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Social Unrests and Fuel Prices: The Role of Macroeconomic, Social and Institutional Factors

Alassane Drabo, Kodjovi M. Eklou, Patrick A. Imam, and Kangni Kpodar

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Prepared by Alassane Drabo, Kodjovi M. Eklou, Patrick A. Imam, and Kangni Kpodar*

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ABSTRACT: This paper investigates the impact of fuel price increases on social unrests in addition to the macroeconomic, social and institutional factors driving this relationship. Using the IV fixed-effect estimator on a sample of 101 developing countries during 2001-2020, we find that changes in fuel prices are positively associated with the number of social unrests, mainly anti-government demonstrations. This impact is however amplified: (i) during economic downturns and periods of high exchange rate instability; (ii) when government spending is low, especially on health and education, thus suggesting that streamlining fuel subsides and diverting parts of the reform savings to the health and education sectors is an appropriate policy that could appease social tensions; (iii) in countries with high income inequality, low institutional quality and high level of corruption. The results are robust to a battery of tests, including the use of an instrumental variable approach to address reverse causality concerns given that social unrests could also prompt a freeze in fuel prices. We also find consistent results using either changes in diesel or gasoline prices. Overall, the findings of the paper provide support to the grievance and deprivation theory in explaining the association between fuel price increases and social unrests, but fail to find evidence for the resource theory and the theory of political opportunities.

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WORKING PAPERS

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Prepared by Alassane Drabo, Kodjovi M. Eklou, Patrick A. Imam, and Kangni Kpodar[1]

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I. Introduction

At the start of the 21st century, despite some progress in the transition to renewable energies, society (still) depends heavily on fossil fuels, accounting for more than 80 percent of total world energy use (Ritchie, Roser and Rosado, 2022). Notwithstanding the adverse consequences of fuel consumption on global warming, it remains a dominant source of energy, both directly and indirectly, in the consumption basket of households (for the rich and poor alike from low-income countries to advanced economies). High and volatile fuel prices can generate an economic shock to households, government and firms, particularly in oil-importing countries.[2] Against this backdrop, fuel prices are often regulated and subsidized in many countries, particularly in the developing world where adequate social safety nets are lacking.

The sensitivity of households to changes in fuel price is reflected in the frequent protests encountered around the world when fuel prices are hiked. Fuel price increases, by directly affecting transportation costs, often translate into a generalized increase in the cost of living for most households, and in some cases, a second-round increase in the prices of goods and services. This was evident in rich countries like France in 2018/19 with the “gilets jaune” (yellow vest) movement, when taxes on fuel were hiked. In developing countries, these effects are even more evident, as seen in riots fueled by fuel price increases from Haiti in July 2018 to Zimbabwe in January 2019 or Nigeria in September 2020.[3] In extreme cases, some protests that were triggered by fuel price increases have even led to revolutions. Myanmar’s “Saffron Revolution” of 2007 was triggered by fuel price increases (see Steinberg, 2008), and more recently in Sri Lanka where protests broke out as fuel prices rose by 90 percent between January and May 2022. The risk of a contagion effect is not negligeable, with Sri Lanka’s neighbor, Bangladesh, having also experienced violent protests after the government hiked fuel prices by about 50 percent in June 2022.[4]

However, not all fuel price increases are alike, with some leading to unrests while others don’t. For instance, in 2015, Indonesia increased fuel prices by 30 percent, without major protests (IISD, 2015). Egypt raised gasoline prices fourfold between November 2016 and July 2019 in a move to shore up public finances amid large and unstainable fuel subsidies, without generating riots. It follows that, understanding where, when or in what context fuel price increases lead to social unrests is a crucial question for policymakers in designing fuel price reforms, particularly as social unrests may hold back growth, and thus aggravate poverty and income inequality.

In this paper, we investigate the effect of retail fuel price increases on social unrests in a sample of 101 developing countries over the period 2001-2020. In doing so, the paper aims to address two fundamental questions: (i) are fuel price increases unconditionally associated with social unrests after controlling for other factors that could drive social unrests? (ii) what are the mitigating or amplifying factors affecting the likelihood of fuel price increases triggering social unrests?

[2] It is well known that as a commodity, crude oil is unique, in that it’s price is highly volatile. Historically, crude oil prices, and hence refined petroleum prices, are more volatile than 95 percent of other domestic product prices (Regnier, 2005).

[3] While some environmental groups protest against the environmental consequences of fuel (mainly in developed countries) in most cases, people protest because they cannot afford the fuel on which their everyday lives depend. Particularly low-income individiuals in urban areas depend on affordable transportation.

[4] The contagion effect has been modelled by Buenrostro, Dhillon and Wooders (2007) to explain the fuel protests in France and the UK that took place in 2000.

While news articles on fuel price protests have been recurrent, there are surprisingly very few empirical studies in the economic literature investigating the complex link between fuel price increases and social unrests. Some notable exceptions include Natalini et al. (2020) and McCulloch et al. (2022). Nevertheless, these studies fall short of exploring in a comprehensive way under which conditions fuel price increases lead to violent unrests, relatively minor protests, or none at all. Shedding light on this issue has practical policy implications for the political economy of fuel subsidy reforms in developing countries.

Using the IV fixed effect estimator, we find that fuel price increases tend to spur social unrests. Fuel price changes in a given country are instrumented by the weighted average of that of other countries in the sample (the weights being inversely proportional to the distance between the two countries). Further, a more granular analysis reveals that fuel price increases are mostly associated with anti-government demonstrations, and not necessarily to other types of social unrests, such as strikes, terrorism and government crises. More importantly, the paper finds that whether or not fuel price increases lead to unrests is conditional on prevailing macroeconomic conditions, the size of social expenditure, and the strength of the institutional environment. In particular, the impact of fuel price increases on social unrests is stronger; (i) during economic downturns and in countries with high exchange rate instability; (ii) when government spending is low, especially in social sectors such as health and education; (iii) where income inequality is high, corruption is widespread, and institutions are weak. For some of these conditional factors, there is evidence of a threshold effect. Using either gasoline or diesel price changes does not alter the conclusions of the paper. Overall, these results lend support to the grievance and deprivation theory of protests, which argues that people protest when they perceive a situation as unfair. On the other hand, we do not find evidence for the resource theory and the theory political opportunities. The different theories of protests will be discussed in more details in the next section.

The rest of the paper is organized as follows. Section II provides a review of the literature and the different theories put forward to explain protests, while Section III investigates the empirical relevance of fuel price increases for social unrests in developing countries. Section IV focuses on the instrumental variable approach, and section V looks at the range of country's macroeconomic, social and institutional factors that shape the link between fuel price increases and protests. Finally, Section V concludes and draws policy implications.

II. Literature Review

Theoritical considerations and channels

While protests[5] have existed for centuries—from the French revolution to the Equal Rights movement in the 1960s—they have become more frequent in recent years and are now part of the norm in the political process in many countries (Norris, 2002; Rucht, 2007). The literature identifies three theories that explain why people protest: (i) resources, (ii) political opportunities/contextual conditions, and (iii) grievances and deprivation (Quaranta, 2017).

According to the resource theory, the educational and wealth level of an individual positively influences the probability of going on to the street. Therefore, protests are more likely when individuals organizing the

[5] Protest can be defined as an action aimed at affecting the political process, changing the status quo or a decision seen as unfair, whether it's through petitions, demonstrations, boycotts, sit-in or strikes (della Porta and Diani, 2006).

protests are well-off and educated—as a poor individual cannot easily go and protest and forego a day's salary, whereas a better off individual can. The same argument applies for more educated individuals, with evidence from Europe (Quaranta, 2015), Latin America (Moseley, 2015) and the Middle East (Beissinger et al, 2015). Therefore, the resource theory predicts that low income and low educated individuals are less likely to protest their hardship conditions, in contrast to the middle-classes. This would suggest that in lower-income countries, the probability of protests should be lower, ceteris paribus, than in higher-income countries, following a fuel price hike, given the lower educational and wealth to go on the street: in other words, they "cannot afford" to protest. The experience has shown the opposite, however, since protests that erupts following a fuel price increase are often motivated by the adverse impact of the fuel price increase on the poorest households.

The theory of political opportunities posits that protests hinge on the openness/closeness (democracy/non-democracy) of the political system and the state's capacity to repress. It is often argued that democracy stimulates protests, as it encourages people to express their opinion openly (Fatke and Freitag, 2013). At the same time, protests are likely to be less violent in nature in a democratic setting. By contrast, protests in closed systems are likely to be less frequent, but when they happen, more violent (Tarrow, 1998). If the theory of political opportunities holds, then a fuel price increase is more likely to result in protests in more democratic regimes than others. This prediction remains an empirical question as in practice, fuel price unrests have occurred in democratic and autocratic regimes.

Turning to the grievances and deprivation theory, the rationale is that when individuals perceive a situation as unfair, arguably because an implicit or explicit social contract is broken, they protest. In other words, people feel deceived because their expectations—for instance, keeping fuel prices low—were not met, and a protest is an expression of such dissatisfaction (see Lipsky, 1968). In this situation, protests provide a means that allows individuals to influence the political system. The inability of the government to keep low fuel prices or to avoid its impact on unemployment and inflation may be considered (rightly or wrongly) as unfair. In a fuel exporting country, low fuel prices are often a way to redistribute the oil wealth by using revenue from oil exports to subsidize fuel prices. When oil prices fall, it becomes harder for the government to maintain these subsidies, which can result in an increase in fuel prices, causing the population to suffer on top of the downtown that is already hitting the economy. The fall in income and rise in unemployment can generate grievances, which can translate in unrests. In the context of this study, the grievance hypothesis would suggest that the probability of protests following a hike in fuel prices is higher in the context of poor countries, and where macroeconomic conditions are worse.

The mechanisms of transmission from fuel prices to social unrests are well known, and clearly they are anchored in the grievance and deprivation hypothesis. First, with oil being an important input, increasing fuel prices lead simultaneously to a negative income shock for consumers in fuel importing countries, and a negative supply side shock. This lowers growth—through reducing demand and increasing prices such as transportation—reduces productivity and raises unemployment (Hamilton, 2003). The increase in living costs, and the concern that poor households may suffer the most, are a potential recipe for unrest.

Second, studies have documented the so-called "rocket and feather effect" whereby retail fuel prices rise rapidly in times of rising world oil prices and fall slowly when world prices come down (see Borenstein et al., 1997; Radchenko, 2005; Kpodar and Abdallah, 2017). In a repeated game, if economic agents perceive that they are not benefiting from dropping oil prices as much they pay for rising oil prices, they will resist an increase in fuel prices at some point, which could take the form of protests.

Third, this asymmetry also plays out in the transmission of fuel price increases to overall inflation. Kpodar and Abdallah (2023) find that energy price increases tend to have larger and more significant impact than energy price decreases on inflation. In this setting, even a temporary increase in fuel prices may be perceived by consumers as a permanent shock since consumer prices will not return to where they were before the fuel price shock. This could trigger social unrest in demand for higher wages following the rise in living cost.

