# How Do Sectoral Interests Shape Distributive Politics? Evidence from Gasoline and Diesel Subsidy Reforms*

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**Abstract**

Sectoral interests play an important role in distributive politics, but their influence is difficult to measure. We compare the effect of international oil prices on subsidies for domestic gasoline and diesel consumption. Because diesel is used by a smaller number of organized agricultural and transportation interests, they are more capable of collective action than the dispersed beneficiaries of gasoline subsidies. The conventional wisdom holds that sectoral interests could mobilize to stop reform (e.g., price increases, deregulation). Challenging this view, we consider the possibility that sectoral interests promote reform by facilitating the targeted allocation of compensation and exemptions. An empirical analysis of gasoline and diesel prices, 1991-2012, strongly supports the second hypothesis: diesel prices respond to international oil prices more strongly than do gasoline prices. Quantitative tests and case studies allow us to explore causal mechanisms, verify that the gasoline-diesel difference is related to actual policy reforms, and reject alternative explanations.

**Keywords**: distributive politics; special interest politics; policy reform; subsidies; energy policy

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## 1 Introduction

Drawing on Olson's (1965) logic of collective action, the literature on distributive politics proposes that sectoral interests – people and firms within a given sector with joint interests – shape the demand for trade protection and subsidies (Grossman and Helpman, 1994; Dixit and Londregan, 1996; Gawande, Krishna, and Olarreaga, 2009; Golden and Min, 2013). Such interests can organize and engage in collective action to demand preferential treatment by the government. For example, studies have shown that agricultural interests exert a powerful influence on subsidies across the industrialized world (Davis, 2003; Daugbjerg and Swinbank, 2008), whereas in developing countries concentrated urban interests induce an "urban bias" in policy-making (Bates, 1981; Bezemer and Headey, 2008). However, comparing the influence of sectoral interests is difficult because sectors differ across a range of characteristics. For example, the economics of agricultural production are very different from the economics of manufacturing. Such differences make it very hard to contrast the political influence of agricultural and industrial producers.

We offer a new approach to testing the classic hypothesis of sectoral interests as a key driver of distributive policies. Specifically, we examine the political economy of energy subsidies and consider governmental incentives to subsidize the consumption of two different fuels, gasoline and diesel. While the benefits of gasoline subsidies are largely limited to private transportation, especially households that own automobiles, diesel subsidies benefit two economic sectors of importance: transportation and agriculture. Because diesel is a more efficient fuel for heavy engines, it has replaced gasoline as the fuel of choice for trucks, tractors, and other heavy engines in transportation and agriculture over the past half a century.

The implications of this sectoral difference for fuel subsidy reform – typically, price increases and/or liberalization to allow supply and demand to determine fuel prices – are not obvious. Examples of such reforms include Sri Lanka's deregulation of fuel prices in 2006, Iran's decision to increase fuel prices in 2010, and India's choice to deregulate diesel prices in 2014. In each case, increased fuel prices would reduce the government's subsidy burden, discourage wasteful consumption of energy, and reduce environmental pollution – but the price increases would hurt different interest groups. As governments consider reforms that bring clear fiscal and environmental benefits but impose costs on different interest groups and segments of the population (e.g., Victor, 2009), they consider the net political effect of the reform. From this perspective, the difference between gasoline and diesel could lead to two competing expectations, one conventional and the other original.

On the one hand, conventional arguments would lead us to expect that sectoral politics of fuel subsidies make governments more sensitive to diesel than to gasoline price increases. Diesel price increases would create more interest group pressure for countervailing subsidy measures; at the same time, increased diesel prices would increase food and transportation prices, threatening a public backlash against the government. Because these factors facilitate collective action, vested interests would be able to resist diesel subsidy reforms.

But there are reasons to be skeptical of the received wisdom. The concentrated nature of vested interests for diesel use could facilitate the implementation of measures such as targeted compensation and exemptions. If the diesel lobby's focus is on securing compensation and exemptions, then instead of stopping reform altogether it is even possible that diesel subsidy reforms are easier to enact and implement than gasoline subsidy reforms. In this case, the collective action capacity of vested interests would *promote* diesel subsidy reforms. Targeted compensation and exemptions to organized interests allow governments to implement economy-wide reforms with limited sectoral exemptions.

Fuel subsidies are an excellent area for testing theories of distributive politics because the stakes are high. Countries around the world spend lots of money in fuel subsidies. According to the 2014 *World Energy Outlook* of the International Energy Agency (IEA, 2014), global fuel subsidies reached USD 548 billion in 2013.[1] Most fuel subsidies are given by non-industrialized countries in the form of artificially low consumer prices, and they constitute a major threat to the financial stability in the developing world. Both energy exporters and importers give generous fuel subsidies. What is more, the subsidies increase the consumption of fossil fuels and, as such, increase the rate of climate change. At the same time, their merits as social policy are questionable at best, as the literature shows that inexpensive energy often mostly benefits the urban middle class (Coady et al., 2010, 2015). According to the estimates of del Granado, Coady, and Gillingham (2012: 2234), "the top income quintile captures six times more in subsidies than the bottom."

A quick look at the data suggests considerable variation in the propensities of governments to subsidize gasoline, as opposed to diesel. Based on data from the German Development Agency (GIZ) during the period 1991 to 2012, of the 172 countries in our sample, seven of them had gasoline prices that were on

[1] The numbers for the years 2014-2015 would be lower because of lower international oil prices.

average more than double the price of diesel. An additional thirty-six had gasoline-to-diesel price ratios that were higher than 1.5, and fully half had ratios above 1.25. These data indicate a general tendency toward diesel subsidies but are ultimately not conclusive, as the difference in pricing partly reflects differences in the cost of producing the two fuels. Moreover, they call for explaining the variation in pricing that we see.

With data for the years 1991-2012, we use a country-year-fuel unit of analysis to distinguish between the effects of international oil price changes on gasoline and diesel diesel prices. Drawing on the standard "price-gap approach," which assumes that subsidies or taxes on a globally marketed fuel are reflected in the gap between the actual price and a benchmark that considers the total cost of the fuel (Koplow, 2009; Coady et al., 2010), we test our hypotheses by assessing how much domestic gasoline and diesel prices fluctuate with international oil prices, as they should under deregulation or cost-recovering pricing systems. To summarize, we find differential effects of international oil prices on domestic gasoline and fuel prices. The positive relationship between the price of oil and the price of fuel is much weaker for gasoline than for diesel, supporting the hypothesis that the concentrated collective action of the diesel lobby actually facilitates reform by allowing the government to target compensation and exemptions. Our case studies – both "typical" and "deviant" (Seawright and Gerring, 2008) – provide direct evidence for the causal mechanisms at play, and additional quantitative tests allow us to reject alternative explanations ranging from urban bias to regime type and exporter-importer differences and relative dependence on diesel versus gasoline.

These findings add new evidence for the role of sectoral interests in distributive politics. Our innovation regarding the differential sectoral benefits of gasoline and diesel subsidies offers a new empirical approach to studying distributive politics. Contrary to many studies on the difficulty of reform when interests are organized (Olson, 1965; Drazen and Grilli, 1993; Grossman and Helpman, 1994; Hellman, 1998; Gawande, Krishna, and Olarreaga, 2009), we find that organized vested interests may facilitate the political strategies needed to carry out difficult reforms. Because concentrated interests can be compensated or exempted, they need not raise insurmountable obstacles to reforms. This approach to explaining variation in the success and failure of reforms adds nuance to conventional accounts of the political economy of reform and expands the theoretical horizons of the literature. Acemoglu and Robinson (2006: 115) argue, for example, that powerful interest groups "will block beneficial economic and institutional change when they are afraid that these changes will destabilize the existing system and make it more likely that they will lose political power and future rents," and our results show how a strategy of compensation and exemption can help governments overcome this dilemma.

The results also add to the emerging research program on fuel subsidies. The findings suggest that the political obstacles to dismantling gasoline subsidies are very different from obstacles to removing diesel subsidies. Gasoline subsidies are less central to powerful sectoral interests and their removal provokes less public backlash. More specifically, our analysis shows that governments are actually quite adept at overcoming obstacles to diesel subsidy reform. Although fuel subsidy reforms are generally seen as difficult, we have found that when interest groups are concentrated, governments have been able to create the bargains required for policy reforms. Even in the cases of Iran, Jordan, and Turkey, where diesel prices started off at a much lower level than those on gasoline and policymakers faced steep opposition to diesel subsidy reform from vested interests, governments were able to use targeted measures such as compensation and exemptions to overcome the mobilization of affected industries. Moreover, the cases of Nigeria and Kuwait were characterized by a generally low level of sectoral pressure from diesel-heavy industries.

## 2 Politics of Fuel Subsidies: Gasoline and Diesel

We argue that governments have stronger incentives to subsidize diesel than gasoline. While subsidizing each type of fuel benefits middle-class households, diesel subsidies also secure the support of influential interest groups in agriculture and transportation.

### 2.1 Why Fuel Subsidies?

Governments frequently argue that fuel subsidies are social policy. In this telling, fuel subsidies offer the poor access to basic energy services at a lower cost. Households need energy for lighting, cooking, household business, agriculture, and transportation. Because modern energy is expensive, the argument goes, governments must control or subsidize the price of various fuels to ensure adequate access. In practice, however, this argument is weak. Studies of fuel subsidies show that they mostly benefit wealthier, often urban households (del Granado, Coady, and Gillingham, 2012). Because wealthy people consume much more energy than poor people, most of the monetary gain from subsidies goes to households that use energy for purposes such as automobile transportation, air conditioning, heating, and cooking with liquefied petroleum gas (LPG). At the same time, fuel subsidies put a lot of stress on government budgets (Coady et al., 2010). If governments replaced fuel subsidies with other, more effective policies, such as cash transfers, they would reach their poverty alleviation goals at a lower cost and without harmful price distortions.

Instead, fuel subsidies are a strategy of political survival. Governments use them to distribute resources to powerful interests in exchange of political support. This tendency is particularly pronounced in urban areas, where political unrest may threaten the government's survival. Victor (2009) has argued that governments do not replace fuel subsidies with more efficient policies, such as cash transfers, because of limited institutional capacity. Accordingly, fuel subsidies are a necessary evil to deal with popular unrest and political instability. Governments use fuel subsidies to maintain their popular support because they are unable to achieve the goal of political and social stability through less costly means.

Cheon, Lackner, and Urpelainen (2015) offer another institutional perspective and report strong negative effects of NOC presence on gasoline prices. Because NOCs allow governments to manipulate fuel prices without direct and transparent budgetary expenditures, they increase the temptation to use fuel subsidies for political gain. In a country without an NOC, fuel subsidies are visible because they must be paid with tax revenue or public debt. But in a country with an NOC, fuel subsidies can be offered simply by ordering the NOC to lower the prices and by hiding the losses into the NOC's accounts.

### 2.2 Targeting by Fuel

The key difference between the two fuels is that diesel is used for a wider range of purposes than gasoline, and many of these purposes are of concern to organized interest groups. While gasoline is mostly used for private road transportation, diesel is used for both such transportation and for a variety of other uses. Of these, the most important are agriculture and trucking. Over time, the size of engines used in agriculture and trucking has increased significantly and, because diesel releases more energy relative to volume than gasoline, it is more economical in heavy engines (Uri and Day, 1992). In a study of tractor engine performance over time in the United States, for example, Kim, Bashford, and Sampson (2005: 950), report that, since 1979, the Nebraska Tractor Test Laboratory, which is the official testing laboratory for tractors in the country, has not tested a single gasoline engine. After that year, only diesel engines have been available on the market. Not only the European Union and the United States, but also the major emerging economies of Brazil, China, India, and South Africa all rely largely on diesel for agriculture and transportation. In China, for example, in 2008 38.5% of oil demand was in diesel products and diesel was only second to coal in total consumption, although diesel is rarely used in automobiles.[2]

The use of diesel for agriculture and trucking is important because it expands the coalition in favor of fuel subsidies. While the beneficiaries, and hence supporters, of gasoline subsidies are largely limited to households that use the gasoline engine for private transportation, diesel subsidies also benefit large farmers engaged in mechanized cultivation, as well as the transportation industry.[3] These industries add to the numbers of the subsidy advocacy coalition. Moreover, sectors such as agriculture and transportation are economically critical because any price increases for them would result in price inflation across a wide variety of basic goods, such as foodstuffs. In Thailand, for example, diesel subsidies were largely targeted toward keeping transportation companies from raising their prices, and principally to avoid a rise in the price of food.[4] Besides interest group politics, then, the nature of the uses of diesel puts pressure on the government to continue subsidies.

Sectoral mobilization here often takes the form of not only classic lobbying of politicians, but also more aggressive forms of mobilization, such as threats to strike in response to rising prices. As described in the case studies, truck drivers, fishermen, and bus drivers lobbied emphatically, publicly protested, and often went on strike in an effort to forestall or reverse rising diesel prices in Iran and Jordan. The mobilization against dismantling of diesel subsidies is the sum of lobbying and protest activities.

### 2.3 Conventional Wisdom: Sectoral Interests Impede Reform

The highly organized nature of the diesel subsidy lobby has two countervailing effects on the government's willingness to lobby. On the one hand, the conventional wisdom in political economy suggests that governments may have stronger incentives to subsidize diesel than to subsidize gasoline. Studies here emphasize the *negative consequences* of concentrated sectoral interests for reform. The logic of increased interest in subsidizing diesel has already been described above. If this effect is powerful enough, then diesel subsidies should be more difficult to remove than gasoline subsidies. Following conventional accounts of special interest politics (Olson, 1965; Grossman and Helpman, 1994), the concentrated interests in favor of diesel subsidies are able to engage in collective action to pursue their interests. In the literature on trade policy,

[2] See "With Rising Gasoline Demand, Beijing Plans to Pass on Costs to Consumers" at `http://breakingenergy.com/2014/02/19/with-rising-gasoline-demand-beijing-plans-to-pass-on-costs-to-consumers/`.

[3] One exception to this general pattern are taxi drivers, who are capable of organized lobbying in favor of gasoline subsidies.

[4] "Diesel-price policy has flaws," *The Nation* (Thailand), March 4, 2011.

for example, most studies find that import-competing interests have had considerable success in delaying or stopping liberalization (Baldwin, 1989; Gawande, Krishna, and Olarreaga, 2009). Similarly, producers can be expected to secure beneficial forms of government regulation – such as subsidies or protectionism – by virtue of their of their ability to mobilize, in contrast to the diffuse interests of consumers (Stigler, 1971; Wilson, 1974). Such collective action may make the government unwilling to remove diesel subsidies to avoid losing political support from organized interests.

