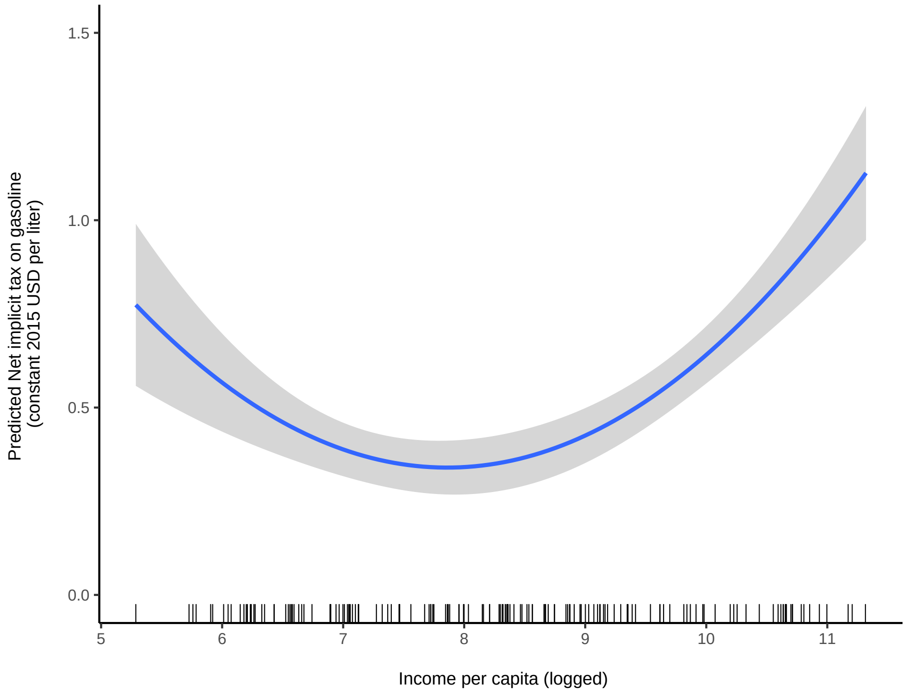

Figure S1: **Income per capita and predicted fuel taxes by country**. Marginal effects of logged income per capita and logged income per capita squared on fuel taxes, based on results from Table 1, column 1. Predicted values for fuel taxes are plotted on the y-axis. Distribution of logged income per capita values plotted as a rug above the x-axis.

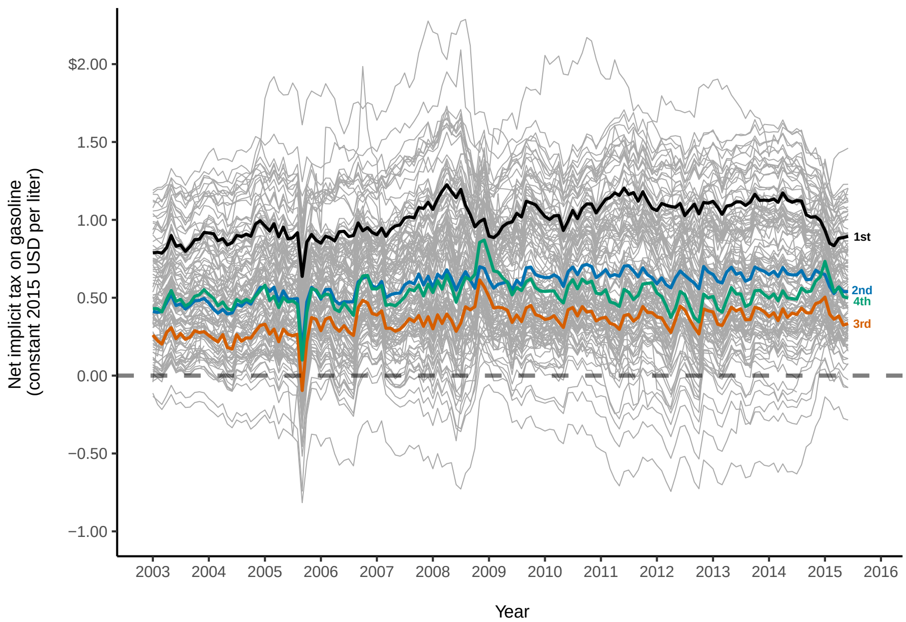

Figure S2: **Net taxes and subsidies by income group over time.** Income group averages are computed monthly using unweighted country taxes and subsidies. This figure excludes oil-exporting countries. Color-coding is as follows, from top to bottom as of 2015. Black: first income quartile; blue: second income quartile; green: fourth income quartile, orange: third income quartile.

