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Political Economy Aspects of Fuel Subsidies

A Conceptual Framework

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Abstract

While notoriously inefficient, fuel subsidies are widespread, and in many cases politically stable. This paper discusses and models various political economy aspects of fuel subsidies, focusing on gasoline and kerosene. Both economic and political are considered to explain differences in subsidies, with particular focus on democratic and autocratic governments. A political process is modeled whereby a promise of low fuel prices is used in democracies to attract voters, and in autocracies to mobilize support among key groups. Subsidies to fuels are viewed as either easier to observe, easier to commit to, easier to deliver, or better targeted at core groups, than other public goods or favors offered by rulers. Easier commitment and delivery than for regular public goods can explain the high prevalence of such policies in autocracies, and also in young democracies where the capacity to commit to or deliver complex public goods is not yet fully developed. The analysis provides a framework for empirical testing and verification.

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Political Economy Aspects of Fuel Subsidies: A Conceptual Framework

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Introduction

This paper develops a conceptual framework related to the political economy of fuel subsidies, with a view to subsequent empirical applications. The paper seeks to provide systematic explanations of why and how fuel prices, including subsidies to or taxes on fuels, vary between countries. A key question in this context is how formal models can be fruitfully specified, and subsequently parameterized and estimated, to give more substance to empirical relationships between fuel prices, political variables, and other variables.

This research grows out of empirical work currently ongoing in the World Bank dealing with energy subsidies and related themes. For previous broader discussions of such issues see World Bank (2011), and Commander (2011). Current work focuses on building, estimating and testing empirical models for fuel (gasoline, diesel and kerosene) pricing across countries over a 20-year period, based on a much more extensive data set for such pricing integrated with a wide range of economic and political variables; see Strand (2011); Beers and Strand (2012); and Kotsogiannis (2011). Recently it has also become possible to match these with data for car ownership by country for a large set of countries (matching many albeit not all of the countries for which we have fuel price and consumption data).[2]

Some empirical political economy aspects of fuel pricing have been treated in earlier papers, including Hammar, Löfgren and Sterner (2004), and Fredriksson and Millimet (2004), albeit on the basis of far more limited data sets than those we have available. Most existing work has focused on high-income countries. Our improved data situation also opens up the possibility to meaningfully include a range of new political variables, representing democratic or autocratic governments, length of regime or regime type tenure, and democratic system (such as presidential versus parliamentarian).

For this exercise I find it useful to start with a rather coarse classification of government types and population groups, to make a preliminary investigation of what factors are likely to mainly drive their interests in each case. I also distinguish between fuel types and focus on gasoline and kerosene which may seem as rather "opposite" in terms of political backing and interest in terms of constituencies interested in low prices: gasoline is presumably, on the whole, preferred by households in the middle class, and kerosene by households with lower average incomes (in the lower class by my classification). Classes are defined in a stylized way.[3] By middle class I will

[2] Car stock data have, been subject to serious empirical scrutiny in previous research. See e.g. Dargay (1991; 2001; 2002), Fridstrøm (1998); Lescaroux and Rech (2008), Medlock and Soligo (2002) focusing on high-income countries; and Dargay, Gately and Sommer (2007) and Storchmann (2005) where also lower-income countries are included.

[3] I do not discuss separately an upper class. In a democracy, this would be non-consequential given that it is very small as compared to the two other classes. In an autocracy it could be more consequential. My approach here is then simply (for such cases) to lump it with the middle class by assuming that households in both classes consume, and are concerned with the price of, gasoline.

roughly mean a population group with substantial purchasing and financial power (at least relative to the lower-class households in the given society), (usually) with more than a minimum education, and usually with substantial political power, both in democracies and autocracies, and with high voting propensities in democracies. I will make a further distinction, between middle class households who own motor vehicles and those who do not, and assume that only the former have strong preferences for low gasoline prices.[4] This can be empirically important as the extent of car ownership, a variable for which we have substantial data, differs widely across countries, and is still very low in many countries, and often covers only a low share of those naturally identified as the middle class.

By lower class I will mean a population group with only a minimum buying power, and little financing power outside of necessities of life, and with only a basic or no education. I will assume that very few households in this group own cars, and (in countries where appropriate) that they consume kerosene for heating and cooking.

A further distinction between the middle and lower classes is that while middle-class individuals can (and often do) give financial contributions to politicians and politically important actors, I will assume that the lower-class individuals do not. Another politically important distinction in the context of democracies is that while the voting frequency of middle class individuals is often (and is here assumed to be) very high, voting frequencies of lower class individuals are more volatile and typically lower. But this could be more complicated: our predicted relationship is likely to hold in particular for young democracies (where often only the most literate, usually higher-income, groups would have high voting propensities); but perhaps less so for old and very established democracies, where just the right to vote is considered one of the main favors of the poor.[5]

A second main distinction is between democracy and autocracy. This distinction is often not sharp. In particular, a formally democratic regime (with a formally elected leadership) can be more or less democratic in the sense of involving the populace in actual decision making. One can think of a sliding scale from very democratic to very autocratic regimes.[6] Note that most of the formal literature on political economy, at least in economics, deals with economic policies under formally democratic regimes; there is much less literature dealing with authoritarian

[4] This is a slightly different definition from that applied by Ferreira et al (2012) for Latin America; where income is the key issue. The concepts are however not that different: in both cases, the potential to own motor vehicles play a large role in defining the middle class.

[5] An important and illustrative case in point is India, a now very old and established democracy, where voting propensities are very high among the poorest groups; this fits well with the fact that electric power subsidies in India are the highest for the (largely poor) farming community. In some formal democracies (such as Venezuela), much of the public may also be subject to great "populist" pressure from the top of government.

[6] Empirically, the so-called "Polity 4" variable is constructed to represent such a gliding scale, from -10 as the most authoritarian and +10 as the most democratic; see Marshall, Jaggers and Gurr (2011).

regimes.[7] Yet, part of our task is to make this distinction, which is arguably very important in practice.

