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What types of political regimes subsidize fuel consumption?

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ABSTRACT

Recent studies suggest that political institutions have little impact on the size of consumer fossil fuel subsidies, concluding instead that subsidies reflect country-specific and slowly changing economic factors. Such findings bode poorly for reforming these costly policies. I argue that this conclusion stems from an overly narrow view of the kinds of non-democratic regimes that exist. I introduce a large literature from political science that distinguishes “electoral authoritarian” regimes from other non-democracies and develop a theoretical argument connecting the former’s reliance on broad-based public support to higher levels of fossil fuel subsidies. I test the argument using a price-gap measure of domestic consumer gasoline subsidies for more than 160 countries for most years between 1990 and 2014. The results demonstrate that the emergence of electoral authoritarianism is associated with larger fuel subsidies, and that an increase in hydrocarbon production revenue has a larger impact on the size of subsidies within electoral authoritarian systems than in other regime types. Reform efforts must acknowledge this political logic while focusing on how to offset subsidies with less environmentally harmful measures.

1. Introduction

Global fossil fuel consumption subsidies cost upwards of \$500 billion annually. Including the social and environmental impact boosts these estimates to more than \$5 trillion (Skovgaard and Van Asselt 2019, 2; Coady et al. 2017, 12). Consumption subsidies are especially costly for low income countries, since commitments to maintaining artificially low prices can threaten long-term financial stability (Blankenship and Urpelainen 2019, 422). Environmentally, subsidies encourage greater consumption, increasing global CO₂ emissions while simultaneously acting as a barrier for further adoption of lower-carbon alternatives (Skovgaard and Van Asselt 2019, 3; Rentschler and Bazilian 2017, 892).

These consequences are well known. International organizations including the International Monetary Fund, the World Bank, and the International Energy Agency have been urging member governments to reduce these fossil fuel subsidies since the early 2000s, yet progress on subsidy reform has been slow across the globe and uneven at the country level (Rentschler and Bazilian 2017, 892; Mahdavi et al., 2020). Ross et al. (2017) document that between 2003 and 2015, the average global gasoline tax actually decreased.

The primary impediments to reform are public opinion and political economy barriers, not technical capacity or administrative competence. Subsidies, especially those for domestic consumption, are common

political tools to lure voters or shore up other avenues of political support (Rentschler and Bazilian 2017: 902–3; Victor 2009; Lockwood 2015; Alkon and Urpelainen, 2018). Blankenship and Urpelainen (2019: 424) put it in the starkest terms: “...fuel subsidies are a tool of political survival. Governments use them to distribute resources to powerful interests in exchange for political support.” Subsidizing governments are understandably hesitant to eliminate such policies. This logic underpins the common finding that planned reductions to consumer subsidies are frequently met with political unrest and quick policy reversals (Houeland 2020; Natalini et al., 2020; Rentschler and Bazilian 2017, 903; Lockwood 2015; Sivaram et al., 2016).

A number of scholars have explored how different political institutions influence this dynamic. For instance, some have argued that this political survival logic is more common – and thus subsidies tend to be higher – in authoritarian regimes. For instance, Victor (2009) argues that autocracies prioritize minimizing societal unrest, and that “one way to reduce those dangers is to provide highly visible services at low cost” (8). Strand (2013) offers a complementary argument, suggesting that autocracies subsidize consumption because of their diminished ability to credibly commit to alternative social welfare policies. Democracies, by contrast, have both increased capacity and incentive to focus on public goods more broadly (Bueno de Mesquita et al., 2003). As Strand (2013: 5) concludes, fuel subsidies are “universally easy to deliver even by inept

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autocratic leaders.” A number of recent studies report results consistent with this general argument. For instance, [Kim and Urpelainen \(2015\)](#); see also [Overland 2010](#)) show that autocracies tend to have lower gasoline prices (and thus greater subsidies) than democracies, and that the effect is driven by such regimes needs to pacify urban constituents whose support is more important for regime survival.

By contrast, recent work by [Mahdavi et al. \(2020\)](#) finds little evidence that political institutions are associated with subsidies. They present new data on fuel prices for more than 150 countries, observed monthly, and demonstrate that autocracies are no more likely to subsidize gasoline consumption than democracies. Nor do the authors find any evidence that bureaucratic effectiveness or election timing has an association with the level of fuel taxes. Instead, the authors demonstrate that fuel subsidies reflect slowly changing country-specific factors, including rates of income per capita, government debt, and a country’s hydrocarbon endowments. In the few instances when fuel taxes increased, these changes “were primarily associated with unobserved, time-varying, country-specific factors” (3).

These findings, along with their conclusion that subsidies and reform prospects reflect “each country’s unique configurations of actors, events, constraints and opportunities” (4) bode poorly for addressing the economic and environmental costs of these policies. To put it bluntly, if there is no discernable politico-institutional basis for fuel subsidies, then global emissions reductions will depend on finding other methods to curb fossil fuel use.

In this paper, I argue that these specific conclusions – along with the mixed empirical evidence on the question generally – stem from an overly narrow conceptualization of the political regimes that exist in the world, especially amongst autocracies. I introduce a large research area from political science that distinguishes *electoral* authoritarian regimes from their *closed* authoritarian counterparts. Specifically, I argue that the former requires a broader basis of political support than the latter, and highlight how prior research has linked the unique imperatives of electoral authoritarian regimes to greater provisions of public goods and improved rates of human development. I extend this framework to develop and test two related hypotheses: first, that the emergence of electoral authoritarianism should be associated with an increase in the size of consumer fossil fuels subsidies, and second, that an increase in hydrocarbon production should have an especially large effect on the size of consumer subsidies in such regimes.

I then describe construction of a price-gap measure of consumer gasoline subsidies for a panel of more than 160 countries from 1990 to 2014. Both descriptive patterns and regression analysis provide evidence of the critical role played by political institutions on the size of fuel subsidies. All else equal, transition to electoral authoritarianism leads to an increase in subsidy size, and even a modest increase in the value of domestic oil and gas production in such regimes is associated with an increase in subsidy size that measures twice as large as occurs in closed autocracies. These findings imply that consumer fossil fuel subsidies are, in part, a tool of political survival and that future reform efforts will require scholars and policymakers to wrestle with how to convince such regimes to replace these politically beneficial tools with less harmful alternatives. These challenges will become even more acute as the electoral variant of authoritarianism continues to supplant the closed version globally.