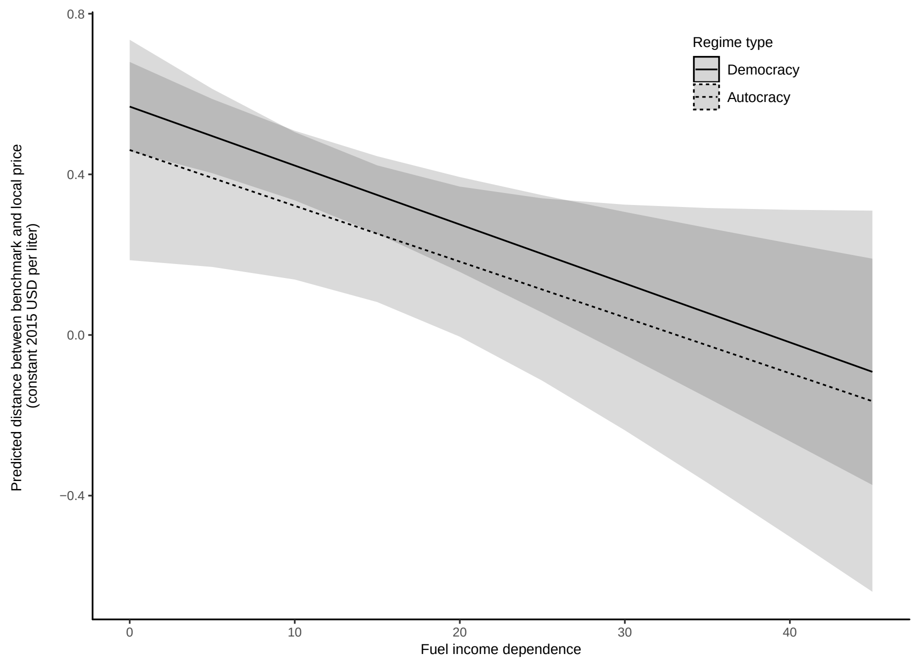

Figure S3: **Predicted values (marginal effects) plot for fossil fuel dependence and autocracy.** Marginal effects of fuel dependence on fuel taxes by regime type, based on results from Table 2, column 2. Predicted values for fuel taxes are plotted on the y-axis: marginal effects for democracies (autocracies) shown as a solid black line (dashed line) with dark gray (light gray) confidence bands.

Figure S4 illustrates the importance of *Fossil Fuel Dependence*: it is similar to Figure 5 in the main text but highlights countries above the 30% *Fossil Fuel Export Dependence* threshold. Of the 27 oil exporters, 20 had net subsidies in either 2003, 2015, or both. Sixteen of them also fall below the 45 degree line, indicating that their taxes fell (or subsidies grew) during this period.