Evidence

What do the theoretical and empirical evidence suggest? Surprisingly, not much evidence exists between fuel price increases and social unrests, but insights can be drawn from related literature. For instance, an example of theoretical work related to this topic is from Passarelli and Tabellini (2017) who provide a framework where social unrests can shape policies, and this is internalized by the policymaker. Policy changes deviating from a reference point, which is a policy outcome that individuals expect on the ground of fairness (in our case low fuel price) could generate social unrests. However, most of the advancements in recent years trying to explain protests movements have been empirical.

There have been also a lot of empirical work looking at food price increases on demonstrations. The similarities with the effect of fuel prices are likely to be important as fuel price increases put upward pressures on food prices, given that the latter are sensitive to transport costs. Hendrix, Haggard and Magaloni (2009), in a study looking at food prices and protests in a sample of major Asian and African cities from 1961-2006 find that changes in wheat prices are significantly correlated with the number of protests. Similarly, Smith (2013) finds a strong correlation between monthly food prices and social unrest in Africa. Arezki and Bruckner (2011) use a sample of 120 countries from 1970-2007 and find that rising food prices increase the probability of protests, particularly in low-income countries (see also Bellemare, 2015). Within LICs, the high poverty level explains why large parts of the population are impacted by food price increases.

To the best of our knowledge, only two studies have specifically investigated the link between fuel prices and social unrest. Natalini et al. (2020) use data on fuel riots for the period 2005-2016 to analyze the link between changes in crude oil prices and fuel riots. The authors find a positive association between the two variables. In addition, countries that are net fuel importers, politically unstable and poorer tend to experience more fuel riots. In contrast, the likelihood of fuel riots declines with higher government effectiveness, but the democratic nature of the political regime does not seem to play a role. While this study is informative, the identification relies on international oil prices instead of domestic fuel prices, whose dynamic can be disconnected from crude oil price cycles due to government control of fuel prices in many developing countries. McCulloch et al. (2022), on the other hand, addressed this issue and find a positive impact of domestic fuel price adjustments on fuel riots over the period 2005-2018, with the marginal effect being stronger in less flexible fuel pricing regime.[6]

However, the two studies have some limitations. Natalini et al. (2020) and McCulloch et al.'s (2022) employed samples with very few number of fuel riots (59 occurrences out of 3011 country-year observations). King and Zeng (2001) note that in the presence of rare events, standard estimators, such as the logic estimator, can significantly underestimate the occurrence probabilities and produce biased

[6] The rationale is that lees flexible fuel pricing regimes give rise to large fuel subsidies, which make public spending unsustainable and often lead to riots when countries are forced to reduce subsidies.

standard errors (see also Timoneda, 2021). There are also potential errors of exclusion given that social unrests can be driven by a wide array of grievances (often spread over time), making it difficult to attribute the protests to a single factor. More importantly, there are several other macroeconomic and institutional factors that could play a mitigating or amplifying role in the transmission of fuel price shocks to social unrests. Lastly, the feedback effect from unrests to fuel prices merits due consideration.

Our paper complements the existing literature in several ways. First, it takes a broader approach by considering the number of social unrests, recognizing the challenges of classifying unrests according to a specific cause. As such, we also capture the frequency of social unrests by accounting for the number of events in a given country-year, as opposed to a dummy variable indicating whether there is a riot in a given country or not. Second, the paper explores heterogeneity across different types of social unrests, some more violent than others. Third, given that policy makers may account for the risk of social unrests in the decision to adjust fuel prices, this reverse causality may lead to bias in the OLS estimates. We propose, therefore, an instrumental variable approach to address the issue, allowing us also to address potential omitted variable bias. Fourth, our paper improves on previous works by testing for nonlinearities in the relationship through a wide range of macroeconomic, social and institutional conditions that could help explain why fuel price increases lead to unrest in some countries but not in others. This will, therefore, shed light on the enabling conditions for a successful fuel subsidy reform, given that literature on the political economy of energy subsidy reforms highlights the fear of unrests as a major obstacle.[7] Fifth, on the empirical determinants of social unrests, the paper adds to the literature on the role of economic conditions (Miguel et al., 2004, Bohlken and Sergenti, 2010, and Brückner and Ciccone 2011), the literature on the role of democratic institutions (Tarrow, 2011 and, Fatke and Freitag, 2013) and the literature on the role of resource wealth (Collier and Hoeffler, 2005; Basedau and Lay, 2009).

III. Fuel Prices and Unrests: Model Speficiation, Data and Baseline Results

A. The Model

To investigate empirically whether fuel price changes are associated with social unrests, we estimate the following equation:

$$Y_{c,t} = \beta_0 + \beta_1(Fuel\ price\ change)_{c,t} + \delta X_{c,t} + u_c + \varepsilon_{c,t} \quad (1)$$

where:

- $Y_{c,t}$ is the logarithm of the number of social unrests (combining riots, anti-government demonstrations, strikes, revolution, political assassination, terrorism, and government crises) in country *c* and year *t.*[8] The social unrest data is taken from Banks and Wilson (2022).

- $(Fuel\ price\ change)_{ct}$ represents the annual growth rate of domestic fuel pump prices for diesel or gasoline. Data on fuel prices is taken from a database compiled by Kpodar and Abdallah (2017) and updated in Kpodar and Liu (2022).

[7] See for instance North et al. (2007), Inchauste and Victor (2017) and Cox et al., (2019).

[8] To deal with zeros values, we take the logarithm of the number of social unrests plus one.

- $X_{c,t}$ is a set of control variables, which includes the logarithm of real GDP per capita, GDP growth rate, population size, inflation rate, urban population and the quality of institutions.

- u_c is the country-fixed effect, and ε_{ct} is the error term.

Our main control variables relate to the determinants of social unrests used in the literature (e.g., Donni et al, 2021; McCulloch et al, 2022). Macroeconomic conditions are captured by real GDP growth and inflation. As our study is about investigating the effect of fuel price changes on social unrests, controlling for inflation (change in consumer price index, a proxy for the increase in prices) is essential to isolate the specific shock to fuel prices.

Consistent with the grievance and deprivation theory, social unrests should be influenced by the economic cycle, proxied by real GDP growth. Furthermore, previous studies document a negative relationship between economic shocks and political instability (e.g. Miguel et al., 2004). We also control for the level of income using real GDP per capita. Next, as social unrests take place mostly in urban areas (Gizelis et al, 2021), the model controls for the share of the urban population. A variable to control for the quality of institutions, namely the rule of law, is alo added to the model. Data on the above are extracted from the World Development Indicators (WDI) and the Worldwide Governance Indicators (WGI). Annex 1 provides details on the description of each variables and sources, whereas Annex 2 provides the summary statistics.

The model is estimated by the fixed-effect estimator with clustered standard errors at the country level. Controlling for country-fixed effects allows to account for time-invariant or slow-moving unobserved characteristics of countries, such as structural differences in the propensity to have an unrest. β_1 is the coefficient of interest. We test whether $\beta_1 > 0$, that is whether fuel price increases spur social unrests.

In a second step, we adopt an augmented model with the following specification:

$$Y_{c,t} = \beta_0 + \beta_1(Fuel\ price\ change)_{c,t} + \beta_2(Fuel\ price\ change)_{ct} * Macro\_InstF_{c,t} + \beta_3 Macro\_InstF_{c,t} + \delta X_{c,t} + u_c + \varepsilon_{c,t} \quad (2)$$

where:

- $Macro\_Inst$ depicts the macroeconomic, social and institutional conditions that can influence the likelihood of an increase in fuel prices to trigger social unrests. Drawing on the literature, these conditioning factors include total government current spending, spending on critical social services (education and health), income inequality, economic growth, exchange rate instability, overall socioeconomic conditions, the quality of institutions (democratic accountability, bureaucracy quality, government effectiveness, voice and accountability, regulation quality and corruption).

- All other variables are defined in the same way as in eq(1)

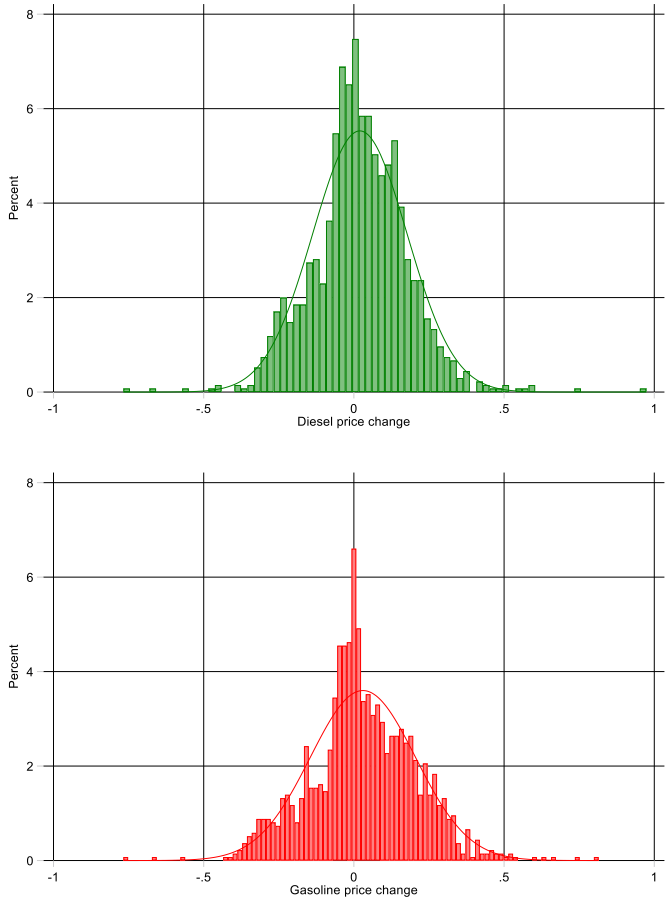
In this specification, the coefficient of interest is β_2. A positive (negative) coefficient implies the conditioning factor considered amplifies (mitigates) the occurrence of social unrests following an increase in fuel prices.

B. Data and Stylized Facts

In this section, we focus on fuel prices and social unrest. Our sample covers 101 developing countries for which data is available during the period 2001-2020.

Figure 1 shows the distribution of the change in diesel and gasoline prices in the sample.[9] We use data on the prevailing retail prices per liter of gasoline and diesel (annual average) in local currency and converted it in US dollars to ensure comparability across countries in the sample. The distribution is slightly skewed to the right, suggesting that positive price changes are more prevalent in the sample. Less than one percent of the observations are zero and more than 55 percent are positive. Episodes of price declines coincide mostly with the slump in international oil prices in the second half of 2008.

