ICTD

Centre International pour la Fiscalité et le Développement
International Centre for Tax and Development

Working Paper 104

Fuel Subsidy Reform and the Social Contract in Nigeria: a Micro-economic Analysis

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January 2020

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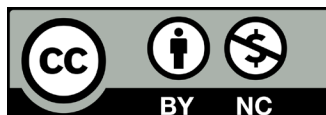# Fuel Subsidy Reform and the Social Contract in Nigeria: a Micro-economic Analysis

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Summary

Fuel subsidies in Nigeria are enormous. At last estimate, the state subsidises petrol to the tune of US$3.9 billion – almost double the entire health budget. Such subsidies come at great cost: the opportunity costs of such spending on other development objectives are large; the distribution of resources to the state governments is reduced; the vast majority of the subsidy goes to better-off Nigerians; and cheaper petrol encourages greater pollution, congestion and climate change. Despite this, most Nigerians oppose the reduction or removal of subsidies. We draw on a new nationally representative household survey that asked Nigerian men and women about their knowledge and attitudes towards subsidies. We construct and test a set of hypotheses about the determinants of support for subsidy reform. We also use a survey experiment to explore how different framings of the issue influence support for reform. We find that different framings of reform are not able to alter Nigerians' opinion from opposing to supporting reform, indicating deep-rooted beliefs about the role of petrol subsidies in Nigeria's social contract. We find that people that already pay more than the official price and that have experienced a lack of fuel availability are more likely to support reform. Trust in government is also associated with support for reform, as is delivery of reasonable national and local services, supporting the idea that building the 'social contract' is key to reform. Social and personal norms also appear correlated with support for reform. Intriguingly, actual knowledge about subsidies is not – people appear to form their opinions on the issue regardless of their understanding of it.

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Acknowledgements

Acronyms

ATT	Average Treatment Effect on the Treated
ESMAP	Energy Sector Management Assistance Program
FGD	Focus group discussion
IGR	Internally generated revenue
PMS	Petroleum motor spirit

1 Introduction

Fossil fuel subsidies are large and widespread. The International Energy Agency estimated the value of fossil fuel consumption subsidies[1] globally as $325 billion in 2015 (International Energy Agency 2019). This is significantly larger than the value of all aid ($163 billion in 2015) – McCulloch (2017) shows that, for the 96 countries where there is data for both energy subsidies and aid, 59 per cent have subsidies that are larger than all the bilateral aid that they receive. Energy subsidies are particularly prevalent in the Middle East and Africa – even in sub-Saharan Africa the median country has energy subsidies of over 1 per cent of GDP (McCulloch and Dom 2019) –making subsidies larger than some important sources of domestic revenue in several countries. Hoy and Sumner (2016) calculate that three-quarters of global poverty could be eliminated – at least in principle – via redistribution of nationally available resources through cash transfers funded by new taxation and the reallocation of public spending from fossil fuel subsidies (and surplus military spending). Moreover, this only takes into account the fiscal cost of subsidies. When including the cost of negative externalities induced by such subsidies – such as air pollution, greenhouse gas emissions, congestion, accidents, road damage and foregone tax revenue – the IMF estimate of the cost of energy subsidies rises to $5.3 trillion, or over 6 per cent of global GDP (Coady et al. 2015).

There is an extensive literature on the harm caused by such subsidies. Fossil fuel subsidies typically encourage greater consumption of such fuels leading to higher levels of air pollution, notably the emission of sulphur dioxide, nitrogen oxides and particulates, notably that from burning coal. Outdoor air pollution from fossil fuels as well as other sources was responsible for an estimated 3.2 million premature deaths a year worldwide in 2012 (WHO 2014). Fossil fuel subsidies also encourage greater greenhouse gas emissions. The IMF estimates that CO_2 emissions would be reduced by 24 per cent if prices were to be increased to their efficient level (Coady et al. 2015), although the size of this impact has been challenged recently by Jewell et al. (2018). Estimates also exist for the additional congestion, accidents and road damage caused by fossil fuel subsidies (van Benthem 2015). Moreover, fossil fuel subsidies are inequitable; Arze del Granado et al. (2012) estimated the welfare impact for 20 countries from Africa, Asia, the Middle East and Latin America. They found that fuel subsidies are an extremely costly approach to helping the poor, with the top income quintile typically capturing six times more in subsidies than the bottom.

Given the harmful nature of fossil fuel subsidies, it is perhaps surprising that there has not been more concerted effort to remove them.[2] The answer lies in the complex political economy of subsidy reform (Victor 2009; van Asselt and Skovgaard 2018; Inchauste and Victor 2017). Politicians in all countries are reluctant to implement reforms, particularly where they may result in a significant increase in fuel or electricity prices. This is especially the case in countries where no effective mechanisms exist for protecting the poor or compensating those worst affected (Moerenhout 2017). Moreover, subsidy mechanisms are notoriously prone to corruption; this creates vested interests who strongly oppose reform (Inchauste et al. 2018), as well as popular political movements who use reform episodes as an opportunity to protest against governments that are felt to be illegitimate (Hossain et al. 2018).

Given the overwhelming evidence that the removal of fossil fuel subsidies would be beneficial if the resources were deployed to more developmental purposes, how can governments that

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[1]   The IEA uses a price-gap approach to calculate energy subsidies, which include both fossil fuel subsidies and subsidies to electricity, much of which is generated from fossil fuels.

[2]   e.g. McCulloch (2017) estimates that globally bilateral donors provided only $35 million in direct efforts to remove energy subsidies – a tiny fraction of all aid.

wish to pursue reform persuade their populations to support, or at least accept, such changes? Recent evidence suggests that communication is a key part of successful reform efforts – governments that have made clear the reasons for reform, compensated those worst affected and ensured that the benefits are widely shared, have tended to be more successful (Kojima 2016; Rentschler and Bazilian 2017). However, there is to date relatively little evidence about which factors make people more likely to support reform.

This paper provides rigorous empirical evidence about the determinants of support for fuel subsidy reforms in Africa's largest economy – Nigeria.[3] Fuel subsidies in Nigeria are large – at the last estimate the state subsidises petrol to the tune of around USD 3.9 billion[4] – almost double the government's spending on health.[5] Subsidies exist because the government fixes the price of petrol for consumers below the international price, and uses government resources to pay for the difference.[6] They were first introduced in Nigeria in the 1970s as a response to the oil price shock in 1973.[7] However, despite numerous attempts at reform, Nigeria has never successfully removed petrol subsidies,[8] in large part because of strong popular opposition to reform. We draw on a new large, nationally representative dataset of the perceptions of Nigerians regarding taxes and subsidies (McCulloch and Moerenhout 2019) to assess the factors that make people more or less likely to support reform. Support for reform is low, at under 30 per cent of the population. We also exploit a survey experiment that randomly provided respondents with different framings of the subsidy issue, to estimate the impact of different types of messages on support for subsidy reform. Our findings suggest that economic variables (related to price and availability), along with greater trust and service delivery, and stronger social and personal norms, are all associated with stated support for subsidy reform. However, different framings of the survey question did not yield significant changes in peoples' opinions.

Our paper is structured as follows. The next section reviews the existing literature on the perceptions of subsidies, and offers some hypotheses about the determinants of support for reform. The following section describes our data and the survey experiment that was conducted. The next section describes the variables used, the model we employ and our identification strategy. Our results are then presented, along with a set of robustness checks. The final section concludes with some lessons for policy and further research.

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[3]   Our analysis only looks at stated support for reform in a survey question. We are conscious that what matters from a policy perspective is not only people's views but whether they take action, which depends on a wide variety of factors including the perceived legitimacy of reforms and the context in which they take place (see Hossain et al. (2018) for more on these issues). Nonetheless, we believe that empirical evidence on the determinants of stated support for reforms can help to identify factors associated with such support, and point to measures that the government might take to make reforms more palatable.