A main difference between democratic and autocratic governments in my context is that vote getting is central for politicians in democracies, but much less so in autocracies. A key issue is then, in democracies, to consider how policies are shaped so as to maximally capture voters. Under extreme autocracy or authoritarianism, by contrast, vote getting is of no concern, while staying in power more generally is. It may still be difficult to draw a sharp empirical distinction between these two mechanisms, since authoritarian governments will also need to mobilize support from key groups. But a clear difference is that an autocratic government will a) be concerned mainly with staying in power outside of an electoral political process, thus not needing broad popular support crucial for a democratic government; and b) have little concern for the welfare of broad population groups and generally less so than a democratic government; in particular, key support groups are often far smaller than in democracies. One consequence may be to expect autocratic governments to supply less public goods than democratic governments.[8] This of course also depends on the amount of resources available to the regimes: some very resource-rich autocracies (such as some of those in the Middle East) do spend heavily on a wide range of public goods, benefitting wide population groups, in order to avoid conflict.

Another possible difference between democratic and authoritarian regimes could lie in the degree to which the preferences of politicians and the public overlap. For authoritarian regimes, rulers' preferences may differ widely from those of many population groups, especially the poor, and this difference is often more pronounced than for democratic regimes. This is an issue separate from the vote-getting motivation of democratic policies, although it may sometimes be difficult to disentangle them empirically. One case where it may seem possible to disentangle such motivations is for politicians who are not up for reelection, so that vote getting is no (or less) concern for them. The hypothesis is then that politicians who were elected democratically, more than non-elected politicians implement policies in line with wide public preferences, in particular due to their higher overall education.[9] This is likely to translate into both greater average ability, and higher average leadership quality, in democratic versus autocratic regimes. There is also

[7] Persson and Tabellini (2000) survey the related analytical literature for democratic regimes, but have little to say about authoritarian regimes. Persson, Roland and Tabellini (1999, 2000) discuss differences between types of democratic governments, namely presidential-congressional versus parliamentarian, with the prediction that fuel taxes will be lower in the former. Such differences are not embedded in my analytical model below.

[8] See e.g. Deacon (2009), McGuire and Olson (1996), Lake and Baum (2001). Lott (1999) however finds that totalitarian regimes spend relatively much on education, he argues mainly for indoctrination purposes; but relatively less on health services.

[9] See Besley and Reynol-Querol (2011) for an empirical study of how leaders are selected in democracies and autocracies. They find that democratically elected leaders are far more likely to be highly educated. This they take to indicate that ability and quality of democratic leaders is consistently higher than for autocratic leaders. This is also consistent with Papaioannou and Siourounis's (2008) and Persson and Tabellini's (2009) findings that democracies have higher economic growth rates than autocracies.

direct evidence that more educated leaders are more civic and care more for wide population groups, when compared to autocratic leaders.[10] Note however that even many democratic governments which have not yet been able to establish sufficient trust among the public, may have difficulty in credibly promising a high level of public-goods supply; see Keefer and Vlaicu (2012).

Authoritarian governments or autocracies may also have more limited scope than democratic governments, to offer credible policies to their constituencies. This could be related to autocratic politicians' lower overall ability and talent, or lack of education, as indicated e.g. by Besley and Reynal-Querol (2011); such weaknesses may limit the ability of autocratic leaders to provide complex goods and services e.g. in the education and health sectors. One good that seems to be universally easy to deliver even by inept autocratic leaders, is fuel subsidies. Democratic governments, while usually also having this option, may have more attractive policies available, including the provision of more complex public goods, and direct and targeted financial support to the poor, thus opting to subsidize fuel less or not at all, given its notoriously inefficient aspects. Authoritarian governments and rulers may also be more prone to corruption and system losses.[11] Fuel subsidies are "relatively easy" to deliver credibly for virtually all governments, and may then be a coping (albeit far from optimal) strategy for keeping the populace in check.[12] But even for fuel subsidies there may be limitations on some (less trustworthy) autocratic governments; see e.g. Gehlbach and Keefer (2011) for discussion.

We will below demonstrate how such assumptions play out in the formal model. Ultimately, however, such hypotheses need to be tested in empirical work, which is in fact carried out in parallel to this analytical modeling work.

A well-developed class of analytical models suited to the study of such issues (in particular for democracies) is the so-called common agency models, see Bernheim and Winston (1986); Dixit (1996); Sinclair-Desgagné (2001); see Persson (1998) for the more specific political economy approach close to our area of application. Basically in this literature, several principals (voter or population groups) are assumed to seek to influence an agent (a government authority or administrator) to their own benefit, possibly using influence activities (which could include bribes and other favors). A key issue in this literature for political economy settings is that the agent can be more or less benevolent (thus, to a larger or smaller degree take the basic interest of each principal into consideration). Under autocracy this model has somewhat more limited

[10] See Dee (2004), and Milligan, Moretti and Oreopoulos (2004).
[11] Literature to support such a view includes Chang and Golden (2009); Deacon and Saha (2006); Deacon (2009); and Treisman (2007).
[12] Further tasks, which are not accomplished in this note, is, first, to explain more fully why non-democratic regimes do not or cannot credibly offer many of the public services that are customarily offered in democracies; and secondly, to explain why fuel subsidies are easier to deliver by such governments (or, seemingly, by any government).

application; it would then apply mainly when the ruler relies on support from particular constituent groups to stay in power.

1. A Basic Model

Consider an economy where the (overwhelming majority of the) population can readily be divided into two groups or classes, the middle class, and the lower class.[13] Assume that the "middle class" (of which politicians or autocrats may themselves be part) cares about gasoline subsidies, while the lower class does not. Both classes care about public goods (which may include other private goods such as foods or food subsidies). The middle class has the following preference function, related to the anticipated package of goods provided by the government, and the payments made:

$$U_M = V_M(q_G, G, \alpha X_M) + R_M - T - B \quad (1)$$

where q_G = the gasoline price (with preference for lower price); G = the amount of gasoline consumed by the middle class; X_M = government supply of public goods (when delivered effectively and in a trustworthy way; with preference for higher supply level); and R_M - T = income and net taxes (and net of any transfers) facing the middle class respectively. We assume that only the middle class pays net taxes. Partial derivatives are V_{qM} (< 0), V_{GM} (> 0), and V_{XM} (> 0). B represents contributions ("bribes") from the middle class to politicians. Initially these are taken as given; in section 4 below these will be endogenized to indicate a mechanism for policy influence for the middle class. The parameter α is primarily taken to represent the subjective probability that a promised public good X_M actually will be delivered. (There could be alternative interpretations of α, such as in terms of the value of these public goods as perceived by the middle class; this is an issue relevant when both the middle and lower classes, and politicians themselves, may benefit from such public goods delivery.) Delivery of promised gasoline price and quantity is assumed to occur with full certainty.[14]

I will offer two separate definitions of middle class. The first, used in much of the paper, is in terms of motor vehicle ownership: Anyone who is part of a household in possession of (at least) one motor vehicle belongs to the middle class.[15] Thus the middle class under this definition

[13] In some contexts it will make sense to specify a "ruling class" which will be far smaller than the "middle class" as usually defined. A "ruling class" could be particularly important and powerful under some autocratic regimes. This consideration is ignored here.

