Energy Policy 96 (2016) 491–503

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Incidence and impact: The regional variation of poverty effects due to fossil fuel subsidy reform

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HIGHLIGHTS

- Fossil fuel subsidy reforms can induce significant distributional shifts and price shocks.
- There is significant regional variation of a reform's effects on poverty rates.
- Compensation is key to protect livelihoods and win public support for reform.
- Compensation schemes must be carefully tailored to account for regional variation.

ARTICLE INFO

Article history:
Received 25 February 2016
Received in revised form
13 June 2016
Accepted 14 June 2016
Available online 24 June 2016

Keywords:
Fossil fuel subsidies
Reform
Cash transfers
Poverty
Regional variation

ABSTRACT

Since fossil fuel subsidy reforms can induce significant distributional shifts and price shocks, effective compensation and social protection programs are crucial. Based on the statistical simulation model by Araar and Verme (2012), this study estimates the regional variability of direct welfare effects of removing fuel subsidies in Nigeria. Uncompensated subsidy removal is estimated to increase the national poverty rate by 3–4% on average. However, uniform cash compensation that appears effective at the national average, is found to fail to mitigate price shocks in 16 of 37 states – thus putting livelihoods (and public support for reforms) at risk. States that are estimated to incur the largest welfare shocks, coincide with hotspots of civil unrest following Nigeria's 2012 subsidy reform attempt. The study illustrates how regionally disaggregated compensation can be revenue neutral, and maintain or reduce pre-reform poverty rates in all states. Overall, it highlights the importance of understanding differences in vulnerability, and designing tailored social protection schemes which ensure public support for subsidy reforms.

1. Introduction

Fossil fuel subsidies have been documented to be highly regressive, as they predominantly benefit the rich, thus having substantial implications for the distribution of wealth. The reason is that high-income households consume larger quantities of subsidised products – energy in particular – thus siphoning off a disproportionately large share of overall subsidies (Arze del Granado et al., 2012). As a necessary consequence the removal of fuel subsidies is also likely to trigger significant distributional impacts and income shocks. If unmitigated, these adverse effects can be felt across all income groups, with the poorest being particularly vulnerable.

Nigeria's attempted fuel subsidy removal in 2012 illustrates how the mis-management of such adverse effects can jeopardise entire reforms: the government's decision to remove subsidies on fossil fuel imports caused fuel prices to more than double. Strikes and violent public protests followed, prompting the government to immediately reintroduce subsidies (Bazilian and Onyeji, 2012; Siddig et al., 2014). Similarly, governments of Bolivia (2010), Cameroon (2008), Venezuela (1989), and Yemen (2005 and 2014) were all forced to abandon reform attempts following heavy public protests, particularly by low-income population groups (IEA, 2014; Segal, 2011).

These cases confirm that it is critical to understand the incidence of existing subsidy benefits, and the potential welfare impacts of a reform. Carefully designed compensation measures are essential for mitigating energy price shocks, ensuring the affordability of fuel, and protecting livelihoods of vulnerable households (Ruggeri Laderchi et al., 2013). Indeed, several

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http://dx.doi.org/10.1016/j.enpol.2016.06.025

successful subsidy reforms have demonstrated that – besides timely and credible communication of reform benefits – effective compensation is crucial for securing public support for reform (IMF, 2013a; Vagliasindi, 2012).

This paper focuses on Nigeria, and uses the statistical simulation model by Araar and Verme (2012) to estimate the regional variability of direct welfare effects of removing fuel subsidies. It finds that an uncompensated removal of fuel subsidies can increase the national poverty headcount rate by 3–4%. The paper investigates different compensation strategies and their effect on poverty rates both at the national and state level.

Crucially, this paper shows that uniform cash compensation that appears effective when considering national averages, fails to mitigate price shocks in 16 of 37 states – thus putting livelihoods at risk, and provoking public opposition. Notably, states identified to incur the largest price shocks were hotspots of violent public protests in 2012. As an alternative, this paper illustrates how a regionally disaggregated compensation strategy can ensure for all states that price shocks are mitigated, and poverty rates either unchanged or lower than before the reform. Overall, the analysis shows the need for thorough, disaggregated analyses of subsidy reforms, and tailored reform strategies.

The remainder of this paper is structured as follows: Section 2 provides more detailed information about Nigeria's fossil fuel sector and subsidy program. Section 3 presents a disaggregated analysis of energy consumption patterns in Nigeria to highlight underlying inequalities. Section 4 presents an empirical subsidy simulation: Section 4.1 presents the methodology, followed by an outline of the (hypothetical) reform scenarios in Section 4.2. Section 4.3 presents the results both at the national level (4.3.1) and disaggregated to the state-level (4.3.2). Section 5 concludes.

2. Fuel subsidies in Nigeria

As a developing country with substantial fossil resource wealth and a mixed track record of fiscal prudence and transparency, Nigeria is a frequently cited case for studying fossil fuel subsidies and natural resource management more generally.

Nigeria extracts 2.5 m barrels of oil a day, which account for 70% of government revenues and 95% of total exports (GSI, 2012; IMF, 2013b). These oil exports make Nigeria the fifth largest oil exporter in the world. Despite abundant energy resources, only 55% of Nigerians have access to electricity (34% in rural areas); annual per capita electricity consumption in 2012 was 155 kW h, compared to 4405 kW h in South Africa (World Bank, 2015). And electricity supply is not only elusive, but also unreliable: chronic underinvestment and corruption in the electricity sector mean that the average Nigerian enterprise experiences over 36 power outages a month, wiping out 4% of annual GDP. Similar problems plague the country's four national oil refineries, which operate at just 20–30% capacity. While over 70% of fuel consumption is met by imports, shortages are endemic (IMF, 2013a; World Bank, 2015).

Through the Petroleum Products Pricing Regulatory Agency, Nigeria maintains artificially low energy prices – most notably for kerosene and petrol (GSI, 2012). The gap between fuel import costs and regulated prices are financed through the Petroleum Support Fund, which administers fuel subsidies.[1] Fig. 1 provides estimates of the overall volume of the subsidy program, as well as fuel prices per litre; the reliability of these figures remains

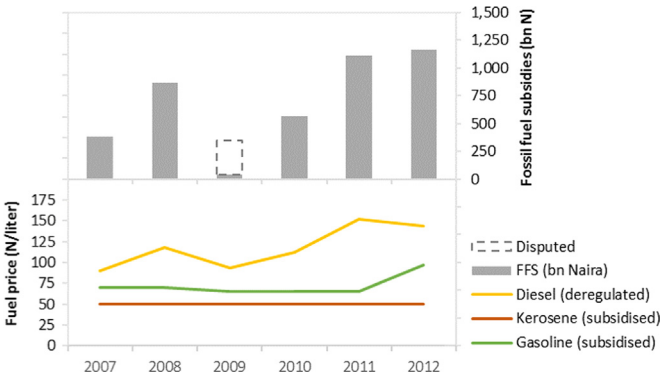

Fig. 1. Fossil fuel subsidies in Nigeria: *Upper panel*: Estimated annual fossil fuel subsidies, primarily for oil and oil derivatives (millions of Naira). Uncertainty persists over the amount of subsidies paid after a presidential directive in 2009 to suspend kerosene subsidies. *Lower panel*: Prices for diesel, petrol and kerosene in Naira per liter. (IEA, 2014; IMF, 2013).

uncertain due to conflicting information from different national authorities and large-scale subsidy theft (GSI, 2012; also see Section 4.2).[2]

At nearly 5% of GDP in 2011 subsidies are a significant expense for the government (IMF, 2013a); and fail to reach Nigerians in more than one sense: As with all fossil fuel subsidy schemes, the direct financial benefits to households are concentrated on the rich, thus failing to benefit the absolute poor (which constitute 61% of the population).[3] In addition, a complex and opaque system of intermediary dealers and political influence means that, instead of lowering the market price, subsidies are often privately appropriated before the fuel reaches the market. For kerosene, anecdotal evidence suggests that the subsidised rate of N50 per litre is in fact only available to privileged individuals, while regular consumers often pay prices between N120 and N250 (Udo, 2015). Finally, rampant fuel smuggling means subsidy benefits are leaking out of the country. Mlachila et al. (2016) estimate that over 80% of petrol consumed in Benin in 2011 was smuggled from Nigeria (about 60% in Togo).

Facing mounting fiscal pressures and recognising the inefficiencies of its subsidy scheme, Nigeria attempted a radical subsidy reform in 2012. While the need for such reform was pressing, the government failed to garner sufficient public support for its reform efforts. Public opposition to the reform had two key reason in particular: (i) A lack of credibility and transparency with respect to the handling of reform revenues, and (ii) inadequate plans for compensation and social protection, resulting from a poor understanding of the needs and vulnerability of affected energy consumers. Subsidy removal was met with extensive strikes and violent public protests, and prompted the government to swiftly reintroduce subsidies (Bazilian and Onyeji, 2012; Siddig et al., 2014).

3. Understanding energy demand

Understanding the patterns of energy consumption is crucial for understanding who stands to lose most from subsidy removal, and designing effective social protection schemes. This paper uses the Harmonized Nigeria Living Standard Survey of 2009/2010,

[1] The Petroleum Support Fund is managed by the Petroleum Products Pricing Regulatory Agency, and receives a set allocation in the federal budget. Contributions to the fund are made by the federal, state, and local governments. Moreover, the fund is supplemented by subsidy "surpluses", which essentially occur when international market prices exceed the government-set fuel price (GSI, 2012).

[2] For instance, there is conflicting information on the amount of subsidies provided following a 2009 government decision to remove kerosene subsidies (GSI, 2012). The NNPC maintains that N310 bn in subsidies have been paid out, but disputes between different authorities persist.

[3] This figure is based on the absolute poverty definition, using an absolute poverty line of N54,401 (NBS, 2010).

which provides consumption data for 33,775 households (or 149,261 individuals) across all 37 federal states (National Bureau of Statistics, 2013). The survey provides a detailed breakdown of household expenditure on food, education, health, energy and other goods.

Especially in countries such as Nigeria, where existing subsidy schemes are justified as a mechanism for redistributing natural resource revenues and for supporting poor households, it is critical to understand the scale of regressivity. Various studies have highlighted how energy subsidies fail to reach poor households: Arze del Granado et al. (2012) analyse a sample of 20 developing countries from around the world and find that on average the richest 20% benefit six times more from fuel subsidies than the poorest 20% (in absolute terms). Soile and Mu (2015) confirm similar patterns for Nigeria.