[4]   Statement by the Minister of State for Petroleum https://www.ft.com/content/8094bfd4-ca29-11e8-9fe5-24ad351828ab.

[5]   Estimated by the World Bank to be $2.2 billion – see Hafez (2018).

[6]   Previously the government paid the difference to private marketers out of the government budget. Currently the government mandates the national oil company, NNPC, to undertake all imports, and they deduct the 'under-recovery' from the oil revenue that they remit to the government.

[7]   Subsidies used to be provided to diesel and kerosene as well, but are now only provided to petrol.

[8]   The government has attempted to 'reform' subsidies numerous times. However, this has almost always been done simply by increasing to a new fixed price. As a result of inflation, currency depreciation and changes in international oil prices, subsidies always re-emerge.

2 Literature and hypotheses

The literature on perceptions of subsidy reform comes from a variety of sources. The political science literature focuses on reform as a change to the social contract. For example, scholars of the Middle East and North Africa have emphasised that the implicit social contract between citizens and the state is reliant on welfare distribution via price subsidies and public employment (Hertog 2017; Luciani 1990; Fattouh et al. 2016; Moerenhout, Vezanis and Westling 2017). Similarly, Nigeria has a social contract largely depending on resource revenue. It fits the description of a classic rentier state, in which the government is granted the authority to extract, manage and trade natural resources, and is expected to redistribute this wealth to its citizens (Beblawi and Luciani 1987). Reforming subsidies then affects the social contract and erodes the sustainability of the rentier state model. In the absence of distributional and moral mitigation measures, such interventions can lead to political instability when considered as a unilateral change in the social contract (Moerenhout 2018a, 2018b). There is a consensus in this literature that public perceptions play a key role in making a shift in the social contract sustainable (Fattouh et al. 2016).

There is also a substantial policy-oriented literature on subsidy reform, including studies based on public opinion surveys. Sharma et al. (2018) find that households in Uttar Pradesh, India, are more willing to accept tariff increases if the availability of electricity supply improves. They also find that awareness about the existence of energy subsidies among households is very low. Also in India, Blankenship et al. (2019) find that willingness to pay for energy increases with the level of trust that citizens have in members of their community. A lack of community support for pricing reform and delays in improvements to services are critical factors in reducing popular support for reforms. Garg et al. (2016) also conclude that availability and reliability have a positive impact on accepting reform, and vice versa, with the absence of improvements having a negative impact.

However, to date, very few of these studies have been conducted in sub-Saharan Africa. Almost all studies start from the recognition that successful subsidy reform is not technical but more reliant on political economy factors, and that perceptions about subsidies and subsidy reform are strongly influenced by non-economic factors (Blankenship et al. 2019; Inchauste and Victor 2017; Craig and Allen 2014; Moerenhout, Sharma, and Urpelainen 2019). Our theoretical framework draws upon the literature on perceptions about tax compliance and tax morale (Luttmer and Singhal 2014; McCulloch et al. forthcoming). In particular, we explore five potential factors that may influence support for subsidy reform.

1. **Economic factors**. As in the literature on tax compliance (Allingham and Sandmo 1972), we would expect economic factors to have an influence on support for subsidy reform. Since subsidy reform generally entails an increase in fuel prices, we would expect those with high consumption (either in absolute terms or as a share of their overall income) to be more opposed to reform. On the other hand, those currently experiencing high prices when paying for fuel (indicating that they do not receive the subsidy) may be more in favour of reform than those facing lower prices. Since the short-run price elasticity for fuel is generally low, price increases erode real income and therefore have an impact on livelihoods, particularly of poorer households (Acharya and Sadath 2017). In Nigeria, it has been estimated that an uncompensated fuel price reform could increase the national poverty headcount by up to four percentage points (Siddig et al. 2014; Rentschler 2016), and our own focus group discussions in Nigeria pointed to the negative effects people experienced during the 2015 fuel price increase. However, the availability of fuel may also influence support for reform, as the literature suggests that consumers are often willing to pay for greater availability (Alkon et

al. 2016).

2. **Trust in government.** Trust in government in general (not specifically on subsidy reforms) appears to influence peoples' openness to subsidy reforms (Moerenhout, Vezanis and Westling 2017; Inchauste and Victor 2017). Government credibility is also strongly linked to a perception of government's ability to implement reforms and redistribute or reinvest savings from reform (Beaton et al. 2013; Bridel and Lontoh 2014; Baig et al. 2007; Indriyanto et al. 2013; Scobie 2018). In the Nigerian context, some authors have suggested that there is a trust deficit (Ogbu 2012), with many reform opponents such as labour unions and civil right groups highlighting the inability of governments to protect the poor (Soile and Mu 2015).

3. **Reciprocity and fiscal exchange.** In many countries with high rates of energy subsidisation, subsidies (and public employment) are central to welfare distribution and part of an implicit social contract. Reducing subsidies without improving social welfare protection may therefore be considered as a unilateral change in the social contract, which can give rise to protest and political instability (Moerenhout 2018a, 2018b). Substantial opposition in rentier states occurs when the public believes that the state is failing to fulfil their part of the contract (Luciani 1990). Conversely, if people believe that the state is fulfilling its obligations, by providing better services and transparently investing the savings from fuel subsidy reform into sectors of direct relevance to households (e.g. health, education and infrastructure), then they may be willing to accept subsidy reform, in the same way as improved services can increase support for tax compliance (Bodea and LeBas 2016; McCulloch et al. forthcoming).[9]

4. **Social and personal norms.** There is a large literature on the effect of social and personal norms on tax compliance and tax morale (Jimenez and Iyer 2016) as well as the influence of societal norms more indirectly (Bobek et al. 2013; Bobek et al. 2007; Damayanti et al. 2015). There is also a literature on the impact of religion and religiosity on tax compliance and tax morale (Torgler et al. 2008; Richardson 2008). However, tax payment is typically a choice, whereas whether one receives a fuel subsidy is not. As a result, there is very little literature on the connection between personal and social norms and support for subsidy reform. There is, however, some evidence that citizens from resource-rich countries appear prone to the belief that resource wealth should be distributed among the population, including by lowering prices of the resource (Chelminski 2018). In some OPEC countries there remains a strong belief that certain sections of society (the poor, car drivers, farmers) deserve at least some form of subsidised energy (Hochman and Zilberman 2015). Furthermore, support for pricing reform is clearly influenced by the extent to which those in the same community support reform (Blankenship 2019).

5. **Knowledge and complexity.** In countries all over the world, household surveys show an overwhelming lack of awareness about the existence of subsidies. This lack of awareness has a negative impact on the acceptance of energy price increases (Garg et al. 2016; Sharma et al. 2018; Pradiptyo et al. 2015). The lack of awareness of the existence of a subsidy has also been confirmed in a previous survey in Nigeria (Nwachukwu and Chike 2011). The complexity of subsidies and subsidy reform also impacts potential support, which is why being able to frame subsidy reform has been considered crucial (Lindebjerg et al. 2015). Such framing is about linking fuel subsidy reform to the dominant belief systems of a particular stakeholder, in many cases households. This framing thus varies across countries and cultures. For example, in Egypt in 2014 subsidy reforms were framed as being necessary to lift Egypt out of economic crisis, and thus appealed to both the patriotism and quest for economic opportunity of most Egyptians (Moerenhout 2018a). In Jordan, on the other hand, fuel subsidy reforms were framed as being essential not to end up in a

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[9] This said, we acknowledge that fiscal reciprocity around taxation does differ from that around subsidies. In particular, people often regard services as a right, and view taxation as a reasonable obligation if those services are delivered. In contrast, many people regard subsidies as a right, and so do not always see the provision of services or other public goods as a reasonable form of compensation for their removal.

situation like Syria, thus convincing Jordanians they are necessary for security and stability (Moerenhout, Vezanis, and Westling 2017). Our intervention, therefore, examines whether particular frames have a higher impact on reform acceptance than others.