To illustrate this logic, consider the case of Indonesia (Benes et al., 2015). On January 1, 2015, President Joko Widodo, after years of efforts, announced the dismantling of gasoline subsidies, allowing domestic gasoline prices to fluctuate according to market prices – for the first time in four decades. While President Widodo also capped diesel subsidies to "IDR 1,000 per litre below its true cost" (Pradiptyo et al., 2016: 6), he did not dismantle them altogether, citing concerns about the effect of diesel price increases on the cost of public transportation and fisheries. Here we see how concerns about specific sectors of the economy result in the perpetuation of diesel, but not gasoline, subsidies, despite low international oil prices of the time. Below, we offer five additional case studies to illustrate these dynamics.

Given this reasoning, one would expect domestic diesel prices to vary less strongly with international oil prices than domestic gasoline prices. Governments have very strong political and economic incentives to keep diesel prices low, whereas the incentives to subsidize gasoline prices are less strong. Thus, governments would be more hesitant to let diesel prices respond to changes in international oil price fluctuations.

**Hypothesis 1** (collective action against reform)**.** *Domestic diesel prices vary less strongly with international oil prices than domestic gasoline prices.*

### 2.4 The Alternative Hypothesis: Compensation and Exemptions

Studies have argued that concentrated interests are actually not as powerful or as able to lobby for benefits as suggested by collective action logic (Derthick and Quirk, 1985; Trumbull, 2012), and that reform is actually quite common in the face of opposition such groups (Patashnik, 2003). However, concentrated sectoral interests may even facilitate reform by allowing for targeted compensation and exemptions. As a result, the existence of diesel-heavy interests may have *positive consequences* for reform. When interest groups are concentrated, the government can easily bargain with them and design a package of compensation for reform. With a small number of highly organized key players, effective bargaining is possible. The government does face organized interests capable of collective action, but the small number of concerned players facilitates bargaining. Several studies of the political economy of energy policy have found that the fragmentation of interests is an obstacle to efficient policies (Cirone and Urpelainen, 2013), and Frye (2002) finds that polarization of legislative positions can explain weak economic performance in post-communist countries.

This logic runs counter to the conventional wisdom on organized interests and policy reform. While the presence of vested interests creates a problem for the government, the solution is also found in the same condition: because interests are heavily concentrated, the government can proceed with policy reform and compensate or exempt politically pivotal players. In the case of fuel subsidy reforms, the government has two practical strategies at its disposal: compensation and exemptions. On the one hand, the government can offer compensation, such as cash transfers or other favorable policies. For example, a government could dismantle diesel subsidies but increase the supply of agricultural credit or increase food procurement prices. On the other hand, the government can offer exemptions from subsidy removal to specific sectors. The abandonment diesel subsidies could be accompanied by the creation of targeted subsidies for agricultural users and heavy trucks.

Acemoglu and Robinson (2006) emphasize the incentives of vested interests to block changes that reduce their political power over time, but a strategy that relies on negotiated arrangements for compensation and exemptions avoids this pitfall. Even as the economy-wide reform proceeds, specific sectors retain their political power because of the resources derived from compensation and because exemptions reduce the pressure on their sector to change. Furthermore, this approach to fuel subsidy reform solves another problem highlighted by Acemoglu, Johnson, and Robinson (2001): organized interest groups prefer redistributive solutions that do not reduce the size of their sector. A package of compensation and exemption can leave the sector in focus vibrant without blocking reforms in other sectors of the economy. Such a partial reform is clear improvement over the existing policy, even if policies for certain sectors with concentrated special interests are either partially reformed or require resources for compensation.

Practitioners recognize the importance of these strategies. In a policy report on strategies for fuel subsidy reform, Laan, Beaton, and Presta (2010: 27) emphasize "measures to reduce any negative effects ... [f]inding a means to identify target groups reduces the risk that subsidies will dissipate, be misspent or reach unintended recipients." They also warn that "[s]hort-term measures tend to be administratively difficult to design and implement, because they are situation-specific." If targeting and administration are major problems for reducing the negative effects of subsidy removal on key groups, being able to bargain with a highly organized sector should facilitate the implementation of policies that compensate the losers.

Our case studies below also support this view. For example, as shown in the case studies below, in Nigeria the government attempted to use the savings from subsidy reform to expand public transportation, while Jordan raised public transportation fares in order to offset the increased cost of fuel. Similarly, Kuwait and Iran provided exemptions for a number of diesel-heavy industries such as fishing, public transportation, and agriculture.

The ease of bargaining with concentrated interest groups might be of particular import when institutional capacity is limited. Scholars such as Victor (2009) and Cheon, Lackner, and Urpelainen (2015) highlight the issue of institutional limitations as a constraint on fuel subsidy reform, pointing out that generous fuel subsidies are common in countries with limited capacity for social policy. In such a setting, the government's prospects of replacing fuel subsidies with more sophisticated social policy, such as cash transfers, might be particularly sensitive to identifying a clear and organized group of politically pivotal beneficiaries. If a lack of institutional capacity prevents social policy on a large scale, then the value of being able to focus on a concentrated interest group is particularly high.

To summarize, concentrated interests could facilitate reforms by allowing the government to bargain with a small group of highly organized players. Policies to compensate and exempt losers from diesel subsidy reform should be easier than policies to compensate and exempt a large number of middle glass households in the case of gasoline reform. Targeted compensation using less distortionary means than fuel subsidies would allow governments to reduce the total subsidy cost both because of targeting and because the lack of subsidy would discourage the wasteful energy consumption that the government previously subsidized. The number of people receiving subsidies decreases, and each of them is subsidized less because excessive consumption is no longer subsidized. If this reasoning is valid, domestic diesel prices should vary more, not less, strongly with international oil prices than do domestic gasoline prices.

**Hypothesis 2** (compensation and exemptions for reform)**.** *Domestic diesel prices vary more strongly with international oil prices than domestic gasoline prices.*

## 3 Research Design

To test the above hypotheses, we analyze cross-national time-series data during the 1991-2012 period. The key innovation of our strategy is to compare how domestic gasoline and diesel prices vary with international oil prices. If governments are unwilling to let diesel prices fluctuate (sectoral interests impede collective action), we would expect gasoline prices to react more strongly to international oil prices; if governments do not hesitate to let diesel prices vary (compensation and exemptions enable reform), we would expect gasoline prices to react less strongly to international oil prices. Because pricing reform entails allowing domestic fuel prices to be determined by market prices, we can exploit both price increases and price decreases in international oil prices to test the competing hypotheses. As the quantitative data do not allow us to examine directly the behavior and strategies of organized interest groups, we alsoo report below results from five case studies. Thus, the quantitative analysis establishes broad patterns consistent with our argument at the global level and the case studies test the specific theoretical mechanisms in a direct manner.

The basic unit of analysis is a country-year-fuel, where the fuel is either gasoline or diesel. The fuel price data are provided by the German Development Agency (GIZ). Although the dataset begins in 1991, there are many gaps in the data for that year and 1992; thus, we collapse the data for those two years, using the mean value for a given country in the case that we do have data for both years. Additionally, we do not have data for 1993-1994, 1996-1997, and every other year beginning in 1999. As such, we ultimately have data on a maximum of 168 countries for 10 time periods. The lack of data for every year does not pose a serious problem for analysis, as there is no *a priori* reason to anticipate that trends in years for which we have no data will differ from those in which we do.

We assess whether changes in international oil prices have different effects on domestic fuel prices depending on the type of fuel (gasoline, diesel). The regression equation is specified as follows:

$$\text{Fuel Price}_{i,j,t} = \beta_1 \text{Oil Price}_t + \beta_2 \text{Fuel Type}_j + \beta_3 \text{Oil Price}_t * \text{Fuel Type}_j + \gamma \mathbf{X}_{i,j,t} + \mu_i + \epsilon_{i,j,t},$$

where $i$ indexes countries, $j$ indexes fuel type, and $t$ indexes years, $\mathbf{X}_{i,t-1}$ is a vector of country-specific control variables, $\mu_i$ is a vector of country fixed effects, and $\epsilon_{i,t}$ is a stochastic error term. Fuel Price is the logged price of the fuel (whether diesel or gasoline), Oil Price is the year-specific, logged global price of oil, and Fuel Type is a binary variable indicating whether the fuel price refers to diesel (indicated by a 0) or gasoline (indicated by a 1). We employ country-clustered standard errors to account for serial correlation.

As a robustness check, we also estimate split sample models so that the effects of oil prices are separately estimated for gasoline and diesel. To account for serial correlation in another way, we also estimated lagged dependent variable (LDV) models in the appendix. The results from these estimations are consistent with our main findings.

### 3.1 Dependent and Explanatory Variables

Our dependent variable is the domestic retail price of fuel, in constant 2000 U.S. dollars. Since we compare gasoline and diesel, we have data on both, which come from the GIZ. To make their prices more comparable and ensure that our findings do not simply reflect fundamental differences in cost between the two fuels, perhaps due to variation in demand or production cost, we use the logarithmized value for both gasoline and diesel. The logarithmic transformation means that we explain *percentage changes* in the dependent variable, and thus the different baseline cost of gasoline and diesel cannot explain differences in pricing. Even though gasoline tends to be more expensive than diesel and the process of refining oil into each fuel is different, the logarithmization ensures that any changes in the explanatory variable generate proportional changes in the dependent variable. Thus a gasoline-diesel difference in sensitivity to international oil prices would be difficult to attribute to the baseline characteristics of the fuel.

We follow the "price-gap approach" to detecting the presence of subsidies, which assumes that since oil is a global commodity, variation in the price of fuel that is not accounted for by other factors (e.g., the cost of shipping) will reflect government intervention (Koplow, 2009; Coady et al., 2010). If the government's fuel pricing is either deregulated or based on an efficient pricing mechanism that adjusts the domestic price for the actual cost, then international oil price changes – both increases and decreases – should rapidly induce changes in domestic fuel prices.[5] Ideally, we would have data on the actual size of the subsidy for the countries in the sample, but such data is not available, and we thus follow the price-gap approach.

The key technical assumption behind this approach is that fuel subsidy reforms are reflected in the pass-through rate, that is, how much international oil prices shape domestic gasoline and diesel prices (Ross,

[5]Notably, this is also true of fuel price decreases. Even if the government imposes fuel taxes, domestic fuel prices should respond to decreases in international oil prices.

Hazlett, and Mahdavi, 2017). When policymakers reform fuel subsidies, pass-through rates should increase as domestic prices begin to reflect the true cost of the fuel. While pass-through rates are not themselves reforms, they offer a clear and transparent indicator for the extent to which policymakers allow domestic fuel prices to follow the international oil price, a key determinant of the true fuel cost.

The most important determinant of the price of fuel should, in the absence of subsidies, be the price of oil, which is time-varying but universal across countries. The price is in constant 2000 USD, with data coming from BP (2014). We again logarithmize the price in order to make it more comparable to the prices of gasoline and diesel. Given the importance of diesel to concentrated interests in the transportation and agricultural sectors, Hypotheses 1 predicts that diesel prices will be less responsive to changes in the price of oil than gasoline. However, Hypothesis 2 expects diesel prices to be *more* responsive than those of gasoline, since governments can use targeted policies of exemption and compensation to overcome opposition from diesel-dependent industries.

The evolution of gasoline and diesel prices over time is illustrated in Figure 1. There is a strong correlation between fuel prices and international oil prices. Specifically, as shown in Table A2 the correlation between diesel and oil prices is 0.531, while the same correlation for gasoline is 0.412. The correlations are stronger for diesel than for gasoline, which provides suggestive initial evidence that while diesel prices are generally lower than gasoline prices overall, they are more responsive to changes in the price of oil.

[Figure 1 about here.]

Table A4 provides a list of the ten countries with the highest gasoline/diesel price ratio between the years 1991-2012. As the table shows, these countries tend to be major oil producers from the Middle East. The gasoline-diesel gap is typically maximized when fuel subsidies are generous, as is common among major Middle Eastern producers, further highlighting the importance of diesel subsidy reform.

### 3.2 Control Variables

In some models, we include control variables to guard against omitted variable bias and improve the precision of our estimates. Both gasoline and diesel prices vary for many reasons, and the direct relationship between international oil prices and domestic fuel prices may be confounded by other changes induced by changing oil prices. Because we are interested in the direct association, we control for such indirect changes in some models.

To begin with, we control for regime type. Although autocratic governments do not face the same level of accountability to the population, they do face the threat of revolution or armed insurrection – particularly from urban dwellers (Victor, 2009). On the other hand, democratic governments may use fuel subsidies as a means of gaining electoral support. Regime type may also be a confounder, as political institutions depend on oil revenue (Ross, 2012). To capture states' level of democracy, we use the composite Polity score provided by the Polity IV Project (Marshall and Jaggers, 2011).

Next, we account for countries' logarithmized population. Although fuel subsidies are an inefficient method of redistribution, it may be difficult for governments in larger countries to handle the logistics of undertaking more efficient means, such as direct cash transfers. Our data for this and the next three variables is from the WDI.

Third, we control for logarithmized GDP per capita (in constant 2000 dollars) in order to capture countries' level of economic development. We do so because developed countries are more likely to use taxes as a means of discouraging overuse of fossil fuels and raise revenue, whereas developing countries may use fuel subsidies as a means of providing a safety net for the poor. At the same time, oil prices influence the income levels of both oil exporters and importers.

Next, we control for the percentage of the state's population that lives in urban agglomerations. Urban populations represent a threat to governments' political survival, especially in autocratic states, due to their comparatively greater ability to organize and act collectively than rural populations (Victor, 2009). Since subsidies, particularly on gasoline, tend to disproportionately benefit urban dwellers, fuel subsidies can be a means of staving off riots by citizens living in urban areas (Coady et al., 2010; Sterner, 2011; Fattouh and El-Katiri, 2012). Urbanization may also increase due to high oil prices, as transportation costs grow.

We account for countries' level of trade openness by including their volume of trade as a percentage of their GDP. On the one hand, governments may use fuel subsidies as a means of cushioning the blow from foreign economic competition; on the other hand, however, the costs of the subsidies may be unsustainable in light of that same increased openness. Moreover, states characterized by substantial degrees of economic nationalism and governmental involvement in the economy may be more prone to see fuel subsidies as an instrument of growth, and controlling for trade openness allows to at least roughly capture governments' interest in controlling the economy. At the same time international oil prices are an important determinant of trade costs.

Fifth, we include a measure of bureaucratic capacity. Fuel subsidies are an inefficient means of redistributing income, as the benefits from them disproportionately accrue to wealthier citizens (Coady et al., 2010, 2015). Some scholars posit that governments with limited institutional capacity to undertake other forms of redistribution, such as direct cash payments, are more likely to use fuel subsidies (Victor, 2009; Fattouh and El-Katiri, 2012). Similar to political institutions, bureaucratic capacity may depend on oil windfalls (Ross, 2012). We use the bureaucratic quality score employed by the International Country Risk Guide (ICRG). This measure ranges from 0 to 4, with higher scores indicating greater bureaucratic autonomy from policymakers, more regularized means of recruiting and training its members, and greater ability to continue providing services regardless of changes in government (Coplin, O'Leary, and Sealy, 2007).[6]

While we expect oil prices to have a significant influence on the price of fuel – albeit differently for diesel – fuel in countries with a national oil company could be less responsive to variation in the global price of oil, owing to governments' greater ease in hiding and dispensing subsidies in those countries. Our primary data on national oil companies come from the World Bank (2008), which provides a list of major NOCs and the years of their creation; in Section A3, we explore alternative definitions. In some models, this variable is interacted with oil prices and fuel type, following the logic of Cheon, Lackner, and Urpelainen (2015).