[14] Subjective delivery security of q_G and G can be given alternative interpretations. One is the high visibility of gasoline prices and related quantities (where a quantity reduction for given price would need to be implemented through highly visible rationing), coupled with a high likelihood of public rioting against tightened policies; the latter may serve as a commitment device to ensure government compliance.

[15] Here and in the following we assume that no lower-class households own cars. This is inaccurate but a reasonable approximation for many countries.

includes all those, and only those, with their own motor vehicles, who consequently consume gasoline and have corresponding preferences. It is however clear that in many of the countries relevant for our analysis, far from all those that would be said to belong to the middle class by e.g. an income-based definition, would own a car. X_M is thus in many countries likely to concern a larger population group than just car owners.[16] Thus we need to have in mind in the following.

G is likely to be strongly influenced by the numbers and types of motor vehicles in the household. But the more important distinction here is likely to be between households that possess one (or more) motor vehicle(s), and those who do not. In particular, for middle-class households with no motor vehicles, $G = 0$ and q_G should drop out of (1).

In a democracy, all middle class individuals are assumed to vote. Considering first middle-class household with cars, the probability of voting for a particular candidate (number 1) which delivers an expected utility level $U_M(1)$, while an alternative candidate (0) delivers utility $U_M(0)$, is $\Phi_M(U_M(1)-U_M(0))$, where Φ_M denotes the cumulative distribution function among middle class voters. Reasonably, $\Phi_M' > 0$ on the relevant domain, so that voting for a given candidate is an increasing function of the utility provided to the voter by the candidate's program. The higher is Φ_M', the more "sensitive" are individual middle-class voters to such utility differences (and, perhaps, the less is voting driven by pure ideology). Assume that the fraction of the middle-class voting population that own cars equals λ, so that the fraction without cars is $1-\lambda$. The government is assumed to use two instruments versus the middle class, q_G and X_M. The amount of gasoline sold, G, is then assumed not to be an instrument; we assume that whatever amount of gasoline demanded by drivers is actually supplied at the given price q_G.[17] When q_G is reduced (or promised to be reduced) by politician/party 1 (and no other variables change), the change in the probability that a middle class individual votes for politician/party 1when the gasoline price is changed is then given by $-\lambda\Phi_M'V_{qM}$, where V_{qM} = the derivative of V_M with respect to q_G. The equivalent change in probability when the (promised) public goods supply is changed is given by $\alpha\Phi_M'V_{XM}$ (affecting the wider set of middle-class voters, also those without cars). I stress that public goods supply applies to all middle-class households, while gasoline prices is of interest only to those households with cars (a share λ of all middle-class households). α is here likely to play a major role: when politicians can credibly promise an increased supply of a valuable public good to the middle class, α will be close to 1 and the issue more becomes one of cost (which is more costly for the government: providing the public good, or providing the fuel subsidy).

Assume also that the middle class can influence policies through contributions (or bribes), denoted B, which might have an independent influence on politicians' funding decisions. We come back to this issue in section 4 below.

[16] But it could of course also be the case that the income of a household which possesses a car is so low that we would not group that household in the "middle class". This will not be discussed further in the following.

[17] We thus rule out in this formulation the possibility of gasoline rationing, which might be an option in some cases when the gasoline price is kept below world market levels.

The lower class is assumed to care about kerosene subsidies and public goods aimed specifically at the lower class. Their utility function is specified as

$$U_L = V_L(q_K, K, \beta X_L) + R_L + S \tag{2}$$

where q_K is the kerosene price, K the amount of kerosene consumed, X_L a set of public goods benefitting primarily the lower classes, β a subjective delivery probability for such public goods, R_L (exogenous) income for the lower classes, while S denotes net pecuniary subsidies (so far unspecified, net of any taxes, and exogenous) flowing to the lower class. Partial derivatives are V_{qL} (< 0), V_{KL} (> 0), and V_{XL} (> 0). We assume that the entire lower class consumes kerosene and thus benefits from kerosene subsidies. In the basic model dealing with this case, in section 5 below, we will generally assume that also lower-class individuals vote in democracies; albeit possibly with reduced frequency when compared to those in the middle class.

Consider next politicians' preferences in this case. In a democracy, politicians care about staying in power, their private incomes, and might in addition have personal preferences for levels of public services provided to the population, and for the price of gasoline. These preferences are likely to coincide or overlap with those of the middle class. Their utility functions are represented by

$$U_P = V_P(P) + \gamma X_M + \theta X_L - \rho q_G + \tau\lambda B + W \tag{3}$$

where P denotes the probability of being reelected to office in the "following period", and W denotes salaries (considered as given).[18] The partial derivative with respect to V_P is denoted V_p'. X_M and X_L are as before public goods supplied to the middle class and lower classes respectively. γ and θ express the "strengths of preferences" among politicians for these two goods. A "totally disinterested" politician (and who has no personal value of these public goods) would have $\gamma = \theta = 0$. Politicians may also themselves have a private value of public services, and then most reasonably those provided to the middle class (which could include highways, higher education, and more advanced medical facilities). For "highly engaged" politicians these parameters would likely take higher values. The more inclined such politicians are to support the poor, the more the L group public goods should weigh in these preferences (via the parameter θ). ρ would represent a similar personal preference among politicians for low gasoline prices (assuming that all politicians have cars). The two last terms in (3) represent private consumption of politicians, where we assume that a fraction τ of bribes is spent in this way (while a fraction 1-τ of bribes work to enhance public budgets), and where λ as before represents the relative size of the middle class that has cars, assuming that this group may try to influence fuel pricing policies through bribes (and assuming that no other group among the public pays bribes).