Figure 1. The Distribution of Diesel and Gasoline Price Changes in the Sample



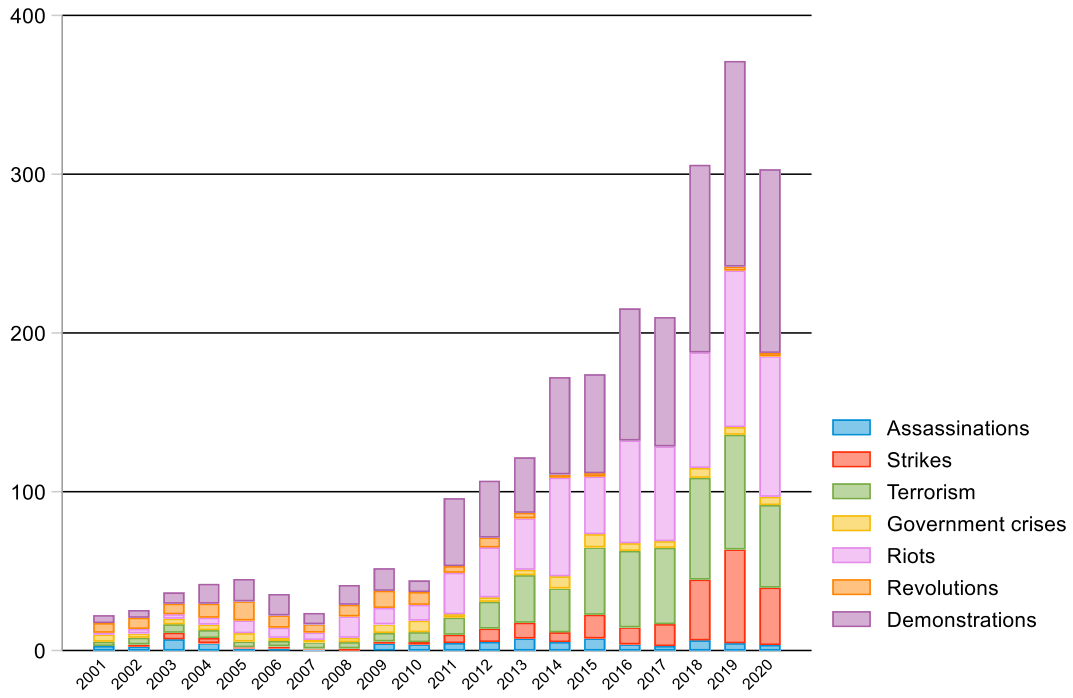
Sources: Kpodar and Abdallah (2017), Kpodar and Liu (2022) and Authors' calculations.

The data on social unrests from Banks and Wilson (2022) has been collected from articles published in the *New York Times.* It distinguishes between eight different types of domestic conflicts following Rummel (1963). These categories include assassinations, general strikes, terrorism, major government crises, purges, riots, revolution and anti-government demonstrations. Given our research question, we consider all

[9] We use the growth rate of diesel and gasoline prices.

these categories, but purges.[10] For instance, anti-government demonstrations consist of any peaceful public gathering of at least 100 people for the primary purpose of displaying or voicing their opposition to government policies or authority, excluding demonstrations of a distinctly anti-foreign nature. Figure 2 below shows the evolution of social unrests (per year) over time in the sample. While there is significant variation both over time and across types of events, towards the end of the period, social unrests appear to be more frequent, mostly driven by terrorism, riots and anti-government demonstrations.

Figure 2. Number of Social Unrests, 2001-20

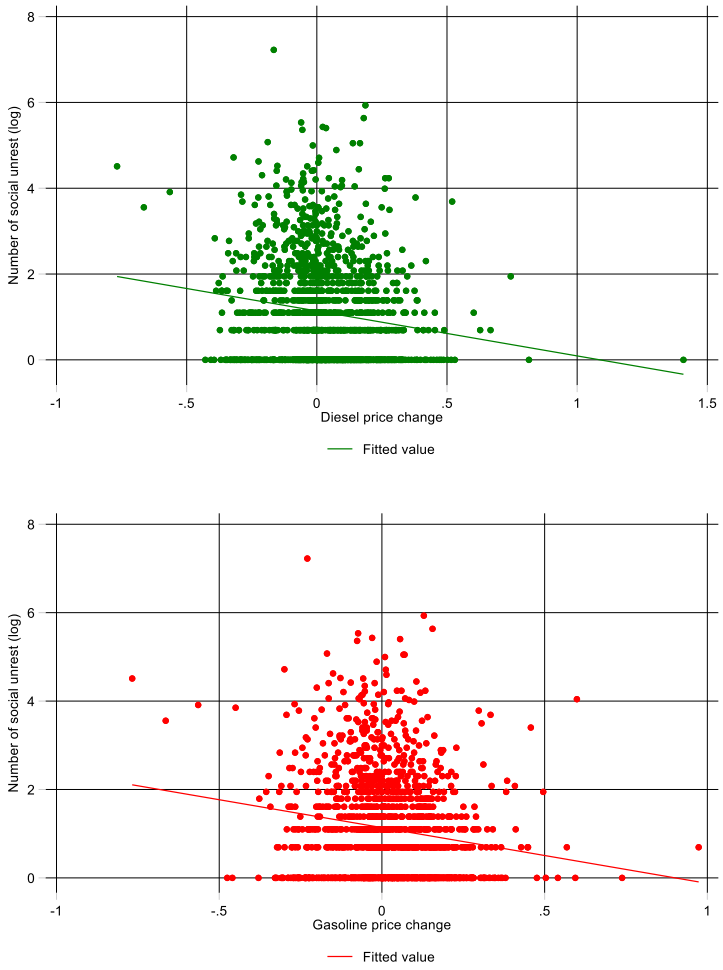


Sources: Banks and Wilson (2022) and Authors' calculations

Figure 3 below displays the correlation between the logarithm of the number of social unrest events and the change in fuel price. Surprisingly, it shows a negative correlation between changes in fuel price (both diesel and gasoline) and the number of social unrests, which suggests that fuel price increases do not unconditionally lead to social unrests, and that fuel price increases without protests are much more common than thought. Figure 3 provide only correlations, but the relationship between changes in fuel prices and social unrests needs to be tested empirically in a more comprehensive setting to evaluate its statistical significance, but also to remove the effect of potentially confounding factors.

[10] Purges are defined as any systematic elimination by jailing or execution of political opposition within the ranks of the regime or the opposition.

Figure 3. Correlation between Social Unrests and Fuel Price Changes



Sources. Banks and Wilson (2022), Kpodar and Abdallah (2017), Kpodar and Liu (2022) and IMF staff calculations.

C. Baseline Results

Table 1 illustrates the baseline findings, focusing on the changes in diesel and gasoline prices. Our estimates show a positive and statistically significant effect of fuel price changes on social unrests, which is robust across specifications and fuel products. This confirms that fuel price dynamics are associated with social unrests, once other determinants of social unrests are controlled for. Among these control variables, as expected the coefficient of the GDP growth rate is negative and highly significant in all specifications, suggesting that a growing economy is less prone to social unrests. Nevertheless, unrests are more prevalent in richer and more populated developing economies as shown by the positive and significant

coefficient for real GDP per capita and population size. We do not find a statistically significant effect for institutional quality, inflation, and the share of urban population.[11]

Table 1. Changes in Fuel Prices and Social Unrests: Baseline

Dependent variable: number of social unrest events (log)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Changes in diesel price	0.133**	0.145**	0.143**	0.152**				
	(0.064)	(0.066)	(0.064)	(0.067)				
Changes in gasoline price					0.153*	0.172**	0.167*	0.183**
					(0.085)	(0.087)	(0.084)	(0.087)
GDP per capita PPP (log)	1.126**	1.124**	1.028**	1.028**	1.135**	1.135**	1.028**	1.029**
	(0.457)	(0.467)	(0.476)	(0.486)	(0.464)	(0.474)	(0.485)	(0.495)
GDP growth rate	-0.042***	-0.044***	-0.042***	-0.043***	-0.041***	-0.042***	-0.040***	-0.042***
	(0.008)	(0.009)	(0.008)	(0.009)	(0.008)	(0.009)	(0.008)	(0.009)
Population (log)	3.518***	3.446***	3.152***	3.050***	3.537***	3.466***	3.147***	3.046***
	(0.531)	(0.512)	(0.594)	(0.588)	(0.535)	(0.516)	(0.600)	(0.596)
Rule of law WGI	-0.189	-0.160	-0.193	-0.166	-0.147	-0.116	-0.151	-0.121
	(0.270)	(0.274)	(0.270)	(0.274)	(0.275)	(0.279)	(0.275)	(0.279)
Inflation		0.006		0.012		0.007		0.013
		(0.039)		(0.038)		(0.039)		(0.038)
Share of urban population			0.023	0.024			0.025	0.026
			(0.026)	(0.026)			(0.027)	(0.027)
Constant[12]	-65.318***	-64.272***	-59.644***	-58.207***	-65.703***	-64.692***	-59.650***	-58.229***
	(7.147)	(6.800)	(8.528)	(8.516)	(7.192)	(6.851)	(8.650)	(8.661)
Observations	1,335	1,296	1,335	1,296	1,323	1,284	1,323	1,284
Countries	101	101	101	101	101	101	101	101
R-Squared	0.30	0.29	0.30	0.29	0.30	0.29	0.30	0.29

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

In Table 2, we test the robustness of the results by adding more control variables, especially on the institutional environment. In addition to the rule of law index,[13] a broad indicator of the quality of institutions, the specification includes other indicators measuring different dimensions of the institutional environment, namely: government effectiveness, regulation quality, voice and accountability and corruption (see Annex 1 for the definitions). We also add total public expenditure to capture the role of fiscal policy.

While our earlier finding that fuel price increases positively correlate with unrests holds, most institutional controls are not statistically significant, which might be due to the fixed effect model, as institutions are slow-moving variables. Institutions can also operate through other variables such as the GDP per capita. An exception is the quality of regulation, for which we find a negative and statistically significant effect on

[11] To gauge the relative size of the marginal impact of the covariates, we standardized all the variables in the model and reran the regressions. Comparing the marginal impact of a change in fuel prices and that of GDP growth rate suggest that the latter is a more powerful tool to contain unrests than highly subsidized fuel prices. For instance, the coefficient on the changes in fuel prices is around 0.03 while that of GDP growth is around -0.16.

[12] The size of the constant term is driven by the log transformation of the dependent variable expressed as log(1+number of unrests).

[13] The index captures the perceptions of the extent to which agents have confidence in and abide by the rules of society (the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime).

social unrests (Table 2, columns 2 and 6). It transpires that the quality of regulation—"the perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development"—could be linked to the ability of the government to safeguard macroeconomic stability and promote job creation, which could help mitigate the risk of social unrests.