We use country fixed effects in order to control for time-invariant differences across states. Perhaps most important are geographic factors, such as whether a country is landlocked, which may influence the price of fuel by affecting the costs of transporting it. Additionally, the country fixed effects allow us to account for whether the country is a major oil producer. Substantial oil production may affect a country's likelihood of subsidizing fossil fuels by influencing citizens' expectations for cheap fuel – both by heightening their feelings of resource nationalism, owing to the country's natural endowment, and by leading them to expect to share in the windfall from oil revenues (Hartley and Medlock, 2008; Victor, Hults, and Thurber, 2012; Ross, 2012; Fattouh and El-Katiri, 2012). Similarly, the fixed effects also allow us to account for whether the country is an OPEC member. Mahdavi (2014) finds that OPEC members are more likely to form NOCs

[6]See `http://www.prsgroup.com/wp-content/uploads/2012/11/icrgmethodology.pdf`. Accessed on June 4, 2015.

than non-members. Finally, fixed effects could capture historical legacies in fuel policy, such as generally high fuel taxes in wealthy European countries or environmental regulations across the industrialized world.

We include fuel type fixed effects to ensure that the coefficient on the interaction between oil prices and fuel type does not simply reflect baseline differences in the prices of gasoline and diesel. While diesel is cheaper in many countries, we expect that its price will be more sensitive to changes in the price of oil. We include linear, squared, and cubic time trend terms in order to account for global changes in fuel prices over time that are due to factors other than changes in the price of oil.

We do not control for inflation in the main models because inflation indices also include the price of fuels, and could thus result in biased estimates.[7] However, in the appendix (Table A11) we control for additional variables, such as inflation. It turns out that inflation is not associated with domestic fuel prices after we account for the effects of international oil prices.

## 4 Findings

We begin with a presentation of our main results, then test alternative explanations, and finally summarize robustness checks. To summarize, there is a substantial difference in governments' use of subsidies for gasoline and diesel. This is consistent with our expectation that although concentrated sectoral interests create incentives for governments to place great emphasis on subsidizing diesel fuel, this effect is dominated by the government's ability to offer compensation and exemptions. Diesel prices are generally lower than those on gasoline for supply-side reasons, but they increase more steeply in response to increases in the price of oil.

### 4.1 Main Results

Table 1 shows the main results. Models 1 and 2 contain baseline results before adding controls, with Model 1 excluding the interaction terms involving the NOC variable. Model 3 adds linear, squared, and cubic time trends, while Model 4 adds additional controls and Models 5 and 6 further control for bureaucratic quality. Model 5 excludes the NOC interactions as well.

[Table 1 about here.]

[7] We also exclude total oil exports and government spending as "bad" controls, because both of them are directly affected by fuel subsidies: total exports decrease with domestic subsidies and government spending increases.

The results support Hypothesis 2: diesel prices are more, not less, sensitive to oil prices than gasoline prices. Throughout the models, the product term between oil prices and the gasoline fuel indicator is negative. This is true even when we allow NOC presence to condition the effects. The inclusion of the NOC interaction terms in Models 2-4 and 6 do not affect the size or direction of the coefficient on the interaction between fuel type and oil price.[8]

Interestingly, NOC presence does not drive a wedge between gasoline and diesel. The triple interaction term never reaches statistical significance, and indeed its direction flips across models. This suggests that the difference between gasoline and diesel subsidies is more fundamental and does not depend on the presence of an NOC, but rather reflect the difference in the two fuels' distributive logics, as per our hypotheses. As for the other control variables, Models 4-6 suggest that logarithmized population and trade openness have a negative effect on the price of fuel, while GDP per capita has a positive effect. The other controls – bureaucratic quality, urban population, and the Polity score – have no statistically significant effect in any of the models.

To assess the magnitude of the effect of the price of oil on the price of fuel we use Stata's *clarify* (Tomz, Wittenberg, and King, 2001), with 1,000 simulations and holding all other variables, except country fixed effects, at their means. The simulated values of the price of fuel, both at the mean value of the log oil price (3.574) and at up to three standard deviations (0.621) above and below the mean, from Model 4 but without the NOC interaction terms are shown in Figure A1. Each standard deviation increase in the log oil price has an average effect of increasing the log diesel price by 0.135, compared to 0.018 for gasoline.

Table A14 repeats our analysis, but now the unit is the country-year and the dependent variable is the gasoline-diesel price ratio, with higher values indicating a higher gasoline price relative to the diesel price. As the table shows, higher oil prices shrink the gap between gasoline and diesel prices, again suggesting that governments react to higher oil prices by increasing diesel prices at a relatively greater rate than gasoline prices.

[8]While the inclusion of cubic time trends halves the coefficient for the association between international oil prices and diesel prices, it does not change the interaction term of interest. While the estimated sensitivity of both gasoline and diesel prices to oil prices thus decreases when accounting for global trends, the differential between gasoline and diesel actually grows in proportional terms. This observation goes against the alternative hypothesis that changes over time, such as new environmental regulations, could explain the gasoline-diesel gap.

## 4.2 Testing Alternative Explanations

We now rule out a number of other potential explanations for the gasoline-diesel gap – or lack thereof. First, we examine the effects of oil prices in autocracies versus democracies. One concern is that vested interests might be better able to achieve their goals in autocratic settings, when the government does not need to consider the preferences of the mass public. The results presented in Tables A16, A17, and A18 suggest that democracies and autocracies do not systematically differ in their gasoline and diesel prices' responsiveness to changes in global oil prices. Thus, electoral accountability does not seem to drive the gasoline-diesel gap.

We also use data from the World Bank's Distortions to Agricultural Incentives Database on government assistance "for more than 70 [agricultural] products," such as wheat, rice, and beef, which "represent around 70 percent of the gross value of agricultural production in the focus countries" (Anderson and Nelsen, 2013: 7). Data are available for 75 countries between 1955 and 2007. By using the World Bank's variable Relative Rates of Assistance (RRA), which captures the extent to which the government supports the agricultural sector relative to the nonagricultural sectors, we examine how the government's general agricultural policies modify the effect of oil prices on diesel and gasoline prices. We find that countries' relative level of bias toward agricultural products has no effect on the gap between the responsiveness of diesel and gasoline prices to oil prices (Table A15). Thus, governments can use targeted compensation and exemption policies to cushion the effect of diesel price increases on diesel-heavy industries even in countries that are heavily dependent on agriculture, thus rendering subsidy reform less difficult than might otherwise be expected *a priori* in light of sectoral interests.

One might be concerned that some of the NOCs in the sample are merely token companies, given their countries' lack of oil production, and thus would not be expected to make a difference in the government's ability to provide subsidies. Moreover, one might expect exporters to be generally more likely to subsidize fuel, owing to their greater oil wealth (Ross, 2012). We split the sample into major oil producers (exporters, for short-hand) and non-major oil producers (importers), as defined by Ross (2012). The results shown in Tables A9 and A10 indicate that this is not the case. In both exporters and importers, diesel is significantly more responsive to oil prices than is gasoline, while NOCs continue to have little effect on this gap. Thus we can rule out the possibility that our results are being driven solely by the effects of oil production.

Finally, these results could be driven by countries in which diesel is not an important fuel, allowing governments to reform simply because of a lack of public opposition. As we show in Table A19, this concern is not valid. We construct a measure of countries' dependence on diesel, which is captured using the ratio of diesel consumption to combined diesel and gasoline consumption, using data from the U.S. Energy Information Administration. To mitigate the potential for endogeneity to variation in oil prices, we calculate this measure using countries' consumption levels in 1990. The results show that while countries that rely on diesel do have relatively high gasoline prices (as compared to their diesel prices), this gap actually shrinks when oil prices increase. This result goes against an alternative explanation based on public opinion, as it shows that governments of countries heavily dependent on diesel are more, not less, likely to allow diesel prices to rise under high oil prices.

### 4.3 Robustness

We further subject these results to a variety of robustness checks. First, we control for the presence of an IMF program, which may constrain governments' ability to keep their subsidies, and consumer price inflation, which accounts for general trends in the prices of goods and services (Table A11). Data on the former came from the IMF's Monitoring of Funding Arrangements (MONA) database, while data on the latter come from the WDI. The findings are effectively unchanged after the inclusion of these terms, with the coefficients of interest remaining statistically significant and virtually the same in magnitude. Next, we ensure that the results are not being driven by outliers. The findings survive the exclusion of both OECD countries, which have significantly higher fuel prices than the global average, as well as countries whose diesel prices were on average twice as large (or more) as their gasoline prices during the 1991-2012 period. We consider different codings of NOC presence, following the approach in both the World Bank (2008) and Cheon (2015). As we show in Tables A12 and A13, variation in the NOC definition does not change our results.

We use a lagged dependent variable in place of the country fixed effects in order to account for country-specific trends in fuel prices (Table A6). The results show that even after accounting for each country's previous level of fuel prices, the price of gasoline is more sensitive to the price of oil than is the price of diesel, as the interaction between oil price and fuel type remains negative and statistically significant. Furthermore, rather than relying solely on interaction terms to assess the extent to which the type of fuel modifies the relationship between oil price and fuel price, in Tables A7 and A8 we split the sample into observations for diesel and gasoline.

## 5 Case Studies

We conduct case studies on five countries: Iran, Jordan, Turkey, Kuwait, and Nigeria. The first three cases focus on causal mechanisms when the values of independent and dependent variables are as expected; the remaining two cases investigate unexpected outcomes.

The first three cases can be considered "typical" (Seawright and Gerring, 2008: 297). While they initially had gasoline prices that were far higher than those of diesel, diesel subsidy reforms were relatively successful as the price of oil rose, and thus we would expect to see the hypothesized causal mechanisms: compensation and exemptions to highly organized diesel users. Moreover, the cases exhibit a lot of variation in other relevant variables, such as oil production, the governance of the energy sector, and regime type. Indeed, the first two of these countries have historically had very large differences in their diesel and gasoline prices, as shown in Table A4, and thus allow us a great deal of leverage to illustrate that there is a similar but distinct political calculus governing the use of diesel subsidies. Additionally, Iran has a large national oil company, and thus is coded as having an NOC in our dataset; however, Jordan is coded as not having an NOC, as its national oil company, the Jordan Petroleum Refinery Company, operates only one oil refinery and does not control the oil/gas sector to the extent of its Iranian counterpart.[9]

The other two, Kuwait and Nigeria, are "deviant" cases of countries with a smaller gasoline-to-diesel price ratios (George and Bennett, 2005; Seawright and Gerring, 2008). As major oil producers with NOCs, Kuwait and Nigeria should be expected to be heavy subsidizers of diesel. Indeed, the data show that major oil producers with NOCs have a much higher gas-to-diesel price ratio than do other countries. These cases allow us to further demonstrate the importance of sectoral pressure in generating incentives for subsidizing diesel; our theory leads us to expect that Kuwait's and Nigeria's higher price of diesel, compared to gasoline, should be accompanied by either special treatment of concentrated sectoral interests or by weak sectoral pressure.

As a whole, these cases also represent "most-different cases" which allow us to show that targeted compensation and exemption can be used across a variety of circumstances to facilitate subsidy reform (Seawright and Gerring, 2008: 297). Across these countries, there was a broad range of variation in the

[9] As noted above, the quantitative results do not change if we code Jordan as a country with an NOC.

level of democracy, urbanization, diesel dependence, and oil production; a table summarizing the country-mean values of these cases for regime type, oil production, urbanization, rural bias, and diesel dependence can be found in the appendix (Table A5). Yet in all cases, the government was able to mitigate opposition from sectors with a vested interest in diesel subsidies in order to enact reform. Kuwait, Nigeria, and Iran are have large resource endowments and are major oil producers, which should make them predisposed towards subsidies (Ross, 2012). Similarly, Kuwait, Jordan, and Turkey are highly urbanized while Nigeria is highly rural, with Iran being in between. Finally, these cases feature broad variation in regime type, ranging from having Polity scores of -6 (Iran and Kuwait in many years) to scores of 9 (Turkey in some years). While Nigeria and Kuwait were the least dependent on diesel relative to gasoline – which partly explains the greater ease with which they were able to reform diesel rather than gasoline – even in highly diesel-dependent countries such as Iran, Jordan, and Turkey, the governments were able to use targeted measures to mitigate sectoral opposition to diesel reform.[10]

In each case study, we focus on the same time period, the past 10-15 years. We start by describing the state of gasoline and diesel subsidies in the beginning of the analysis period, and the contrast it with the same statistics at the end of the period of analysis. In each case study, we then focus on changes, or lack thereof, in fuel pricing policies for gasoline and diesel. In particular, we attempt to unpack the political process that explains variation in gasoline and diesel prices. To preview, diesel reform was easier in Kuwait and Nigeria by virtue of their lower dependence on diesel consumption relative to gasoline consumption. However, even in the other four cases, governments were able to overcome opposition to diesel reform by interests in the transportation and agricultural sectors in order to reduce diesel subsidies and shrink the gasoline-diesel gap.

To summarize, the cases of Iran, Jordan, Turkey, Kuwait, and Nigeria suggest that governments do see diesel subsidies differently, and that such subsidies function as means of appeasing concentrated sectoral interests. Agricultural and transportation interests play a particularly important role, and governments often attempt to cushion the blow through a variety of alternative social policies and distributive measures that would compensate the losers. When governments sought to ease the burden of fuel subsidies overall, due to

[10]In the appendix (Section A5) we also present a case study on subsidy reform in Sri Lanka. The case quite similar to that of Jordan, as it is a small country with a small NOC, and is an oil importer that is heavily reliant on diesel. However, Sri Lanka is far more rural, and is more democratic, than Jordan. Thus, while the case does provide evidence that supports our theory, the other cases give us the analytic leverage we need by virtue of their enormous variation on regime type, oil production, urbanization, rural bias, and diesel dependence.

rising oil prices or to economic crises, the use of these measures enabled them to at least partially overcome sectoral opposition in order to reduce subsidies on diesel, thus reducing – and in some cases eliminating – the gap between gasoline and diesel pricing. A summary of our cases can be found in Table 2.

[Table 2 about here.]