In addition to the above five factors, support for reform may be influenced by a wide range of personal and social characteristics: income (Acharya and Sadath 2017), education (Garg et al. 2016; Pradiptyo et al. 2015) and geographical location (Garg et al. 2016; Pradiptyo et al. 2015) have all been shown to be relevant in explaining willingness to accept fuel subsidy reforms. Table 1 below communicates the general hypotheses we want to test for each explanatory category.

Table 1 Hypotheses under each explanatory category

Explanatory category	Hypotheses tested
Economic	1. People who pay more for fuel are more likely to support reform.
	2. People who suffer more from problems of availability are more likely to support reform
Trust in government	3. People with a higher trust in government are more likely to support reform
	4. People who support the current president (who has opposed reform) are less likely to support reform
Reciprocity & fiscal exchange	5. People who are satisfied with services are more likely to support reform
	6. People who have noticed an improvement in services are more likely to support reform
Social & personal norms	7. People who believe citizens need to contribute for the country to develop are more likely to support reform
	8. People who are more religious are more likely to support reform
Knowledge & complexity	9. People who understand that a subsidy exists are more likely to support reform

3 Data and survey experiment design

To test our hypotheses, we draw on a new dataset of the attitudes and perceptions of Nigerians towards tax compliance and subsidy reform. This consisted of two major quantitative surveys – a household survey and a survey of small firms conducted during July 2018, as well as a set of focus group discussions (FGDs) on subsidy reform.[10] We briefly outline below the composition of each
source of data.

3.1 Household/individual survey

In July 2018, a survey was conducted of 10,000 Nigerian adults across the country. A clustered, stratified, multi-stage random selection procedure was used to achieve a nationally representative sample. The sample is also representative of Nigeria's six geopolitical zones,[11] as well as representative of both urban and rural areas. Households were sampled from all states (with probability proportionate to their populations). Because of the small sample size in each state, results are not statistically representative at the state level, except for the oversampled states (see below). The data was collected by in-home, face-to-face personal

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[10]   The data collection process was coordinated by Neil McCulloch and Tom Moerenhout, and funded by the Bill and Melinda Gates Foundation in support of the work of the Nigeria Economic Summit Group. The Nigeria-based survey firm Practical Sampling International conducted the data collection. The survey and focus group discussions were piloted in May 2018, and the data collection exercise was conducted in July and August 2018. The firm survey did not contain questions on subsidy reform. The full data and documentation are available at https://www.ictd.ac/dataset/ nesg-nigeria-tax-subsidy-perception-dataset/.

[11]   North-Central, North-East, North-West, South-East, South-South and South-West.

interviews in the language with which the respondent was most comfortable. Respondents were adult Nigerian males and females aged 18 years and above. They were also expected to have lived in the household for a period of not less than six months. An equal number of male and female respondents were selected. The survey excluded non-Nigerian citizens, people aged less than 18 years and people living in institutionalised settings. The sample was stratified to provide greater representation in urban areas: 70 per cent of individuals were selected from urban areas and 30 per cent from rural areas. Sampling weights were created to account for this design.

It was also desired to be able to provide representative results at the state level. Doing this for every state would have been prohibitively expensive. Therefore, six states were 'oversampled' – one in each geopolitical zone: Ogun (South-West); Rivers (South-South); Abia (South-East); Nasarawa (North-Central); Kano (North-West); and Bauchi (North-East). The sampling and data collection procedure in each of these states was the same as that for the nationwide survey. In each of these six states, 1,000 individuals were selected (again, split 70% urban, 30% rural, and 50:50 men/women). This provided a sufficiently large sample in these six states for comparisons
of results across these states.

The criteria for the selection of the six states for the over-sample (other than having one per geopolitical zone) were three-fold:

1. GDP per capita: ensuring representation of states with relatively high GDP per capita (Ogun, Abia, Rivers), as well as those with much lower GDP per capita (Kano, Bauchi)
2. Growth of internally generated revenue (IGR):[12] inclusion of states that have achieved significant increases in their IGR between 2012 and 2016 (Ogun, Bauchi, Kano), as well as those whose IGR performance has been much weaker (Abia, Nassarawa)
3. Derivation vs. non-derivation:[13] inclusion of some states that receive revenue from the 13 per cent derivation of oil income (Abia, Rivers), as well as those that do not.

Figure 1 shows a map with the geopolitical regions and states indicated.

Sampling weights have been calculated so that it is possible to use the entire sample of 16,000 households as a single dataset, with weights reflecting both the urban/rural stratification and the much higher probability of selection of the respondents in the over-sampled states.[14]

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[12]   This reflects the main purpose of the survey which was to explore perceptions on tax – see McCulloch et al. (2019).
[13]   In Nigeria, 13% of oil revenue is reserved to be distributed to the states with the oil. This is known as the 'derivation'.
[14]   See the Field, Technical and Methodology Report available from https://www.ictd.ac/dataset/nesg-nigeria-tax-subsidy-perception-dataset/for details.
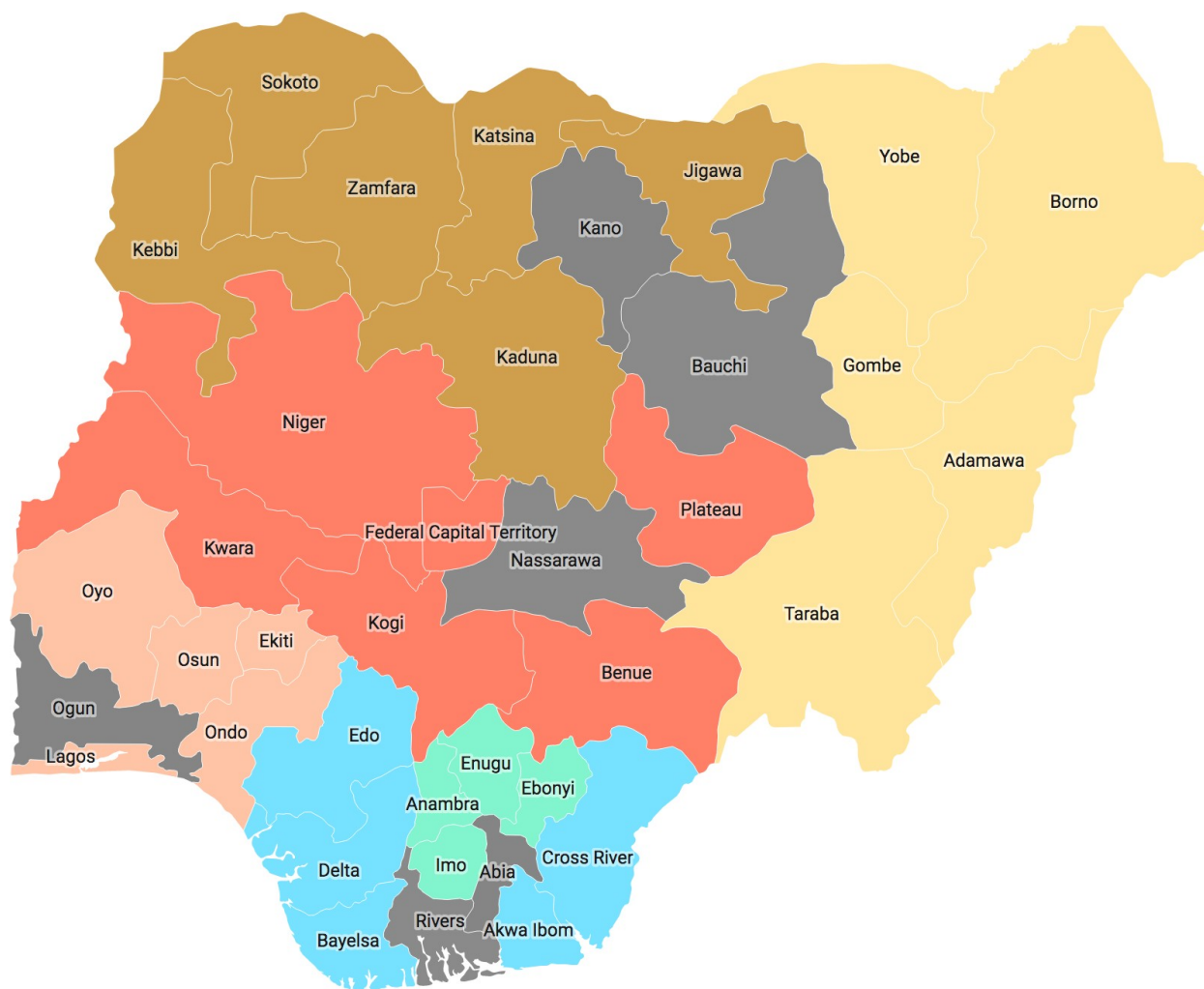
Figure 1 Map of Nigeria and geopolitical regions