2. What is electoral authoritarianism and why does it matter?

Most prior research regarding political institutions and fossil fuel subsidies relies on a binary distinction between democratic and authoritarian regimes, with the former being defined largely by the competitive election of legislatures and executives and the latter defined, more often than not, as simply ‘not democratic.’ Studies differ in terms of the operational definitions of the concept, with some authors ([Kim and Urpelainen 2015](#)) employing binary regime measures and others ([Mahdavi et al., 2020](#)) transforming interval-level measures of

regime characteristics into categorical measures distinguishing autocracies from democracies.

By contrast, the last two decades have seen the emergence of a rich political science literature on comparative authoritarianism, starting with [Geddes’ \(1999\)](#) path breaking study, which identifies a wide variety of institutional arrangements within authoritarian regimes. A central distinction concerns how regimes achieve and maintain political power. There remains a handful of countries where executive power is hereditary and many more where it is achieved via military coup. Still other autocracies are one-party systems, where opposition parties are illegal and elections – if they occur at all – are either single or no-party versions that are largely ceremonial ([Miller 2020: 19](#)). Such autocracies are *closed*, since citizens play essentially no role in the selection of those with political power who exercise authority over the policymaking process.

Alternatively, many authoritarian regimes have chief executives and members of legislative bodies who are, in fact, subject to multiparty electoral competition ([Schedler 2013; Lührmann et al., 2018: 63](#)). Elections in such autocracies are characterized by legal multiparty competition and are broadly inclusive and pluralistic in design. Of course, *de facto* limitations on citizen’s rights, restrictions on the formation and functioning of opposition parties, and a general environment that allows the ruling party to dominate the media and manipulate the electoral process means that these regimes fall short of even the most procedurally minimalist definitions of democracies ([Geddes et al., 2018: 138](#)). As [Schedler \(2013, 2\)](#) notes, such regimes “establish the institutions of liberal democracy on paper, yet subvert them in practice through severe, widespread, and systematic manipulation” and “practice authoritarianism behind the institutional façade of representative democracy” ([Schedler 2013, 2](#)). Nevertheless, these *electoral* autocracies differ from their closed autocratic peers in that the rulers of the former achieve their power, in part, by appealing to citizens and winning their support at election time.

Electoral autocracies have proliferated since the end of the Cold War. ([Miller, 2020](#)): 19 reports that 113 countries have held a multiparty election under autocracy since 1946, and today the share of countries governed by an electoral autocracy is more than three times as large as the share governed by closed autocracies. [Fig. 1](#) displays these trends.¹

Despite their competition and citizen’s involvement, autocratic elections remain tools of regime survival. As [Hanson \(2018: 18\)](#) describes, the purpose of autocratic elections “is not to select which set of actors has control over the state but instead to help incumbent autocratic rulers manage the range of intra-elite and societal pressures that threaten their survival.” More specifically, autocratic elections can help demonstrate ruling party dominance, discourage elite defection, build and shore up patronage networks, and identify regime supporters and opponents, all of which stabilizes and prolongs authoritarian rule (see, for instance, [Geddes et al., 2018: 139–40; Magaloni 2006; Gandhi and Lust-Okar 2009; Svolik 2012; Hanson 2018](#) provides a useful overview).

While it is clear that winning elections aids in regime survival, the contestation of multiparty elections, even in the context of strong ruling parties, introduces political uncertainty and is inherently dangerous. On the one hand, autocratic elites are unlikely to allow competitive elections to proceed unless they are convinced they can win.² Yet at the same time, as many as one in five elections in electoral autocracies results in the incumbent executive leaving office ([Miller 2020: 20](#)). In theory, ruling parties in electoral autocracies have a number of tools at their disposal to reduce the uncertainty that comes from contesting multiparty elections, including restrictions on participation, intimidation, and even outright election fraud ([Schedler 2013: 2](#)). Relying too heavily on

¹ This graph draws on data from [Lührmann, Tannenberg, and Lindberg 2018](#); an in-depth discussion of the measure follows in [section 4.1](#).

² For a more general critique about the endogeneity of autocratic institutions, see [Pepinsky 2014](#).

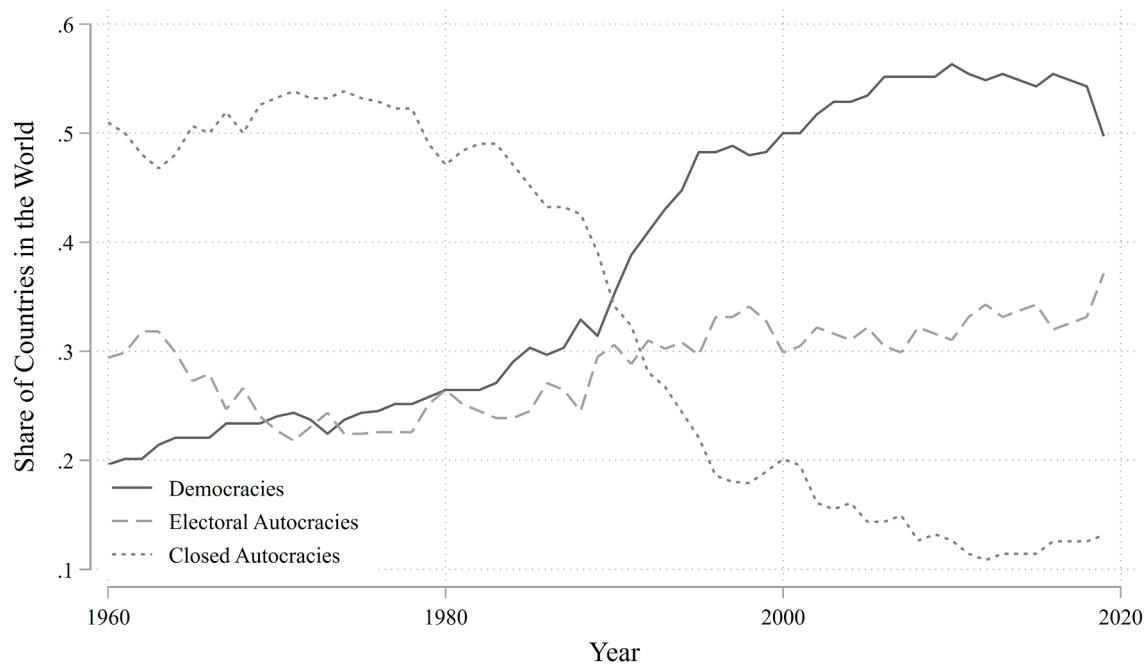


Fig. 1. The Evolution of Political Regimes, 1960–2019

Note: Measure of political regimes drawn from Luhrmann, Tannenber, and Lindberg (2019).

these tools, however, runs the risk of delegitimizing the ruling party, an outcome directly contrary to the reason elections were held in the first place (Teo 2021: 206). By contrast, leaving too much up to fate runs the risk of an underwhelming electoral victory which would undermine the dominance that such elections sought to demonstrate.