Table 2. Changes in Diesel Prices and Social Unrests: Additional Controls

Dependent variable: number of social unrest events (log)	(1)	(2)	(3)	(4)	(5)	(6)
Changes in diesel price	0.161**	0.139**	0.147**	0.152**	0.129**	0.123*
	(0.067)	(0.069)	(0.066)	(0.067)	(0.062)	(0.065)
GDP per capita PPP (log)	1.151**	1.250**	1.023**	1.032**	1.513**	1.708***
	(0.499)	(0.501)	(0.493)	(0.485)	(0.596)	(0.610)
GDP growth rate	-0.044***	-0.044***	-0.042***	-0.043***	-0.043***	-0.043***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)
Population (log)	3.006***	2.840***	3.076***	3.046***	3.102***	2.914***
	(0.580)	(0.566)	(0.584)	(0.598)	(0.599)	(0.563)
Rule of law WGI	-0.038	0.049	-0.052	-0.157	-0.174	0.118
	(0.271)	(0.257)	(0.293)	(0.315)	(0.273)	(0.286)
Inflation	0.004	0.004	0.011	0.012	0.010	-0.001
	(0.038)	(0.038)	(0.037)	(0.038)	(0.036)	(0.037)
Share of urban population	0.020	0.018	0.025	0.024	0.026	0.020
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.027)
Gov. effectiveness WGI	-0.282					-0.164
	(0.222)					(0.227)
Regulation quality WGI		-0.558*				-0.596**
		(0.292)				(0.286)
Voice and accountability WGI			-0.217			-0.158
			(0.240)			(0.248)
Corruption WGI				-0.021		0.198
				(0.255)		(0.264)
Government total expenditure per capita					-0.387*	-0.336
					(0.222)	(0.231)
Constant	-58.378***	-56.522***	-58.622***	-58.172***	-60.889***	-59.649***
	(8.496)	(8.125)	(8.472)	(8.613)	(8.816)	(8.426)
Observations	1,296	1,296	1,296	1,296	1,294	1,294
Countries	101	101	101	101	101	101
R-Squared	0.30	0.30	0.30	0.29	0.30	0.31

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

In column (5) and (6), we look at the role of fiscal policy through the size of public spending. Indeed, Ponticelli and Voth (2020) shows that expenditure cuts are particularly potent in fueling social unrest. Additionally, developing countries are also likely to use public expenditure to reduce risks of social unrests. Our findings suggest that high public expenditure tends to have a negative and statistically significant effect

on social unrest, although the coefficient is only significant in column 5 (see further discussion in section V).[14]

Further, we also use an alternative measure of social unrest developed by Barrett et al. (2022)—the Reported Social Unrest Index (RSUI)— to test the robustness of our findings. This indicator is based on counts of relevant media reports for 130 countries. Two measures of the RSUI Index are proposed: the headline and the alternative measure. The headline index uses the fraction of all articles which are about unrest in a given country. The alternative measure is obtained by rebasing the headline measure to have a mean of 100 within each country, thus removing country-specific fixed effects. We replace our dependent variable by both measures and the results obtained are presented in Appendix table 2. Our results remain broadly robust; changes in diesel and gasoline prices continue to be positively correlated to social unrest in most specifications.

IV. Addressing Potential Endogeneity Issues and Differentiating by the Nature of Social Unrest: An Instrumental Variable Approach

A. Endogeneity of Fuel Price Changes

A major challenge to the identification of the impact of fuel price increase on social unrest relate to the potential two-way causality of this relationship which was not addressed in previous papers. Indeed, politicians are likely to internalize the risk of social unrest in setting domestic fuel prices, and therefore would not be willing to increase fuel prices if the perceived risk of social unrest is high. It is common that policy makers put forward the risk of social instability as a key bottleneck for fuel subsidy reforms. In this setting, OLS estimates might be downward biased because the process behind the formation of domestic fuel prices factors in the risk of unrest, but it is not observable. In addition, if there are confounding factors driving both fuel price changes and social unrests, and those factors are not controlled for in our regressions, the OLS estimates will suffer from omitted variable bias.

To tackle the endogeneity issue, our paper draws on Buera et al. (2011) and Ponticelli and Voth (2020) to instrument policy actions in a given country by that of other countries. Buera et al. (2011) propose a framework where countries' policy decisions may affect policymakers' choices in another country through their impact on policymakers' beliefs. A strong catalyzer of a such diffusion of policy reforms is geographical proximity (see for instance Brueckner, 2003; Pitlik, 2007). The political and social science literature has also highlighted four channels through which policy diffusion across countries may take place (see Dobbin et al., 2007; Shipan and Volden, 2008): coercion, competition, learning, and social construction. Coercion refers to a case where a policy is imposed by another powerful state while the competition channel relates to a situation where policies are changed in order to compete against other countries (for instance a trade partner). The learning channel implies that countries may learn from their peers (and this may lead to imitation as countries make policy choices through being influenced by other

[14] The results using gasoline prices are similar. They are presented in Appendix table 1 to save space. This will also apply to the rest of the paper.

prominent allies or partners). Finally, the social construction mechanism refers to a shared belief among policy makers resulting, for example, from a global political culture.

We do not aim to disentangle the different channels of diffusion of policy reforms related to fuel pricing, but instead to extract exogenous fuel price changes that would enable to properly identify the impact on social unrest.[15] The instrument for fuel price changes is calculated as the weighted average of fuel price changes in all other countries in the sample, with the weight inversely proportional to the distance between the two countries, thus giving a larger weight to neighboring countries (a similar approach is used by Ebeke and Lonkeng Ngouana (2015) for energy subsidies).[16] It is reasonable to argue that this instrument fulfills the exclusion restriction as it is unlikely that changes in fuel prices in a country trigger social unrest in another country, through mechanisms other than the country's fuel prices.

Table 3 shows the IV results for diesel, which confirm the premise that increases in fuel prices are positively associated with the occurrence of social unrests (the results are similar for gasoline, see Appendix tables 4 and 5).[17] As anticipated, the OLS results are biased downward, with the IV coefficients being almost three times larger than the OLS coefficients. This underlines the critical importance of isolating the exogenous component of fuel price changes to mitigate the underestimation of the true impact on social unrests, thus allowing policy responses to be calibrated appropriately. We will therefore keep the IV approach for the remainder of the paper.

The IV estimation was subject to a battery of robustness tests. As social unrest may be persistent over time, and a fuel price increase may ignite social unrest with a delay, we tested a dynamic specification whereby equation (1) is augmented with the lag of social unrest and the lag of fuel price change (or the cumulate change over two years). The results (Appendix table 6) show that the positive correlation between social unrests and fuel price changes is mainly driven by contemporaneous changes in fuel prices. As expected, countries are more likely to experience social unrests if they had them in the past, but the coefficient on the lag of social unrest is below 1, suggesting that the persistence of social unrest dies out over time. We also test a non-linear specification by including in the model (equation 1) an interaction variable between fuel price changes and a dummy taking the value 1 for large fuel price changes (above the sample median). The result (not shown in the paper) remains inconclusive, suggesting that the marginal impact does not necessarily depend on the size of the fuel price change. Our main findings also remain unaltered after excluding potential outliers with very large fuel price increases (Yemen in 2015, Sudan in 2020, Iran in 2011 and Azerbaijan in 2006). Finally, controlling for the level of education does not change the main results either.

[15] In the context of our study, learning and social construction may play a role in linking fuel price changes in one country to that of other countries. For instance, with the global consensus to implement climate actions, progress in one or several countries in removing fuel subsidies (or increasing carbon taxation) may foster fuel price reforms in other countries as well. Similarly, domestic fuel price policies can be influenced by fuel prices in neighboring countries because a large fuel price differential may give rise to fuel smuggling.

[16] The distance data is provided by the CEPII. (http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele.asp)

[17] The first stage results presented in Appendix table 3 support the idea that there is a co-movement between the change in diesel prices of other countries and the change in diesel prices observed in a given country. Furthermore, with the F-stat being well above the Stock -Yogo rule of thumb 10, there is less concern with weak instruments.

Table 3. Changes in Diesel Price and Social Unrests, 2SLS

Dependent variable: number of social unrest events (log)	(1)	(2)	(3)	(4)
Changes in diesel price	0.354**	0.436**	0.375**	0.450**
	(0.180)	(0.197)	(0.181)	(0.198)
GDP per capita PPP (log)	1.175***	1.172***	1.069***	1.068***
	(0.192)	(0.194)	(0.200)	(0.203)
GDP growth rate	-0.045***	-0.047***	-0.044***	-0.047***
	(0.006)	(0.006)	(0.006)	(0.006)
Population (log)	3.558***	3.480***	3.152***	3.050***
	(0.289)	(0.301)	(0.372)	(0.387)
Rule of law WGI	-0.184	-0.151	-0.189	-0.156
	(0.152)	(0.157)	(0.152)	(0.157)
Inflation		-0.016		-0.010
		(0.036)		(0.036)
Share of urban population			0.026*	0.027*
			(0.015)	(0.015)
Constant	-66.379***	-65.191***	-60.120***	-58.603***
	(4.051)	(4.231)	(5.401)	(5.634)
Observations	1,335	1,296	1,335	1,296
Countries	101	101	101	101
R-Squared	0.30	0.29	0.30	0.29

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

B. Disaggregation of Social Unrest

Not all social unrests are equal: some are more violent than others; some are lawful, others are not. So far, we have used an aggregate measure of the occurrence of social unrests, but it is worth distinguishing among the different categories of social unrests. In this regard, we run the baseline regression for each of the seven types of unrest (riots, anti-government demonstrations, strikes, revolutions, assassinations, terrorism and government crisis) that are part of the aggregate measure. The results shown in Table 4 indicate that social unrests driven by diesel price changes mainly take the form of anti-government demonstrations, since this is the only type of social unrest with a statistically significant impact (column 7).[18]

[18] Similar result emerges for gasoline (Appendix table 7).

Table 4. Changes in Diesel Price and Different Categories of Social unrests, 2SLS

Dependent variable: number of social unrest events (log)	(1) Assassinations	(2) Strikes	(3) Terrorism	(4) Governme nt crises	(5) Riots	(6) Revolutions	(7) Demonstration s
Changes in diesel price	-0.043	0.042	0.128	-0.068	0.191	0.080	0.320*
	(0.054)	(0.097)	(0.149)	(0.047)	(0.135)	(0.049)	(0.172)
GDP per capita PPP (log)	-0.068	0.382***	0.413***	-0.021	0.614***	-0.256***	1.322***
	(0.055)	(0.100)	(0.153)	(0.048)	(0.138)	(0.050)	(0.176)
GDP growth rate	-0.001	-0.013***	-0.008*	-0.003**	-0.026***	-0.005***	-0.038***
	(0.002)	(0.003)	(0.005)	(0.001)	(0.004)	(0.002)	(0.005)
Population (log)	0.083	0.507***	2.334***	-0.094	2.146***	-0.585***	0.964***
	(0.106)	(0.190)	(0.292)	(0.091)	(0.264)	(0.096)	(0.336)
Rule of law WGI	-0.084**	-0.041	-0.308***	-0.031	0.036	-0.135***	0.150
	(0.043)	(0.077)	(0.118)	(0.037)	(0.107)	(0.039)	(0.136)
Inflation	-0.007	0.043**	-0.011	0.007	0.015	-0.008	0.002
	(0.010)	(0.018)	(0.027)	(0.009)	(0.025)	(0.009)	(0.032)
Share of urban population	-0.005	0.017**	-0.018	-0.001	0.000	0.013***	0.029**
	(0.004)	(0.007)	(0.011)	(0.004)	(0.010)	(0.004)	(0.013)
Constant	-0.480	-12.160***	-40.257***	1.818	-39.483***	11.069***	-27.533***
	(1.540)	(2.766)	(4.241)	(1.330)	(3.845)	(1.399)	(4.881)
Observations	1,289	1,289	1,289	1,289	1,289	1,289	1,289
Countries	100	100	100	100	100	100	100
R-Squared	0.005	0.12	0.13	0.009	0.24	0.11	0.22

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

V. Mitigating and Amplifying Factors of the Transmission of Fuel Price Increases to Social Unrests

Main results

Using equation (2) in Section III.A, we explore factors or conditions that can alter the fuel price-unrest nexus, with the view to inform policy making. It is commonly accepted that prevailing macroeconomic, social, and institutional conditions matter for fuel price reforms. In many countries where fuel price increases led to social unrest, this coincided with poor macroeconomic performance, and weak social indicators and institutions. This is consistent with the grievance and deprivation theory as described in Section II. Nonetheless, this view is not unanimously shared in the literature. Some scholars (e.g. Drazen and Vittorio, 1993; OECD, 2009) argue that economic downturns present an opportunity for reforms because they uncover structural weaknesses, and public opinion will be more understanding of the urgency of the reform and will be willing to bear the short-term cost in exchange for a better future. In this setting, the political cost and resistance to reform (hence the likelihood of protests) is attenuated.