[18] Politicians are more likely to belong to the middle class instead of lower class and thus have similar preferences to those represented by (1). We however abstract from a separate positive value of G in (3). Including this adds little analytically.

Politicians are assumed to face the following budget constraint for their respective governments:

$$(4) \qquad (q_{G0} - q_G)\lambda G + (q_{K0} - q_K)K + X_M + X_L + S = T + (1-\tau)\lambda B.$$

q_{G0} denotes the world market price of gasoline, and λG the volume of gasoline sold (λ measuring the size of the middle-class population that own cars, while G is a measure of gasoline consumption per car owner). The first main term then represents the gasoline subsidy. The second main term has a similar interpretation for kerosene. By (4), available net tax revenue can be spent on four alternative classes of goods: gasoline subsidies (benefitting car owners); kerosene subsidies (benefitting the poor); public goods benefitting the middle class; and public goods benefitting the lower class.[19] The terms on the right-hand side represent available public revenue, namely net taxes (paid by the middle class) plus (possibly) a share of bribes (or whatever other extra income), 1-τ, from car owners into public budgets.

2. Effects Based on Middle Class Preferences: Base Case

I now first focus on the case where only middle-class and not lower-class preferences come into play. Then kerosene subsidies are not relevant, only gasoline subsidies are. In this section I abstract from effects of explicit influence activities (payment of bribes) by the middle class, and return to a discussion of such activities in section 4. From (4), taking all variables except q_G and X_M as given, I derive the following trade-off for politicians, between gasoline subsidies and public good supply to the middle class "narrowly defined" (to the group of car owners):

$$(5) \qquad \lambda G dq_G = dX_M .$$

Changes in X_M affects the utility, and thus in principle also the voting propensity, for all middle-class voters, thus also for those who do not own cars. Changes in q_G however only affect the utility of car owners.

Assume initially that G, S, T, B and W are all given. The objective of politicians is to maximize the probability of reelection, P, using as instruments the fuel subsidy rate, q_G, and the public goods purchases, X_M, subject to the constraint (5).

From (1), given $B = 0$ (no bribing), the change in utility for car-owning middle class households when the rate of gasoline subsidies and public good supply are changed in such a way that budget balance (5) is observed, is given by

$$(6) \qquad dU_M = (V_{qM} + \alpha\lambda G V_{XM})dq_G ,$$

[19] In addition there is a transfer payment by the government to the poor, S, which is here considered as exogenous.

where we have $V_{MG} < 0$, and $V_{MX} > 0$. A reduction in q_G thus increases welfare for this group of households if and only if

$$\left|V_{qM}\right| > \alpha\lambda G V_{XM} . \quad (7)$$

When α is very small, (7) will hold and it is always perceived as more beneficial for the middle class to be subsidized in terms of a low gasoline price, than in terms of high (promised) public goods supply. Two alternative interpretations of a low α apply: a) a low probability that the public good will actually be delivered (most of the money set aside for X_M is eaten up through corruption and waste, or is diverted to other uses); or b) the public good has (or is perceived to have) little value to those households in the middle class that have cars. Conversely, when α is large, and the value of public goods supply is high (and/or the subjective probability of public-good delivery is high) for the middle class, it is less likely that (7) holds, in which case subsidizing gasoline (much) would make less sense for politicians.

Likewise, λ, which expresses the share of the middle class that owns a car, influences car owners' preferences and thus voting. When λ is low, there is a relatively small group of households that benefit from gasoline consumption. This implies that, for given G, it is relatively inexpensive for the government to subsidize gasoline, and all subsidies go to those with cars. This makes it more likely that this group favors (budget-balanced) gasoline subsidies over public goods. But note that relatively few voters are affected in their voting by gasoline subsidies. For all those in the middle class without cars, a budget-balanced increase in gasoline subsidies at the expense of public goods is viewed negatively, thus affecting their voting negatively for the government. Two factors then go in opposite directions when λ is increased, which (it can be shown) tend cancel out when voting characteristics otherwise are similar for middle-class households with and without cars. By contrast, a higher G (indicating a higher rate of gasoline consumption per household with cars) makes such subsidies unambiguously more expensive for the government, thus leading to a higher preference for X_M.

Assume as before that $G = 0$ for households without motor vehicles, and $G > 0$ for households with vehicles.[20] The size of G may for these households depend on the type(s) of vehicle(s) owned and the need for driving. As a first approach, we may here simply assume a common value of α for all households owning vehicles.

In many least developed countries condition (7) will hold due to limited administrative capacity to provide the public good, with low quality of X_M and often low α values.

A complicating factor is that in economies with higher income levels, G is likely to be relatively high. A high G has two separate effects. First, a high G is likely to be correlated with high

[20] This assumption may not be entirely accurate insofar as public transport also relies on gasoline, and "middle class" households without own vehicles use public transport. This will be ignored in the following.

(absolute value of) V_{qM}. This implies that middle-class households with cars put more emphasis on gas subsidies in countries where cars are used more on the average. But when the middle class is large as a fraction of total population, G in the context of our model is likely to be large as well. This factor is likely to be strengthened when q_G is low, since a lower gasoline price of course induces more driving. The second and countervailing factor is that a high G makes subsidizing the gasoline price more expensive for the government, as seen in (5). A high G could also be associated with a greater deadweight loss, related to over- consumption of gasoline, which the government may want to avoid. This deadweight loss is however likely to be smaller for given subsidy amount, when the amount of gasoline subsidized is greater (so that the subsidy inefficiency wedge is smaller).[21]

When the government simultaneously determines the public good supply to the middle class, and the gasoline tax or subsidy, it also needs to consider preferences of those in the middle class that do not have (and do not plan soon to acquire) cars given that this is a substantial group. The group could be substantial when car ownership is still not widespread and a range of "middle-class" goods is still supplied (such as decent higher education and health services; and when the country has a good public transportation system). The fraction of the middle class belonging to this group being 1-λ, the utility change for this group when q_G changes is (denoting this group by subscript G)

$$dU_G = \alpha\lambda G V_{XG} dq_G . \tag{8}$$

This change is positive since a higher gasoline price gives room for more middle-class oriented public goods, from (5).