The reason that the rich reap most of the subsidies is simply that they consume more energy. For instance, considering the correlation between vehicle ownership and spending on consumption goods, including energy, illustrates that richer households in Nigeria tend to own more and bigger motorised vehicles, and thus consume more petrol (Fig. 2).

The level of income inequality in Nigeria is reflected in Fig. 3. Consumption expenditure (which includes food, rent, education, energy, among others) is a common proxy for income levels, and indeed varies substantially across income deciles. In per capita terms, the data suggests that consumption expenditure by the richest 10% of the population exceeds that of the poorest 10% by a factor 10. The 2nd and 9th deciles still differ by a factor 4 – and there is little difference to this pattern between urban and rural areas.

Considering energy consumption separately, inequality is significantly more pronounced than for aggregate consumption (Fig. 3, right). In urban areas, the richest 10% spend 28 times more on energy consumption than the poorest 10% (factor 23 in rural areas). Notably, across the entire income distribution, average energy expenditure by urban households is consistently higher than by rural households (despite having the same level of total expenditure). This may reflect a variety of issues, including access to and availability of energy, and differing economic activities. It comes as no surprise that fuel subsidies primarily benefit the rich, and thus directly reinforce existing patterns of inequality and poverty.

Moreover, regardless of income levels, urban households spend a larger share of their income on energy than their rural counterparts (Fig. 4). Roughly speaking, most of the urban population spends around 5% of their income on energy, while rural households spend around 3%; and in both cases the energy share is significantly larger for the highest income households.

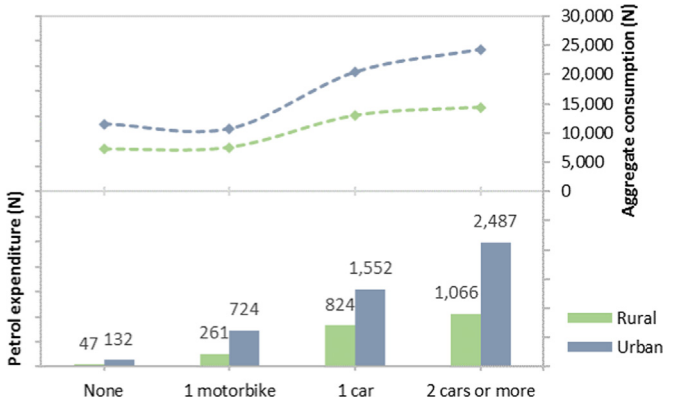

Fig. 2. Average household expenditure for all consumption goods (upper panel), and petrol (lower panel), according to ownership of motorised vehicles (N/month).

Note, however, that these figures only reflect direct spending on energy goods (e.g. fuels and electricity), and do not take into account the energy cost of other consumption goods. In the medium to long run, changes in energy prices will indirectly affect the costs of public transport, manufacturing, distribution of goods, and other parts of the economy. Moreover, particularly for low-income households even small amounts of energy can be crucial for income-generating activities (incl. agriculture), and for ensuring access to services and markets. This means that livelihoods of the poor are likely to be more strongly affected by energy prices than the above numbers suggest. For high-income households, energy consumption is more likely to be "compressible" – i.e. relatively more energy (such as transport fuels) is used for non-essential purposes.

To understand this, it is useful to disaggregate consumption patterns for different forms of energy, which typically serve very different purposes (Fig. 5). Kerosene, for instance, is a fuel most commonly used for lighting and cooking – richer households typically substitute kerosene for cleaner energy, such as electric light. Moreover, natural constraints (e.g. on the number of meals prepared per day) mean that kerosene has a lower income elasticity than, for example, petrol which displays the characteristics of a luxury good. Indeed, petrol consumption is highly "unequal": the richest 10% consume 65.8% of all petrol used in urban areas (29.7% in rural areas), while the poorest 10% consume a mere 0.03% (1.9% in rural areas). In contrast, kerosene consumption is more evenly distributed.

Across all fuels types, consumption inequality is less pronounced in rural than in urban areas (Fig. 5, left). In terms of average expenditure, rural households spend less than urban households, particularly on electricity and kerosene. Again the fact that total energy consumed in rural areas is considerably less than in urban areas may reflect issues around access and availability.

This difference hints at a more complex underlying pattern, which the binary *rural–urban* distinction may not fully capture. Even at the same income level, regional differences may have a substantial influence on energy consumption. Fig. 6 illustrates the sharp regional differences: for each state, it maps the average monthly expenditure by poor people (here defined as total consumption expenditure being under N55,000 per year) for energy overall, petrol, kerosene, and electricity. Expenditure levels differ significantly across states, and across different energy goods. In general, poor people in the more developed South-West spend more on energy than those in the North-East, suggesting stronger reliance on energy products.

The data presented in this section allow for several observations on energy consumption in Nigeria: (i) Absolute spending on energy goods is more unequally distributed than overall consumption and income. The highest income decile accounts for 37.5–66% of total expenditure (depending on which energy good is considered). (ii) Energy expenditure relative to income is increasing with income. Top income households spend the highest income share on energy. (iii) Roughly speaking, poor people in the more industrialised Southern states spend significantly more on energy than poor people in Northern states.

It is reasonable to infer that poor households, which are particularly reliant on energy for their livelihoods (e.g. for income generating activities), will be especially vulnerable to energy price shocks. Hence, identifying vulnerable households and assessing the level of their exposure and vulnerability is necessary for designing adequate compensation and social protection measures.

4. Simulating reform

This section provides the results from a subsidy reform simulation for the case of Nigeria, conducted based on the empirical

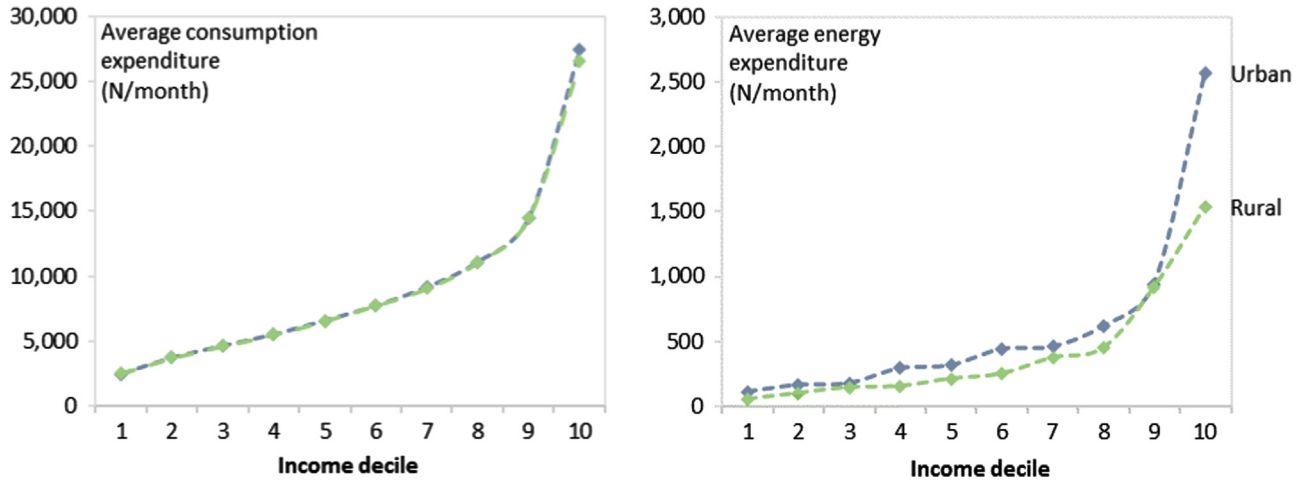

Fig. 3. *Left panel:* Average per capita expenditure on all consumption goods, according to income deciles. *Right panel:* Average per capita expenditure on energy goods, according to income deciles. All numbers are in Naira per month.

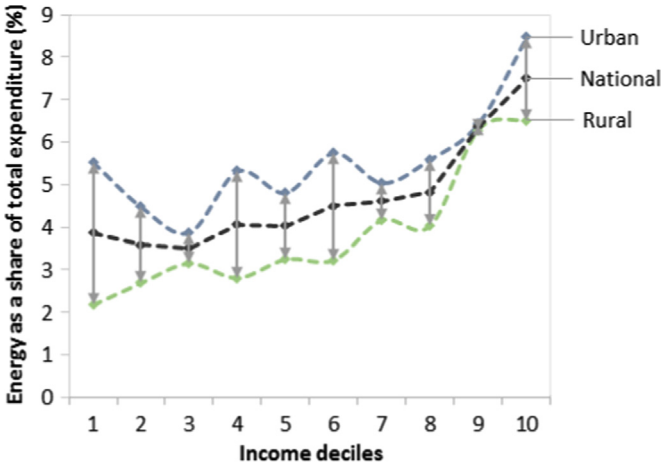

Fig. 4. Expenditure on energy goods as a share of total consumption expenditure, according to income deciles.

simulation model by Araar and Verme (2012, Subsim). The focus of this simulation is to get an indication of the magnitude of the short- to medium-term welfare effects of a subsidy removal, and understand how these effects may vary across regions.

This simulation only considers the direct welfare effects that occur when a removal of fuel subsidies increases households' cost of maintaining energy consumption. It does not account for further indirect welfare effects which are bound to occur as rising energy prices also increase the cost of other consumption goods, such as food and public transport; accounting for such indirect price effects requires the analysis of input-output tables, or use of general equilibrium models. A study by Arze del Granado et al. (2012) suggests that on average indirect effects make up about 60% of the total impacts of a subsidy removal.

Araar and Verme (2012) suggest that the omission of indirect price effects is reasonable if the focus is on short- to medium-term effects (e.g. up to 2 months) of a subsidy removal. They point out that analysing direct effects has the advantage of requiring only a single household expenditure survey, and few ex-ante modelling assumptions.[4] This paper follows this approach and focuses on the variability of impacts across income groups and federal states. Note that input-output tables are not available at the state-level, and the generalised use of a national input-output table would defeat the point of looking beyond national averages.

4.1. Methodology

The underlying methodology for assessing direct welfare effects of standard fossil fuel subsidy removals is based on Araar and Verme (2012) who offer a more detailed exposition: expenditure on aggregate consumption is used as a proxy for a household's income and thus its level of welfare.[5] As subsidies for certain energy goods are removed, their prices increase. Given the developing country setting, it is assumed that the majority of households cannot simply draw on savings to compensate for higher energy prices. This implies that – at least in the short- to medium-run – it is reasonable to assume that households' budgets are fixed; thus, households can only respond to higher prices by reducing the consumption of the (formerly) subsidised good, or by substituting it (e.g. for a cheaper type of fuel). Aggregated at the national level, these effects mean that overall consumption expenditure (i.e. welfare) would fall, and poverty increase.