A far better strategy is for ruling parties to take pre-election steps to ensure that they dominate the results. As in other prominent models of political survival (e.g. (Bueno de Mesquita et al., 2003), providing public goods and focusing on redistribution to key support groups reduces the odds of voters defecting to political challengers. This is especially true of electoral autocracies, which have a larger and more diverse support coalition than closed autocracies (Hanson 2013). In this way, multiparty elections in autocracies force elites who wish to remain in power to draw from the same set of tools employed by leaders in democracies. As Teo (2021: 219) describes, electoral competition in autocracies “compels them to pay attention to citizen concerns.”

This logic underlies a growing body of literature that links the competitive pressures in electoral autocracies to broad improvements in human development. For instance, Miller (2015a) shows that electoral autocracies outperform closed autocracies along a variety of indicators of population health and human development. Teo (2021) demonstrates that electoral autocracies have stronger incentives to redistribute, and thus have lower levels of income inequality. Fails (2020) shows that this same logic applies to specific social transfer programs; electoral autocracies are more likely to adopt programmatic social welfare policies such as family allowances, pensions, and cash transfers. In sum, even the flawed and unfree elections in autocracies incentivize political accountability and the need for the regime to secure the support of a relatively broad segment of the population. This accountability helps explain the tendency of electoral autocracies to provide more public goods and social benefits than closed autocracies.

Extending this logic to the realm of consumer fuel subsidies is straightforward. Though disastrous to national budgets, consumption subsidies directly increase the welfare of individual households. Moreover, given that subsidies tend to be mostly consumed by higher income households (Arze del Granado et al., 2012) and urban dwellers (Kim and Urpelainen 2015), they tend to disproportionately target the population segments whose political support is most critical. As such, they represent

the kind of preventive measures such regimes may take to ensure electoral victories. By contrast, closed autocracies have smaller and narrower support coalitions and lack the same incentives to adopt policies that benefit broad segments of the population. This leads to this paper’s first hypothesis: all else equal, a transition from closed to electoral autocracy should result in more generous fuel subsidies.

Despite disagreement over the impact of political institutions, most existing scholarship on fossil fuel subsidies recognizes that they are linked to a country’s hydrocarbon assets. Simply put, countries that produce oil and gas are much more likely to subsidize domestic consumption than are non-producers (Cheon et al., 2013). I argue that the effects of electoral autocracy on consumer subsidies will be larger when a country is a domestic oil producer. More specifically, if the value of oil and gas production increases, electoral authoritarian regimes have uniquely strong incentives to use the added revenue to further decrease the price citizens pay for fuel. Thus this paper’s second hypothesis is a conditional one; an increase in oil income is especially likely to translate to more generous fuel subsidies if the regime is an electoral autocracy.

Prior research on electoral autocracy supports this argument. For instance, Miller (2015b) shows that electoral authoritarian regimes respond to negative electoral shocks by boosting spending on education and social welfare. While his focus is on election-based policy responsiveness, a more general implication is that electoral autocracies are willing to shift their spending strategies to response to changing circumstances. I argue that an increase in domestic oil production should be especially likely to encourage electoral authoritarian regimes to increase fuel subsidies.

Though this paper relies primarily on cross-national quantitative evidence, a variety of country-specific evidence is broadly consistent with the argument. Take, for instance, the interactions between political conditions and fuel subsidies in Cameroon, a small oil producer in central Africa. Since the mid-1970s, Cameroon’s *Caisse de stabilisation des Prix des Hydrocarbures* (CSPH, or Hydrocarbon Price Stabilization Board) has maintained legal authority to set petroleum prices throughout the country (Kojima 2016). However, the CSPH did not actively intervene to manage pump prices until 2004, when the government first initiated a policy to maintain prices against the rising price of oil on the international market, ostensibly to prevent erosions of

household purchasing power (Nguetse et al., 2018: 18).

Once initiated, the size of these subsidies grew dramatically, with a particular spike in 2008. By global standards, per liter subsidies were small, especially compared to other oil producers. Nevertheless, they were economically significant, both for consumers and in terms of central government finances. By 2011, a liter of gasoline had a subsidy rate of around thirty percent, with similar levels for diesel fuel and kerosene (Nguetse et al., 2018: 19). In aggregate, these subsidies were costly for the national government; Kolerus and Touna-Mama (2016: 141) estimate that fuel subsidies between 2008 and 2013 accounted for nearly eight percent of total GDP.

Most accounts of the dramatic increase in subsidies post-2008 emphasizes the emergence of widespread protests, led by transportation unions, stemming from the government's decision in late 2007 to let fuel prices rise (Amin 2012: 22). Against a backdrop of economic crisis, including rising food prices, anti-government protests spread rapidly throughout the capital and other port cities and economic hubs, eventually forcing the government to relent and reinstate generous fuel subsidies.

Without minimizing this traditional 'fuel riot' dynamic, a close reading of these patterns also demonstrate some key elements of the argument developed above. For instance, in early 2008, Cameroon's President Paul Biya was aggressively pushing a constitutional amendment that would abolish presidential term limits (Morse 2018: 125). Passing this would enable him to continue contesting elections and help solidify his party's electoral dominance over a fragmented opposition. The need to ensure ratification to preserve his regime's electoral dominance – and the recognition that quickly re-instating fuel subsidies was an essential concession, and one made easier by the oil producer's established price stabilization agency – reflects key elements of the argument above.³

In sum, I argue that prior efforts to examine the impact of political institutions on consumer fuel subsidies have relied on too narrow a conceptualization of regimes. Specifically, a large body of research on comparative authoritarianism suggests that electoral autocracies – and not non-democracies generally – have the strongest incentive to subsidize fuel consumption, and that they are more likely than other regime types to use an influx of oil production revenue to further reduce the price citizens pay. In the next sections, I describe a price-gap measure of consumption fuel subsidies that facilitates evaluating these hypotheses.

3. Measuring fuel subsidies using the "Price-Gap" approach

I measure consumer fuel subsidies using the price-gap approach. This compares the domestic price of a good to a benchmark price the good would fetch in a competitive market (for an overview of subsidy definition and measurement options, see Kojima and Koplow 2015). The resulting price gap can be positive, signifying a net tax on fuel consumption, or negative, signifying a net subsidy. Though this approach does not capture all energy subsidies, it is a particularly useful and common way to capture subsidies whose main goal is to reduce costs for end-use consumers (e.g. Coady et al., 2010), and accounts for the end results of the subsidization process, no matter the specific steps and policies governments undertake to implement this policy.