We selected a non-exhaustive list of macroeconomic, social and institutional factors for which data are readily available for a large sample of countries. These include GDP per capita level and growth, exchange

rate instability, government total spending per capita with the breakdown between public health and education expenditure, income inequality measured by the Gini coefficient, an overall index of socioeconomic conditions, and the quality of institutions measured by democratic accountability, bureaucracy quality, government effectiveness, prevalence of corruption, regulatory quality and voice and accountability. The regressions will also provide the opportunity to test the relevance of the three different theories of protests (resources, political opportunities, grievances and deprivation) in explaining fuel protests.

The dependent variable is anti-government demonstrations, given that it is the predominant category of social unrests associated with fuel price changes (as evidenced in Section IV.B). All regressions are run with the 2SLS approach. Table 5 shows the results for government expenditure, the Gini coefficient, and overall socio-economic conditions. The results illustrate that while fuel price increases tend to be positively associated with the occurrence of social unrest, the marginal impact is lower in countries where government spending per capita is higher (as evidenced by the negative and significant interaction term between diesel prices and government expenditure per capita). In other words, the ability of the government to provide public goods helps contain social unrest due to fuel price increases.

Some categories of government expenditures are more pro-poor than others. Therefore, we isolate public expenditure per capita on education and health from other types of public spending. The results indicate that the mitigating effect is only observable for countries where the government spends most on critical social sectors such as education and health. This provides strong support to the premise that streamlining fuel subsides and diverting parts of the reform savings to the health and education sectors could appease social tensions as these types of spending disproportionately benefits the most vulnerable part of the population.[19] When using the Gini coefficient and the index of socioeconomic conditions, we find that unequal societies and countries with deteriorating socioeconomic conditions are more prone to social unrests following a fuel price increase. The results are also consistent when using gasoline prices (see Appendix table 8).

Turning to the institutional factors, the results in Table 6 show that democratic accountability, which measures how responsive the government is to its people, mitigates the effect of fuel price increases on social unrest. Similarly, countries with high bureaucratic quality scores are less likely to experience social unrests following fuel price increases, presumably because the bureaucracy tends to be less subject to political pressures, thereby helping depoliticize fuel pricing. Further, favorable perceptions of the quality of public services as captured by a high score of the government effectiveness index dampens potential social tensions associated with fuel price increases, in the same vein as the ability of a country's citizens to select their government (as measured by the voice and accountability index).[20] Similar results are obtained using gasoline price (Appendix table 9).[21]

[19] There is a caveat, though. While it is often necessary to protect the poor from the adverse effect of higher fuel prices, there are cases where it is the middle class that protests (or powerful stakeholders such as the transport sector). Therefore, the mitigating measures of a fuel subsidy reform could go beyond basic social services to include targeted support to specific groups that stand to lose significantly from the reform.

[20] The voice and accountability index also captures the perception of freedom of expression, freedom of association, and a free media, which can increase the propensity of people to protest. But in this context, power of citizens to influence the selection of their government appears to be the dominant factor.

[21] We also consider the fuel price setting mechanism as one could argue that social unrests may be less likely in countries with liberalized prices (or with an automatic pricing mechanism) given that the society would be used to volatile fuel prices. Using the number of monthly changes in fuel prices over a year as a measure of price flexibility, the results, however, do not provide evidence supporting this hypothesis.

Table 5. Testing for the Role of Macroeconomic and Social Factors, 2SLS

Dependent variable: number of demonstration events (log)	(1)	(2)	(3)	(4)	(5)	(6)
Interaction variables	gov. total expend.	education expend	health expend.	non-health and non-education expend	Income inequality	Socioeconomic Conditions
Changes in diesel price	1.922**	1.675**	1.155***	1.787*	-1.708	0.147
	(0.853)	(0.724)	(0.419)	(0.918)	(1.218)	(0.184)
Changes in diesel price x log gov. total expend. per capita	-0.260**					
	(0.131)					
Government total expenditure per capita (log)	-0.298**					
	(0.139)					
Changes in diesel price x log gov. education expend		-0.289*				
		(0.155)				
Government education expenditure (log)		0.145				
		(0.125)				
Changes in diesel price x log health expenditure			-0.230**			
			(0.102)			
government health expenditure (log)			-0.183**			
			(0.073)			
Changes in diesel price x non-health and non-education gov. expend				-0.243		
				(0.153)		
non-health and non-education gov. expend				-0.148		
				(0.122)		
Changes in diesel price x GINI WDI					0.058**	
					(0.029)	
Inequality (Gini WDI)					0.000	
					(0.015)	
Changes in diesel price x Socioeconomic conditions						-0.258**
						(0.129)
Socioeconomic Conditions						0.260***
						(0.045)
GDP per capita PPP (log)	1.721***	1.410***	1.880***	1.710***	2.344***	1.261***
	(0.246)	(0.235)	(0.234)	(0.264)	(0.414)	(0.228)
GDP growth rate	-0.035***	-0.030***	-0.029***	-0.026***	-0.059***	-0.035***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.013)	(0.008)
Population (log)	1.117***	1.280***	1.421***	1.602***	-0.427	1.494***
	(0.340)	(0.419)	(0.374)	(0.437)	(0.730)	(0.414)

Rule of law WGI	0.136	-0.038	0.082	-0.078	0.027	-0.102
	(0.136)	(0.156)	(0.141)	(0.161)	(0.262)	(0.177)
Inflation	0.003	-0.014	0.012	0.008	-0.141**	0.017
	(0.031)	(0.036)	(0.032)	(0.037)	(0.062)	(0.045)
Share of urban population	0.028**	0.014	0.018	0.014	0.031	0.011
	(0.013)	(0.017)	(0.015)	(0.018)	(0.024)	(0.017)
Constant	-31.535***	-33.402***	-38.569***	-39.791***	-14.580	-36.805***
	(5.024)	(6.281)	(5.609)	(6.525)	(10.661)	(6.121)
Observations	1,287	988	1,174	938	475	920
Countries	100	94	98	94	86	67
R-Squared	0.52	0.52	0.51	0.51	0.28	0.48

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Table 6. Heterogeneity with Institutional Variables, 2SLS

Dependent variable: number of demonstration events (log)	(1)	(2)	(3)	(4)
Interaction variables	Democratic accountability	Bureaucracy quality	Gov. effectiveness	Voice and accountability
Changes in diesel price	2.208***	1.890***	0.139	0.147
	(0.683)	(0.506)	(0.188)	(0.184)
Changes in diesel price x democratic accountability	-0.456***			
	(0.152)			
Democratic accountability ICRG	0.035			
	(0.054)			
Changes in diesel price x bureaucracy quality		-0.875***		
		(0.249)		
Bureaucracy quality ICRG		0.236		
		(0.216)		
Changes in diesel price x Gov. effectiveness WGI			-0.519*	
			(0.305)	
Gov. effectiveness WGI			-0.362**	
			(0.144)	
Changes in diesel price x Voice and accountability WGI				-0.451**
				(0.218)
Voice and accountability WGI				-0.056
				(0.132)
GDP per capita PPP (log)	1.529***	1.463***	1.489***	1.450***
	(0.220)	(0.221)	(0.189)	(0.183)
GDP growth rate	-0.049***	-0.046***	-0.037***	-0.037***
	(0.007)	(0.007)	(0.005)	(0.006)
Population (log)	1.168***	1.056**	0.914***	1.041***
	(0.415)	(0.432)	(0.339)	(0.352)
Rule of law WGI	0.155	0.172	0.324**	0.198
	(0.186)	(0.178)	(0.152)	(0.157)
Inflation	-0.030	-0.027	-0.012	0.008
	(0.045)	(0.045)	(0.033)	(0.033)
Share of urban population	0.023	0.029*	0.023*	0.023
	(0.016)	(0.016)	(0.013)	(0.014)
Constant	-33.060***	-31.187***	-27.944***	-29.529***
	(6.174)	(6.303)	(4.928)	(5.132)
Observations	957	946	1,289	1,252
Countries	69	68	100	98
R-Squared	0.46	0.44	0.51	0.53

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Overall, our results lend support to the grievance and deprivation theory in explaining the association between fuel price increases and social unrest. Even though poor people are likely to benefit relatively little from fuel subsidies, higher fuel prices may create a sense of injustice or unfairness in an environment where social safety nets are weak or non-existent. In other words, people may feel deceived because their

expectations—such as keeping fuel prices low—were not met, and protests are a response to such dissatisfaction. This is exacerbated by high income inequality and poor overall socioeconomic conditions. In contrast, higher public education and health spending can help alleviate social pressures by lessening the feeling of grievance and deprivation.

On the other hand, the finding regarding democracy and institutional quality does not lend credence to the theory of political opportunities whereby protests against fuel price increases would be more prevalent in democratic regimes. There is also a mixed support to the resource theory which predicts that the likelihood of protests should be lower in low-income countries as poor people are less educated and thus could have high opportunity costs. While GDP per capita enters positively in the regressions (Tables 5 and 6, all specifications), implying that protects are more common in richer countries, the coefficient for its interaction terms with fuel price changes is negative and statistically significant. As a result, the effect of fuel price increases on social unrest is stronger in low-income countries. The conclusion remains broadly unchanged when using the level of education captured by the secondary school enrollment rate (Appendix table 10).

Evidence of threshold effects

In testing the relevant macroeconomic, social, and institutional factors, we find that the interaction terms between fuel price changes and a few of the variables (namely GDP per capita growth rate, instability of exchange rate,[22] corruption control and quality of regulation) are not statistically significant at the conventional level. One could therefore conclude these factors do not matter. This may, however, be premature if we are not certain that the nonlinear specification imposed by the interaction terms fit the data. As a result, we investigate the presence of threshold effects using a moving Chow test (Chow, 1960). The advantage of this procedure is that the threshold is endogenously determined, as opposed to a pre-determined threshold such as the sample average or median.

For each of the conditioning factors, we start by leaving out 10 percent of the observations at each tail-end of the distribution. Then, between the 10^{th} and 90^{th} percentile the distribution, the threshold dummy (equal to 1 if the value of the variable is above the threshold and 0 otherwise) is moved by an increment of 1 percentile point to see where the interaction term between the threshold dummy and fuel price change becomes statistically significant. Obviously, this approach can give rise to multiple thresholds, but by using simple criteria, it is straightforward to isolate the most reliable threshold. For instance, we exclude thresholds found to be close to both tails of the distribution because they are likely to be imprecisely estimated due to the imbalance between the two subsamples below and above the threshold, and the influence of potential outliers. Thresholds, for which the coefficient on the interaction term becomes suddenly significant and then loses significance at the next percentile, are also not reliable, as they can be driven by data issues. We, therefore, focus on the thresholds that exhibit sustained and statistically significant breaks in the slope coefficient.