Formally, the overall change in welfare (ΔW) due to subsidy removal can be expressed as

$$\Delta W = \Delta C = -\sum_{i=1}^{N} c_{g,i}^{0} dp_g = -\sum_{i=1}^{N} c_{g,i}^{0} \frac{\Delta p_g}{p_g^0} \quad (1)$$

where $c_{g,i}^{0}$ denotes consumption expenditure for subsidised good g by household i before the reform (i.e. $t = 0$). N denotes the overall number of households in a country or state, and Δp_g the absolute price change (i.e. $\Delta p_g = p_g^0 - p_g^1$). This implies that irrespective of whether and how households substitute away from the subsidised good, the real decrease in welfare is equivalent to the relative change of the cost of pre-reform consumption of the subsidised good.

In other words, the countrywide welfare effect of a subsidy reform depends on two main factors, which can differ across regions, and thus necessitate different compensation measures:

- *Pre-reform consumption of the subsidised good (c_g^0):* In absolute terms, the more a household consumes of the subsidised good, the higher the absolute welfare effects of reform. Likewise,

[4] Araar et al. (2015) and Verme and El-Massnaoui (2015) both follow this approach to consider fuel subsidy reforms in Libya and Morocco respectively. See Siddig et al. (2014) for a CGE analysis.

[5] For the purpose of household survey analyses consumption based welfare measures are the most common approach; see Deaton (2003).

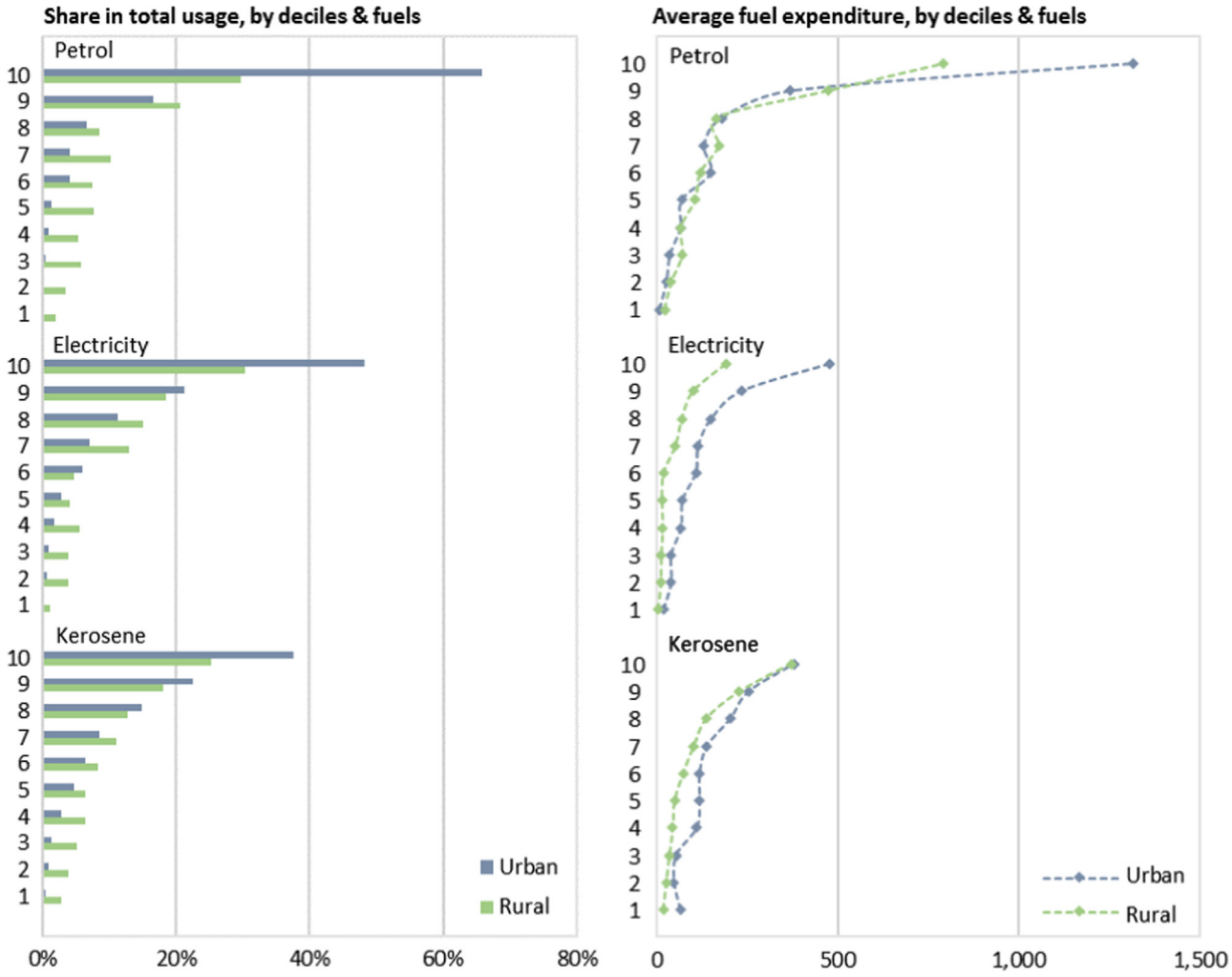

Fig. 5. Different fuels, different usage patterns: *Left:* Share in total expenditure, according to income deciles and different fuels. *Right:* Average monthly per capita spending on different fuels, according to income deciles.

relative welfare effects depend on the share of the subsidised good in total consumption expenditure (c_g^0/c^0); i.e. the more a household spends on the subsidised good relative to income, the more it is "exposed" to the welfare effects due to the removal of subsidies.

- *Relative price change due to subsidy removal (dp_g):* The extent to which a subsidy reform affects household consumption and welfare depends on the extent to which prices increase. In principle, if the level of subsidy is known (e.g. in terms of $/litre of petrol), the price change due to subsidy removal is straightforward to establish. In practice, as in the Nigerian example, official government-set prices may vary substantially from actual prices in the market place, due to issues such as misappropriation of subsidy funds, corruption, and ineffective distribution. This issue is difficult to quantify, and remains an uncertainty throughout the analysis.

In line with Eq. (2), which shows the post-reform decrease in overall spending or welfare, the absolute change in consumption of the subsidised good can be expressed as

$$\Delta C_g = \sum_{i=1}^{N} \epsilon_{g,i} c^0_{g,i} dp_g. \tag{2}$$

The price elasticity of demand $\varepsilon_{g,i}$ reflects that households may adjust their consumption of the subsidised good in response to changing prices. Note that the elasticity is given by the ratio of the relative changes in consumed quantity and price:

$$\epsilon_{g,i} = \frac{\Delta q_{g,i}/q^0_{g,i}}{\Delta p_g/p^0_g} \tag{3}$$

Note that inelastic demand (ε_g=0) would imply that subsidy removal does not cause households to adjust the consumed quantity of the subsidised good (yet, a fixed budget constraint means that consumption of other goods is reduced). In practice this could, for instance, be the case if the subsidised fuel is critical for income generating activities, and no alternative fuels are available. On the other hand, fully price elastic demand (ε_g= − 1) would imply that households reduce consumption of the subsidised good at the same rate with which prices were increased.

In addition to investigating aggregate consumption and welfare, it is possible to make a simple approximation of a government's reform revenue. In the formal setting introduced above, the additional revenue for a government that results from the removal of fuel subsidies can be expressed as

$$\Delta R_s = \sum_{i=1}^{N} c^0_{g,i} dp_g \Big(1+\epsilon_{g,i}\Big(1+dp_g\Big)\Big). \tag{4}$$

This expression implies that reform revenue is equivalent to the nominal aggregate change in households' consumption

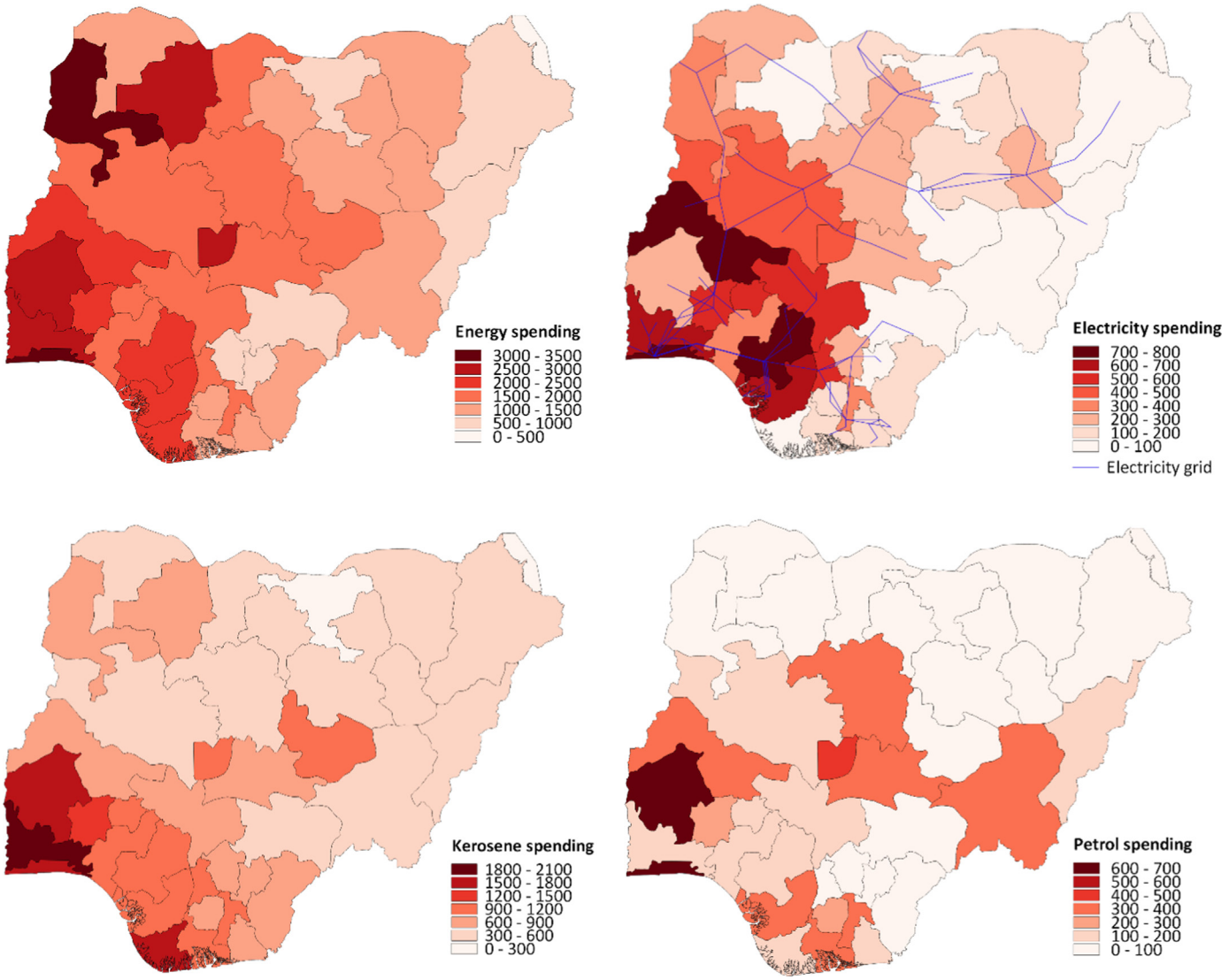

Fig. 6. These maps display the average monthly per capita spending on energy by all Nigerians living below the absolute poverty line (here defined as total consumption expenditure below 55,000 Naira per year, which roughly corresponds to $1 per day in 2010). All numbers are in Naira per month.