I follow the approach outlined by the German Corporation for International Cooperation (*Deutsche Gesellschaft für International Zusammenarbeit*, various years; denoted as 'GIZ' hereafter) and use the price per liter in the United States as the benchmark price. US prices represent a "revenue neutral" international benchmark, meaning that

prices cover transportation and distribution costs along with industry margins, though do not include sufficient taxes to offset the environmental or health costs associated with fossil fuel usage.

US costs per liter are calculated using data reported by the US Energy Information Administration (EIA). Specifically, I collected data on the average United States cost for a gallon of gasoline in November of each year 1990–2014, and converted this to a price per liter using the EIA conversion guide. I used prices in November of each year to match the GIZ's reporting of fuel prices in other markets, discussed in more detail below. This price serves as the benchmark fuel price for all countries except those that are net oil importers. For oil importers, I follow the IMF's (Clements et al., 2013) approach and add 20 cents per liter to cover the additional transportation and distribution costs. I use Ross and Mahdavi's (2015) data on net oil exports to distinguish countries that are importers from exporters.

I use data collected from the IMF (Coady et al., 2010) and supplemented by GIZ (various years) to measure domestic fuel prices across countries for a variety of years. Prices are reported in constant US cents per liter. Country coverage is broad, though temporal coverage is less so. The data from the IMF cover fuel prices for the years 2002–2009. Using additional reporting from GIZ, I obtain measures of domestic fuel prices for the additional years of 1995, 1998, 2000, 2010, 2012, and 2014. Some countries also have prices reported for 1991 and 1993, though country coverage for these years is sparser.

Unsurprisingly, missing data is a problem when it comes to time-series cross-national data. Even in the best-case scenario (meaning that a country has non-missing data on fuel prices for all years covered by these two sources), fuel prices are still missing for 7 years out of 24. Of course, in other instances, the proportion of missing data are higher. My main analyses adopts a two-pronged approach. For countries that are long-term subsidizers (defined as having an average observed fuel price per liter more than 20 US cents below the benchmark price), I impute missing values as the moving average of observed gas prices in the year immediately before and after the year in which fuel price data is missing. The logic behind this approach is that countries that are long-term subsidizers of fuel tend to have relatively stable fuel prices that are immune to fluctuations in the underlying price of oil – this price stability, after all, is what subsidies are designed to accomplish. If a country has a history of subsidizing fuel costs, then averaging over missing years is a reasonable way of estimating fuel costs in years that were not covered by the GIZ surveys.

For countries that are not long-term fuel subsidizers, I fill in missing data by using a panel-specific linear interpolation of fuel prices based on the observed price of crude oil in missing years. The logic behind this approach is that for countries that do not intervene to lower the costs of fuel, the main driver of fuel prices is the underlying price of oil – when oil prices increase, fuel prices should increase, and vice versa. When this interpolation is completed on a country-by-country basis, the process is able to account for country-specific trends in added taxation, such as distinguishing high-tax from relatively low-tax countries when it comes to domestic gasoline consumption. I use data from the EIA to measure the spot price of Brent crude oil in Europe. I use oil prices in November of each year to be consistent with the reporting of fuel price data in the sources described above. The results section describes the robustness of my findings to a variety of changes to this strategy, including using only non-imputed domestic price measures.⁴

Calculating the per-liter subsidy is as simple as subtracting the benchmark price from the domestic price. When this difference is positive (meaning that the domestic price is above the benchmark price), the difference implies a per-liter tax. When this difference is negative (meaning that the domestic price is lower than the benchmark price), this indicates that gasoline consumption is subsidized. The analysis

³ Even when the post-2014 collapse of world oil prices finally forced Cameroon to let prices rise, the extent of subsidy reform was modest and offset with accompanying measures targeting the regime's political base, including increased civil servant wages and reductions in small business taxes (Kolerus and Touna-Mama 2016: 141).

⁴ For more detail on missing data in the construction of the price gap measure, see the supplemental materials.

below describes this variable as *net implicit tax on a liter of gasoline*. For convenience, I report these figures in US dollars per liter. Fig. 2 displays the distribution of this measure for the entire sample employed below, and demonstrates that nearly one-third of all price gaps are negative.

This approach offers a number of improvements over those previously employed. Cheon et al. (2013) and Kim and Urpelainen (2015) utilize the IMF data on domestic prices. This limits direct comparability across countries, since some price variation – adjustment for net fuel importers, for instance – is expected and not always an indication of a subsidy or tax regime for domestic fuel consumption. Ross et al. (2017) employ a similar price-gap approach in their analysis of fuel subsidies, though they collect data on a per-month basis instead of the annual measures I describe. This results in an incredibly rich dataset that is able to track global progress and backsliding on gasoline subsidies precisely, especially as it relates to changing oil prices. However, this dataset is limited to just over one decade in duration, which may impede modeling the political economy dynamics of fuel subsidies, as they may take longer to emerge than more direct relationships between oil prices and the size of gasoline subsidies.⁵

4. Empirical approach

I adopt a two-pronged approach to evaluating the argument. First, I use the aforementioned data on the size of consumer subsidies in a largely descriptive analysis, focusing on whether transitions to electoral autocracy are associated with an increase in the subsequent size of fuel subsidies, and whether oil production moderates this relationship. Though relatively simple exercises, this descriptive approach provides important evidence supporting the argument. The trade-off, of course, is the inability of these exercises to control for the myriad of other observed and unobserved factors that drive fuel subsidies. Therefore, I also present the results of various two-way fixed effect regression analyses for the period 1990–2014, on a global sample of countries, and a suite of robustness analyses that provide greater confidence in the results.

Both the descriptive and regression approaches require a measure of political regimes that disaggregates non-democracies. I base my measures on the Varieties of Democracy project (Coppedge et al. 2020), specifically their index of *electoral democracy*, and Lüthmann et al. (2018) transformation of this measure and other indicators of the presence of multiparty and free and fair elections into a regime classification consisting of *closed autocracies*, *electoral autocracies*, and *democracies*.⁶ For this measurement, the key differentiation between democratic and autocratic regimes is the presence of *de facto* multiparty and free and fair elections along with minimum thresholds of the institutional prerequisites of democracy, such as associational autonomy and free expression. Among those regimes falling short of this minimally democratic threshold, regimes are further separated by the presence or absence of *de jure* multiparty elections for executives and legislatures. Where these electoral processes exist, regimes are dubbed *electoral authoritarian*. When these processes are absent, regimes are *closed authoritarian*. This typology best matches the theoretical argument regarding electoral authoritarianism described above, namely how the existence of some electoral process, and the regime's desires to win overwhelmingly, generates some level of political accountability and responsiveness to citizen demands.