### 5.1 Iran

The price of Iranian gasoline and diesel remained almost constant throughout the 2000s, with gasoline hovering around \$0.06-\$0.08 per liter and diesel remaining between \$0.01-\$0.03.[11] In 2004, the price of gasoline was \$0.08 per liter, while the price of diesel was \$0.02. Diesel consumption was moderately higher than gasoline consumption throughout the decade, averaging 498,000 and 369,000 barrels per day, respectively.[12] The consistently low level of these prices was the result of extensive governmental subsidies, especially price controls that forced the National Iranian Oil Company (NIOC) to provide oil to refiners below market price, thus leading the government to lose significant revenues compared to selling the oil abroad (Mahdavi, 2012). This resulted in around \$32 billion (current-year U.S. dollars) in lost export revenue in 2007 (International Monetary Fund, 2008: 23-27).

Between 2010 and 2012, the price of both fuels increased significantly. The price of diesel rose to \$0.10 in 2012, while the price of gasoline rose to an annual average of \$0.26. This is particularly striking when one considers the prices of diesel and gasoline in countries in the developed world without an NOC. The United States, for example, had an average gasoline price of \$0.76 in 2012 and an average diesel price of \$0.82, while Sweden's gasoline and diesel prices were \$1.64 and \$1.68.

This substantial change in the price of fuel was the result of Iran's attempt to reform its subsidies in 2010, as part of an effort to stimulate economic growth, reduce fuel consumption in the wake of international sanctions, and reduce expenditures after the global financial crisis (Demirkol, Moers, and Ostojic, 2013: 87-90; Vagliasindi, 2013: 233-235). Although Parliament curtailed the subsidy reductions in 2012, partly in response to popular dissatisfaction that followed the rise of food, fuel, and utilities prices, to opposition from the transportation sector, and to difficulties in identifying which households qualified to receive cash

[11] All fuel prices are in constant 2000 U.S. dollars unless noted otherwise.

[12] Fuel consumption data obtained from the U.S. Energy Information Agency, `http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm` (accessed April 5, 2015).

payments, it ultimately did not revoke them (Hassanzadeh, 2012: 3-4; Kojima, 2013: 30, 49-50).[13] Prices rose again in 2014 as the new President, Hassan Rouhani, sought to redirect government expenditures toward improving the country's infrastructure and reducing unemployment. As a result of these increases, gasoline rose by 75% in April 2014, from $0.16 to $0.28 per liter (current-year dollars).[14]

Iran's efforts toward subsidy reform exhibit the importance of appeasing interests in the transportation and agricultural sectors. The prices on diesel were significantly lower than those on gasoline to start with, and thus the cost of diesel had to be increased substantially more than those on gasoline in order to achieve the across-the-board subsidy reductions that the government sought (Hassanzadeh, 2012: 3; Vagliasindi, 2013: 233). As part of the reforms, the government established two price grades for diesel: one for industry, agriculture and fisheries, and public transportation (Rs 1,500 per liter), and another (Rs 3,500 per liter) for everything else, up from a previous level of Rs 165 per liter (Guillaume, Zytek, and Farzin, 2011: 15). Gasoline prices also remained heavily subsidized for government vehicles and vehicles used in public transportation and industry (Rs 1,000 per liter) with a free market price of Rs 7,000 in 2011 (Hassanzadeh, 2012: 3). Thousands of Iranian truck drivers went on strike in December 2010 to protest the rise of diesel prices.[15] The Iranian government took measures to cushion the increased pain at the pump, including direct cash payments to (especially poor) households (Vagliasindi, 2013: 236-237), but also made targeted efforts toward diesel-heavy industries. Price increases were timed to be after the harvest was over, and the concerns of the trucking industry led the government to offer them more low-price diesel (Guillaume, Zytek, and Farzin, 2011: 11, 21).

### 5.2 Jordan

In Jordan, prior to the late 2000s there was an enormous gap between gasoline and diesel prices. The price of diesel ($0.17) was less than a third of that of gasoline ($0.56) in 2004; indeed, gasoline was actually taxed substantially, and the revenues from that were used to help fund the subsidies on diesel, kerosene, and fuel oil (Coady et al., 2006: 14; World Bank, 2010: 90; Fattouh and El-Katiri, 2012: 22). Fuel consumption leaned slightly more heavily toward diesel than in Iran, with Jordanian diesel use averaging 32,000 barrels

[13] "Iranians brace for price hikes as government rolls back on subsidies," *The Guardian*, April 28, 2014; "Cut those subsides," *Economist*, April 30, 2014.

[14] Parisa Hafezi, "Iran fuel price hikes will be big test for Rouhani," *Reuters*, March 27, 2014; "Iranians brace for price hikes as government rolls back on subsidies," *The Guardian*, April 28, 2014.

[15] Thomas Erdbrink, "Iranian truck drivers stay off roads as gas prices rise steeply," *Washington Post*, December 22, 2010.

per day and gasoline use averaging 18,200 gallons per day in 2000-2010.

Prices rose in the latter half of the 2000s as the result of a gradual elimination of subsidies, largely in response to the increasingly untenable cost of the subsidies – both due to rising oil prices in the mid-2000s and to the loss of its supply of preferential oil from Iraq (Coady et al., 2010: 14; Fattouh and El-Katiri, 2012: 20, 52; Kojima, 2013: 12). By 2010, petroleum subsidies had fallen to 0.4% of GDP, down from 2.6% in 2006 and 5.8% in 2005 (Fattouh and El-Katiri, 2012: 52). The price of diesel rose to $0.76 in 2012, while the price of gasoline increased to $1.12. Although Jordan's gasoline price was even higher than that of the United States, the gap between gasoline and diesel had shrunk significantly from its level in the mid-2000s.

Because diesel prices were so low to begin with, they had to increase dramatically as part of Jordan's efforts to phase out subsidies (World Bank, 2010: 90). To mitigate the effects of the price increases, Jordan temporarily suspended the government sales tax on public transportation, among other measures such as direct cash transfers to lower-income households and minimum wage increases (Coady et al., 2006: 12, 20; International Monetary Fund, 2011: 47; Vagliasindi, 2013: 73-76). This was in large part due to fear of riots, as had occurred in previous attempts at reform (World Bank, 2010: 85, 90; Ragab, 2010: 6). In 2011, there were temporary subsidies put in place in response to popular pressure, and in order to avoid the sorts of protests that were taking place in Tunisia. Subsidies on diesel, kerosene, and LPG proved more resilient than those on gasoline. Ultimately, though, subsidies were re-eliminated in late 2012 despite popular protests, and were replaced with cash payments (Fattouh and El-Katiri, 2012: 20; Kojima, 2013: 12, 51).[16]

Subsidies on diesel reflected the logic we describe above. Concentrated interests in the transportation sector – including truckers and bus drivers – had substantial stake in keeping the price of diesel low, and lobbied extensively to this end. Similarly, the government had incentive to appease these industries in order to forestall general inflation that might follow the rise of transportation costs.[17] Indeed, protests and strikes by members of the transportation sector forced the government to raise public transportation rates by eleven percent for diesel-run vehicles and nine percent for gasoline-run vehicles in November 2012.[18]

Similar to Iran, compensation to the transportation sector played an important role in the government's reform strategy. While public opinion did oppose reforms and pro-poor social policy played a role in Jordan,

[16]"Fuel prices up after subsidies removed, decision triggers protests," *The Jordan Times*, November 13, 2012.

[17]Interview with a Middle East energy policy analyst.

[18]"Public transport fares rise as taxis protest fuel price hike," *The Jordan Times*, November 14, 2012; "Taxi owners union 'satisfied' with increase in transport fares," *The Jordan Times*, November 15, 2012.

the government also accommodated the transportation sector with targeted compensation.

### 5.3 Turkey

Prior to the late 1980s, the Turkish government controlled the petroleum industry and set prices. It officially liberalized petroleum product prices in 1989 in an effort to reduce the government deficit and pave the way for EU membership (Vagliasindi, 2013: 167-168). In practice, however, gasoline and diesel remained effectively subsidized, as the government still owned the major petroleum companies in Turkey (International Monetary Fund, 2013: 67-68). Through the use of an "Automatic Pricing Mechanism," the government established a price cap on petroleum products until 2004. Throughout the 1990s and into the 2000s, the price of gasoline was higher than that of diesel, though not dramatically so; gasoline slowly rose from $0.61 per liter in 1995 to $0.98 in 2002, while diesel increased from $0.40 to $0.75 in the same period.

Starting in late 2004, the government effectively removed its interference in petroleum prices (Vagliasindi, 2013: 168). As a result, the prices of both fuels increased considerably, with the gap between gasoline and diesel prices shrinking. By 2010, gasoline cost $2.03 per liter while diesel cost $1.63 – a difference of only 24%. Since the early 2000s, gasoline and diesel prices have risen and fallen in tandem (Vagliasindi, 2013: 175). Indeed, diesel subsidy reform occurred in lock-step with that of gasoline even despite Turkey's much heavier reliance on diesel; between 2000 and 2010, Turkey consumed an average of over 237,000 barrels of diesel per day compared to 62,000 of gasoline.

Turkey's subsidy reform was made possible largely because of its social safety net that includes cash transfers, particularly to poor households and those with children (Vagliasindi, 2013: 172-173). Moreover, despite reform, Turkey maintained major exemptions for public transportation as well as for farmers that use diesel. In 2006, Turkey passed a law exempting public transportation companies from the excise and value-added taxes, and the following year it introduced a rebate program in which farmers could receive compensation for their diesel fuel costs (International Monetary Fund, 2013: 70-71).

In sum, then, Turkey's experience with fuel subsidy reform provides support for the causal mechanisms we expect to be at work in diesel subsidy reform. The case shows that even in a highly diesel-dependent democracy, governments can use targeted exemptions and compensation to diesel-heavy industries in order to facilitate reform. While diesel reform did not precede gasoline reform, this was largely because the government decided to tackle petroleum subsidies altogether. Regardless, however, the case shows that diesel reform need not be any more difficult than gasoline reform, despite the concentrated sectoral interests that rely on diesel.

### 5.4 Kuwait

The government of Kuwait has significantly subsidized gasoline and diesel in recent years. The prices of both fuels remained highly stable over the late 1990s and into the 2000s and 2010s, never falling below $0.17 per liter (in 1998 and 2012) or rising above $0.22 (in 2004). While gasoline was in most years more expensive than diesel, the gap was substantially less than in Iran or Jordan; Kuwait's gasoline-to-diesel price ratio averaged 1.135 during the period under study. Indeed, in 2004, the average annual prices of gasoline and diesel were identical. Gasoline consumption averaged 47,800 barrels per day, while diesel was consumed at a daily rate of 36,900 barrels between 2000 and 2012. In 2014 and 2015, as part of a broader wave of subsidy reform among the Gulf states, Kuwait ended subsidies on diesel – but not on gasoline – by raising the price of diesel to 0.17 dinar (approximately $0.59) from 0.055 dinar. The Kuwaiti government faced the prospect of massive deficits, and sought to save $1 billion USD per year by eliminating the diesel subsidies.[19] The diesel price tripled, from $0.19 per liter to $0.59 (in current-year dollars) in late 2014.[20]

The end of diesel subsidies led to public opposition. This opposition largely took the form of protests from consumers – and from members of Parliament on their behalf – as well as individual closures on the part of some bakeries and restaurants, rather than collective action by interests in the transportation or agricultural sectors.[21] Although the Kuwaiti government attempted to stifle opposition from consumers and individual vendors, and to pressure companies and restaurants into keeping their prices stable despite the rise in diesel prices, the government backpedaled somewhat on the diesel price increases in early 2015, reducing the price to 0.11 dinar. Most importantly, the government provides exemptions to the rise in diesel pricing for diesel-heavy sectors, offering them the original 0.055 dinar rate.[22]

The experience of Kuwait suggests that, where diesel is a less crucial fuel, diesel subsidy reform becomes comparatively easier. However, diesel-heavy sectors can still exert a powerful influence if they mobilize for

[19] "Kuwait to end subsidies on diesel over deficit fears," *Times of Oman*, June 10, 2014.

[20] "Kuwait triples diesel, kerosene prices," *Agence France-Presse*, October 15, 2014; Clifford Krauss, "Low Energy Prices Offer Opening for Subsidy Cuts," *New York Times*, February 4, 2015.

[21] "Kuwaitis slam govt for removing diesel, kerosene subsidy," *Arab Times*, October 16, 2014.

[22] "Govt scrambles to contain fallout of cancled subsidies," *Kuwait Times*, January 4, 2015; "Removal of subsidies continue to attract criticism from public," *Arab Times*, January 6, 2015; "Kuwait cuts diesel fuel prices after political pressure," *Reuters*, January 28, 2015.

strong opposition to the reforms, which gives the government incentive to appease them through the use of partial exemptions to the price increases. Although there was public opposition, the mass public's demands were met with only partial concessions, while the government accommodated the needs of the organized sectoral interests considerably.

### 5.5 Nigeria

Until 2004, gasoline and diesel prices in Nigeria were quite comparable, with both fuels were heavily subsidized. While diesel was cheaper in most years, the gap was generally quite narrow. Fuel subsidies took the form of both explicit payments and price controls, with prices set monthly by the Petroleum Products Pricing Regulatory Agency (PPPRA). The cost of these subsidies increased from 1.3% to 4.7% of GDP between 2006 and 2011 (Vagliasindi, 2013: 242-243; David et al., 2013: 57-59). Although the prices of the two fuels were comparable for much of the decade, gasoline consumption was dramatically higher than diesel consumption, with daily usage of 156,000 and 38,200 barrels per day, respectively, from 2000-2012.

Although the diesel price increased substantially, the price of gasoline fluctuated only slightly during the latter part of the 2000s. While gasoline and diesel cost $0.44 and $0.57 per liter in 2006, by 2012 they had increased to $0.48 and $0.85, respectively. Diesel subsidies ended in the mid-2000s, while those on gasoline and kerosene remained intact (Kojima, 2013: 12, 60-61; David et al., 2013: 57-59). President Goodluck Jonathan tried to remove the remaining subsidies in early 2012, but strikes and riots forced the government to reduce the gasoline price by around one-third shortly after the January price increase.[23]

Diesel subsidy reform was possible largely because of the low importance of diesel for the Nigerian economy. In contrast to the other cases, consumption of gasoline was considerably higher than that of diesel in Nigeria, even before the diesel subsidy was removed; average gasoline consumption was three times as high as diesel consumption between 2000 and 2006. Although manufacturing, transportation, and agriculture were adversely affected by the rise in diesel prices, they did not bring a high level of pressure to bear on the government to maintain the diesel subsidies.[24]

[23] Tony Edike, "Transport Fares Shoot Up By 300 Percent As Fuel Sells for N200 Per Litre in Enugu," *Vanguard* (Lagos), January 3, 2012; "Nigeria Restores Fuel Subsidy to Quell Nationwide Protests," *Guardian*, January 16, 2012, `http://www.theguardian.com/world/2012/jan/16/nigeria-restores-fuel-subsidy-protests`; Xan Rice, "Nigerian president yields on fuel subsidy," January 16, 2012, *Financial Times*, `http://www.ft.com/intl/cms/s/0/9592e0cc-4020-11e1-9bce-00144feab49a.html`.