The results are summarized in Table 7. For instance, for GDP per capita growth, the identified threshold is about zero, suggesting that the mitigating effect of economic performance materializes only if GDP per capita growth rate is in the positive territory. With regards to exchange rate instability, the threshold is located at the 72th percentile. An exchange rate instability exceeding this threshold magnifies the impact of

[22] To compute the instability of exchange rate, for each country we first regress the monthly exchange rate on its first eleven (11) lags, and the month and year dummies. Then, the yearly standard deviation of the error terms is used as the indicator of the instability of exchange rate

fuel price increases on the frequency of social unrests. The results also suggest that countries with rampant corruption (lowest scores) are more likely to experience social unrest with fuel price increases, with the threshold for the corruption index being the 20th percentile of the sample distribution. The strength of the regulatory environment also exhibits a threshold effect close to the sample median, with a higher regulatory environment being associated with less occurrence of social unrests induced by fuel price increases. As for the previous findings, the conclusions remain unchanged using gasoline price instead of diesel price (Appendix table 11).

Table 7. Heterogeneity with Threshold Effects, 2SLS

Dependent variable: number of demonstration events (log)	(1)	(2)	(3)	(4)
Interaction dummy variable	GDP per capita growth	Instab. exchange rate	Corruption WGI	Regulation quality
Changes in diesel price	0.899**	0.117	1.523***	0.802***
	(0.380)	(0.204)	(0.566)	(0.280)
Changes in diesel price x GDP per capita growth dummy	-0.709*			
	(0.396)			
Changes in diesel price x Instab. exchange rate dummy		0.634**		
		(0.317)		
Instab. exchange rate dummy.		0.111		
		(0.090)		
Changes in diesel price x Corruption WGI dummy			-1.313**	
			(0.553)	
Corruption WGI dummy			-0.221**	
			(0.102)	
Changes in diesel price x Regulation quality dummy				-0.746**
				(0.307)
Regulation quality dummy				-0.187**
				(0.088)
GDP per capita PPP (log)	1.320***	1.262***	1.501***	1.415***
	(0.177)	(0.179)	(0.189)	(0.182)
GDP growth rate	-0.040***	-0.036***	-0.040***	-0.038***
	(0.006)	(0.006)	(0.006)	(0.006)
Population (log)	0.904***	1.151***	0.715**	0.743**
	(0.340)	(0.349)	(0.353)	(0.349)
Rule of law WGI	0.135	0.163	0.207	0.270*
	(0.137)	(0.138)	(0.142)	(0.145)
Inflation	-0.008	0.007	-0.021	-0.000
	(0.033)	(0.034)	(0.034)	(0.032)
Share of urban population	0.030**	0.029**	0.029**	0.031**
	(0.013)	(0.013)	(0.014)	(0.013)
Constant	-26.523***	-30.063***	-24.806***	-24.647***
	(4.953)	(5.061)	(5.087)	(5.055)
Observations	1,289	1,282	1,289	1,289
Countries	100	99	100	100
R-Squared	0.509	0.521	0.461	0.472
Interaction variable threshold	0.00	8.00	-1.00	-0.50

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

VI. Conclusion

Social protests arising from fuel price increases can have socioeconomic costs. In countries with government-regulated fuel prices, raising fuel prices is a complex policy decision that requires careful consideration of the trade-offs between fiscal sustainability, social welfare, and political stability. Policymakers must therefore balance these competing priorities, hence the relevance of understanding underlying conditions that minimize the risks of social unrests. This paper addresses a gap in the literature by studying the impact of fuel price increases on social unrests in a sample of 101 developing countries over the 2001-2020 period, while teasing out the macroeconomic, social and institutional factors that exacerbate or inhibit the risks of social unrests associated with fuel price increases.

Our results using the IV fixed-effect estimator indicate that fuel price increases spur social unrests, with anti-government demonstrations being the main form of unrest associated with fuel price increases. This finding holds even after addressing the potential double causality between fuel prices and unrests, using an instrumental variable approach whereby changes in fuel prices are instrumented by the weighted average of that of other countries (the weights being inversely proportional to the distance between the two countries). More importantly, the paper shows that this finding hides significant heterogeneities across countries. Specifically, we find that fuel price increases are more likely to lead to social unrests (i) during economic downturns and period of high exchange rate instability, (ii) when government spending is low, especially on health and education (iii) in countries with high income inequality, low institutional quality and high level of corruption. We find consistent results using either changes in diesel or gasoline prices.

Overall, the results lend support to the grievance and deprivation theory in explaining the association between fuel price increases and social unrests, considering that fuel price increases may be perceived by the most vulnerable households as unfair when they benefit little from public spending. In contrast, we do not find evidence for the resource theory and the theory of political opportunities. The former theory predicts that the likelihood of fuel protests should be lower in low-income countries, reflecting the high opportunity cost for the poor to participate in demonstrations, but our results show the opposite. The latter theory advocates that fuel protests would be more prevalent in democratic regimes, but our results show that more democratic and institutionally developed countries tend to experience less social unrests amid fuel price increases.

What policy implications can be drawn for countries seeking to increase domestic fuel prices? Since the findings in this paper put forward the grievances and deprivation theory as the dominant theory shedding light on fuel protests, this underscores the critical importance of social protection. Countries are more likely to generate acceptance for the need to hike fuel prices when they protect or compensate the most vulnerable part of the population by increasing social spending, particularly on health and education. Policymakers should internalize the political economy implications by designing such reforms in a way to ease the social impact on the poor and address inequality issues. Second, timing matters. Policymakers should implement fuel price reforms during economic upturns – when growth is strong, and the exchange rate is stable. Implementing fuel price reforms during downturns could amplify a sense of grievance and thus trigger opposition in form of protests. Nonetheless, waiting for the ideal time to implement a fuel

subsidy reform entails a fiscal cost that a country may not be able to afford. Third, policymakers should also focus on tackling corruption and implementing reforms to strengthen the institutional environment.

It is important to bear in mind that our study does not argue that some macroeconomic, social and institutional factors are more important than others as country-specific circumstances should guide policymakers on which areas they should focus their reform efforts. In addition, while the paper shows that public health and education spending matters, the efficiency of those spending is also crucial to ensure that they translate in an improvement of education and health indicators. Finally, other factors that our study was not able to test empirically, can also contribute to the success of fuel subsidy reforms, for instance: a better communication with the public for why changes are needed, and creating coalitions that involve civil society to ensure the buy-in of a broad swath of society. This could be a promising avenue for future research.

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Annex 1. Variable Definitions and Sources

Variable	Description	Sources
Social unrest events	Sum of assassinations, general strikes, terrorisms, government crises, riots, revolutions, anti-government demonstrations	Banks and Wilson (2022)
Assassinations	Any politically motivated murder or attempted murder of a high government official or politician.	
General strikes	Any strike of 1,000 or more industrial or service workers that involves more than one employer and that is aimed at national government policies or authority.	
Terrorism	Any armed activity, sabotage, or bombings carried on by independent bands of citizens or irregular forces and aimed at the overthrow of the present regime.	
Government crises	Any rapidly developing situation that threatens to bring the downfall of the present regime - excluding situations of revolt aimed at such overthrow.	
Riots	Any violent demonstration or clash of more than 100 citizens involving the use of physical force	
Revolutions	Any illegal or forced change in the top government elite, any attempt at such a change, or any successful or unsuccessful armed rebellion whose aim is independence from the central government.	
Anti-government demonstrations	Any peaceful public gathering of at least 100 people for the primary purpose of displaying or voicing their opposition to government policies or authority, excluding demonstrations of a distinctly anti-foreign nature.	
Changes in diesel price	Yearly growth rate of the annual average pump price for diesel	Kpodar and Abdallah (2017), Kpodar and Liu (2022)
Changes in gasoline price	Yearly growth rate of the annual average pump price for gasoline	
Real GDP per capita (Log)	GDP per capita (constant 2010 USD)	World Development Indicators (WDI))
Real GDP growth	GDP (constant 2010 USD) growth (Annual %)	
Inflation (Log)	Inflation rate based on Consumer Price Index (Annual %)	
Urban population	Urban population (% of total population)	
Population (log)	Log of population size	
Democratic accountability	This is a measure of how responsive government is to its people, on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic but possibly violently in a non-democratic one.	The International Country Risk Guide (ICRG)
Socioeconomic conditions	This is an assessment of the socioeconomic pressures at work in society that could constrain government action or fuel social dissatisfaction. A score of 4 points equates to Very Low Risk and a score of 0 points to Very High Risk.	
Bureaucracy quality	High points are given to countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services	

Annex 1 (continuous)

Government effectiveness	Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	Worldwide Governance Indicators (WGI, World Bank)
Rule of Law	Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	
Voice and accountability	Voice and accountability capture perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	
Corruption control	Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	
Regulation quality	Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	
General government expenditure	General government total expenditure	World Economic Outlook (WEO)
Government consumption expenditure	General government final consumption expenditure per capita.	World Development Indicators (WDI)
Public education expenditure	Government expenditure on education per capita	
Public health expenditure	Domestic general government health expenditure per capita	
Income inequality	Gini index	
Exchange rate instability	Standard deviation of the standard errors from the regression of the monthly exchange rate on its first eleven (11) lags, and the month and year dummies.	International Financial Statistics (IFS)

Annex 2. Summary Statistics

Variable	Observations	Mean	SD	Min	Max
Social unrests (log)	1,335	1.1	1.21	0	7.22
Assassinations (log)	1,328	0.05	0.24	0	3.3
Strikes (log)	1,328	0.16	0.45	0	3.3
Terrorism (log)	1,328	0.32	0.88	0	7.22
Government crises (log)	1,328	0.06	0.2	0	1.39
Riots (log)	1,328	0.47	0.73	0	3.95
Revolutions (log)	1,328	0.07	0.22	0	1.39
Demonstrations (log)	1,328	0.63	0.9	0	5.01
Changes in diesel price	1,335	0.04	0.25	-0.66	4.54
Changes in gasoline price	1,322	0.02	0.19	-0.66	3.48
GDP per capita PPP (log)	1,335	8.6	0.87	6.59	10.39
GDP growth rate	1,335	3.69	4.41	-36.39	34.5
Log population	1,335	16.14	1.76	11.38	21.07
Rule of law WGI	1,335	-0.51	0.55	-1.82	1.08
Inflation	1,296	1.68	0.92	-4.11	6.32
Share of urban population	1,335	46.96	19.7	8.68	91.42
Corruption WGI	1,335	-0.52	0.55	-1.56	1.23
Gov. effectiveness WGI	1,335	-0.49	0.55	-2.08	1.06
Regulation quality WGI	1,335	-0.4	0.55	-1.93	1.21
Rule of law WGI	1,335	-0.51	0.55	-1.82	1.08
Voice and accountability WGI	1,335	-0.35	0.7	-1.85	1.15
Government total expenditure per capita (log)	1,333	6.25	1.15	3.62	9.02
Government education expenditure (log)	1,054	4.38	1.13	1.78	6.77
Gross secondary school enrolment	855	0.65	0.27	0.10	1.41
Log government health expenditure	1,246	3.61	1.51	0.25	6.67