3.2 Focus group discussions

Quantitative surveys can provide excellent representative data on the perceptions of individuals and firms on subsidy reform, but it is sometimes difficult to know why respondents hold the views shown. We therefore complemented the quantitative surveys with a set of focus group discussions (FGDs). Two FGDs on subsidy reform were held with households in each region – one
with men, and another with women. The FGDs were spread across both urban and rural areas.[15] The FGDs explored: availability and delays in access to fuel; knowledge of subsidies; the incidence and relative size of the subsidies; the impact of the 2016 price increase; and attitudes towards government policy.

3.3 Survey experiment

One of our aims was to explore how different types of messaging or framing of the issue of fuel subsidies affect support for reform. To design a set of alternative framings for subsidy reform, we drew on the existing literature as well as our own experiences. Existing studies emphasise that attitudes toward energy subsidy reforms can be influenced by a better understanding of

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[15]   Separate FGDs were also held to explore tax perceptions – see McCulloch, Moerenhout, and Yang (forthcoming) for details.

the size of energy subsidies and their regressive nature (Fattouh 2016; Garg et al. 2016; Moerenhout 2018a; Pradiptyo et al. 2015), better quality of service (Kennedy et al. 2019; Sharma et al. 2018), trust in government including the promise of reducing corruption and providing better services (Alkon et al. 2016; Bridel and Lontoh 2014), and an increase in social trust (Blankenship et al. 2019). Studies also mention the need to tailor messages to particular stakeholders, and to keep them both simple and focused (Beaton et al. 2013; Indriyanti et al. 2013). Others mention that attitudes are more easily changed when there is no space for bargaining – when citizens know reforms will happen for sure (Moerenhout 2018a).

In addition, the World Bank's Energy Sector Management Assistance Program (ESMAP) has conducted several public opinion surveys as a preparation for strategic communications for energy subsidy reforms. Such studies have been conducted in, among others, Egypt, Iraq, Iraqi Kurdistan, Lebanon, Guinee, Togo and Mali. Unfortunately, the results of these opinion polls (and the framings they resulted in within strategic communication campaigns) are not in the public domain, but the authors of this paper have participated in many of these exercises and so we have also drawn on these experiences in shaping our choice of framings below.

Our survey was designed as a survey experiment. Households were randomly allocated to receive one of five framing treatments, including a control. Immediately prior to the main question on whether they thought it would be a good idea for the government to reduce fuel subsidies (which would increase the fuel price), respondents were read one of the following statements:

1. **NARRATIVE GROUP 0 (CONTROL):** PMS[16]/ Petrol currently sells at an official price of N145 but the actual price without subsidy would be around N180 per litre. This is because the government uses the nation's money to buy PMS for about N180 on the international market, and then sells it at the lower price on the local market.
2. **NARRATIVE GROUP 1 (INCOME DISTRIBUTION):** PMS/Petrol currently sells at an official price of N145, but the actual price without subsidy would be around N180 per litre. This is because the government uses the nation's money to buy PMS for about N180 on the international market, and then sells it at the lower price on the local market. What few people know is that the rich actually receive the largest benefit from this subsidy because they consume far more PMS/Petrol than the poor. The richest 20 per cent of Nigerians benefit more than four times as much from the fuel subsidy than the poorest 20 per cent of Nigerians. The fuel subsidy is thus a very unequal subsidy, benefiting mostly the rich.
3. **NARRATIVE GROUP 2 (ALTERNATIVE EXPENDITURES):** PMS/Petrol currently sells at an official price of N145 but the actual price without subsidy would be around N180 per litre. This is because the government uses the nation's money to buy PMS for about N180 on the international market, and then sells it at the lower price on the local market. The amount that the government spends on the fuel subsidy is roughly equal to what the government spends on health annually. It is also about half of what the government spends on education. If government could increase fuel prices it would not have to pay the subsidy anymore, and so it would be able to use this money to spend more on health and education.
4. **NARRATIVE GROUP 3 (AVAILABILITY):** PMS/Petrol currently sells at an official price of N145 but the actual price without subsidy would be around N180 per litre. This is because the government uses the nation's money to buy PMS for about N180 on the international market, and then sells it at the lower price on the local market. The subsidy is one of the reasons for supply shortages of PMS, which you may have experienced, with long queues at the petrol station. This is because private fuel suppliers are not willing to supply fuel for less than it costs them, and so, if the government fails to pay them the subsidy, they stop supply. If the official price were higher, the government would be better able to make sure

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[16]   Petrol in Nigeria is known as Petroleum Motor Spirit or PMS.

there is consistent availability of PMS.

5. **NARRATIVE GROUP 4 (OIL NATIONALISM):** PMS/Petrol currently sells at an official price of N145 but the actual price without subsidy would be around N180 per litre. This is because the government uses the nation's money to buy PMS for about N180 on the international market, and then sells it at the lower price on the local market. Nigeria exports lots of crude oil, but it imports most of its fuel, such as PMS, because its refineries are in a poor condition and so Nigeria cannot make sufficient PMS from its own crude oil. Investment in Nigeria's refineries has been low because they can't make money if they have to sell fuel at subsidised prices. Removing subsidies and increasing the PMS price would enable investment in refineries, so that Nigeria didn't need to import so much fuel and could rely more on its own resources.

Because the survey was administered using electronic tablets, rather than paper, this allowed the software to randomly assign one of the above treatments or control statements automatically to each respondent. This eliminates any bias or error that might occur if enumerators selected which treatment to offer.

By randomly assigning respondents to each group, it is possible to estimate the impact of each type of framing on support for subsidy reform.

4 Variables, model and identification strategy

4.1 Variables

Our key dependent variable is support for reducing subsidies – a binary variable. Specifically, the question asks 'In your opinion, do you think it would be a good thing if the government reduced the fuel subsidy (which would increase the fuel price)?'

Our key explanatory variables follow the explanatory categories described above, as follows.