[24] Austin Imhonlele, Ben Uzor Jr., and Oyibo Egwuoniso, "Manufacturers raise alarm as diesel price soars," *Business Daily* (Nigeria), August 4, 2009; Salihi Abubakar, "Diesel Subsidy, Not Petrol, Needed To Transform Northern Economy," *Leadership*

In contrast to many of the other cases, the transportation sector never went on strike, despite the price increase. Moreover, the government planned to use the savings from the elimination of the gasoline subsidies in order to fund projects for these sectors, as well as for the poor. The transportation sector in general was quite small, and thus had a limited presence. Critically, the savings from the subsidy reform were used in part to expand public transportation, which was quite insufficient to the demands of large cities such as Lagos (Alleyne, 2013: 95), and to fund irrigation for the agricultural sector.[25]

Like Kuwait, the case of Nigeria indicates that diesel subsidy reform will be comparatively easier in economies where gasoline is of more pronounced importance. Again, however, partial measures were taken to cushion the blow of price increases to the transportation sector. The importance of gasoline for the Nigerian public made reforms very difficult, as the government was unable to find policies to accommodate those expecting to lose from subsidy removal. In contrast, the diesel subsidy reforms succeeded because targeted exemptions and compensation were possible.

## 6 Conclusion

We have shown that domestic gasoline prices rise less rapidly than domestic diesel prices in response to increases in international oil prices. Initially surprising, this result can be explained by noting that governments can offer compensation and exemptions to the concentrated sectoral interests that have a strong vested interest in diesel subsidies. Ourr case studies provide direct evidence for this causal mechanism.

For the study of distributive politics, these findings are significant because they provide new evidence for the role of sectoral interests. Although diesel users benefit from a larger and more pivotal set of vested interests, governments have found ways to reform their diesel subsidies. In this regard, our findings go against the conventional wisdom that collective action by incumbent interest groups reduces the likelihood and extent of disruptive and/or liberalizing reforms. Organized interests can promote reforms by making it easier for the government to target compensation and exemptions. Even if full reform remains unfeasible, the government and society can still reap welfare gains from partial reform.

The findings are also important for the growing research program on fuel subsidies. While political

(Abuja), June 15, 2015.

[25] Daniel Adugbo, "Transport Sector Is Key for Development Narto President [interview]," *Daily Trust (Abuja)*, October 1, 2013; Juliet Alohan, "Fuel Subsidy Removal Will Favour the Poor – Alison-Madueke," *Leadership* (Abuja), December 7, 2011; John Vidal, "UK to invest £30m in Nigerian public transport system," *The Guardian*, March 31, 2010; Daniel Idonor, "Fuel subsidy: FG to procure 1,600 mass transit buses," *Vanguard*, January 4, 2012.

economists have hypothesized that interest group politics play an important role in the determination of fuel subsidies, direct and comprehensive evidence for the role of interests in explaining variation in fuel subsidies has been missing. We have provided such evidence. The policy implication of this evidence is that efforts to dismantle gasoline subsidies face very different problems from those intended to dismantle diesel subsidies. Both economic and political reasons favor a sharp policy focus on gasoline subsidies, while reducing diesel subsidies could both impose larger immediate costs on the poor and be more difficult because of interest group politics. Reforms of diesel subsidies require a more elaborate approach, with compensation for organized interests in agriculture and transportation. However, our quantitative and qualitative evidence suggests that such reforms are possible, and perhaps even likely.

The next important research question is to assess the durability of these reforms: have governments succeeded in consolidating reforms? Sustaining the support of diesel users for higher prices and deregulation might require sustaining compensation mechanisms for a long time, and countries with limited institutional capacity could face difficulties on this front. Answering this question could shed new light on the long-term value of the bargains that governments strike with diesel users, as reform reversal would negate the benefits of the initial deal with organized interests.

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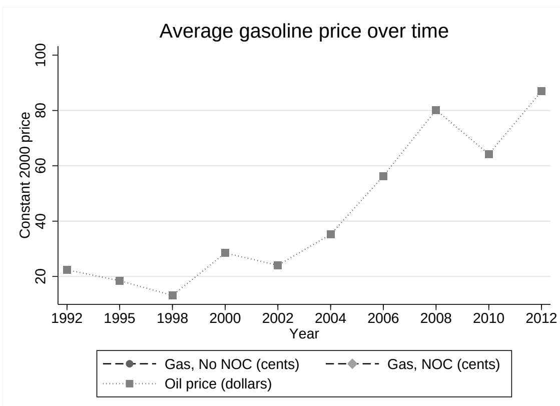
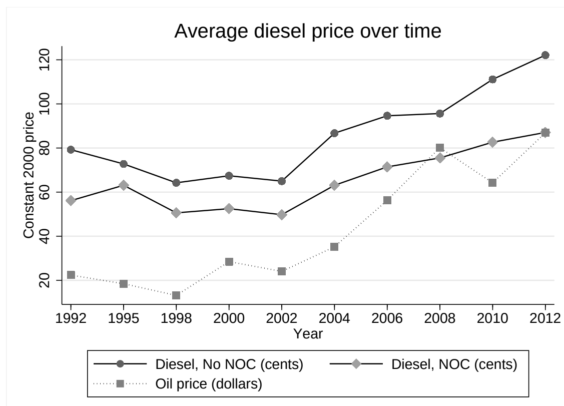



(a) Average gasoline prices over time.




(b) Average diesel prices over time.

Figure 1: The average price of constant 2000 fuel and oil prices, 1991-2012.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Oil price (log) * Gas | -0.174*** | -0.183*** | -0.183*** | -0.180*** | -0.188*** | -0.189*** |
| | (0.013) | (0.015) | (0.015) | (0.015) | (0.016) | (0.018) |
| Gasoline | 0.882*** | 0.855*** | 0.854*** | 0.844*** | 0.934*** | 0.868*** |
| | (0.052) | (0.065) | (0.065) | (0.067) | (0.069) | (0.080) |
| Oil price (log) | 0.501*** | 0.537*** | 0.246*** | 0.261*** | 0.197*** | 0.259*** |
| | (0.024) | (0.021) | (0.032) | (0.036) | (0.033) | (0.039) |
| NOC | -0.247*** | -0.020 | -0.016 | 0.168 | -0.239*** | 0.164 |
| | (0.067) | (0.209) | (0.210) | (0.208) | (0.045) | (0.202) |
| NOC * Oil price (log) * Gas | | 0.016 | 0.016 | -0.009 | | -0.001 |
| | | (0.027) | (0.027) | (0.030) | | (0.032) |
| NOC * Oil price (log) | | -0.081 | -0.086 | -0.120* | | -0.131* |
| | | (0.052) | (0.052) | (0.049) | | (0.051) |
| NOC * Gas | | 0.082 | 0.082 | 0.165 | | 0.142 |
| | | (0.110) | (0.110) | (0.125) | | (0.135) |
| Population (log) | | | | -0.380* | -0.454* | -0.410* |
| | | | | (0.184) | (0.208) | (0.200) |
| Polity | | | | 0.010 | 0.014 | 0.014 |
| | | | | (0.008) | (0.010) | (0.010) |
| GDPpc, 2000 USD (log) | | | | 0.287*** | 0.247*** | 0.281*** |
| | | | | (0.048) | (0.054) | (0.049) |
| % urban population | | | | 0.006 | 0.007 | 0.008 |
| | | | | (0.007) | (0.008) | (0.007) |
| Trade (% of GDP) | | | | -0.002+ | -0.002+ | -0.002+ |
| | | | | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | 0.006 | -0.001 |
| | | | | | (0.032) | (0.032) |
| Constant | 2.097*** | 2.004*** | 3.248*** | 5.266* | 7.621* | 6.293* |
| | (0.083) | (0.079) | (0.153) | (2.597) | (3.275) | (3.096) |
| Observations | 2897 | 2897 | 2897 | 2559 | 2173 | 2173 |
| Countries | 168 | 168 | 168 | 152 | 128 | 128 |
| Adjusted $R^2$ | 0.833 | 0.836 | 0.846 | 0.859 | 0.859 | 0.865 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table 1: Baseline results.

| Country | Summary |
| --- | --- |
| Iran | Iran's efforts at fuel subsidy reform in the early 2010s included numerous measures that specifically mitigated the effects on diesel-heavy industries. These included lower prices for agriculture, trucking, public transportation, and industry. |
| Jordan | In order to stave off both lobbying by the transportation sector and popular riots, the government of Jordan temporarily removed the sales tax on public transportation and launched both direct payments to poor households and increases in the minimum wage as part of its efforts at subsidy reform between 2005 and 2012. |
| Kuwait | In large part because it did not rely on diesel very heavily, Kuwait's reforms in the mid-2010s included the removal of subsidies for diesel but not gasoline. In doing so, however, it created a separate, lower price for industries relying heavily on diesel. |
| Nigeria | The end of Nigeria's diesel subsidies in the mid-2000s faced little opposition compared to its failed efforts at reforming gasoline in 2012, in large part because its reliance on the latter fuel is much greater – such that diesel-heavy industries were not able to exert considerable pressure. |
| Turkey | Diesel and gasoline subsidy reform proceeded in tandem in Turkey, with the government exempting public transportation companies from certain taxes and creating a diesel cost rebate program for farmers. |

Table 2: Summary of case studies.

# How Do Sectoral Interests Shape Distributive Politics? Evidence from Gasoline and Diesel Subsidy Reforms

## Supporting Information

*Review of Policy Research*

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August 7, 2017

## Contents

# A1 Data Description

- Table A1 contains various summary statistics for our variables. Table A2 provides pairwise correlation coefficients between diesel, gasoline, and oil prices (constant 2000 USD), while Table A3 provides pairwise correlation coefficients for logged fuel prices, NOC status, and major oil producer status.

- Table A4 provides a list of the 10 countries with the widest gasoline-diesel price gap. Higher values mean a higher gasoline price relative to the diesel price.

- Table A5 contains country-mean values for the six countries selected for the case studies, which shows that these cases were highly diverse on the values of a large number of variables which would be emphasized by alternative explanations for the ease of diesel reform.

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| Fuel price (log) | 4.091 | 0.715 | -0.193 | 5.34 | 2989 |
| NOC * Oil price (log) * Gasoline | 1.732 | 2.782 | 0 | 8.931 | 4262 |
| NOC * Oil price (log) | 1.155 | 1.721 | 0 | 4.465 | 4262 |
| Oil price (log) * Gasoline | 5.361 | 2.039 | 2.576 | 8.931 | 4262 |
| Oil price (log) | 3.574 | 0.621 | 2.576 | 4.465 | 4262 |
| Gas/Diesel Ratio (country mean) | 1.34 | 0.377 | 0.91 | 4.195 | 3442 |
| NOC | 0.315 | 0.465 | 0 | 1 | 4382 |
| NOC (country mean) | 0.315 | 0.45 | 0 | 1 | 4382 |
| Major oil producer | 0.155 | 0.362 | 0 | 1 | 4382 |
| Population (log) | 15.073 | 2.354 | 9.116 | 21.024 | 4252 |
| Polity | 3.192 | 6.585 | -10 | 10 | 3232 |
| GDPpc, 2000 USD (log) | 8.008 | 1.626 | 4.253 | 11.982 | 3882 |
| % urban population | 55.752 | 24.559 | 5.89 | 100 | 4222 |
| Trade (% of GDP) | 89.008 | 52.142 | 0.309 | 531.737 | 3582 |
| Bureaucratic quality | 2.17 | 1.15 | 0 | 4 | 2716 |
| IMF program | 0.259 | 0.437 | 0 | 1 | 4382 |
| Consumer inflation (%) | 16.637 | 112.449 | -18.109 | 3141.803 | 3320 |
| Rural bias | 0.15 | 0.482 | -0.681 | 3.354 | 1230 |

Table A1: Summary statistics.

| Variables | Gas price | Diesel price | Oil price |
| --- | --- | --- | --- |
| Gas price | 1.000 | | |
| Diesel price | 0.917 | 1.000 | |
| Oil price | 0.412 | 0.531 | 1.000 |

Table A2: Correlations between fuel prices and the price of oil.

| Variables | NOC | Major oil producer | Gasoline price (log) | Diesel price (log) |
|---|---|---|---|---|
| NOC | 1.000 | | | |
| Major oil producer | 0.398 | 1.000 | | |
| Gasoline price (log) | -0.337 | -0.466 | 1.000 | |
| Diesel price (log) | -0.361 | -0.431 | 0.938 | 1.000 |

Table A3: Correlations between fuel prices, major oil producer status, and NOC presence.

| Country | Mean Ratio |
|---|---|
| Iran | 4.195 |
| Syria | 2.954 |
| Egypt | 2.524 |
| Jordan | 2.284 |
| Saudi Arabia | 2.157 |
| Sri Lanka | 2.148 |
| Yemen | 2.127 |
| Venezuela | 1.937 |
| Algeria | 1.927 |
| Eritrea | 1.912 |

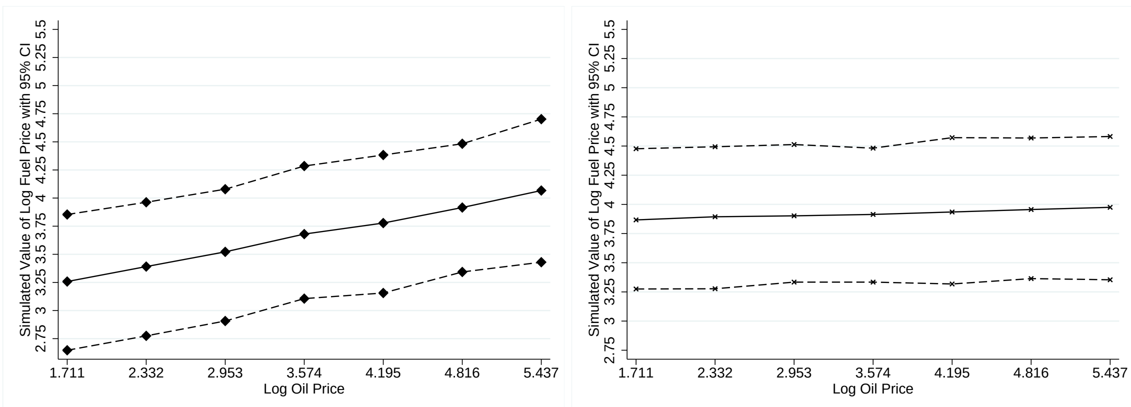
Table A4: Mean gas/diesel ratio for the ten countries with the highest ratio, 1991-2012.

| Country | Polity | Major Oil Producer | Urban Population (%) | Rural Bias | Diesel Dependence |
|---|---|---|---|---|---|
| Iran | -3.5 | Yes | 65.7 | N/A | 0.7 |
| Jordan | -2.4 | No | 80.3 | N/A | 0.7 |
| Kuwait | -7.1 | Yes | 98.2 | N/A | 0.4 |
| Nigeria | 1.6 | Yes | 37.6 | 0.1 | 0.3 |
| Sri Lanka | 5.1 | No | 18.4 | -0.2 | 0.7 |
| Turkey | 7.5 | No | 66.4 | 0.2 | 0.7 |

Table A5: Quantitative summary of case studies for key variables.

