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Estimating the impact on poverty of Ghana’s fuel subsidy reform and a mitigating response

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Estimating the impact on poverty of Ghana’s fuel subsidy reform and a mitigating response

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The study simulates the welfare implications of the fuel subsidy reform carried out in early 2013 and the required scaling up of cash transfers to mitigate the impact of the subsidy removal on poor households in Ghana. Approximately 78 per cent of fuel subsidies benefited the wealthiest group, with less than 3 per cent reaching the poorest quintiles. We find that the removal of the fuel subsidies, by causing an increase in prices, results in a negative impact on household welfare. The negative effect is worst for the poorest group who experience reduction in their total consumption of 2.1 per cent. The simulation estimates that the poverty rate rises by 1.5 percentage points leading to an additional 395,180 individuals being pushed into poverty.

Keywords: subsidy; Ghana; fuel; poverty; inequality; cash transfers; simulation; poor; household welfare

1. Introduction

The price of crude oil fluctuates significantly depending on global supply and demand as well as stocks and global shocks. The use of national price controls, usually through price subsidies, has largely been abandoned in Western countries and yet is still prevalent in developing countries. However, dramatic increases in the price of oil in more recent years have forced the re-examination of this policy.

Coady et al. (2006) citing an International Monetary Fund (IMF) survey report that out of 48 countries in 2006 16 had a liberalised fuel price regime while the remaining ones still had price controls in place. Ostensibly, such controls are to protect the national economy and domestic consumers from unpredictable rises in the cost of living. In practice, they are a political gambit, hotly debated at election time and subject to the political cycle.

Increasing oil prices since the beginning of the twenty-first century have challenged the practicality of fuel subsidies, as their burgeoning cost has drawn attention to questions of fiscal sustainability as well as their overall efficiency and effectiveness. African governments spend approximately 3 per cent of gross domestic product (GDP) on fuel subsidies – equivalent to the region’s average spending on healthcare (IMF 2013c). In Ghana, fuel subsidies would have cost 2.4 billion GHS† (approximately 1.2 billion USD) in 2013 in the absence of any reform, a figure greater than half of Ghana’s allocation to

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the education sector. The ‘post-tax’ full cost of subsidies in Ghana before the reform was equal to 3.2 per cent of GDP (IMF 2013b).

Aside from their cost, there is evidence that subsidies largely benefit the wealthiest groups. del Granado, Coady, and Gillingham (2012) found that about 70 per cent of the benefits from subsidies on gasoline in Africa go to the wealthiest quintile, whereas just 2.2 per cent accrue to the poorest quintile, meaning that they are regressively distributed. Even for those fuel products that are supposedly ‘pro-poor’ such as kerosene – only 16 per cent of the subsidy benefits go to the poorest quintile in Africa.

Despite the inherently regressive nature of fuel subsidies, the poorest are the least able to cope with increases in the cost of living due to their removal. Preliminary estimates by the World Bank suggest a non-negligible loss in incomes as a result of the subsidy removal. This is likely to initiate poor coping strategies, such as withdrawing children from school, sending them to work, or reducing healthcare use or diet variety. For instance, Essuman and Tonah (2004) noted that for urban Nima and Accra, women and children take up additional work (for children this comes at the expense of schooling). While rationalising price subsidies may be envisaged because of inefficiency and budgetary reasons, new or existing social safety nets aiming at protecting the most vulnerable after the reform should be put in place or expanded. Therefore, an additional focus of this article is to estimate the possible mitigating potential of scaling up the social transfer programme estimated to be the best targeted in Ghana (Wodon 2012) – the livelihood empowerment against poverty (LEAP) cash transfer programme.

We extend the results of Coady and Newhouse (2006) and Coady et al. (2006) to the 2013 fuel price reform. There are three key differences in our analysis, (1) a later round of the GLSS survey (round 5 rather than round 4 used in Coady and Newhouse 2006; Coady et al. 2006) is used, (2) the actual reform that occurred in 2013 is simulated and (3) we incorporate a simulation of cash transfers to show how the impact of the reform on households can be mitigated.

This article contributes to the current debate on fuel subsidies by providing estimates of the expected impact of the subsidy reform based on the existing household surveys – where prices and sampling weights have been updated to 2013 prices and population estimates, respectively. A key policy response in the form of scaling up the existing cash transfer programmes is presented. Furthermore, the results presented have policy implications and are relevant to the policy in Ghana as well as the wider African region. Since this research was completed, the Ghana Government have released the results of the new household survey of 2012/2013. Discussions are currently underway with Government to determine how best to use these data in a coordinated way. It is worth noting however that the new data would not provide us with an estimate of the impact of the fuel subsidy shock as the data were largely gathered before the reform occurred.