expenditure on the subsidised good; or in other words, the households' loss (in terms of reduced consumption) is the governments gain (i.e. avoided payment of subsidies). Note that for the purpose of this paper, overall reform revenue is the sum of revenues from subnational states s, such that $\Delta R = \sum_{s=1}^{S} \Delta R_s$.

4.2. A hypothetical fuel subsidy reform

This section briefly sets out the main features of a hypothetical fossil fuel subsidy reform:

4.2.1. Elasticities

There are few robust estimates for price elasticities of different fossil fuels in Nigeria. The analysis is complicated by highly distorted and manipulated markets, significant supply shortages and access barriers (Iwayemi et al., 2010). Omisakin et al. (2012) find that energy demand in Nigeria is relatively inelastic: long-run price elasticities are estimated to be -0.016 for petrol and -0.205 for kerosene. Iwayemi et al. (2010) use cointegration regressions to estimate statistically significant long-run price elasticities of –0.115 for kerosene, and –0.106 for aggregate energy products (i.e. petrol, diesel and kerosene). In the short-run, they estimate price elasticities to be –0.415 for diesel, and –0.249 for petrol.

In a survey of 18 developing countries Dahl (1994) suggests that short- run price elasticities for oil demand tend to be clustered between –0.05 and –0.09, while long-run elasticities are as low as –0.3. These figures are in line with a more recent study: Arzaghi and Squalli (2015) estimate elasticities for petrol demand in 32 fuel-subsidizing economies. They find short- and long-run price elasticities to be around –0.05 and –0.25 respectively.

For the purpose of this paper a price elasticity of –0.3 is used for all energy products. For comparison, Verme and El-Massnaoui (2015) conduct a subsidy reform analysis for Morocco, and use a price elasticity of –0.2 for all energy products. Araar et al. (2015) conduct a similar study for Libya, and apply a price elasticity of –0.5 for all energy products. It should be noted that the choice of elasticity plays an important role in estimating the post-reform level of energy consumption. However, estimates of overall welfare impacts do not depend on elasticities, as illustrated by Eq. (1).

4.2.2. Energy goods and subsidies

Subsidies on petrol, kerosene, and electricity are considered. These three energy types represent over 80% of total energy consumption (National Bureau of Statistics, 2013). In the case of Nigeria, obtaining reliable figures on consumer subsidies for these energy goods is remarkably difficult. Large-scale smuggling, black

market activities, and complex intermediary retail structures mean that market prices can be significantly higher than those prescribed (and paid for) by the government.

It is also unclear how large overall subsidy payments have been (both in terms of subsidy per litre, and at the national level). For instance, while the government officially suspended kerosene subsidies in 2009, the Nigeria National Petroleum Corporation (NNPC) which administers kerosene subsidies, claims arrears of N310 bn. But it remains unclear whether or to what extent this sum was actually disbursed as subsidies. Moreover, frequently changing policies, contradicting information and data, and opaque institutions increase the margin of error. The GSI (2012) and (IMF, 2013b) provide detailed accounts of energy subsidies in Nigeria, and provide the basis for the numbers used in this study.

- *Petrol:* The subsidised retail price is assumed to be N65 per litre for 2010 (corresponding to the year of the household survey). Subsidies are assumed to be N90 per litre.
- *Kerosene:* While the government prescribes a price of N50 per litre, the actual retail price is often significantly higher. Middlemen siphon off around N108 per litre. For this study an average retail price of N100 per litre is assumed, and subsidy removal is assumed to be uniformly passed on to end-users.
- *Electricity* usage varies distinctly across different regions. The pre-reform effective electricity tariff of N7/kW h is used as a baseline. As production costs are estimated to be around N23/kW h, this implies an electricity subsidy of N16/kW h.

Fig. 7 illustrates the regressivity of the above defined subsidy levels for petrol, kerosene and electricity. Benefits from electricity and kerosene subsidies can be seen to be concentrated disproportionately on the rich, following a similar distribution as overall income (see Lorenz curve for consumption as reference). Benefits from petrol subsidies are significantly more concentrated on the rich than benefits from electricity and kerosene. Note that this pattern results directly from the starkly unequal distribution of energy consumption (Fig. 5).

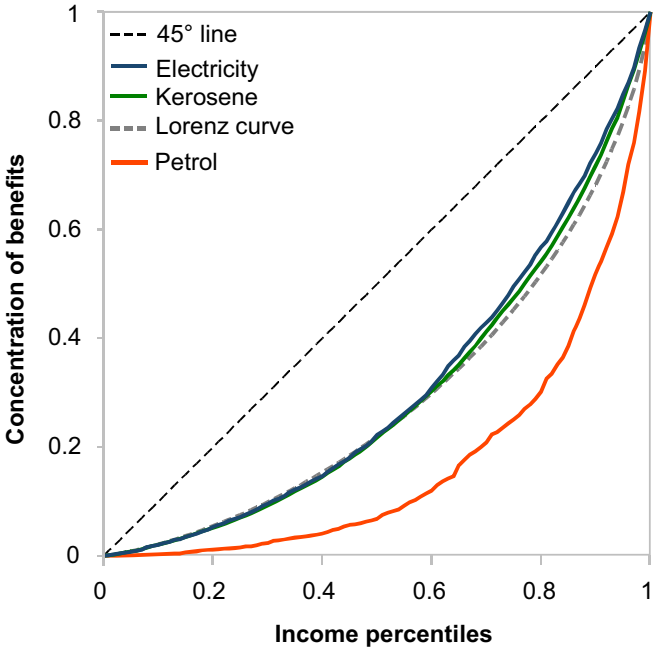

Fig. 7. Regressivity of subsidy benefits: Subsidies predominantly benefit higher income households. Subsidies on petrol are the most regressive.

4.2.3. Compensation and social protection

For this study, a scheme is considered which mitigates adverse effects on households by directly compensating income shocks. This compensation mechanism takes the form of a universal, uniform and untargeted cash transfer scheme. 'Uniform' cash payments imply that regardless of location or income, the same lump sum payment is made per person.

In practice, uniform and universal cash transfer schemes do not require costly and administratively complicated targeting of beneficiaries; this makes them particularly relevant in policy environments with low administrative capacity and limited pre-existing social safety net infrastructure. By assuming that compensation payments are made universally, this study estimates an upper bound compensation costs. Targeting compensation payments to only the most vulnerable, rather than the entire population is likely to be cheaper, especially when existing social protection infrastructure can be used to keep targeting costs low. In Nigeria, no strong social protection system exists with country-wide coverage.

Two reform scenarios are considered. In both scenarios it is assumed that a subsidy reduction will cause a uniform energy price increase throughout the country. (i) In the first scenario subsidies are *reduced by 50%* on all three considered energy goods. This implies price increases of 69% for petrol, 108% for kerosene, and 114% for electricity. (ii) The second case represents complete subsidy removal, i.e. a *reduction by 100%*. This implies price increases of 138% (petrol), 216% (kerosene), and 228% (electricity). While a 100% reduction appears radical – especially considering the high subsidisation rate – this corresponds to what the Nigerian government attempted to implement in 2009 (kerosene) and 2012 (petrol), and again announced for 2016.

4.2.4. Poverty line

The definition of the poverty line can make a significant difference to the estimates. In this study, total consumption expenditure of N55,000 per year or less is used for defining absolute poverty (this roughly corresponds to $1 per day in 2010).

4.3. Estimation results: the impacts of reform

4.3.1. Impacts at the national level

The extent to which subsidy removal increases poverty rates differs across energy goods (Fig. 8). Increases in kerosene prices

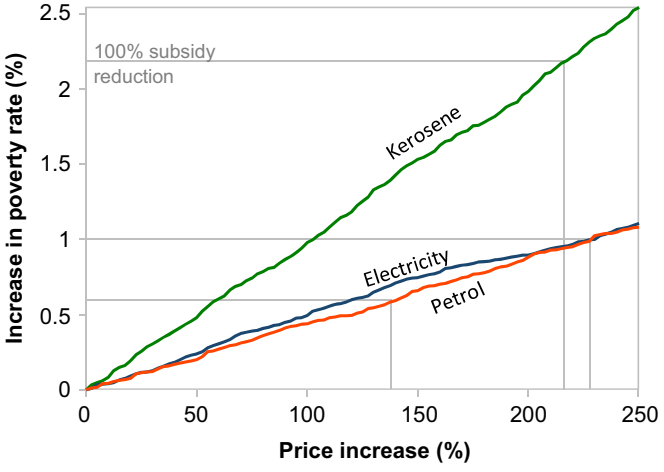

Fig. 8. Uncompensated price increases push up poverty levels: These lines represent the impact on poverty for each energy good separately (i.e. they are not stacked). A 100% subsidy removal corresponds to a 228% increase of electricity prices, 216% for kerosene, and 138% for petrol. Further price increases correspond to energy taxes.

have particularly strong impacts on the overall poverty rate. However, note that poverty rates only capture part of the picture. Energy price shocks adversely affect households at all income levels. Already poor households are pushed deeper into poverty, and previously non-poor households may be pushed close to the poverty line.