1. **Economic factors.** As outlined above, there is a strong theoretical presumption that our neoclassical variables should influence support for reform. For example, respondents who have to pay more than the official price might be expected to feel frustrated that they are not benefiting from subsidies and be more supportive of reform in general.[17] Similarly, respondents who have recently experienced queues or no availability of fuel might also be expected to support reform of the subsidy system.
2. **Trust in government.** Our variable about trust in government focuses on trust in the federal government, which is responsible for subsidy policy. We also include, in some models, a variable on the respondent's approval of President Buhari. The president has expressed consistent opposition to petrol subsidy reform, and so we would expect supporters of the president to be less likely to support reform. However, this variable could also be endogenous, as respondents might support the president because of his stance on subsidy reform. We therefore estimate our model both with and without this variable.
3. **Reciprocity and fiscal exchange.** The variables that we use to capture the concept of reciprocity refer to the quality of service delivery, specifically electricity and bus services. In addition, we include service improvements over the last three years. It seems plausible that the delivery of good services and improvements over time might make respondents

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[17]   Prices actually paid vary significantly across the country. While the National Bureau of Statistics provides monthly figures for prices at the state level, this is still likely to be a lot of variation within states. We therefore use the price that respondents themselves report paying for fuel.

supportive of reform measures more generally, including subsidy reform, whereas there is no obvious pathway through which support for reform would influence people's views on service delivery.

4. **Social and personal norms.** To measure social norms with a variable that assesses the extent to which respondents agree that citizens must pay their taxes to the government for the country to develop. We would expect respondents who believe that they should pay their taxes to support the removal of subsidies for the same reason. Our measure of personal social norms is whether the respondent is an active member of a religious group. The tax literature suggests that religiosity can be associated with tax compliance, but we have no clear prior belief regarding how it should affect support for subsidy reform.

5. **Knowledge and complexity.** Our measure of knowledge about subsidies is based on a question that assesses whether the respondent understands that fuel is in fact subsidised.

In addition to the above explanatory variables, we include dummies for each of the survey experiment treatment groups, to assess the impact of the framing that we provide to the subsidy question.

Finally, we include in our analysis a set of controls for factors that are likely to influence support for subsidy reform. These include: age, level of education, employment status, gender, personal income after tax, whether they are in an urban or rural area, language group (a proxy for ethnicity), geopolitical region (including whether the respondent lives in an oil-producing state) and religion. Appendix Table A1 provides the basic descriptive statistics for all the variables.

4.2 Model

Given that our primary outcome variable of interest is a binary indicator, we mainly estimate logistic regression models. Specifically, our primary regression equation is specified as follow:

$$\text{Logit}(P(\text{SSR} = 1)) = \alpha + \beta 1.\text{Treat}_i + \beta 2.\text{NC}_i + \beta 3.\text{Trust}_i + \beta 4.\text{Recip}_i + \beta 5.\text{Norm}_i + \beta 6.\text{Know}_i + \gamma \mathbf{Z}_i, \qquad (1)$$

where i indexes households. The dependent variable is a binary indicator of whether a household i thinks reducing fuel subsidy is a good thing (SSR_i). Treat is a vector of our treatment conditions (i.e. Narrative Group 1 to 4). NC, Trust, Recip, Norm, and Know denote vectors of variables in each explanatory category – neoclassical factors, trust in government, reciprocity and fiscal exchange, social and personal norms, and knowledge and complexity, respectively. In addition, we include a battery of control variables, denoted with a vector, $\mathbf{Z}_i$. As robustness checks, we also estimate probit regression models and linear probability models.

4.3 Identification strategy

One of the challenges in estimating the relationship between our explanatory factors and support for subsidy reform is ensuring the exogeneity of the variables in the model. Fortunately, our treatment is randomised thus ensuring that the values of our control variables are almost identical across all control variables (see Appendix Table A2 for the balance table).

Moreover, the use of randomisation provides a useful methodological anchor for our broader model. Since the treatment was randomised, the addition of other explanatory variables should not significantly affect the coefficients on the treatments; if they do, this would be an indication either that the randomisation failed for this variable, or that the sample is being altered (through missing values among the added variables) in a non-random way. We have exploited this to ensure that we do not include explanatory variables in our model that give rise to spurious treatment effects.

Unfortunately, we do not have instruments for our other explanatory variables. We have therefore been careful to choose variables that are both plausibly exogenous and empirically not correlated with the treatment variables. Nonetheless, our results for these variables do not guarantee a causal relationship. We indicate where we have grounds for suspecting endogeneity problems and how we have addressed these below.

5 Results

5.1 Intervention results

Because we have randomised each respondent to a different framing of the subsidy issue, the Average Treatment on the Treated (ATT) can be estimated simply as a regression of our dependent variable against the dummies for each framing (Angrist and Pischke 2009). This is shown in the first column of Table 2.

None of the alternative framings show any statistically significant effect on support for subsidy reform.[18] This is not surprising – it would be remarkable if a simple paragraph read out before a question in a relatively lengthy questionnaire substantially altered long-held views on a controversial issue. Focus group discussions supported this point. Nearly all participants agreed about the fundamental value of petrol in Nigerian society, and how previous price increases had caused a negative impact amongst Nigerian households. While focus group participants discussed issues such as the poor state of refineries, the distribution of benefits and the availability of fuel, their opposition to reform seems to not necessarily be about the reduction of subsidies, but rather about maintaining the current price level. Some impacts of low prices, such as the poor state of refineries, are then primarily linked back to corruption rather than the current petrol price.

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[18]   Results are presented as odds ratios, so a value of greater than one indicates an increase in the odd-ratio of support for subsidy reform, while a figure of less than one shows a decrease.

Table 2 Effects of the intervention on support for subsidy reform: logistic regression estimation results

	(1) est1	(2) est2
Narrative group (income distribution)	1.056	1.018
	(0.063)	(0.070)
Narrative group (alternative expenditure)	1.082	1.055
	(0.066)	(0.074)
Narrative group (link subsidy and availability)	1.015	1.019
	(0.055)	(0.064)
Narrative group (subsidy and oil nationalism)	1.097	1.091
	(0.065)	(0.073)
Urbanisation		1.295***
		(0.126)
Female		1.133
		(0.092)
Employed		0.862
		(0.082)
Age (25-31)		1.171*
		(0.104)
Age (32-38)		1.280**
		(0.142)
Age (39-44)		1.579***
		(0.201)
Age (45-51)		1.253*
		(0.165)
Age (52 above)		1.168
		(0.195)
Language group (Yoruba)		1.502***
		(0.235)
Language group (Igbo)		1.237
		(0.267)
Language group (Hausa)		0.577***
		(0.097)
Language group (Other)		0.768*
		(0.121)
Education (Primary school)		0.995
		(0.152)
Education (Secondary school)		1.102
		(0.167)
Education (OND)		1.018
		(0.165)
Education (HND)		1.157
		(0.201)
Income (Less than N20,000)		1.062
		(0.137)
Income (N20,001-40,000)		1.131
		(0.161)
Income (Over N40,000)		1.213
		(0.192)
Christian		0.644
		(0.272)
Muslim		0.655
		(0.282)
Traditional		0.882
		(0.583)
North-east		3.429***
		(1.071)
South-south		0.682
		(0.186)
North-central		2.175***
		(0.600)
South-west		0.961
		(0.276)
North-west		4.565***
		(1.318)
Resident in oil-producing state		1.500*
		(0.345)
Observations	16228	13532

Robust standard errors clustered at the enumeration area in parentheses. South-east region is omitted (baseline category). We report the estimated coefficients and standard errors transformed to odds ratios. *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The second model in Table 2 shows the same treatment effects along with all personal and regional control variables. As the balance table showed, there are no statistically significant differences between the values of these variables across the treatment groups, and thus their

inclusion does not have a major impact on the treatment coefficients. However, Table 2 does reveal some interesting associations between the control and regional variables and support for subsidy reform. Respondents in urban areas are more likely to support reform than those in rural areas, and, conversely, those in rural areas are more likely to oppose subsidy reforms. Focus group discussions confirmed this result, with rural male respondents emphasising the positive impact of the fuel subsidy on economic opportunity and equity more than their urban counterparts. This is in line with other studies that suggest that rural households are more opposed to price increases because of affordability, with incomes relatively lower in rural areas (Blankenship et al. 2019; Garg et al. 2016). This result however remains interesting, as urban households are often believed to capture more of the absolute value of fuel subsidies than rural households (Kyle 2018) and so one might think that they would be more strongly opposed to reform.