## A2 Simulated Fuel Prices

- Figure A1 displays our results from simulations using *Clarify*, which we use to compare how the price of oil affects the prices of gasoline and diesel. The graphs show simulated domestic diesel and gasoline prices at different international oil prices. As the figure shows, domestic diesel prices respond strongly to international oil prices while gasoline prices are virtually flat.




(a) Diesel (b) Gasoline

Figure A1: Simulated fuel price values. The graphs show simulated domestic diesel and gasoline prices at different international oil prices. As the figure shows, domestic diesel prices respond strongly to international oil prices while gasoline prices are virtually flat.

## A3 Robustness

- Table A6 presents the results using a dynamic model in which a lagged dependent variable is used in place of country fixed effects, in order to correct for potential serial correlation.
- Tables A7 and A8 use a country-year level of analysis and limit the sample to the prices of diesel and gasoline, respectively. We do this in order to ensure that our results are not an artifact of the model specification that uses the interaction term, since in those models observations within countries are not independent.
- Tables A9 limits the sample to countries that are not major oil producers, as defined by Ross (2012), while A10 limits the sample to countries that are major oil producers.
- Table A11 subjects our baseline results to a variety of robustness checks. Models 1-3 do not include the NOC interactions, while Models 4-6 do. Models 1 and 4 add two additional control variables: the presence of an IMF program, as well as the consumer inflation rate. Models 2 and 4 exclude countries with a gasoline-to-diesel price ratio of more than 2. Models 3 and 6 exclude OECD countries.
- Tables A12 and A13 use two slightly different operationalizations of our NOC variable, the first using the list of NOCs provided by the World Bank (2008), and the second using that provided by Cheon (2015). We extend the list by including NOCs that meet the following criteria: a government-owned, public company involved in upstream, midstream, and/or downstream oil and gas activities that not only plays a key role in the fuel sector but also makes a significant contribution to the state's revenue (Victor, Hults, and Thurber, 2012). Based on these, we added ten countries to the sample of states that have NOCs.[1] In order to ensure that our findings are not sensitive to these additions, we conducted the analysis using only the original World Bank list, and the results remained virtually unchanged.[2]
- Table A14 presents results uses the country-year as the unit of analysis rather than the country-year-fuel. The dependent variable is the gasoline-diesel price gap – or, the gasoline/diesel ratio.

[1]These are Austria (1956-), Croatia (1964-), Denmark (1972-), Gabon (2011-), Hungary (1988-), Myanmar (1963-), Poland (1982-), Portugal (1999-), Sri Lanka (1961-), and Uruguay (1931-).

[2]The results are also unchanged using the list provided by Cheon (2015), which does not code Peru, Portugal, or Sri Lanka as having an NOC, but which does include the following countries: Cuba (1985-), Greece (1998-), Jordan (1995-), Slovakia (1911-), and Suriname (1980-).

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Fuel price (log)$_{t-1}$ | 0.869*** | 0.868*** | 0.877*** | 0.856*** | 0.861*** | 0.862*** |
| | (0.029) | (0.029) | (0.028) | (0.036) | (0.042) | (0.042) |
| Oil price (log) * Gas | -0.030*** | -0.031*** | -0.030*** | -0.025** | -0.026* | -0.028* |
| | (0.009) | (0.009) | (0.008) | (0.009) | (0.011) | (0.011) |
| Oil price (log) | 0.135*** | 0.146*** | 0.137** | 0.140** | 0.134* | 0.121* |
| | (0.022) | (0.020) | (0.045) | (0.047) | (0.053) | (0.051) |
| NOC | -0.082*** | -0.003 | 0.005 | -0.041 | 0.030 | -0.055** |
| | (0.015) | (0.103) | (0.103) | (0.114) | (0.103) | (0.017) |
| Gasoline | 0.107** | 0.107** | 0.100** | 0.088* | 0.084+ | 0.101* |
| | (0.038) | (0.036) | (0.036) | (0.039) | (0.047) | (0.051) |
| NOC * Oil price (log) * Gas | | 0.004 | 0.004 | -0.009 | -0.004 | |
| | | (0.013) | (0.013) | (0.014) | (0.015) | |
| NOC * Oil price (log) | | -0.023 | -0.024 | -0.009 | -0.026 | |
| | | (0.027) | (0.027) | (0.029) | (0.027) | |
| NOC * Gas | | 0.002 | 0.001 | 0.047 | 0.035 | |
| | | (0.053) | (0.053) | (0.055) | (0.060) | |
| Population (log) | | | | 0.012+ | 0.012+ | 0.012+ |
| | | | | (0.006) | (0.007) | (0.007) |
| Polity | | | | 0.008*** | 0.008*** | 0.008*** |
| | | | | (0.002) | (0.002) | (0.002) |
| GDPpc, 2000 USD (log) | | | | 0.006 | -0.001 | -0.002 |
| | | | | (0.009) | (0.011) | (0.012) |
| % urban population | | | | -0.001 | -0.001 | -0.001 |
| | | | | (0.001) | (0.001) | (0.001) |
| Trade (% of GDP) | | | | 0.000 | 0.000 | 0.000 |
| | | | | (0.000) | (0.000) | (0.000) |
| Bureaucratic quality | | | | | 0.007 | 0.008 |
| | | | | | (0.012) | (0.012) |
| Constant | 0.145* | 0.112 | -0.177 | -0.300 | -0.211 | -0.159 |
| | (0.066) | (0.077) | (0.171) | (0.218) | (0.228) | (0.215) |
| Observations | 2491 | 2491 | 2491 | 2206 | 1912 | 1912 |
| Countries | 167 | 167 | 167 | 152 | 128 | 128 |
| Adjusted $R^2$ | 0.843 | 0.842 | 0.844 | 0.854 | 0.860 | 0.860 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A6: Lagged dependent variable in place of country fixed effects.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Oil price (log) | 0.501$^{***}$ | 0.534$^{***}$ | 0.214$^{***}$ | 0.227$^{***}$ | 0.220$^{***}$ | 0.152$^{***}$ |
| | (0.025) | (0.022) | (0.036) | (0.039) | (0.042) | (0.037) |
| NOC | -0.254$^{**}$ | 0.033 | 0.030 | 0.287 | 0.291 | -0.234$^{**}$ |
| | (0.076) | (0.224) | (0.225) | (0.220) | (0.215) | (0.074) |
| NOC * Oil price (log) | | -0.079 | -0.083 | -0.134$^{**}$ | -0.146$^{**}$ | |
| | | (0.055) | (0.054) | (0.050) | (0.052) | |
| Population (log) | | | | -0.443$^{+}$ | -0.461$^{+}$ | -0.510$^{+}$ |
| | | | | (0.226) | (0.252) | (0.261) |
| Polity | | | | 0.014 | 0.019$^{+}$ | 0.019 |
| | | | | (0.009) | (0.011) | (0.011) |
| GDPpc, 2000 USD (log) | | | | 0.313$^{***}$ | 0.305$^{***}$ | 0.267$^{***}$ |
| | | | | (0.059) | (0.066) | (0.071) |
| % urban population | | | | 0.006 | 0.008 | 0.006 |
| | | | | (0.007) | (0.008) | (0.008) |
| Trade (% of GDP) | | | | -0.001 | -0.002$^{+}$ | -0.002$^{+}$ |
| | | | | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | -0.005 | 0.003 |
| | | | | | (0.039) | (0.040) |
| Constant | 1.614$^{***}$ | 1.479$^{***}$ | 2.761$^{***}$ | 5.801$^{+}$ | 6.831$^{+}$ | 8.343$^{*}$ |
| | (0.095) | (0.106) | (0.191) | (3.253) | (3.987) | (4.160) |
| Observations | 1445 | 1445 | 1445 | 1277 | 1086 | 1086 |
| Countries | 168 | 168 | 168 | 152 | 128 | 128 |
| Adjusted $R^2$ | 0.852 | 0.853 | 0.861 | 0.875 | 0.882 | 0.879 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A7: Sample limited to the price of diesel. Country-year is the unit of analysis.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Oil price (log) | 0.328*** | 0.357*** | 0.096** | 0.114** | 0.109** | 0.054 |
| | (0.021) | (0.020) | (0.034) | (0.038) | (0.041) | (0.034) |
| NOC | -0.241** | 0.006 | 0.017 | 0.214 | 0.174 | -0.247*** |
| | (0.085) | (0.192) | (0.192) | (0.191) | (0.181) | (0.070) |
| NOC * Oil price (log) | | -0.068 | -0.072 | -0.114* | -0.117** | |
| | | (0.045) | (0.045) | (0.045) | (0.044) | |
| Population (log) | | | | -0.316+ | -0.357* | -0.397* |
| | | | | (0.167) | (0.172) | (0.180) |
| Polity | | | | 0.007 | 0.010 | 0.010 |
| | | | | (0.007) | (0.009) | (0.009) |
| GDPpc, 2000 USD (log) | | | | 0.261*** | 0.256*** | 0.226*** |
| | | | | (0.047) | (0.044) | (0.049) |
| % urban population | | | | 0.006 | 0.009 | 0.007 |
| | | | | (0.007) | (0.008) | (0.008) |
| Trade (% of GDP) | | | | -0.002* | -0.001 | -0.001 |
| | | | | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | 0.003 | 0.010 |
| | | | | | (0.030) | (0.030) |
| Constant | 2.994*** | 2.895*** | 4.019*** | 8.368* | 9.629** | 10.858** |
| | (0.073) | (0.071) | (0.153) | (3.410) | (3.499) | (3.684) |
| Observations | 1452 | 1452 | 1452 | 1282 | 1087 | 1087 |
| Countries | 168 | 168 | 168 | 152 | 128 | 128 |
| Adjusted $R^2$ | 0.828 | 0.829 | 0.842 | 0.856 | 0.866 | 0.862 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A8: Sample limited to the price of gasoline. Country-year is the unit of analysis.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Oil price (log) * Gas | -0.182*** | -0.183*** | -0.183*** | -0.180*** | -0.188*** | -0.189*** |
| | (0.013) | (0.016) | (0.016) | (0.016) | (0.016) | (0.019) |
| Gasoline | 0.892*** | 0.860*** | 0.860*** | 0.849*** | 0.918*** | 0.876*** |
| | (0.058) | (0.068) | (0.068) | (0.072) | (0.072) | (0.087) |
| Oil price (log) | 0.539*** | 0.543*** | 0.249*** | 0.269*** | 0.239*** | 0.252*** |
| | (0.018) | (0.022) | (0.032) | (0.036) | (0.035) | (0.042) |
| NOC | -0.240*** | -0.246 | -0.239 | -0.173 | -0.289*** | -0.225 |
| | (0.070) | (0.165) | (0.165) | (0.171) | (0.038) | (0.142) |
| NOC * Oil price (log) * Gas | | 0.003 | 0.003 | -0.009 | | 0.004 |
| | | (0.029) | (0.029) | (0.032) | | (0.033) |
| NOC * Oil price (log) | | -0.012 | -0.013 | -0.034 | | -0.032 |
| | | (0.039) | (0.038) | (0.034) | | (0.038) |
| NOC * Gas | | 0.091 | 0.091 | 0.133 | | 0.093 |
| | | (0.128) | (0.128) | (0.138) | | (0.146) |
| Population (log) | | | | -0.051 | 0.001 | -0.017 |
| | | | | (0.163) | (0.180) | (0.180) |
| Polity | | | | -0.002 | -0.001 | -0.001 |
| | | | | (0.003) | (0.004) | (0.004) |
| GDPpc, 2000 USD (log) | | | | 0.297*** | 0.295*** | 0.298*** |
| | | | | (0.038) | (0.045) | (0.043) |
| % urban population | | | | 0.002 | 0.001 | 0.002 |
| | | | | (0.005) | (0.006) | (0.006) |
| Trade (% of GDP) | | | | -0.001+ | -0.002* | -0.002* |
| | | | | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | 0.021 | 0.019 |
| | | | | | (0.020) | (0.020) |
| Constant | 2.586*** | 2.587*** | 3.789*** | 2.047 | 1.067 | 1.262 |
| | (0.082) | (0.101) | (0.151) | (3.419) | (2.465) | (2.462) |
| Observations | 2328 | 2328 | 2328 | 2030 | 1683 | 1683 |
| Countries | 135 | 135 | 135 | 120 | 98 | 98 |
| Adjusted $R^2$ | 0.784 | 0.786 | 0.806 | 0.828 | 0.828 | 0.831 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A9: Sample limited to non-major oil producers.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Oil price (log) * Gas | -0.141*** | -0.198*** | -0.199*** | -0.192** | -0.186*** | -0.196** |
| | (0.035) | (0.052) | (0.053) | (0.055) | (0.047) | (0.058) |
| Gasoline | 0.844*** | 0.857*** | 0.857*** | 0.828** | 0.984*** | 0.845** |
| | (0.123) | (0.219) | (0.220) | (0.230) | (0.179) | (0.245) |
| Oil price (log) | 0.341** | 0.471*** | 0.215* | 0.219 | 0.079 | 0.315** |
| | (0.094) | (0.079) | (0.104) | (0.130) | (0.090) | (0.113) |
| NOC | -0.154 | 0.241 | 0.235 | 0.776 | -0.043 | 1.120* |
| | (0.141) | (0.532) | (0.554) | (0.603) | (0.166) | (0.534) |
| NOC * Oil price (log) * Gas | | 0.049 | 0.050 | 0.001 | | -0.004 |
| | | (0.064) | (0.064) | (0.077) | | (0.083) |
| NOC * Oil price (log) | | -0.158 | -0.170 | -0.285+ | | -0.364** |
| | | (0.143) | (0.142) | (0.144) | | (0.127) |
| NOC * Gas | | 0.082 | 0.077 | 0.241 | | 0.261 |
| | | (0.258) | (0.258) | (0.309) | | (0.332) |
| Population (log) | | | | -0.250 | -0.434 | -0.065 |
| | | | | (0.412) | (0.391) | (0.389) |
| Polity | | | | 0.079* | 0.074* | 0.075* |
| | | | | (0.034) | (0.032) | (0.031) |
| GDPpc, 2000 USD (log) | | | | 0.452** | 0.335** | 0.459*** |
| | | | | (0.143) | (0.110) | (0.107) |
| % urban population | | | | -0.010 | 0.006 | 0.008 |
| | | | | (0.022) | (0.021) | (0.020) |
| Trade (% of GDP) | | | | -0.002 | -0.003 | -0.003 |
| | | | | (0.003) | (0.003) | (0.003) |
| Bureaucratic quality | | | | | -0.165 | -0.121 |
| | | | | | (0.157) | (0.175) |
| Constant | 2.124*** | 1.790*** | 2.544*** | 2.817 | 7.408 | -1.997 |
| | (0.261) | (0.264) | (0.567) | (9.247) | (7.633) | (7.919) |
| Observations | 569 | 569 | 569 | 529 | 490 | 490 |
| Countries | 33 | 33 | 33 | 32 | 30 | 30 |
| Adjusted $R^2$ | 0.813 | 0.816 | 0.821 | 0.858 | 0.879 | 0.890 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A10: Sample limited to major oil producers.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Gasoline | 0.929*** | 0.657*** | 1.020*** | 0.850*** | 0.675*** | 0.958*** |
| | (0.073) | (0.042) | (0.084) | (0.079) | (0.053) | (0.099) |
| Oil price (log) * Gas | -0.186*** | -0.127*** | -0.201*** | -0.183*** | -0.141*** | -0.205*** |
| | (0.017) | (0.011) | (0.021) | (0.018) | (0.012) | (0.023) |
| Oil price (log) | 0.198*** | 0.176*** | 0.238*** | 0.235*** | 0.224*** | 0.311*** |
| | (0.032) | (0.036) | (0.041) | (0.038) | (0.040) | (0.047) |
| NOC * Oil price (log) * Gas | | | | -0.007 | 0.025 | 0.005 |
| | | | | (0.034) | (0.021) | (0.040) |
| NOC * Gas | | | | 0.156 | -0.026 | 0.122 |
| | | | | (0.142) | (0.081) | (0.163) |
| NOC * Oil price (log) | | | | -0.077+ | -0.108** | -0.144* |
| | | | | (0.045) | (0.041) | (0.064) |
| NOC | -0.245*** | -0.249*** | -0.245*** | -0.036 | 0.104 | 0.206 |
| | (0.067) | (0.054) | (0.057) | (0.185) | (0.164) | (0.253) |
| Population (log) | -0.472* | -0.408+ | -0.546* | -0.442* | -0.372+ | -0.470* |
| | (0.204) | (0.208) | (0.237) | (0.191) | (0.200) | (0.232) |
| Polity | 0.006 | 0.008 | 0.013 | 0.006 | 0.008 | 0.012 |
| | (0.006) | (0.006) | (0.010) | (0.006) | (0.006) | (0.010) |
| GDPpc, 2000 USD (log) | 0.305*** | 0.266*** | 0.214** | 0.324*** | 0.294*** | 0.255*** |
| | (0.057) | (0.054) | (0.065) | (0.054) | (0.050) | (0.061) |
| % urban population | 0.006 | 0.005 | 0.007 | 0.007 | 0.005 | 0.008 |
| | (0.007) | (0.007) | (0.009) | (0.007) | (0.007) | (0.009) |
| Trade (% of GDP) | -0.002* | -0.002* | -0.002 | -0.002* | -0.002+ | -0.002 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | 0.005 | 0.023 | 0.008 | -0.002 | 0.016 | -0.001 |
| | (0.034) | (0.028) | (0.035) | (0.033) | (0.028) | (0.034) |
| IMF program | 0.024 | | | 0.019 | | |
| | (0.028) | | | (0.028) | | |
| Consumer inflation (%) | 0.000 | | | 0.000 | | |
| | (0.000) | | | (0.000) | | |
| Constant | 7.995* | 7.434* | 9.518* | 7.287* | 6.497* | 7.850* |
| | (3.088) | (3.120) | (3.709) | (2.883) | (2.970) | (3.622) |
| Observations | 2049 | 1980 | 1673 | 2049 | 1980 | 1673 |
| Countries | 126 | 126 | 106 | 126 | 126 | 106 |
| Adjusted $R^2$ | 0.868 | 0.852 | 0.836 | 0.872 | 0.855 | 0.841 |