Any analysis of fossil fuel subsidies must also include a measure of hydrocarbon production. This has a direct impact on the level of

subsidies, but is also a key part of the conditional hypothesis described above, whereby an increase in hydrocarbon revenue is expected to have a larger impact on subsequent subsidies in *electoral authoritarian* regimes than in others. I measure hydrocarbon production with Ross and Mahdavi's (2015) measure of the (log) per-capita value of oil and gas production, which I label *oil income* in the results below.

The regression approach also controls for a variety of other factors previously linked to fossil fuel subsidies. These include a measure of (*log*) *income per capita* and a measure of the *urban population* as a share of the total. Both of these variables are drawn from the World Bank's World Development Indicators. The models also include a measure of the *oil price*, measured as the Brent crude spot price, observed in November annually to match the timing of the data on per-liter gasoline prices. All independent variables are lagged by one year, to ensure values are observed prior to the measurement of the dependent variable. The models also include country and year fixed effects, with robust standard errors.

4.1. Descriptive patterns

The sections above suggests that, all else equal, electoral autocracies should be more likely to subsidize domestic fuel consumption, and that an increase in oil production in electoral autocracies should translate to an especially large increase in the size of subsidies. Figs. 3 and 4 offer preliminary descriptive evidence consistent with each of these arguments.

Fig. 3 focuses on 59 instances where a country's regime transitions from a *closed* to an *electoral* autocracy. For each of these transitions, I measure the one-year change in the size of consumer fuel subsidies following the transition to an *electoral autocracy*. Recall that the measure of fuel subsidies is the net implicit tax per liter, so larger values of the raw variable correspond to smaller subsidies. Measured as an annual change, positive values indicate that taxes increased over time (or that subsidies decreased), while negative values indicate that taxes decreased over time (or that subsidies increased). If transitions from *closed* to *electoral* autocracy were associated with more generous fuel subsidies, we would expect to see a large share of these “post-EA transition year” measures below zero.

I also plot the yearly change in the size of fuel subsidies for the year prior to the transition to *electoral autocracy* (labeled “pre-EA transition” in the figure). My argument makes no specific prediction about the yearly changes in subsidy size *before* a transition occurs. However, a considerable leftward shift from the “pre-EA transition” to the “post-EA transition” distribution would suggest that instances of regime change are associated with reduced taxes (greater subsidies) compared to the expected change if a regime transition did not occur.

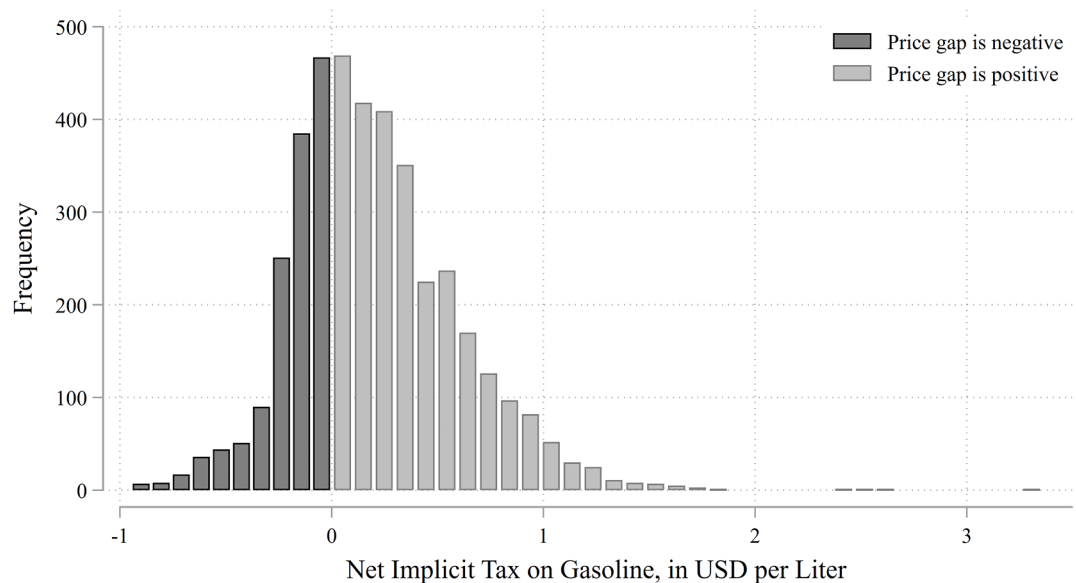
This is exactly the pattern displayed in Fig. 3. In the year prior to a transition to *electoral autocracy*, fuel taxes only decreased in twenty-nine percent of cases. That is, twenty-nine percent of observations in the “pre-EA transition” curve are below zero. However, in the year following a transition, more than forty-four percent of regimes reduced their fuel taxes, resulting in an increase to subsidies. Moreover, this “post-EA transition” curve is associated with greater (absolute) increases in subsidies, denoted by the values extending further leftward than those in the pre-transition curve.

It would be very unlikely if all values for the post-transition period were below zero; for starters, this descriptive analysis is unable to control for the myriad of other factors that influence subsidy size. Yet even where this yearly change is positive (meaning fuel taxes increased), these changes are both smaller in size and less frequent in the post-EA transition period. Though only a simple comparison of yearly changes directly before and after a transition, these results suggest that transitions to *electoral autocracy* are associated with meaningful increases in the size of consumer subsidies, as predicted.

Fig. 4 focuses on the argument that the effect of *electoral autocracy* on fuel subsidies will be greater if a country is a domestic oil producer.

⁵ The results here are robust to substituting Ross, Hazlett, and Mahdavi's (2017) measure for the years 2003–2014. I discuss these robustness results in more detail below.

⁶ The authors' Regimes of the World typology also distinguishes “electoral” from “liberal” democracies, though given the argument here, I collapse these together.



Data calculated by author following price gap approach.
Plot reports all yearly observations 1990–2014 for a global sample.

Fig. 2. Net Implicit Tax on Gasoline, reported in US Dollars per Liter

Data calculated by author following price gap approach. Plot reports all yearly observations 1990–2014 for a global sample.