Annex 3. Sample Composition

Afghanistan		Djibouti		Kenya		Peru
Algeria		Dominican Republic		Kiribati		Philippines
Angola		Ecuador		Kyrgyz Republic		Rwanda
Armenia		Egypt, Arab Rep.		Lao PDR		Samoa
Azerbaijan		El Salvador		Lebanon		Sao Tome and Principe
Bangladesh		Eswatini		Lesotho		Senegal
Belarus		Ethiopia		Liberia		Serbia
Benin		Fiji		Madagascar		Seychelles
Bolivia		Gabon		Malawi		Sierra Leone
Bosnia and Herzegovina		Gambia, The		Mali		Solomon Islands
Botswana		Georgia		Mauritania		Sri Lanka
Brazil		Ghana		Mauritius		St. Lucia
Bulgaria		Grenada		Mexico		Sudan
Burkina Faso		Guatemala		Moldova		Tajikistan
Burundi		Guinea		Mongolia		Tanzania
Cabo Verde		Guinea-Bissau		Morocco		Togo
Cambodia		Haiti		Mozambique		Tonga
Cameroon		Honduras		Namibia		Uganda
Central African Republic		Hungary		Nepal		Ukraine
Chad		India		Nicaragua		Vanuatu
China		Indonesia		Niger		Vietnam
Colombia		Iran, Islamic Rep.		Nigeria		Zambia
Comoros		Iraq		North Macedonia		Zimbabwe
Congo, Rep.		Jamaica		Panama		
Costa Rica		Jordan		Papua New Guinea		
Cote d'Ivoire		Kazakhstan		Paraguay		

Appendix Table 1. Changes in Gasoline Price and Social Unrests: Additional Control Variables

Dependent variable: number of social unrest events (log)	(1)	(2)	(3)	(4)	(5)	(6)
Changes in gasoline price	0.193**	0.171*	0.177**	0.183**	0.159*	0.159*
	(0.087)	(0.088)	(0.087)	(0.087)	(0.086)	(0.088)
GDP per capita PPP (log)	1.153**	1.251**	1.026**	1.024**	1.545**	1.754***
	(0.507)	(0.506)	(0.501)	(0.492)	(0.600)	(0.611)
GDP growth rate	-0.042***	-0.042***	-0.041***	-0.042***	-0.042***	-0.042***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)
Population (log)	2.998***	2.832***	3.067***	3.052***	3.093***	2.905***
	(0.588)	(0.571)	(0.590)	(0.606)	(0.607)	(0.569)
Rule of law WGI	0.008	0.087	-0.024	-0.132	-0.134	0.134
	(0.276)	(0.260)	(0.297)	(0.319)	(0.278)	(0.290)
Inflation	0.004	0.005	0.012	0.014	0.009	-0.002
	(0.038)	(0.039)	(0.038)	(0.038)	(0.036)	(0.038)
Share of urban population	0.022	0.020	0.026	0.026	0.028	0.021
	(0.027)	(0.026)	(0.027)	(0.027)	(0.027)	(0.027)
Gov. effectiveness WGI	-0.283					-0.175
	(0.223)					(0.231)
Regulation quality WGI		-0.558*				-0.604**
		(0.297)				(0.293)
Voice and accountability WGI			-0.187			-0.137
			(0.239)			(0.248)
Corruption WGI				0.027		0.240
				(0.259)		(0.267)
Gov. expenditure per capita					-0.407*	-0.366
					(0.217)	(0.225)
Constant	-58.360***	-56.490***	-58.565***	-58.280***	-60.954***	-59.759***
	(8.627)	(8.247)	(8.606)	(8.761)	(8.940)	(8.515)
Observations	1,284	1,284	1,284	1,284	1,282	1,282
Countries	101	101	101	101	101	101
R-Squared	0.30	0.30	0.30	0.29	0.30	0.31

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 2. Changes in Gasoline Price and Social Unrests: Headline and Alternative Indicators of Social Unrests

Dependent variable: Social unrest indicator from RSUI	(1)	(2)	(3)	(4)
Indicator	Headline	Headline	Alternative	Alternative
Changes in diesel price	0.214**	0.277**		
	(0.104)		(0.111)	
Changes in gasoline price		0.182		0.294*
		(0.163)		(0.166)
GDP per capita PPP (log)	0.373	0.306	0.200	0.134
	(0.640)	(0.636)	(0.493)	(0.492)
GDP growth rate	-0.064***	-0.060***	-0.058***	-0.055***
	(0.017)	(0.017)	(0.014)	(0.014)
Population (log)	1.422	1.374	2.297**	2.302**
	(0.975)	(0.970)	(1.012)	(1.016)
Rule of law WGI	-1.107***	-1.045**	-0.329	-0.280
	(0.410)	(0.411)	(0.319)	(0.325)
Inflation	-0.131	-0.142*	-0.127	-0.130
	(0.080)	(0.082)	(0.090)	(0.087)
Share of urban population	0.071	0.080*	0.043	0.051
	(0.049)	(0.047)	(0.040)	(0.039)
Constant	-23.773*	-22.728*	-35.445**	-35.309**
	(13.612)	(13.529)	(14.138)	(14.227)
Observations	880	870	880	870
Countries	65	65	65	65
R-Squared	0.11	0.11	0.11	0.11

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 3. Changes in Diesel Price and Social unrests: First Stage Regressions

Changes in diesel price	(1)	(2)	(3)	(4)
Weighted average change in diesel prices in other countries	1.028***	0.979***	1.023***	0.977***
	(0.051)	(0.065)	(0.051)	(0.065)
GDP per capita PPP (log)	-0.065	-0.055	-0.042	-0.038
	(0.107)	(0.102)	(0.101)	(0.099)
GDP growth rate	0.004*	0.005**	0.004*	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)
Population (log)	0.111	0.140	0.198	0.209
	(0.158)	(0.177)	(0.192)	(0.202)
Rule of law WGI	-0.014	-0.020	-0.012	-0.019
	(0.053)	(0.055)	(0.054)	(0.055)
Inflation		0.033*		0.032*
		(0.019)		(0.019)
Share of urban population			-0.006	-0.004
			(0.003)	(0.003)
Observations	1,333	1,294	1,333	1,294
Countries	99	99	99	99
F-Statistic	404	226	403	224

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 4. Changes in Gasoline Price and Social Unrests: First Stage Regressions

Changes in gasoline price	(1)	(2)	(3)	(4)
Weighted average change in gasoline prices in other countries	0.804***	0.759***	0.802***	0.759***
	(0.072)	(0.080)	(0.071)	(0.080)
GDP per capita PPP (log)	-0.112	-0.102	-0.078	-0.076
	(0.084)	(0.079)	(0.077)	(0.076)
GDP growth rate	0.004***	0.005***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Population (log)	-0.021	0.005	0.099	0.106
	(0.125)	(0.143)	(0.152)	(0.163)
Rule of law WGI	-0.042	-0.052	-0.040	-0.050
	(0.045)	(0.047)	(0.045)	(0.047)
Inflation		0.028*		0.027*
		(0.015)		(0.015)
Share of urban population			-0.008***	-0.006**
			(0.003)	(0.003)
Observations	1,321	1,282	1,321	1,282
Countries	99	99	99	99
F-Statistic	125.45	89.72	126.25	91.01

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 5. Changes in Gasoline price and Social Unrests, 2SLS

Dependent variable: number of social unrest events (log)	(1)	(2)	(3)	(4)
Changes in gasoline price	0.410	0.516*	0.419	0.514*
	(0.262)	(0.288)	(0.263)	(0.287)
GDP per capita PPP (log)	1.187***	1.192***	1.069***	1.075***
	(0.196)	(0.198)	(0.204)	(0.206)
GDP growth rate	-0.043***	-0.045***	-0.042***	-0.045***
	(0.006)	(0.006)	(0.006)	(0.006)
Population (log)	3.582***	3.508***	3.156***	3.054***
	(0.292)	(0.304)	(0.372)	(0.388)
Rule of law WGI	-0.142	-0.105	-0.147	-0.111
	(0.154)	(0.159)	(0.154)	(0.158)
Inflation		-0.012		-0.004
		(0.037)		(0.037)
Share of urban population			0.027*	0.028*
			(0.015)	(0.015)
Constant	-66.875***	-65.824***	-60.255***	-58.824***
	(4.151)	(4.318)	(5.438)	(5.668)
Observations	1,323	1,284	1,323	1,284
Countries	101	101	101	101
R-Squared	0.30	0.29	0.30	0.29

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 6. Changes in Diesel price and Social Unrests: Dynamic specification, 2SLS

Dependent variable: number of social unrest events (log)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lag number of social unrest events (log)		0.422***		0.428***		0.416***		0.421***
		(0.028)		(0.028)		(0.028)		(0.028)
Changes in diesel price	0.450**	0.500***						
	(0.211)	(0.191)						
Lag changes in diesel price	0.034	-0.026						
	(0.176)	(0.160)						
Two-year changes in diesel price			0.400**	0.451***				
			(0.178)	(0.175)				
Changes in gasoline price					0.545*	0.630**		
					(0.300)	(0.273)		
Lag changes in gasoline price					0.084	-0.014		
					(0.259)	(0.235)		
Two-year changes in gasoline price							0.552*	0.689**
							(0.314)	(0.313)
GDP per capita PPP (log)	1.082***	0.797***	1.046***	0.769***	1.120***	0.844***	1.075***	0.848***
	(0.218)	(0.199)	(0.204)	(0.201)	(0.222)	(0.204)	(0.210)	(0.209)
GDP growth rate	-0.046***	-0.032***	-0.047***	-0.032***	-0.044***	-0.031***	-0.046***	-0.033***
	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)
Population (log)	3.056***	1.701***	3.196***	1.877***	3.055***	1.728***	3.213***	1.953***
	(0.428)	(0.398)	(0.397)	(0.407)	(0.431)	(0.402)	(0.409)	(0.421)
Rule of law WGI	-0.124	-0.013	-0.110	0.049	-0.076	0.015	-0.040	0.082
	(0.168)	(0.152)	(0.160)	(0.156)	(0.170)	(0.155)	(0.164)	(0.161)
Inflation	0.018	-0.012	-0.010	-0.013	0.022	-0.008	-0.009	-0.015
	(0.040)	(0.036)	(0.037)	(0.037)	(0.039)	(0.036)	(0.039)	(0.038)
Share of urban population	0.034**	0.024	0.030*	0.027*	0.036**	0.024	0.033**	0.029*
	(0.017)	(0.015)	(0.015)	(0.015)	(0.017)	(0.015)	(0.016)	(0.016)
Constant	-59.373***	-34.785***	-60.921***	-37.559***	-59.782***	-35.667***	-61.595***	-39.566***
	(6.202)	(5.858)	(5.831)	(6.033)	(6.287)	(5.946)	(6.171)	(6.414)
Observations	1,193	1,193	1,296	1,193	1,180	1,180	1,279	1,180
Countries	99	99	101	99	99	99	101	99
R-Squared	0.29	0.41	0.27	0.40	0.29	0.41	0.28	0.39