Standard errors clustered by country in parentheses. All models include country fixed effects and linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A11: Adding additional controls and excluding outliers.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Gasoline | 0.882*** | 0.862*** | 0.862*** | 0.854*** | 0.887*** | 0.934*** |
| | (0.052) | (0.064) | (0.064) | (0.067) | (0.080) | (0.069) |
| Oil price (log) * Gas | -0.174*** | -0.183*** | -0.183*** | -0.182*** | -0.192*** | -0.188*** |
| | (0.013) | (0.014) | (0.014) | (0.015) | (0.018) | (0.016) |
| Oil price (log) | 0.500*** | 0.533*** | 0.242*** | 0.251*** | 0.249*** | 0.194*** |
| | (0.024) | (0.020) | (0.032) | (0.036) | (0.039) | (0.033) |
| NOC | -0.242** | 0.006 | 0.003 | 0.155 | 0.186 | -0.228*** |
| | (0.074) | (0.231) | (0.232) | (0.232) | (0.231) | (0.052) |
| NOC * Oil price (log) * Gas | | 0.021 | 0.022 | -0.005 | 0.009 | |
| | | (0.028) | (0.028) | (0.032) | (0.034) | |
| NOC * Gas | | 0.072 | 0.071 | 0.156 | 0.110 | |
| | | (0.113) | (0.112) | (0.131) | (0.140) | |
| NOC * Oil price (log) | | -0.087 | -0.090 | -0.112* | -0.132* | |
| | | (0.057) | (0.057) | (0.055) | (0.057) | |
| Population (log) | | | | -0.336+ | -0.356+ | -0.453* |
| | | | | (0.182) | (0.196) | (0.209) |
| Polity | | | | 0.010 | 0.014 | 0.014 |
| | | | | (0.008) | (0.010) | (0.010) |
| GDPpc, 2000 USD (log) | | | | 0.289*** | 0.285*** | 0.248*** |
| | | | | (0.048) | (0.050) | (0.055) |
| % urban population | | | | 0.007 | 0.009 | 0.006 |
| | | | | (0.007) | (0.008) | (0.008) |
| Trade (% of GDP) | | | | -0.002+ | -0.002+ | -0.002+ |
| | | | | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | -0.000 | 0.006 |
| | | | | | (0.032) | (0.032) |
| Constant | 1.707*** | 1.596*** | 2.798*** | 4.661+ | 4.919+ | 6.780* |
| | (0.096) | (0.103) | (0.175) | (2.582) | (2.792) | (3.011) |
| Observations | 2897 | 2897 | 2897 | 2559 | 2173 | 2173 |
| Countries | 168 | 168 | 168 | 152 | 128 | 128 |
| Adjusted $R^2$ | 0.833 | 0.836 | 0.846 | 0.858 | 0.864 | 0.859 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A12: NOC variable coded using list from the World Bank (2008).

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Gasoline | 0.882*** | 0.844*** | 0.843*** | 0.831*** | 0.853*** | 0.934*** |
| | (0.052) | (0.064) | (0.064) | (0.066) | (0.079) | (0.069) |
| Oil price (log) * Gas | -0.174*** | -0.179*** | -0.178*** | -0.176*** | -0.183*** | -0.188*** |
| | (0.013) | (0.015) | (0.015) | (0.015) | (0.018) | (0.016) |
| Oil price (log) | 0.501*** | 0.526*** | 0.236*** | 0.248*** | 0.241*** | 0.194*** |
| | (0.024) | (0.021) | (0.033) | (0.036) | (0.039) | (0.033) |
| NOC | -0.235*** | -0.093 | -0.093 | 0.079 | 0.055 | -0.229*** |
| | (0.067) | (0.207) | (0.208) | (0.208) | (0.202) | (0.046) |
| NOC * Oil price (log) * Gas | | 0.006 | 0.006 | -0.017 | -0.010 | |
| | | (0.027) | (0.027) | (0.030) | (0.032) | |
| NOC * Gas | | 0.107 | 0.106 | 0.184 | 0.165 | |
| | | (0.110) | (0.110) | (0.125) | (0.135) | |
| NOC * Oil price (log) | | -0.057 | -0.061 | -0.092+ | -0.096+ | |
| | | (0.052) | (0.052) | (0.049) | (0.051) | |
| Population (log) | | | | -0.386* | -0.419* | -0.455* |
| | | | | (0.185) | (0.201) | (0.209) |
| Polity | | | | 0.010 | 0.014 | 0.014 |
| | | | | (0.008) | (0.010) | (0.010) |
| GDPpc, 2000 USD (log) | | | | 0.282*** | 0.275*** | 0.248*** |
| | | | | (0.048) | (0.050) | (0.054) |
| % urban population | | | | 0.005 | 0.007 | 0.006 |
| | | | | (0.007) | (0.007) | (0.008) |
| Trade (% of GDP) | | | | -0.002+ | -0.001+ | -0.002+ |
| | | | | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | -0.001 | 0.006 |
| | | | | | (0.032) | (0.032) |
| Constant | 2.099*** | 2.038*** | 3.286*** | 5.436* | 6.595* | 7.646* |
| | (0.083) | (0.077) | (0.153) | (2.619) | (3.121) | (3.279) |
| Observations | 2897 | 2897 | 2897 | 2559 | 2173 | 2173 |
| Countries | 168 | 168 | 168 | 152 | 128 | 128 |
| Adjusted $R^2$ | 0.833 | 0.835 | 0.845 | 0.858 | 0.863 | 0.859 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A13: NOC variable coded using list from Cheon (2015).

| | (1) Gas/Diesel Ratio | (2) Gas/Diesel Ratio | (3) Gas/Diesel Ratio | (4) Gas/Diesel Ratio | (5) Gas/Diesel Ratio | (6) Gas/Diesel Ratio |
|---|---|---|---|---|---|---|
| Oil price (log) | -0.253*** | -0.244*** | -0.161** | -0.148** | -0.138* | -0.145* |
| | (0.024) | (0.027) | (0.059) | (0.050) | (0.058) | (0.056) |
| NOC | -0.015 | 0.065 | 0.085 | -0.030 | -0.048 | -0.103 |
| | (0.126) | (0.224) | (0.225) | (0.226) | (0.189) | (0.260) |
| NOC * Oil price (log) | | -0.022 | -0.021 | 0.001 | | 0.015 |
| | | (0.050) | (0.050) | (0.050) | | (0.054) |
| Population (log) | | | | 0.234 | 0.186 | 0.181 |
| | | | | (0.175) | (0.180) | (0.184) |
| Polity | | | | -0.007 | -0.010 | -0.010 |
| | | | | (0.007) | (0.008) | (0.008) |
| GDPpc, 2000 USD (log) | | | | -0.073 | -0.064 | -0.068 |
| | | | | (0.063) | (0.072) | (0.073) |
| % urban population | | | | -0.000 | 0.003 | 0.002 |
| | | | | (0.007) | (0.009) | (0.008) |
| Trade (% of GDP) | | | | -0.000 | 0.001 | 0.001 |
| | | | | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | 0.018 | 0.019 |
| | | | | | (0.041) | (0.041) |
| Constant | 2.672*** | 2.634*** | 2.446*** | -2.510 | -0.962 | -0.802 |
| | (0.138) | (0.154) | (0.252) | (3.731) | (3.788) | (3.898) |
| Observations | 1443 | 1443 | 1443 | 1276 | 1085 | 1085 |
| Countries | 168 | 168 | 168 | 152 | 128 | 128 |
| Adjusted $R^2$ | 0.622 | 0.622 | 0.625 | 0.641 | 0.647 | 0.647 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A14: Results for the gasoline-diesel subsidy gap. The unit of analysis is the country-year.

## A4 Further Analysis

- Table A15 presents the results after adding the Relative Rates of Assistance (rra) variable from the World Bank's Distortions to Agricultural Incentives Database (Anderson and Nelsen, 2013). For this variable, "If the agricultural and nonagricultural sectors are equally assisted, the RRA is zero. This measure is useful in that if it is below (above) zero, it provides an internationally comparable indication of the extent to which a country's sectoral policy regime has an antiagricultural (proagricultural) bias" (Anderson, 2009, 12). This variable has a mean of 0.150 and a standard deviation of 0.482, with a minimum and maximum of -0.681 and 3.354. Higher values indicate greater agricultural price distortions.

- Tables A16, A17, and A18 assess the difference in the influence of oil prices on diesel and gasoline prices between democracies and non-democracies. Democracies here are defined as countries scoring 6 or higher on the composite Polity score. To simplify exposition we create a binary indicator for democracy by including country-years with a Polity IV composite score equal to or above 6. Fifty-eight countries were democracies during the entire period, while 112 were non-democracies throughout and 49 switched regime type at some point. Tables A16 and A17 split the sample between democracies and autocracies, respectively. Table A18 interacts the oil and fuel price variables with the democracy dummy variable.