The change in politicians' utility when q_G is changed, subject to condition (5) as a constraint from (4), is given by

$$dU_P = \left\{ \lambda V_P' \left[\Phi_M' V_{qM} + \alpha G(\lambda \Phi_M' V_{XM} + (1-\lambda)\Phi_G' V_{XG}) \right] + (\gamma\lambda G - \rho) \right\} dq_G . \tag{9}$$

The direction of dU_P would (roughly) be the same as for dU_M except for the last parenthesis in the curly bracket, which represents the effects on politicians' private consumption and preferences not related to voting.[22] The overall strength and direction of politicians' preferences are affected by V_P' (the strength of politicians' preference for reelection), by $\Phi_M' V_{XM}$ and $\Phi_G' V_{XG}$ (the densities of the two relevant groups of middle-class voters in terms of utility when

[21] When gasoline is not rationed, the allocation loss associated with excessive gasoline consumption resulting from the subsidy is proportional to the square of the subsidy rate, q_G, but proportional only to the absolute level of the amount of gasoline consumed, G, for given q_G. Thus, a given subsidy amount paid out as a lower subsidy rate to a larger volume of gasoline consumed will imply a smaller allocation loss.

[22] Note that this argument could represent also the benefits to politicians from being able to favor friends and influential groups in ways not directly related to voting, and where such groups benefit from a low gas price. Note also that, for autocracies, such arguments are likely to be more dominating.

the amount of the public good changes, on the domain for the relevant utility change), by the weights λ and 1-λ to the groups of middle-class voters with and without cars, and by γ and ρ (the strength of the "personal" preference of politicians, for public goods serving the middle class, and for own gasoline consumption). Also, when V_{qM} (the strength of car owners' preferences with respect to gasoline prices) is large, the related term may dominate the overall expression and then lead to an overall negative value, favoring gasoline subsidies. Finally, when λ is smaller, the square bracket in (9) is smaller and more easily dominated by the last parenthesis (which, again, expresses the preferences of politicians themselves). The interpretation of this effect is that when few ordinary citizens have cars, any possible political preference for low gasoline prices is more likely directly derived from politicians themselves (including their friends and allies).

When the curled bracket in (9) is negative, politicians have an incentive to argue in favor of gasoline subsidies instead of increased public goods supply benefitting the middle class. This is in addition more likely when λ is low, as the first square parenthesis is then small; and as the negative ρ is then more likely to dominate over the positive $\alpha\lambda G$.

We have so far basically discussed the direction of effects (whether or not a gasoline subsidy is chosen by the government), and less the level of subsidy that would in case be optimal. Note that a higher subsidy rate for a given amount of subsidy in general leads to a larger deadweight loss (see footnote 13). Politicians may be averse to such an allocation loss, and may take this factor into consideration by limiting the subsidy rate. Thus in particular, when λ is smaller, one should expect q_G to be set lower, but not so low that the overall level of subsidies is the same. In other words, when λ is lower, the rate of subsidy (if there is a subsidy) should be greater, but the aggregate amount of subsidy should be smaller.

The above arguments hold only when $\Phi_M \, 'V_{XM}$ and $\Phi_G \, 'V_{XG}$ are similar, which however seems like a weak restriction for a rather general public good. More importantly, the above arguments hold only when it is always possible to attract more voters (who own cars) by reducing the gasoline price. It is in particular required that the political effect of lower the gasoline price is stronger, the smaller the group with cars is. But when the group with cars is very small, the argument may fail, for two reasons. First, a small group with cars will likely not have decisive political power in a democracy, even when fully unified. But secondly, even when this group still has considerable political power in aggregate, one can easily picture a situation where (almost) all those (few in number) households with cars already vote for the politician that promises the low gasoline price. If this occurs at a relatively moderate fuel subsidy rate, there may be insufficient political incentives, through the election process, to lower the gasoline price further.[23] When the group of car owners is larger, their preferences are likely to be more

[23] There may still be an incentive for lowering the gasoline price due to politicians' own such preference. This is however not likely to be dominant in a democracy (but may be in autocracies).

heterogeneous, so that a larger number of additional voters may be attracted from a reduction in the gasoline price, even when this price is initially quite low.[24]

Thus overall, one cannot say too much about the (directional) relationship between car ownership and motor fuel subsidies from theoretical arguments alone. It could be that, when comparing democracies and more autocratic governments, subsidies to motor fuels are likely to be relatively more prevalent in the former relative to the latter, when broader groups own motor vehicles; while the opposite could be the case when the group possessing motor vehicles is small. The reason is that with a broad group of vehicle owners, a large number of voters are affected by a given fuel subsidy rate. This may be the dominating factor in many democracies where leaders may need a large core group to stay in power. In autocracies, by contrast, the power base of leaders is often narrower: this makes fuel subsidies attractive for autocracies when few (basically, all in the core support group) own cars. Moreover, the fiscal cost of paying these off through low fuel prices will then be relatively low.

Thus while these relative effects are difficult to sort out in a theoretical model, they can be tested, which I intend to do on our compiled data set. In particular, one can test a) if the propensity to subsidize motor fuels is greater or smaller when the group of vehicle owners is larger; and b) whether this relationship differs between democracies and autocracies, and according to the "strength" of democracy as defined in our data.

Note finally the argument, made by some observers, that political competition models as presented here yield meaningful explanations of political outcomes only when the group of voters at stake (here, the group of car owners) is relatively large. But note that there are here both political benefits (more favorable voters) and costs (fiscal expenditures) associated with fuel subsidies when this group is large; and not obvious in which direction a larger car-owning group should pull. List and Sturm (2006) show that narrowness of this group does not preclude variables directed specifically at this group from having a significant political impact. This we also assume here and in the following.

3. Effects Based on Middle Class Preferences When Influence Activities Are Included

In this section we extend the analysis to take into account possible influence activities by the middle class. This involves bribes, B, now being endogenous and set to optimally influence the policies of government.[25] This is manifested in (1), by assuming that B is now set by middle class households as a function of the levels of q_G and X_M delivered. We assume that only those

[24] In any case, voting is likely to be quite heterogeneous and in most cases far from fully aligned with what are presumed basic interests; see e.g. Huber and Stanig (2009).