The focus of this article is primarily to provide evidence of the magnitude and the distribution of the impacts of the 2013 fuel subsidy reforms on household poverty in Ghana, and to determine to what extent an expansion of the LEAP cash transfer programme is an effective mitigating measure. In Section 2, we outline the background to fuel subsidies, poverty and social protection in Ghana. Section 3 presents a brief review of the literature. Section 4 reviews the methodology and data used and Section 5 summarises the findings. Section 6 looks at possible social protection expansion scenarios using the LEAP cash transfer programme and Section 7 concludes.
2. Background

2.1. Fuel subsidies in Ghana

The first attempt to liberalise Ghana’s subsidised fuel prices occurred in the early 2001 with the establishment of an automatic price setting mechanism that linked domestic prices to international ones. The mechanism was abandoned towards the end of the following year and the price of petrol came under government control. The mechanism was reintroduced in the early 2003, causing an almost doubling of the domestic price of petrol. However, the formula was abandoned following public pressure and by 2004 the cost of fuel subsidies had risen to 2.2 per cent of Ghana’s GDP. Coady et al. (2006) found a significant negative impact on the poor of the fuel subsidy removal, and made recommendations to expand social transfer programmes in order to mitigate the impact of such reforms.

The subsidy reform was preceded by a communication strategy on its rationale and a pricing formula was reintroduced in early 2005 and a National Petroleum Authority was set up to oversee the deregulation of the petroleum sector. However, fuel prices subsequently underwent significant upward adjustments in the mid-2009, early 2011, and early 2012, as shown in Figure 1, culminating in the latest full removal of subsidies in the early 2013. Fuel prices have often featured as a key political gambit, often rising after elections, and efforts to decouple the price of fuel from the political cycle have been unsuccessful. The need for fiscal reforms (including but not limited to the removal of fuel subsidies) has become necessary given the fiscal deficit of 12 per cent of GDP in 2013.

In addition to their high cost and poor targeting, there is also evidence to demonstrate that fuel subsidies encourage inefficient fuel usage and management, contributing to inefficient national growth patterns that are subsidised by the public purse (Coady et al. 2006). Ghana’s fiscal deficit approached 12 per cent of GDP in 2012 due to a range of overspends (largely arising from a new salary structure). Following the new

![Figure 1. Retail price of fuels in Ghana, 2007–2013.](source: Authors’ elaboration based on National Petroleum Authority data)
budget for 2013, the government of Ghana introduced a number of fiscal policy reforms, including the removal of fuel subsidies over the first half of 2013. Prices of petrol, kerosene, diesel, marine diesel, residual fuel oil (henceforth RFO) and liquefied petroleum gas (LPG) saw rises of between 15 and 50 per cent, until prices reached market levels in mid-September 2013. The price of petrol finally stood at its market rate of 222 GHp/litre, up almost 30 per cent in total from 170.80 GHp/litre at the beginning of the year.

2.2. Poverty and social protection in Ghana

Accompanying Ghana’s income growth has been a rapid reduction in monetary poverty from around 50 per cent in 1990 to 28.5 per cent of the population by 2006. The new data disseminated in 2014 from the GLSS6 confirm that Ghana has indeed achieved the first millennium development goal (MDG) target of halving poverty by further cutting poverty to 24.2 per cent in 2013. Likewise, the poverty gap more than halved over the same period to 7.8 per cent in 2013. Real GDP increased from 5.5 billion in 1990 to 11.4 billion in 2006 and further increased to 19.8 billion USD in 2013. Real GDP per capita grew 38.2 per cent between 1990 and 2006 and 47.2 per cent between 2006 and 2013.

However, as growth has accelerated, inequality has worsened, with the Gini coefficient rising from 37 per cent in 1992 to 42 per cent in 2006 and the new 2013 figure having risen to 42.3. The richest 20 per cent of the population now hold almost half of Ghana’s income, whilst the poorest group have seen their income share decline from 6.9 per cent of the total in 1992 to 5.2 per cent in 2006. Inequality between the north and the south of the country has worsened. These accompanying increases in inequality have slowed down the impact of growth on poverty reduction (GSS 2007a).

Although poverty has reduced significantly on average, that of children remains much higher. We estimate that child poverty (that amongst individuals under the age of 18) in 2006 was 39.4 per cent, meaning that more than one in three children live in poverty. Approximately 77 per cent of all poor households have at least one child. This difference between the poverty levels of adults and children is due to the tendency of poorer households to have more children. In households with six or more children, the child poverty rate is around 60 per cent.