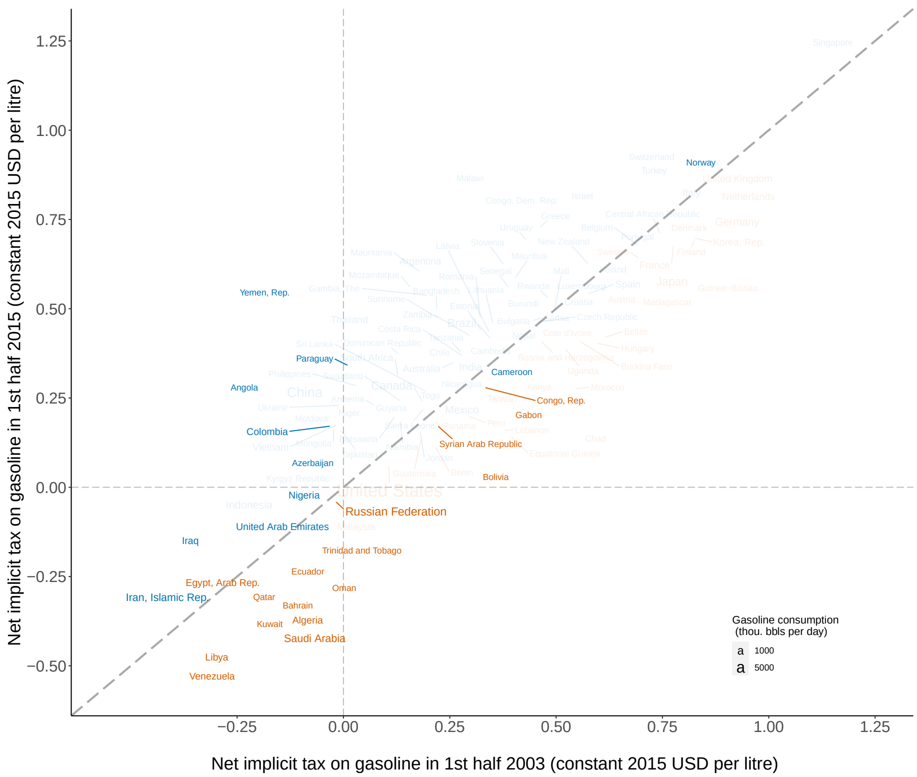

Figure S4: **Net VAT-adjusted implicit taxes in 2003 versus 2015 for fuel dependent countries.** The average level of taxes or subsidies per liter for countries in the first six months of 2003 compared to the first six months of 2015, with highlighted labels for the top 30 most fuel dependent countries. Countries with higher taxes (or lower subsidies) in 2015 than in 2003 are colored in blue; those with lower taxes (or higher subsidies) are colored in dark orange. See notes in Figure 5 for further details.

Figure S5 displays the five countries with the greatest gains, and the five countries with the greatest losses, in democratization over these thirteen years. The five that moved farthest toward democracy (in blue) had, on average, almost precisely the same gasoline taxes at the end as they did at the beginning. In fact, their average fuel tax fell by \$0.005 per liter. In the countries that moved the farthest toward autocracy (in red), the average fuel tax actually rose by \$0.06 per liter. Overall, the average effect of both democracy and democratization was not significantly different than zero.

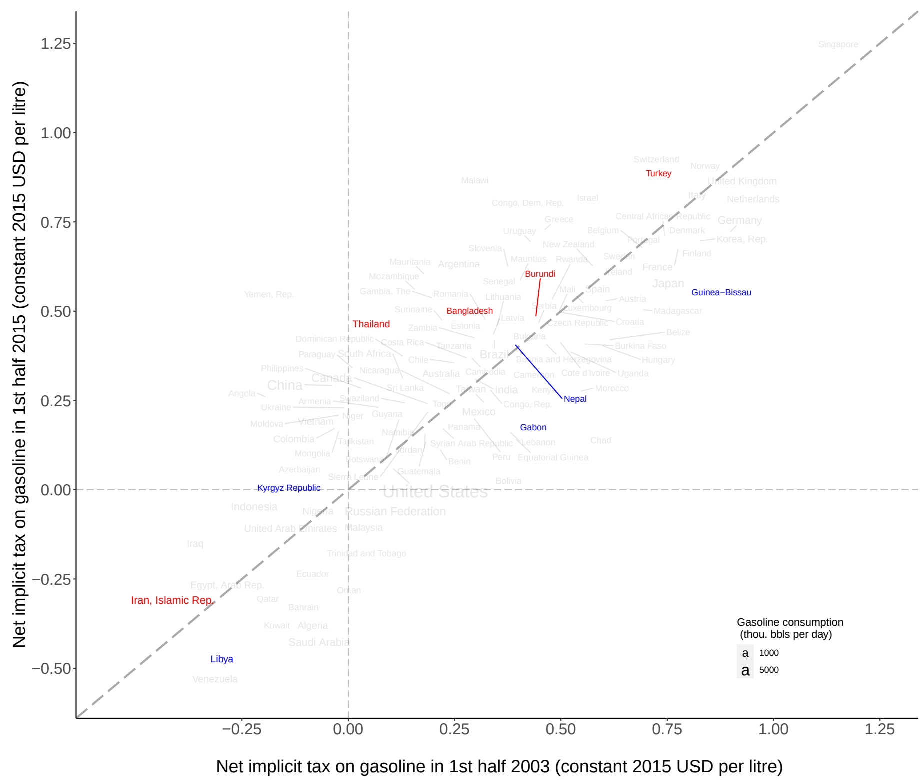

Figure S5: **Net VAT-adjusted implicit taxes in 2003 versus 2015 for countries with largest gains or losses in democratization scores.** The average level of taxes or subsidies per liter for countries in the first six months of 2003 compared to the first six months of 2015, with highlighted labels for the top 5 largest gainers (blue) and the top 5 largest decliners (red) on the Polity index from 2003 to 2015. See notes in Figure 5 for further details.

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