In the absence of any compensation a 100% (or 50%) reduction of subsidies is estimated to instantly increase the poverty headcount rate from pre-reform 60–63.3% (or 61.8%) (Fig. 9); while the poverty gap increases from 25.7% to 27.8%. It comes as no surprise that any uncompensated subsidy reform tends to be met by strong public opposition. The figure illustrates further that by providing a universal (i.e. untargeted) and uniform cash transfer, the government can mitigate the increase of poverty—and above a certain level even offset and reverse it. In comparison – using the same methodology – Araar et al. (2015) estimate that full removal of energy subsidies in Libya would increase energy prices by 670% and more than double the pre-reform poverty rate of 8.5%.

Arguably the most important question for a household is how the proposed subsidy reform impacts on welfare. This impact is determined by several factors, including (i) the extent to which subsidies are reduced (i.e. magnitude of the price shock), (ii) the pre-reform level of income and energy expenditure (i.e. vulnerability and exposure to the shock), (iii) the level of cash compensation received (i.e. government support for coping with the shock).

Fig. 10 shows for all income groups that compensatory cash transfers – depending on their level – can mitigate or even offset consumption shocks. For all income deciles a cash transfer level can be determined which exactly offsets the consumption shock due to subsidy removal. Moreover, in both reform scenarios, a threshold for cash compensation is determined that ensures *net* poverty neutrality of the reform (blue dashed line); i.e. the national poverty rate does not increase due to the reform, if this lump sum compensation is transferred uniformly to each person. Note that these cash transfer levels mean that roughly the poorest 60% of the population are better off after the reform.

In the case of a 100% removal of existing subsidies on petrol, kerosene and electricity, the government can raise N54 bn in gross revenues. With a population of approximately 163 million, this implies that a uniform and universal cash transfer of N331 can be provided. This redistribution of reform revenues would instantly reduce the national poverty rate by about 1% compared to pre-reform levels. Moreover, if compensation is directly targeted to poor households (rather than provided universally), and if additional funds are used, cash transfers may deliver more significant poverty reductions than in Fig. 10. Note that these figures ignore potential transaction costs of cash transfers, but these tend to be lower than those associated with subsidies, which are prone to corruption and graft.

The potential revenues from subsidy removal depend on the overall demand for an energy good, and the associated pre-reform total subsidy payments. This is illustrated by Fig. 11 (left panel), which reflects that the average Nigerian household spends more on kerosene than on petrol, and more on petrol than on electricity. Removing kerosene subsidies will thus yield the highest gross reform revenues – but reducing kerosene subsidies is also associated with the highest rate of poverty increase (Fig. 9), thus requiring larger cash transfers to compensate vulnerable households.

In practice, particularly in developing countries, subsidy removals without compensation are politically unviable, as price shocks have significant impacts on the welfare of a majority of the population. Thus, ultimately, any statement on reform revenues must account for the cost of compensation. Fig. 12 shows the estimated *net* government revenues for both reform scenarios, with respect to the level of the per capita compensatory cash transfer. When subsidy removal is made poverty neutral through cash transfers, *net* revenues are N4.7 bn in the case of a 100% subsidy reduction, and N7 bn for a 50% reduction. In the absence of any compensation, revenues are N54 bn (100%) and N33.3 bn (50%).

These government revenue figures refer to “avoided” monthly subsidy payments which the government can realise immediately after a reform. In practice, case studies of past subsidy reforms show that compensatory cash transfers do not tend to be provided indefinitely, but are complemented with (potentially revenue generating) public investments, e.g. in infrastructure. Thus, measuring reform revenues in the long term is more complex than for the short-term, and depends greatly on redistribution and reinvestment decisions.

In countries such as Nigeria, where fossil fuel subsidies are financed through resource rents, the redistribution and reinvestment of reform revenues is closely linked to the management of natural resource revenues. A large literature exists which discusses different approaches to sustainable resource management, which in many cases calls for capital and infrastructure investments which help to diversify income streams (Gill et al., 2014). Notably, a series of studies have also explored and advocated the implementation of a resource dividend, in the form of a permanent uniform cash transfer (Devarajan et al., 2011; Moss and Young, 2009; Segal, 2011; Standing, 2014). This would essentially

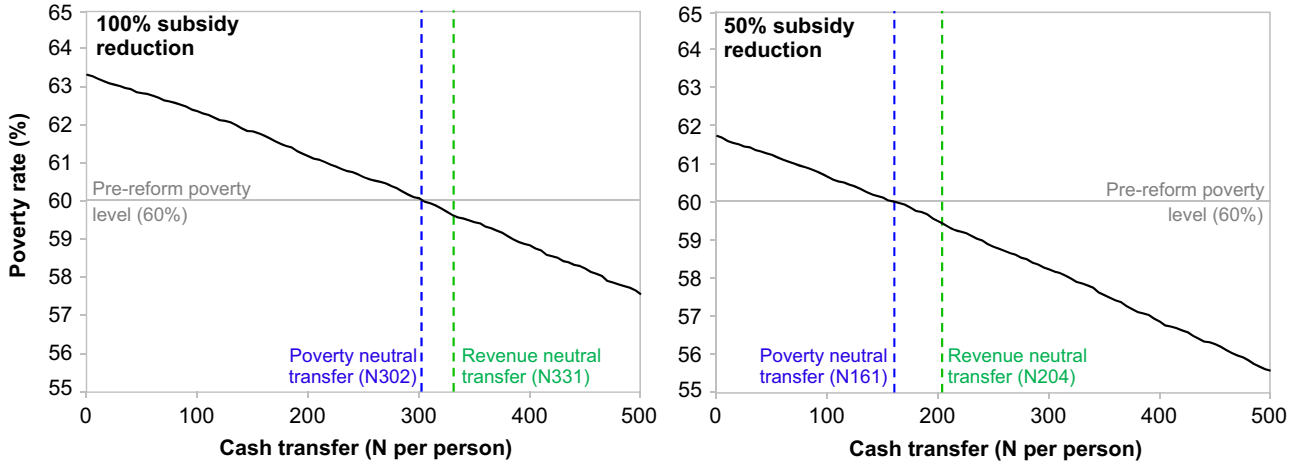

Fig. 9. Cash transfers can mitigate a rise in poverty: *Left:* In the case of a complete removal of fuel subsidies (scenario R100) a monthly cash transfer of at least N302 is necessary to avoid a post-reform increase in poverty (relative to the pre-reform poverty level of 60%). *Right:* For a 50% reduction in subsidies (scenario R50) a monthly cash transfer of about N161 is needed to prevent a rise in post-reform poverty.

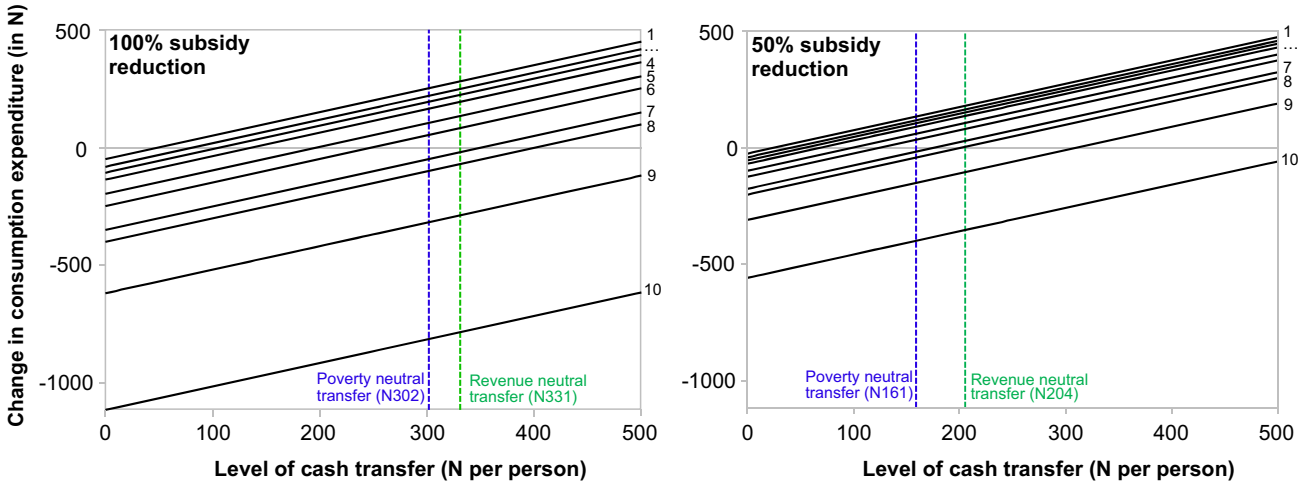

Fig. 10. Compensation makes the difference: The solid lines reflect the ten income deciles; the blue dashed line indicates the minimum cash transfer required to prevent an increase of the national poverty rate. *Left*: Scenario with 100% reduction of electricity, petrol and kerosene subsidies. *Right*: Scenario with 50% reduction in subsidies.

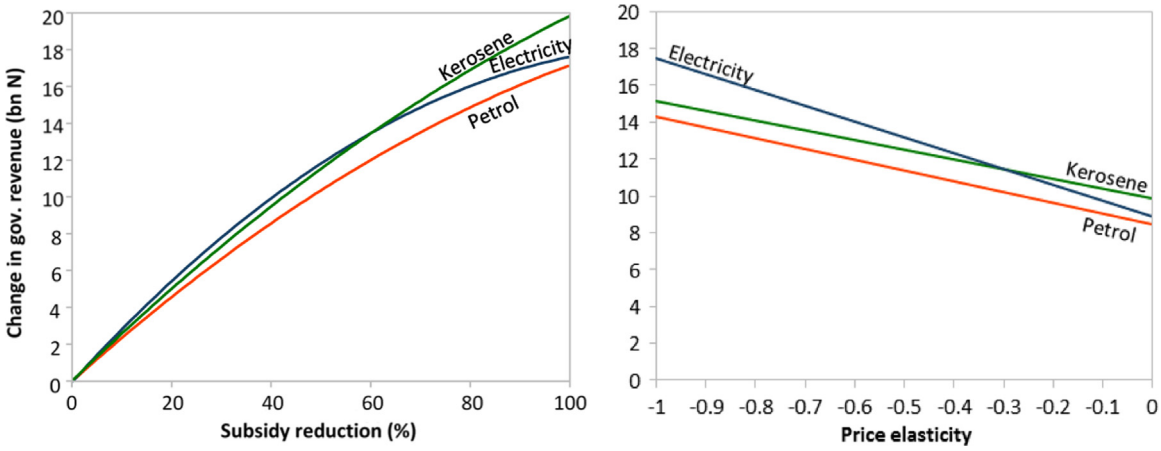

Fig. 11. *Left*: Government revenues from reducing fossil fuel subsidies depend on the specific energy good. Note that these lines are not stacked; they do not account for the cost of compensatory cash transfers. *Right*: The sensitivity of government revenue from a 50% subsidy reduction to variation in the price elasticity of energy consumption. (Note that elasticities do not influence government revenues in the case of full subsidy removal.)