- Table A19 presents results showing how countries' dependence on diesel fuel affects their propensity to subsidize diesel vs. gasoline. The Diesel Share variable is calculated using the proportion of diesel consumption to diesel and gasoline consumption. Since fuel consumption is likely to be a function of fuel prices, in order to mitigate concerns about endogeneity we measure Diesel Share using countries' proportion from 1990, which is one of the first years for which fuel consumption data are available from the U.S. Energy Information Administration. Thus, the Diesel Share variable is time-invariant across countries.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) |
|---|---|---|---|---|
| Oil price (log) * Gas | -0.195*** | -0.190*** | -0.189*** | -0.190*** |
| | (0.020) | (0.021) | (0.021) | (0.022) |
| Oil price (log) | 0.236*** | 0.233*** | 0.200*** | 0.194*** |
| | (0.051) | (0.051) | (0.044) | (0.045) |
| Rural bias | 0.338+ | 0.247 | 0.201 | 0.178 |
| | (0.196) | (0.257) | (0.264) | (0.272) |
| Rural bias * Gasoline | -0.065 | 0.117 | -0.007 | -0.006 |
| | (0.067) | (0.202) | (0.174) | (0.176) |
| Rural bias * Oil price (log) | -0.007 | 0.021 | -0.015 | -0.011 |
| | (0.066) | (0.083) | (0.073) | (0.073) |
| Gasoline | 0.937*** | 0.919*** | 0.916*** | 0.920*** |
| | (0.082) | (0.084) | (0.085) | (0.087) |
| NOC | -0.391*** | -0.391*** | -0.287*** | -0.286*** |
| | (0.057) | (0.057) | (0.058) | (0.060) |
| Rural bias * Gas * Oil price (log) | | -0.055 | -0.028 | -0.028 |
| | | (0.049) | (0.044) | (0.044) |
| Population (log) | | | 0.388 | 0.518 |
| | | | (0.331) | (0.348) |
| Polity | | | 0.001 | 0.001 |
| | | | (0.008) | (0.008) |
| GDPpc, 2000 USD (log) | | | 0.428*** | 0.416*** |
| | | | (0.075) | (0.079) |
| % urban population | | | 0.005 | 0.006 |
| | | | (0.009) | (0.009) |
| Trade (% of GDP) | | | -0.002* | -0.002* |
| | | | (0.001) | (0.001) |
| Bureaucratic quality | | | | -0.006 |
| | | | | (0.035) |
| Constant | 3.541*** | 3.550*** | -5.983 | -7.661 |
| | (0.261) | (0.262) | (5.093) | (5.281) |
| Observations | 1148 | 1148 | 1128 | 1116 |
| Countries | 74 | 74 | 72 | 72 |
| Adjusted $R^2$ | 0.813 | 0.813 | 0.840 | 0.840 |

Standard errors clustered by country in parentheses. All models include country fixed effects and linear, squared, and cubic time trends.
$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A15: Results when interacting the oil price variable with a measure of distortions to agricultural incentives.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Oil price (log) * Gas | -0.188*** | -0.185*** | -0.185*** | -0.186*** | -0.190*** | -0.192*** |
| | (0.017) | (0.017) | (0.017) | (0.017) | (0.018) | (0.018) |
| Oil price (log) | 0.534*** | 0.545*** | 0.201*** | 0.211*** | 0.207*** | 0.197*** |
| | (0.023) | (0.025) | (0.037) | (0.035) | (0.039) | (0.035) |
| Gasoline | 0.885*** | 0.833*** | 0.833*** | 0.838*** | 0.847*** | 0.898*** |
| | (0.072) | (0.072) | (0.072) | (0.073) | (0.079) | (0.078) |
| NOC | -0.354*** | -0.276 | -0.270 | -0.156 | -0.157 | -0.198*** |
| | (0.023) | (0.176) | (0.176) | (0.144) | (0.152) | (0.031) |
| NOC * Gas | | 0.105** | 0.106** | 0.105** | 0.109** | |
| | | (0.033) | (0.033) | (0.033) | (0.034) | |
| NOC * Oil price (log) | | -0.036 | -0.035 | -0.031 | -0.026 | |
| | | (0.045) | (0.045) | (0.037) | (0.039) | |
| Population (log) | | | | 0.061 | 0.199 | 0.213 |
| | | | | (0.207) | (0.236) | (0.238) |
| GDPpc, 2000 USD (log) | | | | 0.336*** | 0.331*** | 0.330*** |
| | | | | (0.036) | (0.040) | (0.041) |
| % urban population | | | | 0.003 | 0.003 | 0.003 |
| | | | | (0.006) | (0.006) | (0.006) |
| Trade (% of GDP) | | | | -0.003** | -0.002* | -0.002* |
| | | | | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | -0.028 | -0.026 |
| | | | | | (0.032) | (0.032) |
| Constant | 1.811*** | 1.797*** | 2.911*** | -1.937 | -4.440 | -4.682 |
| | (0.103) | (0.113) | (0.176) | (3.947) | (4.500) | (4.541) |
| Observations | 1478 | 1478 | 1478 | 1444 | 1319 | 1319 |
| Countries | 99 | 99 | 98 | 87 | | |
| Adjusted $R^2$ | 0.841 | 0.843 | 0.863 | 0.880 | 0.882 | 0.879 |

Standard errors clustered by country in parentheses. All models include country fixed effects and linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A16: Main results, limited to democracies.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Oil price (log) * Gas | -0.150*** | -0.161*** | -0.160*** | -0.172*** | -0.175*** | -0.164*** |
| | (0.022) | (0.020) | (0.020) | (0.024) | (0.030) | (0.032) |
| Oil price (log) | 0.476*** | 0.515*** | 0.285*** | 0.298*** | 0.331*** | 0.193** |
| | (0.042) | (0.039) | (0.059) | (0.065) | (0.091) | (0.068) |
| Gasoline | 0.847*** | 0.814*** | 0.812*** | 0.873*** | 0.910*** | 0.939*** |
| | (0.083) | (0.083) | (0.083) | (0.095) | (0.120) | (0.121) |
| NOC | -0.213* | -0.045 | 0.004 | 0.366 | 0.538+ | -0.251** |
| | (0.085) | (0.294) | (0.300) | (0.282) | (0.281) | (0.089) |
| NOC * Gas | | 0.155** | 0.155** | 0.131* | 0.111+ | |
| | | (0.056) | (0.056) | (0.054) | (0.065) | |
| NOC * Oil price (log) | | -0.068 | -0.082 | -0.182* | -0.243** | |
| | | (0.075) | (0.075) | (0.070) | (0.075) | |
| Population (log) | | | | -0.362 | -0.335 | -0.439 |
| | | | | (0.270) | (0.300) | (0.317) |
| GDPpc, 2000 USD (log) | | | | 0.320*** | 0.368*** | 0.270* |
| | | | | (0.087) | (0.103) | (0.111) |
| % urban population | | | | 0.005 | 0.008 | 0.004 |
| | | | | (0.010) | (0.012) | (0.013) |
| Trade (% of GDP) | | | | -0.001 | -0.001 | -0.000 |
| | | | | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | -0.040 | -0.027 |
| | | | | | (0.056) | (0.058) |
| Constant | 2.816*** | 2.685*** | 3.698*** | 4.093 | 5.802 | 9.043 |
| | (0.181) | (0.178) | (0.269) | (3.276) | (6.022) | (6.435) |
| Observations | 1419 | 1419 | 1419 | 1292 | 932 | 932 |
| Countries | 108 | 108 | 103 | 75 | | |
| Adjusted $R^2$ | 0.824 | 0.826 | 0.834 | 0.848 | 0.855 | 0.848 |

Standard errors clustered by country in parentheses. All models include country fixed effects and linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A17: Main results, limited to non-democracies.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) |
|---|---|---|---|---|
| Oil price (log) * Gas | -0.169*** | -0.149*** | -0.156*** | -0.162*** |
| | (0.013) | (0.022) | (0.027) | (0.032) |
| Oil price (log) | 0.195*** | 0.185*** | 0.181*** | 0.125* |
| | (0.037) | (0.039) | (0.047) | (0.058) |
| Democracy | 0.055 | -0.018 | -0.044 | -0.287 |
| | (0.150) | (0.164) | (0.175) | (0.209) |
| Gas * Democ | -0.104** | 0.040 | 0.009 | -0.026 |
| | (0.032) | (0.112) | (0.130) | (0.150) |
| Gasoline | 0.917*** | 0.845*** | 0.879*** | 0.923*** |
| | (0.054) | (0.082) | (0.104) | (0.125) |
| Oil price (log) * Democ | 0.025 | 0.045 | 0.045 | 0.107+ |
| | (0.040) | (0.046) | (0.050) | (0.060) |
| NOC | -0.241*** | -0.241*** | -0.183* | -0.224*** |
| | (0.071) | (0.071) | (0.075) | (0.052) |
| Oil price (log) * Gasoline * Democ | | -0.040 | -0.033 | -0.029 |
| | | (0.028) | (0.033) | (0.038) |
| Population (log) | | | -0.367+ | -0.309 |
| | | | (0.196) | (0.213) |
| Polity | | | 0.006 | 0.014 |
| | | | (0.008) | (0.011) |
| GDPpc, 2000 USD (log) | | | 0.263*** | 0.269*** |
| | | | (0.054) | (0.058) |
| % urban population | | | 0.005 | 0.008 |
| | | | (0.007) | (0.008) |
| Trade (% of GDP) | | | -0.002* | -0.001 |
| | | | (0.001) | (0.001) |
| Bureaucratic quality | | | | 0.001 |
| | | | | (0.030) |
| Constant | 2.850*** | 2.886*** | 5.531+ | 4.777 |
| | (0.173) | (0.177) | (2.843) | (3.097) |
| Observations | 2897 | 2897 | 2559 | 2173 |
| Countries | 168 | 168 | 152 | 128 |
| Adjusted $R^2$ | 0.844 | 0.844 | 0.856 | 0.863 |

Standard errors clustered by country in parentheses. All models include country fixed effects and linear, squared, and cubic time trends.
$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A18: Results when interacting the oil price and fuel type variables with democracy.

| | (1) Price (log) | (2) Price (log) | (3) Price (log) | (4) Price (log) | (5) Price (log) | (6) Price (log) |
|---|---|---|---|---|---|---|
| Diesel share * Gas | 0.296* | 0.808* | 0.302* | 0.965* | 0.277* | 0.928* |
| | (0.121) | (0.325) | (0.122) | (0.371) | (0.130) | (0.401) |
| Diesel share * Oil price (log) | 0.252 | 0.323 | 0.261 | 0.354+ | 0.305 | 0.397+ |
| | (0.176) | (0.201) | (0.177) | (0.202) | (0.193) | (0.219) |
| Diesel share * Oil price (log) * Gas | | -0.142 | | -0.185+ | | -0.182+ |
| | | (0.087) | | (0.098) | | (0.107) |
| Oil price (log) * Gas | -0.176*** | -0.093+ | -0.183*** | -0.074 | -0.185*** | -0.079 |
| | (0.014) | (0.054) | (0.016) | (0.060) | (0.017) | (0.065) |
| Gasoline | 0.724*** | 0.421* | 0.738*** | 0.346 | 0.769*** | 0.388 |
| | (0.079) | (0.194) | (0.081) | (0.219) | (0.086) | (0.235) |
| Oil price (log) | 0.329** | 0.286* | 0.043 | -0.012 | 0.016 | -0.037 |
| | (0.120) | (0.134) | (0.116) | (0.130) | (0.126) | (0.141) |
| NOC | -0.266*** | -0.266*** | -0.205** | -0.205** | -0.240*** | -0.240*** |
| | (0.055) | (0.055) | (0.067) | (0.067) | (0.050) | (0.050) |
| Population (log) | | | -0.414* | -0.414* | -0.414* | -0.414* |
| | | | (0.189) | (0.189) | (0.200) | (0.200) |
| Polity | | | 0.011 | 0.011 | 0.014 | 0.014 |
| | | | (0.008) | (0.008) | (0.010) | (0.010) |
| GDPpc, 2000 USD (log) | | | 0.261*** | 0.261*** | 0.260*** | 0.260*** |
| | | | (0.058) | (0.058) | (0.065) | (0.065) |
| % urban population | | | 0.007 | 0.007 | 0.007 | 0.007 |
| | | | (0.007) | (0.007) | (0.008) | (0.008) |
| Trade (% of GDP) | | | -0.002* | -0.002* | -0.002* | -0.002* |
| | | | (0.001) | (0.001) | (0.001) | (0.001) |
| Bureaucratic quality | | | | | 0.005 | 0.005 |
| | | | | | (0.033) | (0.033) |
| Constant | 1.965*** | 1.889*** | 6.504* | 6.610* | 9.707* | 6.656* |
| | (0.166) | (0.192) | (2.749) | (2.764) | (4.167) | (2.948) |
| Observations | 2496 | 2496 | 2248 | 2248 | 2023 | 2023 |
| Adjusted $R^2$ | 0.839 | 0.839 | 0.860 | 0.860 | 0.861 | 0.861 |

Standard errors clustered by country in parentheses. All models include country fixed effects. Models 3-6 include linear, squared, and cubic time trends.

$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A19: Results when interacting the oil price and fuel type variables with the share of diesel consumption as a proportion of total fuel consumption in 1990.

## A5 Sri Lanka Case Study

In Sri Lanka, government price controls set the cost of petroleum products up until 2006, despite a brief attempt in 2002 to tie the price of domestic fuel more closely to the market price (International Monetary Fund, 2006, 14-15). While Sri Lanka's gasoline prices were persistently high throughout the 1990s and 2000s, the price of diesel was significantly lower. In 2004, gasoline was $0.66 per liter, compared to $0.50 in the United States, while diesel was $0.38, versus $0.52 in the United States. The Sri Lankan Ministry of Finance and Planning (2005, 20) estimated that diesel subsidies cost the country more than 12 billion rupees in 2004, while those on gasoline totaled less than 2 billion. Consistent with this, average daily Sri Lankan consumption of diesel was dramatically higher than that of gasoline from 2000-2010, averaging 34,800 and 9,200 barrels per day, respectively – a difference of over fourfold.

In response to rising oil prices in the mid-2000s, Sri Lanka curtailed its subsidies. As a result of these reforms, the price of petroleum products increased substantially. Diesel remained cheaper than gasoline by the late 2000s, with an average price of $0.72 per liter in 2012, compared to $1.00 for gasoline. However, diesel increased proportionately more – 89% between 2004 and 2012, compared to 52% for gasoline (International Monetary Fund, 2006, 6-8, 12, 15).

Despite reform, diesel subsidies remained substantial into the 2010s, for the purpose of keeping costs low for the transportation sector. Gasoline and diesel were exempted from customs duties and the value-added tax, and buses were largely exempt from the high taxes imposed upon passenger vehicles (Central Bank of Sri Lanka, 2010, 130).[3] Similarly, in 2011 "A full customs duty waiver was granted for diesel...and only an excise tax of Rs.2.50 per litre and the PAL of 5 per cent were applicable on diesel imports" (Central Bank of Sri Lanka, 2011, 127). In the wake of subsidy reforms in 2005, "targeted subsidy schemes for three wheeler operations and for fishing boats were implemented" (Ministry of Finance and Planning, 2005, 18).

When prices were again raised in 2011, after an extended period of protest the fishing industry was granted significant exemption from the reforms, securing subsidized diesel at a rate of twelve rupees per liter.[4] Bus drivers similarly went on strike, demanding compensation in light of the price increases, and also offered to refrain from a twenty percent fare increase in exchange for diesel subsidies (International

[3]"A pragmatic step," *Sunday Observer* (Sri Lanka), June 6, 2010.

[4]"Subsidy bonanza for fishermen," *Daily News* (Sri Lanka), February 15, 2012; "Fuel subsidy – 130,000 fisher families to benefit," *Sunday Observer* (Sri Lanka), March 11, 2012.

Monetary Fund, 2006, 24; Kojima, 2013, 14, 67).[5]

The Sri Lankan case again suggests that governments can and do use targeted compensation to appease concentrated sectoral interests when undertake costly fuel subsidy reform. Both public transportation and private transportation, as well as fisheries, secured significant exemptions or compensation through protests, riots, and strikes. In contrast, broader protests by the mass public did not appear to play a role in determining the social policies that went with the subsidy reforms.

[5] "PBOA: Increase bus fares by 15%," *Daily Mirror* (Sri Lanka), May 4, 2011; "Pvt bus operators threaten strike action from Monday night," *Sunday Times* (Sri Lanka), November 13, 2011; "Will forego fare if fuel subsidy is provided: Wijeratne," *Daily Mirror* (Sri Lanka), February 15, 2012.

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