[25] The model framework in this section becomes, in many ways, similar to the set of models of "influence activities" in chapter 7 of Persson and Tabellini (2000).

among the middle class who own cars pay bribes. This is of course inaccurate but may represent the idea that car-owning households are, on the average, wealthier and more influential than non-car owners among middle class households. We represent this by assuming the B consists of two components, B_q and B_X, where each is assumed to affect the (perceived) delivery of q_G and X_M respectively:

$$U_M = V_M(q_G(B_q), G, \alpha X_M(B_X)) + R_M - T - B_q - B_X \tag{10}$$

We assume that the derivatives $q_B' < 0$, and $X_B' > 0$, representing the marginal effects of bribes on low gasoline prices and high levels of public goods delivery, respectively, and that both functions are strictly concave in their arguments. The "middle class" can now be perceived to maximize its aggregate utility U_M with respect to bribe payments B_q and B_X, which yield the following first-order conditions for the middle class:

$$V_{qM} q_G = 1 \tag{11}$$

$$\alpha V_{XM} X_B = 1. \tag{12}$$

These functions can be viewed as solving for B_q and B_X as endogenous variables, for given "policy functions" $q_G(B_q)$ and $X_M(B_X)$, respectively. These functions would tell us the government's reaction in terms of goods delivery to the middle class, in response to the two types of bribe payments.

Assume now, for simplicity, that the possibility of influencing X_M through bribes is small relative to the possibility of influencing q_G. Thus we may ignore B_X and focus on B_q in the following.

The decision problem for the government currently in power is now correspondingly to maximize its own utility function (3) subject to the budget constraint (4), and now considering that B_q is affected by q_G and X_B respectively. This problem is similar to the equivalent problem in section 3 except that now an additional variable, B_q, is perceived to be affected by such policy.[26] Differentiating (4) yields in this case:

$$\lambda[G + (1-\tau)B_q']dq_G = dX_M \tag{13}$$

[26] Note the simultaneity problem implied by bribes and policies both being both endogenous: The public sees bribes as affecting policies, while the politicians see policies as affecting bribes. Both views are "correct". But it would raise a more fundamental problem if we were to try to identify, and estimate, "policy response" functions for the two sides. These are issues of concern in future research.

where $B_q' < 0$. We here also take account of the fact that the overall magnitude of "influence" bribes is proportional to the size of the middle class (car owners) with proportionality parameter λ. Assume that (7) still holds at equilibrium.

Considering (13) together with the politicians' utility function (3), we find the following overall effect of a change in the gasoline price on politician utility:

$$(14)\quad dU_P = \left\{ \lambda V_P' \left[\lambda \Phi_M' V_{qM} + \alpha G (\lambda \Phi_M' V_{XM} + (1-\lambda)\Phi_G' V_{XG} \right] + [\gamma\lambda(G + (1-\tau)B_q') - \rho] \right\} dq_G .$$

The only difference from (9) lies in the term containing B_q', which is negative. Thus the effect of bribing by middle-class car owners to achieve a lower gasoline price, is to reduce the expression in the last square bracket, and thus to reduce the entire expression in the curled bracket. This implies that the propensity to subsidize gasoline is increased. This has an easy intuitive explanation: bribes work only on gasoline prices, for politicians to set these lower. As assumed, there is no bribing to increase supply of the public good aimed for the middle class (X_M). This introduces an extra bias to reduce gas prices.

An opposite effect would here occur if X_M were the main object of bribes and consequently B_X' is large. This would make it more likely that public goods will be supplied, instead of gasoline subsidies (or more of the former and less of the latter).

This model assumes that all car owners (in principle) pay bribes, and that bribing is similar in countries where there are many and few car owners. Note however that when the car-owning class is large, and since fuel subsidy is an across-the-board (not individualistic) policy, bribing is subject to a high degree of free riding. Since autocratic governments are generally (on average) more "bribable" than democratic governments, and since there is a high correlation between democracy and the population share with cars, one can expect bribes (with the purpose to keep fuel prices down) to be far more common in autocracies than in democracies. Note also that direct political pressure by car-owning groups may take other forms than direct bribes. One is staged mass demonstrations or riots in response to fuel price hikes, organized by powerful but often rather small groups representing car owners' interests.

We should also here comment on some other factors that would normally affect the rate of motor fuel tax or subsidy. In particular, the optimal gasoline or diesel tax may vary substantially between countries, and tends to be higher in countries where pollution and congestion problems (and thus population and vehicle densities) are higher; see Parry and Small (2005) comparing optimal fuel tax rates in the U. K. and the U.S.; and Parry and Strand (2012) for optimal fuel taxes in Chile (where in particular the pollution problem is greater). These are factors that should also influence actual fuel prices and thus subsidies. Also macroeconomic factors may be

important: High fiscal burdens are likely to put pressure to reduce energy subsidies; and the same may follow from a general economic contraction.[27]

We may now sum up some of the main factors working in the direction of a high rate of gasoline subsidy, as follows:

a) A high (perceived) value to the middle class from gasoline subsidies, relative to public goods supply within a given government budget. This is represented by V_{qM} being large in absolute value, relative to V_{XM}.

b) When the total consumption of gasoline that must be subsidized is high, such subsidies are relatively more expensive (showing up in the terms containing G in (9)). This makes gasoline subsidies less attractive than otherwise to the government, everything else equal, when compared to supporting public goods. On the other hand, a high G may as noted imply a high absolute value of V_{qM}, which would tend to reduce the entire expression in (9); this is strengthened by higher density of voters around the equilibrium value (or more homogeneous voter group) among car owners than among middle class households without cars (high gasoline prices is then a more significant factor in affecting voter preferences among the middle class). In (9), G is then high, which tends to make the first parenthesis in the square bracket greater.

c) A key factor in its own right is that a low perceived likelihood of actual delivery of (possibly promised) public goods, represented by a low value of α, contributes to a high relative value of gasoline subsidies. As noted, less "formal" and lower-income economies are likely to have lower values of α.

d) Given a middle-class preference for gasoline subsidies, a high value to politicians of an increased likelihood of reelection (high V_P'), and a high density of voters (among those owning cars) in the neighborhood of the chosen solution (high Φ_M') contribute to high value to politicians of gasoline subsidies. This factor tends to be higher, the more contested an upcoming election is likely to be, and the nearer it is in time. On the other hand, when gasoline subsidies are less potent in attracting voters (as when the first parenthesis in the bracket of (9) is positive), this factor then works more strongly to remove gasoline subsidies. This would then work independent of any personal politician preference for low gasoline prices, per se.