We also find that women are more likely to support reform than men (a difference that was also remarkable among female rural respondents) On the other hand, those who are employed (and therefore, perhaps, more likely to consume fuel) are significantly less likely to support reform. Support for reform increases with age, up to around the age of 39-44, and declines thereafter, with least support among young adults (18-24).

The results for language and region are interesting. Language was included as a proxy for ethnicity. However, language is strongly correlated with region, with Yoruba speakers dominating in the South-West, Igbo in the South-East, and Hausa in the North. Including dummies for both language and region allows one to distinguish the impact of ethnicity, as well as to control for unobserved characteristics of people in particular regions that may not be captured by other variables. For language, the excluded category is English; for region, it is the South-East. Hence the model suggests that, relative to English speakers, Yoruba speakers are more in favour of reform, while the speakers of Hausa (and other less common languages) are biased against reform. Against this the results from the regional variables are interesting. Relative to the South-East region, all of the Northern regions (West, Central and East) are much more in favour of reform, while the South-South region is even more opposed. The South-East and the South-South are traditionally areas that are opposed to the current government, hence their opposition to reform may simply reflect opposition to any reform proposed by the government.

Interestingly, respondents living in 'derivation states' – oil-producing states that receive an automatic allocation of oil revenue from the government – are more in favour of reform. It is not entirely clear why this is the case. In theory, people in these states might understand that their states lose significant revenue due to the deduction of subsidy costs from revenue submitted by the national oil company to the federal government. However, this seems unlikely, since people in derivation states actually have a poorer understanding of subsidies than those in non-derivation states.[19] Moreover, focus group discussions in two derivation states provided no evidence for such an understanding.

Yoruba speakers – who mostly live in the South-West – are more in favour of reform than speakers of other languages, which is consistent with their traditionally commercial orientation. Hausa speakers, who dominate the Northern regions, traditionally have stronger support for state-driven development; this may explain the opposition to reform among Hausa speakers, while Northern residents in general support the current government, led by a president from the North.

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[19] In non-derivation states, 33% of respondents understood that the price at which the government purchases petrol from the oil companies is higher than the price of petrol sold to the public; in derivation states, only 23% of respondents understood this.

Results for education and income are much as expected, with support for reform rising with both. Many focus group discussants shared stories about the impact of the fuel price increase in 2015. There was a consensus on many people having to adjust lifestyles as a result of higher prices, including radical changes such as rationing food and cutting down on health and basic transport expenditure. This confirms the importance of having sufficient expendable income to deal with inflationary shocks that come alongside fuel subsidy reforms. While some of these shocks are especially high in the short term, none of the focus groups actually seemed to have experienced (or remember) previous reforms that way. Finally, there is no statistically significant difference in support for reform between Christians and Muslims.

5.2 Correlates of support for subsidy reform

Above we laid out a set of hypotheses about the factors that might influence support for subsidy reform. Table 3 shows the results of a model that attempts to estimate the influence of these factors.

Our model confirms some of our hypotheses. We suggested that neoclassical variables were likely to be an important factor in determining support for reform. This appears to be confirmed. Respondents that have had to pay much more than the regulated price are much more likely to support reform;[20] the same is true of respondents that have experienced fuel not being available at all within the month prior to the survey.[21] Focus group discussions confirmed large-scale discontent with supply disruptions, especially around religious holidays.

We also hypothesised that trust in the government would be key to achieving reform. There is some weak support for this. In most focus groups, however, government corruption was widely heralded as the key cause for poor refineries. This could indicate that trust in government is such an elusive concept to Nigerians that there are only a few people that have higher trust in government. Our raw data seems to support this hypothesis, indicating at least 75 per cent of the population do not trust the government at all or only a little. However, we also control for approval of President Buhari. Here we obtain a strong result – respondents who approve of the president's performance are strongly opposed to subsidy reform, reflecting the publicly-stated position of the president. However, this also poses a problem. It is possible that their support for the president is the result of his position on subsidy reform, making the variable endogenous. The second model in Table 3
therefore omits this variable.

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[20]   As a robustness check, we also explored whether deviations from the official price were associated with support for reform; we find rather weak evidence for this, suggesting that support for reform is higher when people perceive that they are paying more than the official price, but does not necessarily depend on what the price they pay actually is (the results are presented in Appendix Table A3).

[21]   We also have data on the prices actually paid and the quantities consumed. Unfortunately, this data has a large number of missing observations and the pattern of these missing observations is highly non-random, so we have excluded these from our analysis.

Table 3 Factors that influence support for subsidy reform: logistic regression estimation results.

	(1)	(2)
	est1	est2
Narrative group (income distribution)	1.072	1.074
	(0.082)	(0.082)
Narrative group (alternative expenditure)	1.062	1.063
	(0.084)	(0.084)
Narrative group (link subsidy and availability)	1.008	1.004
	(0.074)	(0.074)
Narrative group (subsidy and oil nationalism)	1.121	1.126
	(0.084)	(0.084)
Queue	0.995	1.001
	(0.144)	(0.146)
Paid more than the fixed price	1.716***	1.697***
	(0.220)	(0.212)
No availability	1.674***	1.658***
	(0.256)	(0.253)
General trust in federal government	1.073	1.006
	(0.118)	(0.108)
Approval of performance by President Buhari	0.924**	
	(0.031)	
Opinion about services in the area: electricity supply	1.084**	1.083**
	(0.034)	(0.034)
Opinion about services in the area: bus services	1.070**	1.070**
	(0.030)	(0.030)
Quality of government services provided by state govnmt compared to 3 yrs ago	1.043	1.027
	(0.060)	(0.058)
Tax for development	1.127**	1.115**
	(0.061)	(0.061)
Membership of religious group	1.178*	1.184**
	(0.101)	(0.101)
Understanding of subsidy granted	0.951	0.939
	(0.086)	(0.085)
Observations	12082	12107

Robust standard errors clustered at the enumeration area in parentheses.

We report the estimated coefficients and standard errors transformed to odds ratios. Results for control variables are omitted.
*$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$*

Variables representing fiscal reciprocity also appear to be strongly associated with support for reform. In areas where services (electricity and bus services) are better, support for reform is stronger, although recent improvements in service delivery do not appear to have a strong influence on support for reform. The former part is fairly logical. Since electricity provision in Nigeria is notoriously weak, many households receive electricity from generators. Focus group discussants confirmed that these generators run on petrol. As a result, a better supply of grid-based electricity would reduce the need to consume petrol in a generator, and therefore increase the acceptance of a higher pump price.

Social and personal norms also seem to influence support for reform. Respondents who believe that citizens should pay taxes to support development of the country are also more likely to support subsidy reform. Similarly, in a parallel to the tax literature, respondents who are active participants in religious groups are also more supportive of reform. This might be because the personal beliefs that are associated with religiosity are correlated with those that support

reform, or it may be that being part of a religious group provides a degree of social protection making respondents more willing to entertain bold reforms.