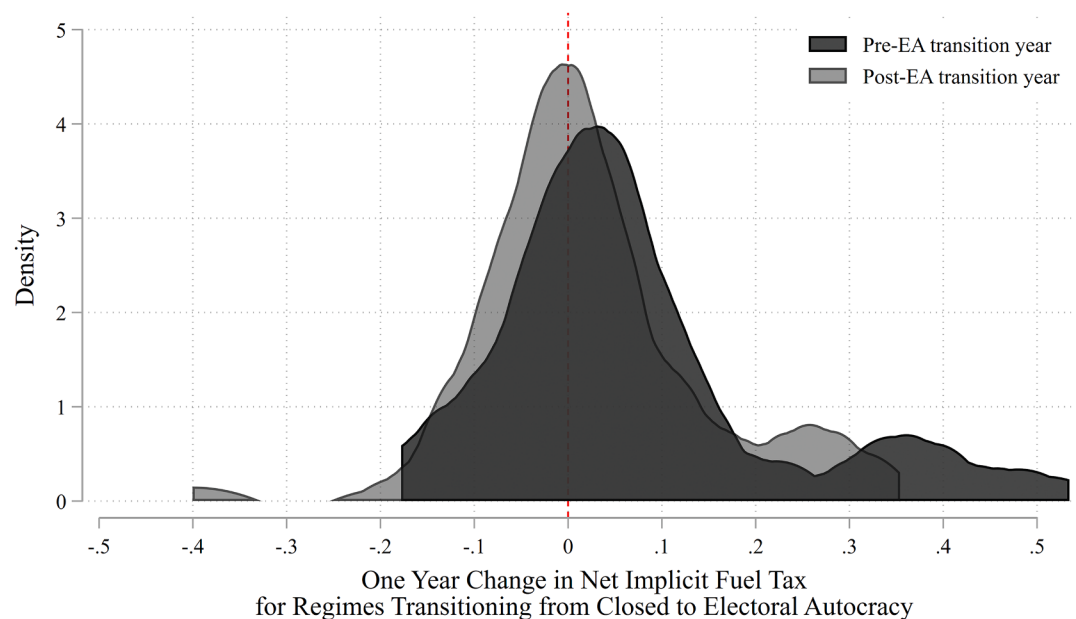


Fig. 3. Comparing Yearly Change in Subsidies Before and After Regime Transition

Note: Plot depicts distribution of one-year change in size of fuel subsidies for year before and after transition from 'closed' to 'electoral' autocracy ($N = 59$).

Specifically, Fig. 4 reports average measures of *net implicit taxes on gasoline* for three groups of regimes: the instances described above where *closed* autocracies transitioned to *electoral* autocracies, all other autocratic regime-years, and all democratic regime-years. Within each regime category, I separate oil producers from non-oil producers, defined as non-zero values of oil income per capita, using Ross and Mahdavi's (2015) data as described in the prior section.

As before, the descriptive patterns provide broad support to the argument. Transitions to *electoral* autocracy tend to be associated with large subsidies (smallest fuel tax rates), and amongst this category, regimes with access to domestic oil rents are associated with even larger

subsidies. The only category in the figure that has more generous average fuel subsidies is oil-producing autocracies that did not experience a regime transition. However, this category includes current *electoral* as well as *closed* authoritarian regimes. A more precise evaluation of any interactive effects between authoritarian regime type and oil production, along with controlling for potential confounders, requires the adoption of the two-way fixed effects regression approach in the next section. Nevertheless, the evidence again suggests that, all else equal, transitions to *electoral* authoritarian models is associated with more generous subsidies, and that the effect is likely to be particularly large when domestic oil rents are present.

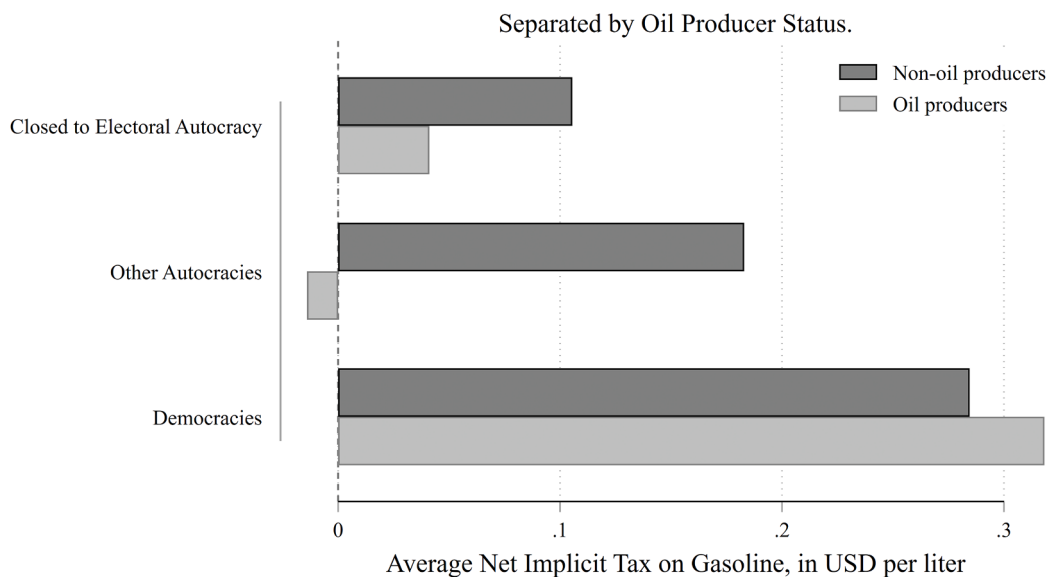


Fig. 4. Regimes and Average Consumer Gasoline Subsidy Separated by Oil Producer Status

Note: Figure separates autocratic regime-years that transition from 'closed' to 'electoral' autocracies from all other autocratic regime-years and democratic regime-years. Oil producer status measured as non-zero oil income per capita using Ross and Mahdavi (2015) data. See text for details.