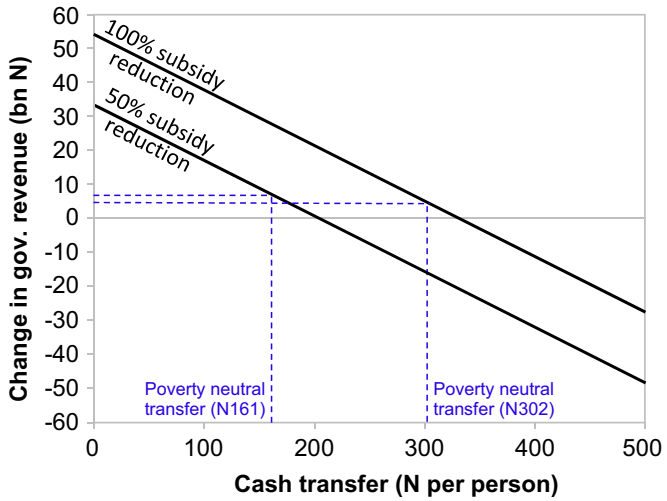

Fig. 12. Change in government revenues: Reform revenues and compensatory cash transfers: For each case, the dotted lines indicate the minimum universal cash transfer necessary to avoid an increase in poverty, and the associated government revenue.

institutionalise the short-term cash compensation suggested in this section, as a direct and long-term measure for reducing poverty and increasing welfare.

4.3.2. *Disaggregating impacts to the state level*

Like most previous studies on the impacts of subsidy removal, the analysis in section 4.3.1 has focused on national averages. However, vulnerability to price shocks is highly context specific and a compensation policy based on national averages is likely to be inadequate for certain population groups. The maps in Fig. 13 illustrate one dimension of state-level differences by displaying two measures of poverty, as measured by the household expenditure survey. As headcount rates of absolute poverty vary between 25% and 88%, the consequences of subsidy removal and energy price shocks are bound to differ.

To complement studies at the national level, this section disaggregates the estimates to each of Nigeria's 37 federal states. This section considers different compensation strategies, and analyses how they may affect poverty levels across states. In particular, the purpose of this section is to show that the effects of subsidy removal differ significantly across states, and illustrate to what

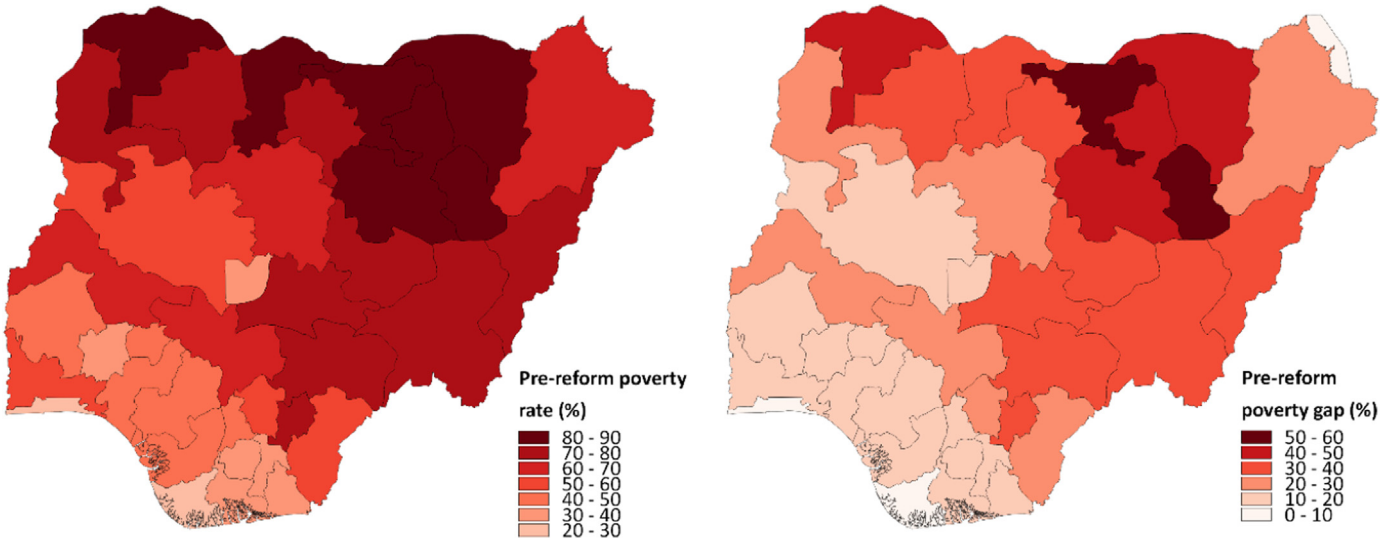

Fig. 13. Pre-reform poverty: *Left*: Headcount rates of people living in absolute poverty in each state, as observed in the household expenditure survey. *Right*: Poverty gap measure for each state, indicating the severity of poverty of people living below the absolute poverty line.

extent a nationally uniform compensation scheme may overcompensate some, while undercompensating others.

The compensation strategies considered in this section are chosen for illustrative purposes, and are uniform at the state-level (i.e. within states, cash transfers are assumed to be of equal size, and provided to everyone). In practice, if large-scale social safety nets and poverty registers are available, these are likely to allow more efficient targeting of vulnerable households. Existing social protection channels can be used to identify and support those who are worst hit. If safety nets lack coverage or simply do not exist – as in the case of Nigeria – identifying and targeting vulnerable households may prove to be expensive and slow. For simplicity, only the scenario of 100% subsidy removal is considered in this section.

4.3.3. *Uncompensated subsidy removal*

Relative to pre-reform levels of poverty, full removal of fossil fuel subsidies is estimated to increase poverty rates most in the more developed states of Southern Nigeria. Low pre-reform poverty rates suggest a large group of near-poor households, who are pushed into poverty through the reform induced energy price shock. This effect is exacerbated as poor and near-poor households in these states tend to rely on energy subsidies more heavily than households of similar income levels in the North.

Poverty rates in northern states are estimated to increase less drastically. However, this must not be interpreted in the sense that subsidy removal has little impact in these states. With pre-reform poverty rates of 70–90%, there is less scope for the *number* of people in absolute poverty to increase. But the *severity* of poverty of those who are already poor is likely to be aggravated (Fig. 14).

The attempted removal of fossil fuel subsidies in Nigeria in 2012 was accompanied by the *Subsidy Reinvestment and Empowerment Program* which was to feature a range of infrastructure investments (especially in the power, transportation, water and downstream petroleum sectors), as well as social safety nets (IMF, 2013a). However, the announcement of these vague plans for compensation and reinvestment came late, and their implementation even more so. Large parts of the population expected reform revenues to flow into wasteful government spending or feed corruption. Thus the reality, or the public's perception of it, resembled the uncompensated subsidy removal

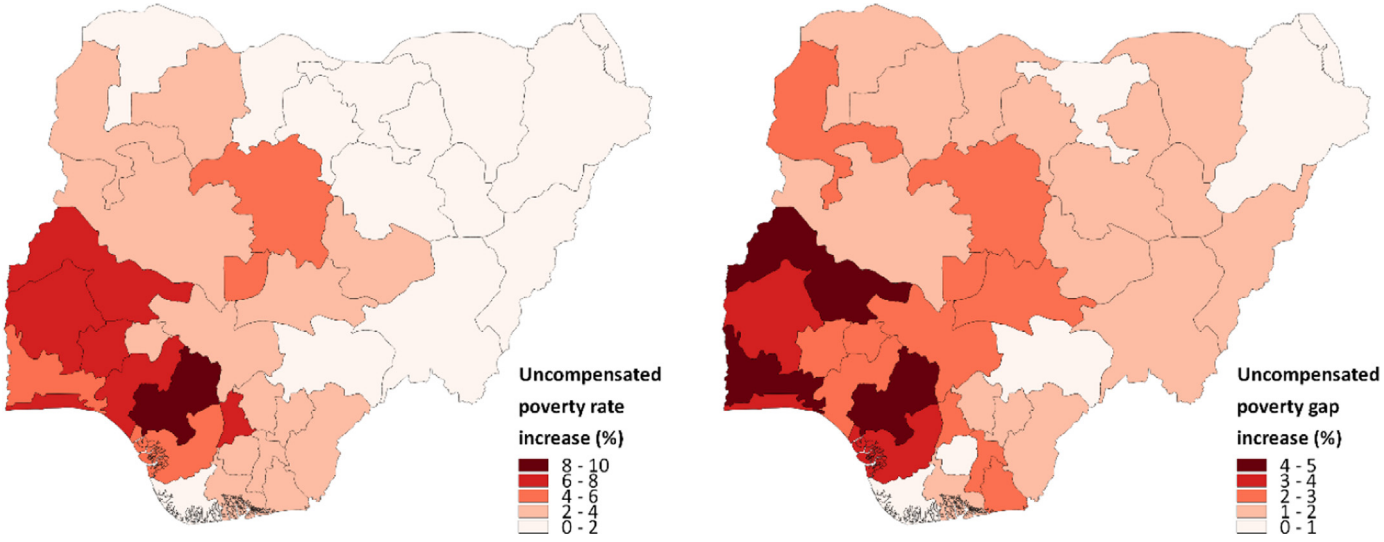

Fig. 14. Poverty increases in the absence of compensation or social protection: *Left*: Estimated increases in poverty headcount rates. *Right*: Estimated increases in the poverty gap of respective states. (For interpretation of colors in the figure legends, the reader is referred to the web version of this article.)