The one major challenge to our hypotheses is that, surprisingly, knowing of the existence of the subsidy does not appear to have any influence on whether one supports subsidy reform. Subsidy reform, it would appear, is something that people have made up their mind about regardless of whether they know what it is. This somewhat odd conclusion is further confirmed by our intervention, where none of the interventions seemed to make a big difference to accepting support. Focus group discussions can provide some insights on how this is possible. Nigeria experienced a subsidy reform in 2015, and it seems many people think the new price is now unsubsidised. This means they focus more on price than about the existence of a subsidy, which requires a more complex understanding of how that subsidy is determined by the international market price of petroleum products.

5.3 Robustness checks

To check that our results are not due to our particular methodology, we also estimated all our models using a Probit model and with OLS. The results for the comprehensive model are presented in Appendix Tables A4 and A5. The results are qualitatively the same. In addition, for each of our explanatory categories we experimented with alternative variables. However, some of these variables resulted in missing observations that were non-randomly allocated. In a few other cases, we obtained strong results – for example, a variable asking if the respondent felt that the money saved by a subsidy reform would be effectively used by the government was strongly positively associated with reform. However, such questions were asked after the treatment and so may reflect a desire not to be inconsistent with an earlier statement of support or opposition towards reform. To avoid such potential endogeneity, we have excluded these variables from our models.

6 Conclusion and policy implications

Given the scale of energy subsidies and the damage that such subsidies cause, reforming them is an important policy objective, particularly in countries like Nigeria where they represent a significant share of public resources. However, achieving such reforms is difficult, not least because subsidies have widespread public support. Understanding what drives support for reform is therefore useful, since it potentially enables policymakers to design more effective reform strategies.

We have outlined a set of factors that theory and the existing literature would suggest are likely to be associated with support for reform. Exploiting a large new dataset in Nigeria, we have tested these hypotheses and find broad confirmation of several of our hypotheses. In particular, traditional neoclassical factors, such as price and availability, appear to be associated with support for reform; where customers are charged more than the regulated price, or where they have experienced a lack of fuel, they tend to be in favour of reform. Trust in government is also associated with support for reform, as is delivery of reasonable national and local services, supporting the idea that building the 'social contract' is key to reform. Social norms, such as support for taxation, and personal norms, such as active participation in religious groups, also appear correlated with support for reform. Intriguingly, actual knowledge about subsidies is not – people appear to form their opinions on the issue regardless of their understanding of it.

We also conducted a survey experiment by randomly framing the context of the question about

subsidy reform in different ways – evoking issues of the distribution of the subsidy, alternative use of the funds, the availability of fuel and oil nationalism, as well as a neutral control. None of the different framings had a statistically significant impact on support for reform, although we do not find this particularly surprising – long-held views on controversial issues are rarely changed by an enumerator reading a single paragraph. However, our experiment did provide a mechanism of improving the identification of our wider model.

As we have shown above, there is surprisingly little rigorous research on the drivers of public opinion about such reforms in developing countries. Future research could usefully develop in three ways. First, to our knowledge, this is the first rigorous assessment of the determinants of support for subsidy reform in Africa; it would be useful to replicate this work in other countries facing significant subsidies (McCulloch and Dom (2019) show that this includes around a quarter of the countries in sub-Saharan Africa and dozens of countries in other regions). Second, it would be interesting to delve into the reasons behind some of our results – for example, why and how do religious norms influence support for subsidy reform. Third, and perhaps most important, it would be useful to replicate this study with a much stronger communications intervention. In this way, concrete evidence could be obtained about what sort of messages are most likely to be effective in shifting peoples' opinions on issues of subsidy reform (i.e. price increases) and how these vary by country and context.

Nonetheless, our results provide some pointers for policymakers designing policy reforms. Policy should strengthen the voice of those who have a natural support for reform, such as those experiencing high prices or shortages. At the same time, wider measures to build trust in government and to strengthen the social contract are also likely to help in making subsidy reforms more feasible. Information campaigns that aim to inculcate norms – for example, about the importance of paying tax – also appear to strengthen support for reform. Our results also suggest that, while improving knowledge about the existence of fuel subsidies may seem to be a logical first step, it is neither necessary, nor sufficient, for increasing support for reform.

Appendices

Table A1 Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Good to reduce fuel subsidy	0.314	0.464	0	1	16228
Narrative group (Control group)	0.2	0.4	0	1	16228
Narrative group (Income distribution)	0.2	0.4	0	1	16228
Narrative group (Alternative expenditure)	0.2	0.4	0	1	16228
Narrative group (Link subsidy and availability)	0.2	0.4	0	1	16228
Narrative group (Subsidy and oil nationalism)	0.2	0.4	0	1	16228
Queue	0.088	0.283	0	1	16228
Paid more than the fixed price	0.109	0.312	0	1	16228
No availability	0.077	0.266	0	1	16228
General trust in federal government	0.306	0.461	0	1	15738
Approval of performance by President Buhari	1.437	1.494	0	4	16156
Opinion about services in the area: Electricity supply	2.308	1.55	0	5	16170
Opinion about services in the area: Bus services	1.937	1.623	0	5	16046
Quality of government services provided by State Govnmt compared to 3 yrs ago	1.73	0.779	1	3	14899
Tax for development	2.408	0.830	1	3	15947
Membership of religious group	0.414	0.493	0	1	16228
Understanding of subsidy granted	0.322	0.467	0	1	16228
Urbanisation	0.700	0.458	0	1	16228
Female	0.5	0.5	0	1	16228
Employed	1.494	0.5	1	2	16096
Age (18-24)	0.223	0.416	0	1	16228
Age (25-31)	0.347	0.476	0	1	16228
Age (32-38)	0.207	0.405	0	1	16228
Age (39-44)	0.101	0.301	0	1	16228
Age (45-51)	0.067	0.251	0	1	16228
Age (52 above)	0.055	0.227	0	1	16228
Language group (English)	0.241	0.428	0	1	16221
Language group (Yoruba)	0.152	0.359	0	1	16221
Language group (Igbo)	0.117	0.322	0	1	16221
Language group (Hausa)	0.349	0.477	0	1	16221
Language group (Other)	0.14	0.348	0	1	16221
Education (No schooling)	0.08	0.271	0	1	16189
Education (Primary school)	0.1	0.301	0	1	16189
Education (Secondary school)	0.451	0.498	0	1	16189
Education (OND)	0.184	0.388	0	1	16189
Education (HND)	0.184	0.388	0	1	16189
Income (none)	0.22	0.414	0	1	13597
Income (less than N20,000)	0.361	0.48	0	1	13597
Income (N20,001-40,000)	0.247	0.431	0	1	13597
Income (over N40,000)	0.172	0.377	0	1	13597
No religion	0.002	0.045	0	1	16228
Christian	0.576	0.494	0	1	16228
Muslim	0.417	0.493	0	1	16228
Traditional	0.003	0.055	0	1	16228
South-east	0.136	0.343	0	1	16228
North-east	0.147	0.354	0	1	16228
South-south	0.157	0.363	0	1	16228
North-central	0.153	0.36	0	1	16228
South-west	0.186	0.389	0	1	16228
North-west	0.221	0.415	0	1	16228
Resident in oil-producing state	0.251	0.434	0	1	16228