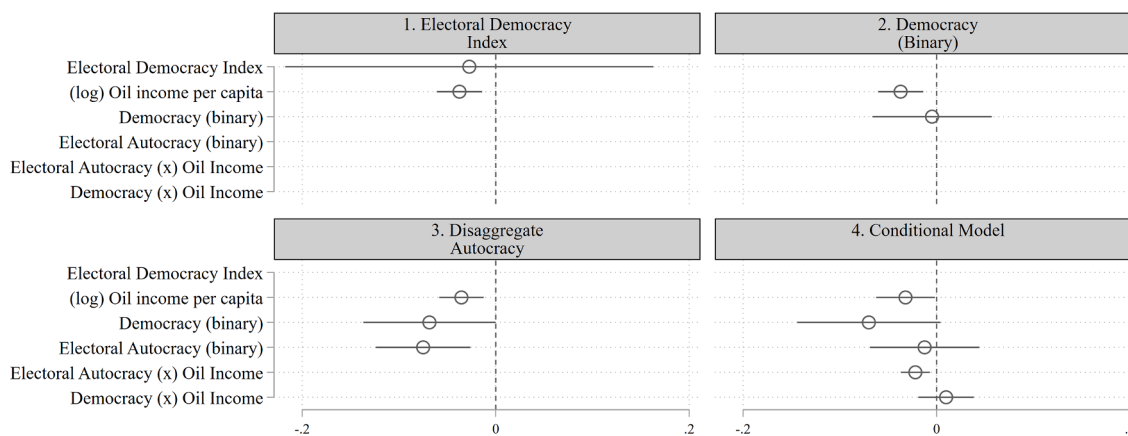
4.2. Two-way fixed effect regression results and discussion

This section presents the results of a series of panel regressions that include a number of control variables as well as unit and year fixed effects, using a global sample of countries for the years 1990–2014. Unit-specific fixed effects help account for the unobserved heterogeneity between countries, though limit the interpretation to within-country variation in the independent variables. The main model specification includes year fixed effects as well.

One potential downside of this strategy, as recently argued by Kropko and Kubinec, 2020, is that coefficients from this specification are difficult to interpret. As Hill et al. (2020: 365) summarize, two-way fixed effects coefficients represent the average difference in within-country changes in the outcome variable for each intra-unit increase in the independent variable, at each time point, averaged across all observed time points. Nevertheless, the inclusion of period fixed effects can help account for the time trends in the frequency of electoral

authoritarianism, as documented in Fig. 1 above. For instance, failure to capture any time variant unobservables that influence the spread of *electoral autocracy* may bias the results. Given the difficult substantive interpretation of these coefficients, I also re-estimate the models while dropping the year fixed effects – thus simplifying the coefficient interpretation to the average change in predicted levels of fuel subsidies given a unit increase in the independent variable over time. These results, reported in the supplemental materials (Table 2A), are identical in terms of coefficient size and statistical significance.

Fig. 5 presents the results of four different two-way fixed effects regressions. The figure plots regression coefficients, along with their 95 percent confidence intervals, though to save space the plots omit some model covariates. Full regression results in tabular form are available in the supplemental materials. Panels 1 and 2 present results that follow most current approaches to evaluating the impact of political regimes on consumer gasoline subsidies, namely by distinguishing regimes on a single axis bookmarked by maximum and minimum levels of electoral



Dependent variable is author calculated measure of net implicit tax on gasoline, in dollars per liter. Sample includes 161 countries, 1990–2014, or 3,492 observations; models include measures of urban population share, oil price, and country and year fixed effects, though these are not reported in the plot, and robust standard errors.

Fig. 5. Two-Way Fixed Effects Regression Coefficients with 95% Confidence Intervals

Dependent variable is author calculated measure of net implicit tax on gasoline, in dollars per liter. Sample includes 161 countries, 1990–2014, or 3492 observations; models include measures of urban population share, oil price, and country and year fixed effects, though these are not reported in the plot, and robust standard errors.

democracy. Panel 1 measures political regimes with a continuous measure of *electoral democracy*, while Panel 2 uses Lüthmann, Tannenber, and Lindberg's (2018) typology to create a simple binary distinction between democracies (both electoral and liberal variants) and authoritarian regimes (both closed and electoral variants).

Collectively, these results are consistent with prior work; both approaches to measuring political regimes results in coefficients that are not statistically different from zero. Given the inclusion of the unit and time fixed effects, this suggests that neither the across-time average of an increase in the degree of electoral democracy within a country (panel 1) nor transitions from an authoritarian regime to a democratic regime (panel 2) has an impact on the subsequent level of fuel subsidies. Greater levels of oil production are associated with greater subsidies, but political institutions – at least as measured in these ways – play a negligible role.

Panel 3, labeled “Disaggregating Autocracy,” offers a simple test of the degree to which this particular conceptualization of political regimes is responsible for these null findings. Specifically, the model reported here disaggregates the sample of authoritarian regimes into *electoral autocracy* and *closed autocracy* categories, with the latter serving as the baseline excluded category. Recall from above that the former of these, with their underlying need to attend to the needs of the population and mitigate unrest, are expected to have more generous fuel subsidies. Given the coding of the dependent variable and the fixed effects specification, this should result in a negative coefficient (i.e., within-country transitions to *electoral autocracy* should be associated with reduced values of the dependent variable *net implicit tax on gasoline*).

The coefficients plotted in Panel 3 support this interpretation; the estimated coefficient for *electoral autocracy* is negative and statistically significant. Once again, the inclusion of country fixed effects imply that the transition between a *closed autocracy* and an *electoral autocracy* – something that occurs 59 total times in the estimation sample – increases the size of consumer gasoline subsidies, while the time fixed effects average these estimates over the observed time period for each panel to control for unmeasured time shocks. This specification also generates a statistically significant coefficient for *democracy*. This implies that transitions to democratic regimes are also associated with a reduction in the net implicit tax on gasoline, or put differently, larger subsidies.

Panel 4 reports the results from a model evaluating the conditional hypothesis that an increase in hydrocarbon production revenue in a country should have a particularly large impact on the size of subsidies

in *electoral autocracy*. I test this expectation by including the interactive terms *electoral autocracy (x) oil income*, and *democracy (x) oil income*. The model retains each constituent term of the interactions. The coefficient for the interactive term *electoral autocracy (x) oil income* is negative and statistically significant, suggesting that the impact of an increase in hydrocarbon production revenue has a different impact in this particular subset of regimes. By contrast, the interactive term *democracy (x) oil income* is not significant.

Fig. 6 uses the results from this conditional model to explore the substantive impact. Specifically, I use the regression results to generate predicted changes in the dependent variable for each regime type when *oil income* increases from \$0 per capita to \$100 per capita. That is, it simulates the change to the size of consumption subsidies when oil income increases, across different political regimes. This is a relatively modest increase in total hydrocarbon production, equivalent to about the amount of oil income in relatively small producers like Cote d'Ivoire in the early 2010s, or Cameroon in the early 2000s. Focusing on small changes to the level of oil production ensures the results minimize the impact of large producers, since their production decisions themselves may move the market price of oil and thus introduce some endogeneity into the relationship.