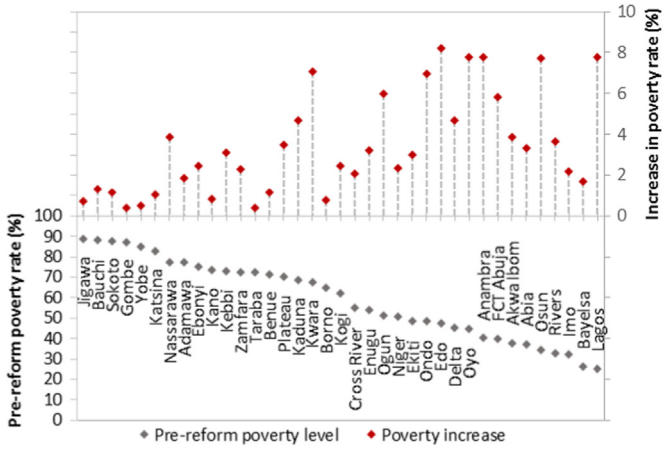

Fig. 15. Post-reform poverty rates without compensation: a 100% reduction of subsidies increases poverty headcount rates in all states. States with lower pre-reform poverty rates tend to have larger increases in poverty.

scenario outlined above. Violent protests followed the removal of subsidies, with particularly severe unrest occurring in metropolitan regions in the South (dark red in Fig. 14).

Fig. 15 highlights that the largest increases in poverty rates are estimated to occur in some of the urbanised and most populous states, including Oyo, Anambra and Lagos. While these are among the more developed states, with lower poverty rates, they are of high political importance. This illustrates the two – possibly competing – needs of a successful subsidy reform: Managing political economy challenges by ensuring adequate compensation in richer states; as well as social protection, equitable redistribution of funds, and poverty alleviation in poorer states.

4.3.4. Poverty neutral compensation

In the previous section, it was estimated that providing nationwide universal cash compensation of N302 could neutralise the increase in poverty that an uncompensated reform would cause. According to the estimates, this would indeed hold at the national average; however, the state level analysis suggests that the N302 cash transfer is likely to undercompensate in some states while overcompensating in others. In other words, the level of cash compensation that maintains poverty neutrality at the national level, does not actually achieve this objective in any specific state (Fig. 16). While some states benefit from poverty reductions of up to 4%, cash transfers of N302 still leave poverty rates spiking

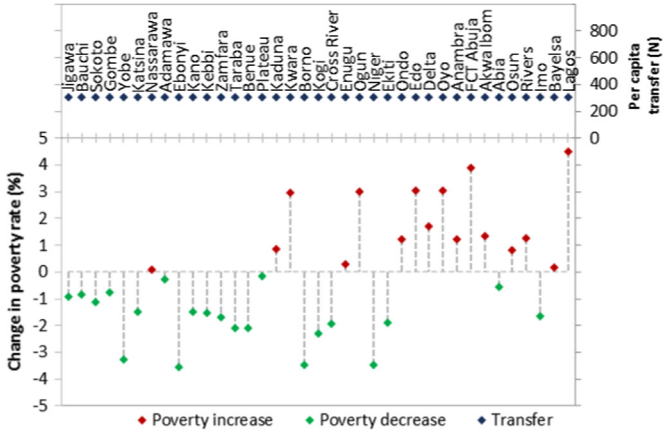

Fig. 16. Paying a compensation of N302 to every Nigerian can neutralise a poverty increase at the national average. At the state level however, this cash transfer level causes poverty reductions in some states, while failing to mitigate poverty increases in others.

by up to 5% in other states. Notably this includes states such Lagos and Abuja, which experienced intense public opposition to subsidy reforms in 2012.

As energy consumption patterns differ across states, so does the level of cash compensation that is needed to maintain poverty neutrality of a given subsidy removal. Fig. 17 (right) shows the minimum cash compensation transfer that is required in each state. Note that, as shown in Fig. 8, this estimated cash transfer threshold will prevent an increase in the state's average poverty rate; low income households are still likely to benefit overall from the reform, while high-income households are likely to lose from the reform. This emphasises that fossil fuel subsidy reform, paired with uniform cash transfers, can be a pro-poor progressive fiscal reform.

Overall, ensuring poverty neutrality is a minimum requirement for protecting the livelihoods of the poorest, and for ensuring broad public support for subsidy reforms. As Nigeria's 2012 experience illustrates, failing to communicate and deliver direct compensation can lead to the downfall of the entire reform endeavour.

However, if the government's goal is to maximise the development potential of a subsidy reform, poverty neutral cash compensation are not sufficient. Poverty neutral cash transfers that are only provided in the short term can mitigate adverse effects for poor households, but further complementary policies are critical to ensure that subsidy reforms actively benefit the poor and are invested in the foundations for future development.

One of the main concerns raised by poverty neutral cash transfers is the unequal distribution of compensation (and thus reform) benefits. States with higher energy consumption and lower pre-reform poverty rates require higher compensation payments. Consequently, states with lower pre-reform poverty rates receive a larger share of the overall compensation budget. Fig. 18 shows how the overall compensation budget – which depends on per capita transfer levels and a state's population size – is distributed.

4.3.5. Revenue neutral compensation: a tailored approach

Besides poverty neutral compensation, it is also worth considering the effect of a revenue neutral compensation scheme. In this scenario, reform revenues are distributed entirely in the form of universal cash transfers. In resource rich countries fossil fuel subsidies are typically financed through resource rents; thus subsidy removal unlocks a continuous revenue stream – rather than simply reducing government expenditure or yielding a one-off windfall. By fully dedicating this revenue stream to compensation in the short-term, governments can not only mitigate adverse effects, but also deliver immediate and tangible benefits to the population and secure broad public support. In the medium- to long-term, governments can then shift their priority from compensation to reinvestment and more targeted social safety nets.

A uniform revenue neutral compensation scheme would redistribute the entire reform revenue of N54 bn at N331 per month to all Nigerians. Such an approach would reduce the national poverty rate by about 1%. This average however conceals significant variation at the state-level (very similar to the poverty neutral scheme, Fig. 16). Most notably the capital Abuja and Lagos, would still experience significant income shocks and thus increases in their respective poverty rates.

Thus, lastly, another hypothetical and revenue neutral compensation scheme is considered: Poverty neutral compensation is provided in states where revenue neutral compensation alone would not prevent increasing poverty rates. The remaining reform revenue (N31.2 bn) is redistributed at N253 per person in all other states. This compensation scheme maintains revenue neutrality

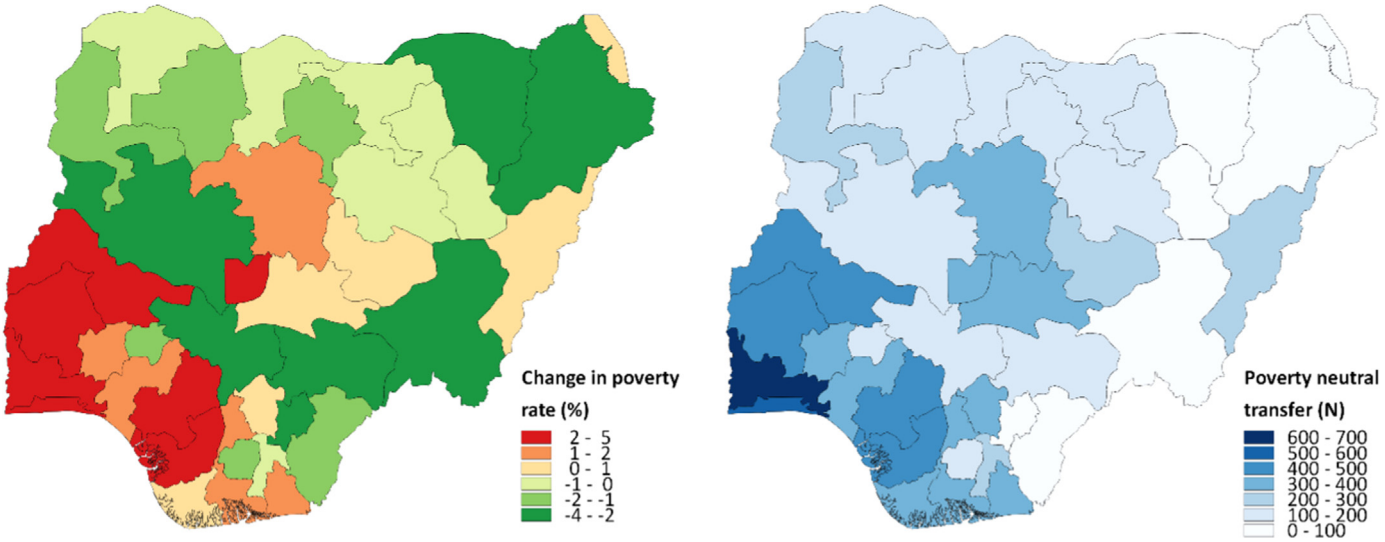

Fig. 17. *Left*: Change in poverty rates after a universal "poverty neutral" compensation payment of N302 per person. While keeping the national poverty level constant, changes in poverty rates can be significant at the state level. *Right*: Estimated cash transfer levels that neutralise post-reform poverty increases in each state.

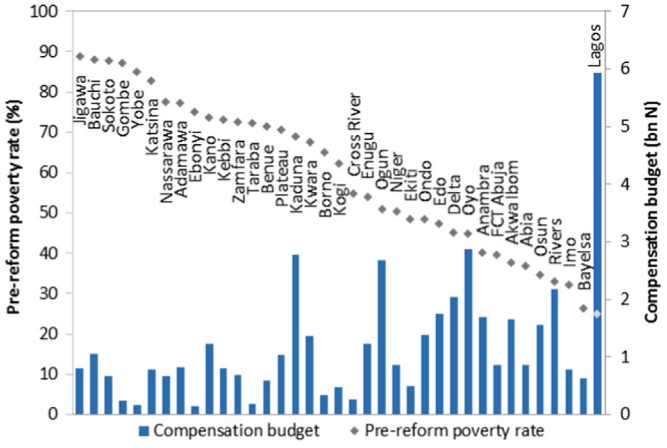

Fig. 18. *Locating the compensation budget:* This figure shows the overall budget requirement in each state for implementing a state-level uniform cash transfers scheme that maintains existing poverty rates.

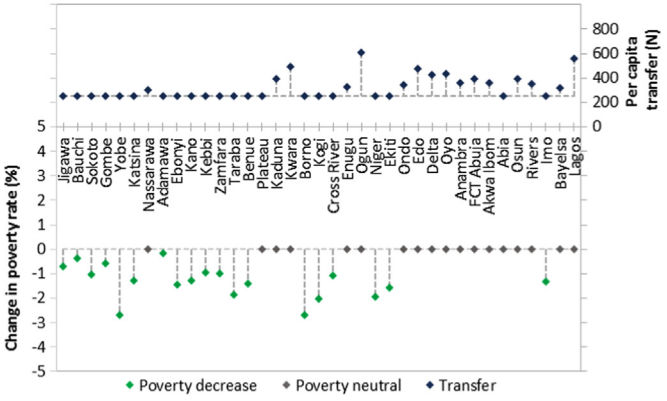

Fig. 19. The poverty impacts of a tailored compensation scheme: Poverty neutral compensation is provided in states where revenue neutral compensation alone would not prevent increasing poverty rates. The remaining reform revenue is re-distributed at N253 per person in other states.

and is preferable to poverty neutral compensation alone. Increases in poverty rates are avoided in all states, while a series of poorer states benefit from poverty rate reductions of up to 3% (Fig. 19).