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 7. Changes in Gasoline price and Social Unrests by Categories, 2SLS

Dependent variable: number of social unrest events (log)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Types of events	Assassinations	Strikes	Terrorism	Government crises	Riots	Revolutions	Demonstrations
Changes in gasoline price	-0.066	-0.158	0.209	-0.120*	0.302	0.054	0.423*
	(0.080)	(0.143)	(0.218)	(0.068)	(0.198)	(0.071)	(0.251)
GDP per capita PPP (log)	-0.074	0.328***	0.430***	-0.034	0.635***	-0.283***	1.338***
	(0.057)	(0.102)	(0.156)	(0.049)	(0.141)	(0.051)	(0.179)
GDP growth rate	-0.001	-0.011***	-0.008	-0.003*	-0.026***	-0.005***	-0.037***
	(0.002)	(0.003)	(0.005)	(0.001)	(0.004)	(0.002)	(0.006)
Population (log)	0.081	0.496***	2.334***	-0.103	2.165***	-0.605***	0.970***
	(0.107)	(0.192)	(0.293)	(0.092)	(0.266)	(0.096)	(0.337)
Rule of law WGI	-0.089**	-0.032	-0.309***	-0.016	0.080	-0.143***	0.201
	(0.044)	(0.079)	(0.120)	(0.037)	(0.109)	(0.039)	(0.138)
Inflation	-0.006	0.056***	-0.010	0.008	0.012	-0.006	0.002
	(0.010)	(0.018)	(0.028)	(0.009)	(0.025)	(0.009)	(0.032)
Share of urban population	-0.005	0.018**	-0.019	-0.001	0.001	0.015***	0.031**
	(0.004)	(0.008)	(0.012)	(0.004)	(0.010)	(0.004)	(0.013)
Constant	-0.407	-11.597***	-40.409***	2.039	-40.013***	11.552***	-27.842***
	(1.562)	(2.810)	(4.288)	(1.339)	(3.886)	(1.396)	(4.926)
Observations	1,277	1,277	1,277	1,277	1,277	1,277	1,277
Countries	100	100	100	100	100	100	100
R-Squared	0.004	0.12	0.13	0.002	0.25	0.13	0.23

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 8. Changes in Gasoline Price and Demonstrations: Testing for the Role of Macroeconomic and Social Factors

Dependent variable: number of demonstration events (log)	(1)	(2)	(3)	(4)	(5)	(6)
Interaction variables	gov. total expend.	education expend	health expend.	non-health and non-education expend	Income inequality	Socioeconomic Conditions
Changes in gasoline price	2.425**	2.127**	1.408***	2.047*	-2.348	1.615*
	(1.126)	(0.909)	(0.529)	(1.167)	(1.710)	(0.931)
Changes in gasoline price x gov. total expend	-0.319*					
	(0.184)					
Gov. total expend. per capita	-0.208					
	(0.137)					
Changes in gasoline price x gov. education expend		-0.393*				
		(0.205)				
Log gov. education expenditure		0.047				
		(0.122)				
Changes in gasoline price x health expend.			-0.255*			
			(0.145)			
Log government health expenditure			-0.151**			
			(0.074)			
Changes in gasoline price x non-health and non-education gov. expend				-0.284		
				(0.202)		
Non-health and non-education gov. expend				-0.171		
				(0.124)		
Changes in gasoline price x GINI WDI					0.077*	
					(0.045)	
Inequality (Gini WDI)					-0.004	
					(0.016)	
Changes in gasoline price x Socioeconomic						-0.342*
						(0.198)
Socioeconomic Conditions						0.259***
						(0.045)
GDP per capita PPP (log)	1.300***	1.155***	1.477***	1.801***	2.365***	1.274***
	(0.249)	(0.234)	(0.238)	(0.267)	(0.430)	(0.231)
GDP growth rate	-0.033***	-0.026***	-0.027***	-0.024***	-0.058***	-0.036***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.015)	(0.007)
Population (log)	1.200***	1.431***	1.512***	1.615***	-0.305	1.539***

	(0.334)	(0.405)	(0.365)	(0.437)	(0.741)	(0.418)
Rule of law WGI	0.293**	0.126	0.264*	-0.040	0.083	-0.022
	(0.135)	(0.153)	(0.139)	(0.163)	(0.270)	(0.179)
Inflation	-0.004	-0.012	0.003	0.010	-0.129**	0.015
	(0.031)	(0.036)	(0.032)	(0.038)	(0.063)	(0.046)
Share of urban population	0.033**	0.015	0.023	0.012	0.030	0.012
	(0.013)	(0.017)	(0.015)	(0.018)	(0.024)	(0.017)
Constant	-29.923***	-33.170***	-36.747***	-40.546***	-16.535	-37.674***
	(4.921)	(6.063)	(5.460)	(6.544)	(10.956)	(6.220)
Observations	1,256	964	1,144	930	467	910
Countries	99	93	97	94	86	67
R-Squared	0.50	0.49	0.48	0.51	0.28	0.48

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 9. Changes in Gasoline Price and Social Unrests, Heterogeneity with Institutional Variables, 2SLS

Dependent variable: number of demonstration events (log)	(1)	(2)	(4)	(5)
Interaction variables	Democratic accountability	Bureaucracy quality	Gov. effectiveness	Voice and accountability
Changes in gasoline price	3.322***	2.295***	0.248	0.025
	(1.031)	(0.751)	(0.315)	(0.229)
Changes in gasoline price x democratic accountability	-0.731***			
	(0.232)			
Democratic accountability ICRG	0.053			
	(0.055)			
Changes in gasoline price x bureaucracy quality		-1.104***		
		(0.376)		
Bureaucracy quality ICRG		0.228		
		(0.217)		
Changes in gasoline price x Gov. effectiveness WGI			-0.857*	
			(0.484)	
Gov. effectiveness WGI			-0.264*	
			(0.147)	
Changes in gasoline price x Voice and accountability WGI				-0.529**
				(0.268)
Voice and accountability WGI				-0.351**
				(0.166)
GDP per capita PPP (log)	1.469***	1.417***	1.501***	0.948***
	(0.225)	(0.225)	(0.194)	(0.224)
GDP growth rate	-0.044***	-0.043***	-0.034***	-0.025***
	(0.007)	(0.007)	(0.006)	(0.007)
Population (log)	1.295***	1.119***	0.868**	1.353**
	(0.421)	(0.434)	(0.359)	(0.528)
Rule of law WGI	0.195	0.231	0.304*	0.081
	(0.190)	(0.180)	(0.162)	(0.179)
Inflation	-0.020	-0.019	-0.011	-0.011
	(0.047)	(0.046)	(0.032)	(0.038)
Share of urban population	0.024	0.031*	0.029**	-0.022
	(0.017)	(0.016)	(0.014)	(0.020)
Constant	-34.807***	-31.933***	-27.536***	-28.667***
	(6.292)	(6.349)	(5.218)	(7.619)
Observations	947	936	1,181	743
Countries	69	68	99	91
R-Squared	0.47	0.45	0.49	0.33

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 10. Testing for the Resource Theory, 2SLS

Dependent variable: number of demonstration events (log)	(1)	(2)	(3)	(4)
Interaction variables	Log GDP per capita PPP	Log GDP per capita PPP	Sec. school enrolment rate	Sec. school enrolment rate
Changes in diesel price rate	3.675***		1.155**	
	(1.409)		(0.472)	
Changes in gasoline price rate		4.193**		0.944
		(1.993)		(0.613)
Changes in diesel price x GDP PPP per capita (log)	-0.388**			
	(0.161)			
Changes in gasoline price x GDP PPP per capita (log)		-0.443*		
		(0.239)		
Changes in diesel price x Sec. School enrolment			-1.275**	
			(0.624)	
Changes in gasoline price x Sec. School enrolment				-0.898
				(0.960)
Second. School enrolment			-0.709	-0.772*
			(0.448)	(0.448)
GDP per capita PPP (log)	1.335***	1.338***	1.792***	1.858***
	(0.176)	(0.179)	(0.259)	(0.264)
GDP growth rate	-0.035***	-0.034***	-0.041***	-0.042***
	(0.006)	(0.006)	(0.008)	(0.008)
Log population	1.135***	1.138***	0.501	0.445
	(0.343)	(0.348)	(0.458)	(0.461)
Rule of law WGI	0.120	0.171	0.008	0.032
	(0.136)	(0.138)	(0.180)	(0.180)
Inflation	0.007	0.010	-0.004	-0.003
	(0.032)	(0.033)	(0.038)	(0.039)
Share of urban population	0.026**	0.028**	0.058***	0.058***
	(0.013)	(0.013)	(0.019)	(0.019)
Constant	-30.299***	-30.459***	-25.044***	-24.652***
	(5.010)	(5.084)	(6.901)	(6.951)
Observations	1289	1277	855	845
Countries	100	100	87	87
R-Squared	0.23	0.23	0.24	0.24

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

Appendix Table 11. Changes in Gasoline Price and Social Unrests, Heterogeneity with Thresholds Effects, 2SLS

Dependent variable: number of demonstration events (log)	(1)	(2)	(3)	(4)
Interaction dummy variable	GDP per capita growth	Instab. exchange rate	Corruption WGI	Regulation quality
Changes in gasoline price	0.964*	0.122	1.759**	0.919**
	(0.511)	(0.300)	(0.856)	(0.402)
Changes in gasoline price x GDP per capita growth dummy	-0.667			
	(0.554)			
Changes in gasoline price x Instab. exchange rate dummy		0.946**		
		(0.451)		
Instab. exchange rate dummy.		0.141		
		(0.092)		
Changes in gasoline price x Corruption WGI dummy			-1.464*	
			(0.838)	
Corruption WGI dummy			-0.196*	
			(0.105)	
Changes in gasoline price x Regulation quality dummy				-0.786*
				(0.442)
Regulation quality dummy				-0.205**
				(0.090)
GDP per capita PPP (log)	1.331***	1.286***	1.460***	1.430***
	(0.180)	(0.182)	(0.190)	(0.184)
GDP growth rate	-0.039***	-0.035***	-0.037***	-0.036***
	(0.006)	(0.006)	(0.006)	(0.006)
Population (log)	0.934***	1.178***	0.795**	0.751**
	(0.341)	(0.350)	(0.351)	(0.349)
Rule of law WGI	0.193	0.217	0.247*	0.316**
	(0.139)	(0.140)	(0.143)	(0.146)
Inflation	-0.005	0.008	-0.014	0.003
	(0.033)	(0.035)	(0.034)	(0.032)
Share of urban population	0.031**	0.031**	0.032**	0.032**
	(0.013)	(0.013)	(0.014)	(0.013)
Constant	-27.162***	-30.782***	-25.907***	-24.951***
	(4.989)	(5.111)	(5.098)	(5.069)
Observations	1,277	1,270	1,277	1,277
Countries	100	99	100	100
R-Squared	0.51	0.52	0.48	0.47
Interaction variable threshold	0.00	8.00	-1.00	-0.50

Notes: Fixed effect estimations. Clustered standard errors in brackets. *,**,*** denote significance at 10 percent, 5 percent and 1 percent, respectively.

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