Even so, the results suggest that modest increase in hydrocarbon production revenue would lead to a larger increase in subsidies (i.e., a larger reduction in the net implicit tax rate) for *electoral autocracy* than in any other regime type. In absolute terms, the estimates predict a decrease of nearly 25 cents US per liter. In relative terms, the predicted change in the subsidy level is nearly twice the size as is estimated for *closed autocracies*. Moreover, the predicted change in democratic regimes is not statistically significant, as the estimated 95 percent confidence interval overlaps zero.

Collectively, these results offer strong support for both hypotheses. The emergence of electoral authoritarian rule within countries is associated with a significant increase in the size of consumer fuel subsidies. Moreover, such regimes are particularly likely to respond to a rise in hydrocarbon production revenue by increasing consumer subsidies for gasoline. These findings are consistent with the general idea that the regular contestation of elections in autocracies – even when lacking the free and fair competition in democracies – compels leaders to pay attention to the needs of citizens.

In the supplemental material, I focus on this conditional model and report the results of additional robustness analyses. First, I include

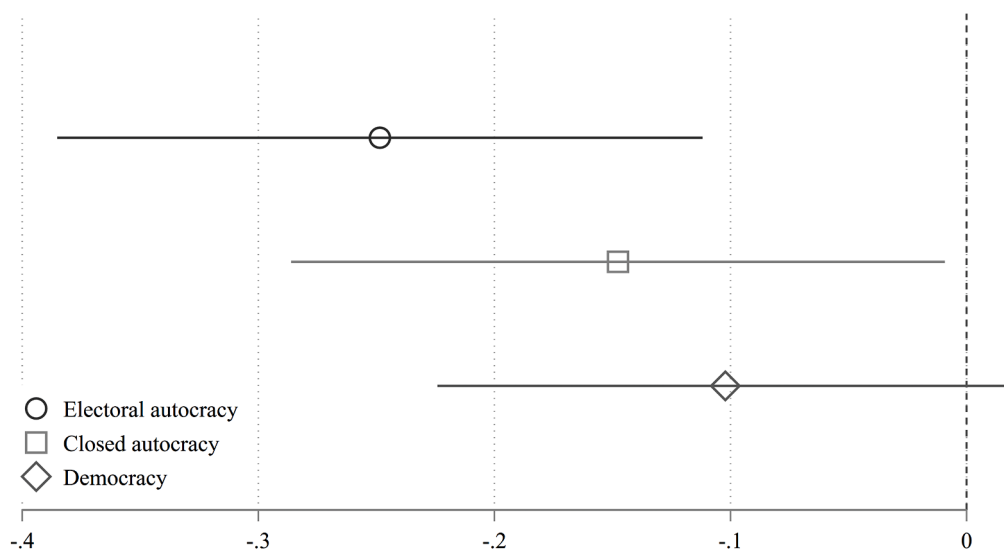


Fig. 6. Predicted Change in Net Implicit Tax on Liter of Gasoline When Oil Income per capita Increases from \$0 to \$100

Note: Estimates are expressed as 95% confidence intervals of the change in the expected value of Net Implicit Taxes on Gasoline in USD per liter. Predicted values calculated while holding all other explanatory variables at mean values.

additional control variables that may be associated with subsidies, including a measure of central government debt and the presence of a national oil company (Cheon et al., 2015). Second, I exclude democratic regimes from the estimation sample, so that the results only compare closed to electoral autocracy. Third, I re-estimate the model in the full regime sample, but exclude year fixed effects. Fourth, I drop countries from the sample if they experience no changes in the observation of electoral autocracy across time; that is, I exclude those countries where electoral autocracy was always present across the time period, and those where it was never present. This exercise ensures that the inclusion of countries with no variation on the key independent variable is not influencing the fixed effects results.

Fifth, I re-estimate the model when limiting the sample to only those years in which the price-gap can be calculated without relying on imputed values. Finally, I re-estimate the model substituting Ross, Hazlett, and Mahdavi's (2017) price-gap measure for the years 2003–2014 in the full sample. These measures are highly correlated ($r = 0.89$, see the supplemental materials for more details). The central finding persists across each of these exercises, namely that an increase in hydrocarbon revenue has a disproportionately large impact on the size of consumer gasoline subsidies in electoral autocracy.

5. Conclusion

Despite their costs, the pace of fossil fuel subsidy reform has been slow. If subsidies are mostly a function of slowly changing economic factors, this trend is likely to persist. This paper challenges prior conclusions on the extent to which political institutions shape the size and scope of global consumption subsidies. My argument concurs with some underlying theoretical perspectives on subsidies – namely, that they are a tool of political survival enabling leaders to provide visible benefits to key supporters (i.e. Victor 2009). Yet it differs by demonstrating that this logic is most likely to appear in the subset of authoritarian regimes where the citizenry plays a role in the selection and maintenance of the regime through participation in *de jure* multiparty elections.

Drawing on a large body of research in political science, I describe these as electoral authoritarian regimes, as opposed to closed authoritarian variants. The former draw their power from overwhelming victory at the ballot box, and providing public goods and redistribution to key support groups helps ensure that the regime wins election without having to resort to fraud, repression, or other strategies that may delegitimize their rule. This logic suggests that electoral autocracies have a particularly strong incentive to subsidize domestic fossil fuel consumption. Regression analysis on a global sample of countries supports this general conclusion, while also demonstrating that electoral autocracies are particularly likely to increase their subsidies when they experience even modest increases in hydrocarbon revenues.

These results have two noteworthy implications regarding the future of subsidy reform. First, the results suggest that the number of countries likely to implement consumption fuel subsidies will rise in the coming decades. This conclusion reflects two trends: the continued rise of electoral autocracy as the dominant form of non-democratic rule globally, and the expansion of hydrocarbon production to frontier countries in the developing world. Collectively, these trends suggest that more and more countries are likely to fall into the political institutional circumstances that are associated with larger fossil fuel subsidies.

Second, while the findings suggest that electoral autocracies are uniquely sensitive to hydrocarbon revenues, responding to an increase in production revenues with increased subsidies, scholars and policymakers should not automatically assume that any subsequent decline in oil production would result in subsidy retrenchment. Once established, subsidies tend to lock in and public opinion strongly resists reform efforts, in part because citizens are skeptical of government's ability to credibly commit to and implement alternative social welfare programs (Kyle 2018). A comprehensive subsidy reform strategy requires acknowledging the important political survival logic of subsidy

deployment, as well as efforts to build the capacity to replace these with alternative social welfare programs.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.exis.2021.101037.

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