Fig. 20 shows that this combined compensation scheme can

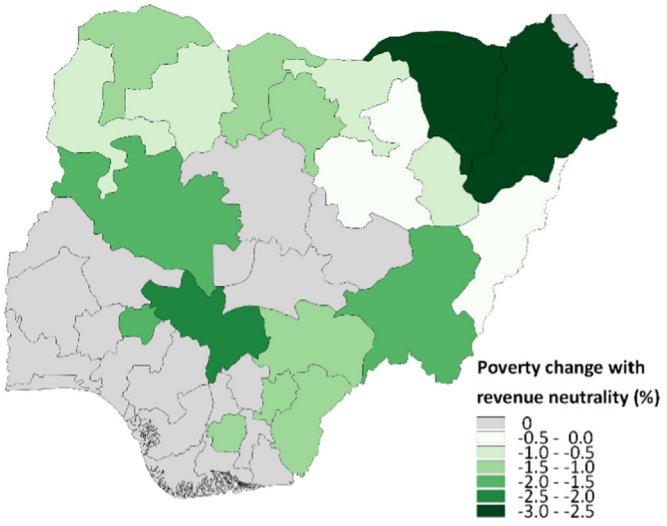

Fig. 20. Combined poverty and revenue neutral compensation: This map depicts impact of a combined compensation program on state level poverty rates.

prevent poverty increases in richer states in the south, thus helping to secure public support for reforms in this region. At the same time, Northern states benefit from reduced poverty rates, and higher transfers of wealth than in the purely poverty neutral case.

It should be emphasised that the compensation strategies considered in this section are hypothetical and stylised. They mainly serve the purpose of highlighting the important differences at the subnational level. Taking these into account may help to design more effective and equitable subsidy reforms.

5. Conclusion and policy implications

The inclusion of fossil fuel subsidy reform in the UN's Sustainable Development Goals reflects a widespread consensus on the notion that fossil fuel subsidies are fundamentally unsustainable. Indeed, primarily driven by fiscal imbalances, in recent years several countries have made significant progress in phasing out fuel subsidies. And considering the wide range of adverse effects of fossil fuel subsidies – including market distortions,

underinvestment in infrastructure and efficiency, escalating fiscal burdens, climate change, and income inequality – the need for such reforms is ever increasing. However, the possibility of major price shocks and adverse distributional effects requires policy makers to carefully design effective social protection measures.

This paper focuses on Nigeria, and investigates the regional variability of the direct welfare effects of fuel subsidies removal. It analyses the role of different cash compensation strategies and investigates their effect on national and state-level poverty rates. Overall, the analysis in this paper highlights several issues:

- *Inequality*: Energy consumption is highly unequal; rich households account for a disproportionately high share of total energy expenditure. The level of consumption inequality varies for different fuel types, with petrol being most and kerosene least unequal.
- *Regressivity*: Consumption inequality is the reason for the high level of regressivity of fuel subsidies; i.e. subsidies predominantly benefit the rich. Nevertheless, removing fossil fuel subsidies can have severe effects on the livelihoods of poor people. These results are in line with findings from similar studies e.g. for Morocco, Libya, and Jordan, and also reflect the insights from cross-country studies (Arze del Granado et al., 2012; Verme and El-Massnaoui, 2015).
- *Compensation is key*: the analysis shows that compensation measures play a central role in mitigating energy price shocks and thus ensuring affordability and protecting livelihoods. For instance, a countrywide universal (i.e. untargeted) cash compensation program can prevent increases in poverty rates, while still unlocking significant net reform revenues. Redistributing all reform revenues in the form of cash transfers can significantly increase welfare levels throughout the country.
- *Seeing beyond national averages*: The analysis also shows that due to varying energy consumption patterns, poverty impacts and vulnerabilities can vary substantially across geographic regions. Income levels alone may be incomplete indicators of vulnerability to energy price shocks. By considering national averages alone, policy makers may fail to recognise certain high vulnerability groups. For instance, certain compensation measures (e.g. uniform cash compensation) that appear effective when considering national averages can still fail to adequately mitigate price shocks in several states, risking strong public opposition and shocks to livelihoods.
- *The need for tailored strategies*: this paper proposes a tailored compensation strategy which can help to offset the largest poverty increases in high income states, while contributing to active poverty reduction in low-income states. This highlights that there can be a trade-off between mitigating public opposition to reform, and pro-poor wealth transfers. Balancing these requirements and priorities calls for careful analysis and tailored reform design.

The practicality and effectiveness of compensation and social protection programs will depend greatly on country-specific characteristics: The availability of pre-existing social safety nets, poverty registers, and access to reliable infrastructure (incl. mobile phones, bank accounts, unique ID) as well as alternative energy forms are critical factors to be considered when designing reforms. The analysis in this paper aims to contribute to developing a more refined understanding of the impacts of subsidy reforms and show the need for a thorough, disaggregated analysis of subsidy reforms, and tailored reform strategies.

Acknowledgements

The author is grateful to Raimund Bleischwitz, Stijn van Ewijk, Bassam Fattouh, Stéphane Hallegatte, Adrien Vogt-Schilb, and anonymous reviewers for helpful comments on an earlier draft of this paper. Advice on various data sources by Mook Bangalore is gratefully acknowledged. All remaining errors are the author's. This study was conducted while the author was a Saudi Aramco Research Fellow at the Oxford Institute for Energy Studies.

References

Araar, A., Choueiri, N., Verme, P., 2015. The Quest for Subsidy Reforms in Libya. World Bank Policy Res. Work. Pap. 7225.
Araar, A., Verme, P., 2012. Reforming Subsidies A Tool-kit for Policy Simulations. World Bank Policy Res. Work. Pap. 6148.
Arzaghi, M., Squalli, J., 2015. How price inelastic is demand for gasoline in fuel-subsidizing economies? Energy Econ. 50, 117–124.
Arze del Granado, F.J., Coady, D., Gillingham, R., 2012. The unequal benefits of fuel subsidies: a review of evidence for developing countries. World Dev. 40, 2234–2248.
Bazilian, M., Onyeji, I., 2012. Fossil fuel subsidy removal and inadequate public power supply: implications for businesses. Energy Policy 45, 1–5.
Dahl, C., 1994. A survey of energy demand elasticities for the developing world. J. Energy Dev., 28.
Deaton, A., 2003. Household surveys, consumption, and the measurement of poverty. Econ. Syst. Res. 15, 135–159.
Devarajan, S., Ehrhart, H., Le, T.M., Raballand, G., 2011. Direct Redistribution, Taxation, and Accountability in Oil-Rich Economies : A Proposal. CGDEV Work. Pap. Ser. 281.
Gill, I.S., Izvorski, I., van Eeghen, W., de Rosa, D., 2014. Diversified Development - Making the Most of Natural Resources in Eurasia. The World Bank, Washington, DC.
GSI, 2012. A Citizens' Guide to Energy Subsidies in Nigeria. International Institute For Sustainable Development: Global Subsidies Initiative, Geneva.
IEA, 2014. World Energy Outlook 2014. International Energy Agency, Paris.
IMF, 2013a. Energy Subsidy Reform: Lessons and Implications. International Monetary Fund, Washington DC.
IMF, 2013b. Case Studies on Energy Subsidy Reform: Lessons and Implications. International Monetary Fund, Washington DC.
Iwayemi, A., Adenikinju, A., Babatunde, M.A., 2010. Estimating petroleum products demand elasticities in Nigeria: a multivariate cointegration approach. Energy Econ. 32, 73–85.
Mlachila, M., Ruggiero, E., Corvino, D., 2016. Unintended Consequences: Spillovers from Nigeria's Fuel Pricing Policies to Its Neighbors. IMF Work. Pap. WP/15/17.
Moss, T., Young, L., 2009. Saving Ghana from Its Oil: The Case for Direct Cash Distribution. CGDEV Work. Pap. Ser.
National Bureau of Statistics, 2013. National Bureau of Statistics: Central Data Catalogue [WWW Document]. (URL) ⟨http://www.nigerianstat.gov.ng/nada/index.php/catalog⟩.
National Bureau of Statistics, 2010. Nigeria Poverty Profile 2010. National Bureau of Statistics, FCT Abuja.
Omisakin, O., Oyinlola, A., Oluwatosin, A., 2012. Structural breaks, parameter stability and energy demand modeling in Nigeria. Int. J. Econ. Sci. Appl. Res., 129–144.
Ruggeri Laderchi, C., Olivier, A., Trimble, C., 2013. Balancing Act: Cutting Energy Subsidies while Protecting Affordability. The World Bank, Washington DC.
Segal, P., 2011. Resource rents, redistribution, and halving global poverty: the resource dividend. World Dev. 39, 475–489.
Siddig, K., Aguiar, A., Grethe, H., Minor, P., Walmsley, T., 2014. Impacts of removing fuel import subsidies in Nigeria on poverty. Energy Policy 69, 165–178.
Soile, I., Mu, X., 2015. Who benefit most from fuel subsidies? Evidence from Nigeria. Energy Policy 87, 314–324. http://dx.doi.org/10.1016/j.enpol.2015.09.018.
Standing, A., 2014. Ghana's extractive industries and community benefit sharing: the case for cash transfers. Resour. Policy.
Udo, B., 2015. Nigerian govt re-launches failed scheme to enforce N50 kerosene price. Prem. Times, URL ⟨http://www.premiumtimesng.com/business/175215-nigerian-govt-re-launches-failed-scheme-enforce-n50-kerosene-price.html⟩.
Vagliasindi, M., 2012. Implementing Energy Subsidy Reforms: An Overview of the Key Issues. World Bank Policy Res. Work. Pap. 6122.
Verme, P., El-Massnaoui, K., 2015. An Evaluation of the 2014 Subsidy Reforms in Morocco and a Simulation of Further Reforms. World Bank Policy Res. Work. Pap. 7224.
World Bank, 2015. World development indicators [WWW Document]. URL ⟨http://data.worldbank.org/indicator⟩.