[27] Empirically, it may still be difficult to identify the effect of fiscal burdens as, for some economies, a large part of this burden can be due to the fuel subsidies themselves. This will induce a positive empirical correlation between the fiscal burden, and fuel subsidies.

e) A private preference among politicians for gasoline subsidies instead of public goods supply to the middle class ($\gamma\lambda G$-ρ negative) leads politicians to subsidize gasoline more. This expression also reflects that when the share of car owners in the middle class (λ) is low, and the amount of gasoline consumed per car owner, to be subsidized, is low, politicians are more likely to themselves prefer gasoline subsidies.

f) A high level of reward to politicians, in terms of bribes, when the gasoline subsidy is increased; in the model in terms of a high negative B_q'. As argued, this reward tends to be greater, as the ease of bribing, and the incentive to bribe, is greater, in autocracies than in democracies.

g) A low reward to politicians in terms of additional bribing, when public goods supply to the middle class is increased. In the model, we have assumed that this "reward" is zero.

h) Note that a high rate of gasoline subsidy leads to a large deadweight loss to the economy (proportional to the square of the subsidy rate).[28] This factor should tend to limit the rate of gasoline subsidy at least for governments with a certain minimum level of social responsibility. A high debt burden for the economy should draw in the same direction.

i) High externality costs of driving should, everything else equal, lead to lower fuel subsidies (and if relevant, higher taxes).

j) It is not entirely clear whether a larger group of car owners would lead to a higher or a lower gasoline price through the political processes specified here. On the one hand, a larger group of car owners leads to more voters potentially being swayed by low gasoline prices in the voting process. But when the group of car owners is large, a large amount of gasoline needs to be subsidized, and this worsens the tradeoff between gasoline prices and public goods for the middle class. Similarly, such a worsened tradeoff also works on politicians themselves, who may personally prefer gasoline subsidies and more so when these are "cheap" to induce (lead to little reduction in public goods supply). It may perhaps be argued that politicians' own preferences are more important when there are fewer car owners. Under autocratic regimes this effect could be strengthened as politicians' preferences are more likely to dominate, and the number of car owners often small; both these factors work in favor of gasoline subsidies in my model. But the issue remains mainly an empirical one.

[28] More correctly, this loss is proportional to the square of the "true aggregate" subsidy rate, where the subsidy is defined in relation to the socially correct fuel price (which is likely to incorporate a tax to correct for climate and other externalities).

4. Effects Based on Preferences of Lower-Class Individuals

We will now deal more explicitly with lower-class individuals, as voters and citizens including their preferences. Consider now again the government budget constraint (4), and let now only q_K and X_L change:

$$K dq_K = dX_L . \tag{14}$$

Consider the impact on utility for individuals in the lower classes, which is given by

$$dU_L = (V_{qL} + \beta V_{XL}) dq_K , \tag{15}$$

where β is the probability that (anticipated) public goods aimed at the poor, are believed by the poor to be actually delivered to them. Assume also that the distribution of voters takes a similar form as for middle class individuals, as Φ_L with density Φ_L'. The change in politicians' utility when the kerosene price and public goods for the poor are changed in a budget-balanced way, is then described by

$$dU_P = \left[V_P' \Phi_L' (V_{qL} + \beta V_{XL}) + \theta K \right] dq_K . \tag{16}$$

We see that (16) takes a very similar form to (8) except that the element representing fuel price is missing in the square bracket. The reason is that (as we have assumed) politicians have no preference for low kerosene prices per se; while they were assumed to have such preferences for low gasoline prices.

How do these factors differ, between the middle class and the lower classes? The following points can be noted.

a) Voting frequencies are often lower in the lower class relative to the middle class. This factor tends to weaken politicians' interest in what happens to the lower class, everything else equal.[29]

b) When the amount of kerosene to be subsidized, *K*, is great, a high rate of kerosene subsidies could be less attractive to the government as it is more costly to provide (the parenthesis in the square bracket in (11) is then more likely to be positive). But on the other hand, a high *K* implies that kerosene is consumed in large quantities among the poor, and could be very important in terms of swaying voter preferences. The balance of these two factors is unclear.

[29] Of course, even with low voting propensity in the low class, the number of voters in this class could still be large if the group is very large. Note also that, contrary to my main argument, voting seems to be particularly high among low-income groups in a very important (albeit not necessarily very typical) democracy, namely India.

c) The delivery probability for public goods to the poor, β, could be lower than the corresponding probability facing the middle class, α. A reason could be less effective monitoring and follow-up of public-good delivery for the poor, and less ability of poor-group representatives to monitor the public-good supply activity. Another reason could be more public corruption in delivery to the poor.

d) The government preference for public goods delivery to the lower class, represented by θ, is likely to have a different interpretation than the similar coefficient for middle class public goods delivery. It is here likely to represent less politician self-interest (since politicians themselves in most cases benefit little directly from such public goods), and more a genuine concern for the poor. A related viewpoint is that more "left-wing" politicians have higher values of θ. For politicians with no such concern we could have θ = (or close to) 0. There is a clear likely correlation with the degree to which the government is democratic versus autocratic or authoritarian. Since a democratic government is more likely to be voted in by the electorate, and then even more so by the lower classes (which are presumably more numerous), θ is likely to be higher the more democratic is government (since those politicians voted in are more likely to represent the poor).

Note also that we can easily combine the two relations (8) and (11) to provide an integrated analysis of fuel subsidies to both gasoline and kerosene simultaneously.