Table A2 Balance checks across intervention groups

	(1) Narrative group 0 (Control)	(2) Narrative group 1 (Income distribution)	(3) Narrative group 2 (Alternative expenditure)	(4) Narrative group 3 (Link subsidy and availability)	(5) Narrative group 4 (Subsidy & oil nationalism)
Urbanisation	0.70	0.70	0.70	0.70	0.70
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Female	0.50	0.50	0.50	0.50	0.50
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Employed	1.49	1.49	1.50	1.49	1.50
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	32.23	32.15	31.84	32.31	32.28
	(0.19)	(0.19)	(0.18)	(0.19)	(0.18)
Education level	3.28	3.28	3.32	3.30	3.29
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Personal Income after tax	2.37	2.37	2.38	2.37	2.36
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Household income (last month, after tax)	2.54	2.54	2.54	2.53	2.56
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Language group (English)	0.24	0.24	0.25	0.24	0.24
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Language group (Yoruba)	0.15	0.15	0.15	0.15	0.15
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Language group (Igbo)	0.11	0.12	0.12	0.12	0.12
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Language group (Hausa)	0.35	0.34	0.34	0.35	0.36
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Language group (Other)	0.14	0.15	0.14	0.14	0.14
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
No religion	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Christian	0.58	0.57	0.59	0.57	0.57
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Muslim	0.42	0.42	0.40	0.42	0.42
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Traditional	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
North-east	0.15	0.15	0.15	0.15	0.15
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
South-south	0.16	0.16	0.16	0.16	0.16
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
North-central	0.15	0.15	0.15	0.15	0.15
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
South-west	0.19	0.19	0.19	0.19	0.19
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
North-west	0.22	0.22	0.22	0.22	0.22
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Resident in oil-producing state	0.25	0.25	0.25	0.25	0.25
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)

Mean/standard errors in parentheses.
We also conducted t-tests to check if the means across groups are statistically distinguishable. We find no evidence of it.

Table A3 The impact of spatial price variation on support for reform. Logistic regression estimations results adding deviations from the official price instead of 'overpay' variable

	(1) est1	(2) est2	(3) est3	(4) est4
Good to reduce fuel subsidy				
Narrative group (income distribution)	1.153	1.151	1.157	1.155
	(0.139)	(0.137)	(0.139)	(0.137)
Narrative group (alternative expenditure)	1.144	1.141	1.152	1.149
	(0.137)	(0.135)	(0.137)	(0.136)
Narrative group (link subsidy and availability)	1.148	1.146	1.151	1.149
	(0.136)	(0.135)	(0.136)	(0.135)
Narrative group (subsidy and oil nationalism)	1.234*	1.243*	1.235*	1.244*
	(0.142)	(0.143)	(0.142)	(0.143)
Queue	0.841	0.838	0.849	0.847
	(0.142)	(0.145)	(0.142)	(0.146)
Deviation from N145	1.005*	1.005		
	(0.003)	(0.003)		
Deviation from N145 (squared)	1.000	1.000		
	(0.000)	(0.000)		
Deviation from N145 (logged)			1.052	1.051
			(0.048)	(0.047)
No availability	2.214***	2.187***	2.208***	2.179***
	(0.342)	(0.340)	(0.343)	(0.340)
General trust in federal government	1.069	0.957	1.068	0.955
	(0.130)	(0.114)	(0.130)	(0.115)
Approval of performance by President Buhari	0.885***		0.884***	
	(0.037)		(0.037)	
Opinion about services in the area: Electricity supply	1.100***	1.097**	1.097**	1.094**
	(0.040)	(0.040)	(0.040)	(0.040)
Opinion about services in the area: Bus services	1.068*	1.069*	1.069*	1.070*
	(0.039)	(0.039)	(0.039)	(0.040)
Quality of government services provided by State Govnmt cf. 3 yrs ago	1.157**	1.133*	1.158**	1.134*
	(0.079)	(0.078)	(0.079)	(0.078)
Tax for development	1.192**	1.185**	1.183**	1.176**
	(0.083)	(0.082)	(0.083)	(0.082)
Membership of religious group	1.266**	1.291**	1.272**	1.298**
	(0.139)	(0.140)	(0.140)	(0.141)
Understanding of subsidy granted	1.064	1.039	1.062	1.038
	(0.115)	(0.112)	(0.115)	(0.112)
Observations	6270	6278	6270	6278

Robust standard errors clustered at the enumeration area in parentheses.
Region dummies are included in models (2) and (3).
We report estimated coefficients and standard errors transformed to odds ratios.
Results for control variables in models (2) and (3) are omitted.
*p < 0.10, ** p < 0.05, *** p < 0.01

Table A4 Effects of the intervention on support for subsidy reform: Probit regression results

	(1) est1	(2) est2
Good to reduce fuel subsidy		
Narrative group (income distribution)	1.033	1.013
	(0.037)	(0.042)
Narrative group (alternative expenditure)	1.049	1.032
	(0.038)	(0.044)
Narrative group (link subsidy and availability)	1.009	1.014
	(0.033)	(0.039)
Narrative group (subsidy and oil nationalism)	1.057	1.053
	(0.038)	(0.043)
Urbanisation		1.169***
		(0.068)
Female		1.074
		(0.052)
Employed		0.913
		(0.052)
Age (25-31)		1.104*
		(0.059)
Age (32-38)		1.164**
		(0.077)
Age (39-44)		1.322***
		(0.102)
Age (45-51)		1.150*
		(0.091)
Age (52 above)		1.103
		(0.110)
Language group (Yoruba)		1.282***
		(0.118)
Language group (Igbo)		1.134
		(0.145)
Language group (Hausa)		0.721***
		(0.073)
Language group (Other)		0.867
		(0.080)
Education (primary school)		0.999
		(0.093)
Education (secondary school)		1.065
		(0.098)
Education (OND)		1.014
		(0.099)
Education (HND)		1.101
		(0.115)
Income (less than N20,000)		1.034
		(0.080)
Income (N20,001-40,000)		1.075
		(0.091)
Income (Over N40,000)		1.120
		(0.106)
Christian		0.785
		(0.202)
Muslim		0.790
		(0.207)
Traditional		0.932
		(0.379)
North-east		2.091***
		(0.385)
South-south		0.802
		(0.131)
North-central		1.585***
		(0.254)
South-west		0.972
		(0.161)
North-west		2.502***
		(0.423)
Resident in oil-producing state		1.273*
		(0.169)
Observations	16228	13532

Robust standard errors clustered at the enumeration area in parentheses.
South-east region is omitted (baseline category).
*p < 0.10, ** p < 0.05, *** p < 0.01

Table A5 Factors that influence support for subsidy reform: Probit regression estimation results

	(1) est1	(2) est2
Good to reduce fuel subsidy		
Narrative group (income distribution)	1.042	1.044
	(0.048)	(0.048)
Narrative group (alternative expenditure)	1.034	1.036
	(0.049)	(0.049)
Narrative group (link subsidy and availability)	1.007	1.005
	(0.045)	(0.045)
Narrative group (subsidy and oil nationalism)	1.067	1.071
	(0.049)	(0.048)
Queue	1.000	1.004
	(0.088)	(0.090)
Paid more than the fixed price	1.382***	1.372***
	(0.108)	(0.104)
No availability	1.371***	1.364***
	(0.127)	(0.126)
General trust in federal government	1.046	1.007
	(0.069)	(0.065)
Approval of performance by President Buhari	0.956**	
	(0.019)	
Opinion about services in the area: electricity supply	1.049**	1.048**
	(0.020)	(0.020)
Opinion about services in the area: bus services	1.042**	1.041**
	(0.017)	(0.017)
Quality of government services provided by State Govnmt compared to 3 yrs ago	1.028	1.019
	(0.035)	(0.035)
Tax for development	1.073**	1.067**
	(0.034)	(0.035)
Membership of religious group	1.103*	1.106**
	(0.056)	(0.056)
Understanding of subsidy granted	0.976	0.970
	(0.053)	(0.052)
Observations	12082	12107

The results for control variables are omitted in the table.
Robust standard errors clustered at the enumeration area in parentheses.
Results for control variables are omitted.
*p < 0.10, ** p < 0.05, *** p < 0.01

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