I have so far basically only discussed democratic systems, represented by politicians' choice of policies influenced by voting patterns. I however take an eclectic view of autocracies as political systems where formal voting plays less of a role, but where influence activities, that affect the propensity of the public to support its leaders, still may play a major role. Also, a dictator would likely need to keep his or her public ("selectorate") happy in order to reduce the risk of the government being overthrown; and might resort to similar mechanisms as those used in democracies. Arguably, the model presented here can almost equally well be considered as adaptable to autocratic regimes. This selectorate is often comprised from elite segments of the population. A key difference between democracies and autocracies is that a selectorate in an autocracy will very often make up a smaller fraction of the overall population, than the electorate in a democracy.

A further point, referring to my model, is that when the selectorate is small, the preferences of rules and selectorate members in autocracies may be highly aligned; perhaps more so than in democracies (where leaders need to satisfy a wider range of population groups). In my model, this might be reflected through an expanded interpretation of the "self interest" arguments in (3) (where these also represent the preferences of powerful allies that may need to be satisfied through high values of these arguments).

Finally, we may have substitution effects between policies that favor the middle-class and those that favor lower-class citizens: no politician is able (or usually interested) to make all voting groups equally happy, and may need to choose between them. This may entail a substitution relation between gasoline and kerosene subsidies; so that in countries where kerosene subsidies are particularly high, one might expect relatively lower gasoline subsidies; and vice versa.[30] This effect may however often be difficult to identify empirically, as there are likely to be countervailing factors of the form that countries with high fuel subsidies (or taxes) are likely to have high subsidy rates across the board.

5. Conclusions

I will sum up some factors that I view as empirically important in explaining positive fuel subsidies. For gasoline, likely factors are:

a) Less ability to deliver other public goods leads to more gasoline subsidies. This could apply to how policies are perceived: it is sufficient with the belief, among the public, that gasoline subsidies will be delivered, while other public goods will not be delivered.

b) A less democratic government leads to less provision of public goods, and greater reliance on gasoline subsidies. This argument can have several motivations. First, autocracies may be less capable than democracies at supplying ordinary public goods, as was argued in section 1 (see footnotes 6 and 7). Secondly, in autocracies politicians' own preferences may dominate more when setting political priorities. Thirdly, the number of car owners is often smaller; and the set of car owners may even, roughly, coincide with rulers' selectorate. Gasoline subsidies would then be both a powerful tool for making the selectorate happy, and also not overly expensive as the group benefitting from subsidies is not very large. All these factors tend to favor gasoline subsidies under autocracies. Additionally, gasoline subsidies could play a role in mobilizing popular support or reduce actual or potential unrest.

c) Under a majoritarian democratic system, when many swing voters are affected by gasoline prices, but fewer by public goods supply, fuel subsidies are an attractive policy. Note however that when the general public goods supply has the broader voter basis (as when the number of vehicle owners is small), these may be favored.

d) A larger middle class (larger relative group of households with motor vehicle ownership) leads to greater reliance on gasoline subsidies, in democracies, but perhaps not in

[30] A am grateful to Per Fredriksson for this observation.

autocracies. This is closely related to the argument under point b). In the model it is represented by the scale parameter λ, which in turn scales the effective density function of voters. This may also lead to a hypothesis that when a given aggregate gasoline consumption is spread over a larger number of drivers, gasoline subsidies are politically more potent as, in particular, more voters are affected.

e) A greater volume of gasoline consumption among the middle class could work in two opposite ways: Gasoline subsidies are made more expensive for politicians, thus discouraging them; but higher volume (which is associated with both a larger group of vehicle owners, and a greater per-owner fuel consumption) also increases the value to the middle class of a given subsidy rate, thus affecting voting propensities by more. The balance here is unclear. A greater level of personal consumption of gasoline among the political class should, presumably, lead to more subsidies.

f) A higher ability, and propensity, of motor vehicle owners to compensate (bribe) politicians into increasing the gasoline subsidy, is likely to increase governments' propensity to subsidize motor fuels. Conversely, less of an ability and propensity to do so in order to increase the supply of public goods. This "corruption advantage" could greater under autocratic than under democratic regimes; for at least two reasons: countries with autocratic regimes could be on the whole more corrupt; and the smaller size of the selectorate could make bribing more direct and easily targeted in autocracies.[31]

g) Various economic factors are bound to influence overall fuel pricing. First, we recognize that (more remote) fuel importers must add an import transportation cost to the supply price of fuels. Secondly, a distressed government budget balance problem is likely to make fuel subsidies less attractive, and net fuel taxation more attractive. One must here however recognize an inevitable endogeneity problem: a negative budget balance is likely to follow at least in part from a policy of large and sustained fuel subsidies. Thirdly, there are several more standard economic reasons for *taxing* motor fuels, due to externality costs of motor vehicle use, in rich and poor countries alike; see Parry and Small (2005); Parry and Strand (2012); Sterner (2007). Some systematic factors behind optimal fuel taxes may be identified, including denser population concentrations (more persons being affected by negative externalities); and a larger number of vehicles relative

[31] A large literature documents that there is more corruption in autocracies than in democracies. Some of the literature, however, including Rock (2009), indicates an "inverse u-shaped" relationship whereby a country may immediately become more corrupt when reverting from autocracy to democracy, but later becoming gradually less corrupt as the democracy matures. Nur-tegin and Czap (2012), in a more recent study, however find no such relationship: young and unstable democracies are shown to be less corrupt than mature autocracies. See also Keefer and Vlaicu (2012), for documentation that less "accountable" democratic government to a larger extent resort to corrupt practices.

to existing road networks (indicating greater average congestion). An appropriately specified model of fuel pricing would need to account for such variables as well.

For kerosene we have similar basic relations, with two major differences. First, personal fuel consumption among members of the political class is likely to play a much smaller role for kerosene than for gasoline. Secondly, influence (corrupt) activities are likely to play a smaller role for kerosene where the main interest group is likely to be poor, with less purchasing power and consequently less ability to bribe politicians.

Several potentially important issues have been neglected in this discussion. One is influence of other groups than voters, such as NGOs, on fuel pricing. Another is supply of public transport (urban and inter-city), which is likely to diminish the need for low fuel prices. We have (at the moment) no data for such variables; once we do, new model developments will become relevant.

These broad issues clearly open up a wide agenda for both analytical and empirical work.

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