Ghana’s National Social Protection Strategy aims at consolidating the wide range of national programmes and projects into a coherent framework that effectively tackles extreme poverty and vulnerability as well as promoting employment and productivity. The national framework seeks to protect the poorest, promote productivity, and put in place a complete system of accessible, quality social services for all. Ghana implements a wide range of programmes including in-kind transfers (that is, school uniforms, school meals), cash transfers (LEAP), public works programmes and fee waivers for certain groups and social services (that is, free maternal health).

In reviewing available information on targeting, impact, coverage and political support of the range of social protection programmes in Ghana, the LEAP cash programme stands out. It is Ghana’s flagship social protection programme, disbursing on average 36 GHS (17.96 USD) every 2 months to extreme poor households which also include an elderly person, an orphan or vulnerable child, or a disabled person who cannot work. Also, it is very effective in reaching the poorest quintile as per its aims (see Table 1) and it has important positive impacts on schooling, food security, savings and debt reduction (Handa et al. 2013). Furthermore, it has strong political support and is operative at the national
scale in just over 100 districts across all Ghana’s regions, though still on a limited scale, reaching 72,000 households in 2013. To improve implementation, the programme undergoes important revisions to refine its targeting, payments, communications and monitoring.

In contrast, the most poorly targeted programme assessed in the table below is the subsidy to petrol and diesel prices, which was estimated to send roughly only 2.3 per cent of benefits to the poorest fifth of the population compared to LEAP’s 57.5 per cent.
3. Literature review on the distributive effects of fuel subsidies

Evidence in the literature suggests that fuel subsidies benefit the richer quintiles of a country’s population significantly more than the poorest. del Granado, Coady, and Gillingham (2012) estimated that, on average, the top income quintile receives six times more subsidies than the lowest quintile.

The incidence of subsidies varies across fuel products. Poorer households in developing countries, for example, mostly consume kerosene, and benefits are more equally distributed among quintile groups (del Granado, Coady, and Gillingham 2012).

Petrol subsidies are the most regressive. The top four quintiles receive approximately 97 cents out of every dollar spent on petrol subsidies (del Granado, Coady, and Gillingham 2012). When looking at spending on fuel subsidies by each income group for Africa, South and Central America and other regions, the subsidy is regressive in all cases with the top quintiles obtaining around 40 per cent of the subsidies; about six times what the poorest receive.

Coady and Newhouse (2006) and Coady et al. (2006) showed that Ghanaian fuel subsidies are regressive, with the top income quintiles benefiting the most from the subsidies. Regarding the impact of previous attempts to remove subsidies, Table 2 below provides a summary of the results in Coady and Newhouse (2006). It shows that the largest negative impact on household consumption is experienced by the bottom income quintile, which witnesses a 9.1 per cent decline in their welfare. Clearly, this is a major impact for such families who live below the poverty line. Our current article extends the work of Coady and Newhouse (2006) and Coady et al. (2006) to analyse the recent reform. Furthermore, new results from scaling up the current LEAP cash transfer programme are provided.

4. Analytical framework and methodology

The main cited aim of fuel subsidies is to reduce the cost of living for a country’s population and to cut domestic production costs. It is therefore relevant to ascertain how the fuel subsidies benefit the country’s population, and to determine who the beneficiaries are and to what extent the poorest benefit from the subsidies.

The focus of the analysis here is: (1) a simulation of the impact of the subsidy reforms on household welfare, and (2) simulations of scenarios for mitigating the impact through scaling up cash transfers to the poorest households.

Table 2. Household budget shares and real income effects of subsidy withdrawal in Ghana (in %).

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Household budget share</th>
<th>Real income effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Petrol</td>
<td>Kerosene</td>
</tr>
<tr>
<td>1-Bottom</td>
<td>0.1</td>
<td>5.9</td>
</tr>
<tr>
<td>2</td>
<td>0.1</td>
<td>4.1</td>
</tr>
<tr>
<td>3</td>
<td>0.2</td>
<td>3.4</td>
</tr>
<tr>
<td>4</td>
<td>0.2</td>
<td>2.4</td>
</tr>
<tr>
<td>5-Top</td>
<td>2.1</td>
<td>1.6</td>
</tr>
<tr>
<td>Total</td>
<td>0.6</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Source: Table 11.2 in Coady and Newhouse (2006: 400) using data from GLSS round 4. The required rise in prices used in calculating the real income effects are 17 per cent, 49 per cent, 67 per cent, 50 per cent and 108 per cent for a litre of petrol, kerosene, diesel, fuel oil and LPG (per kilo), respectively.
Similar impact analyses in the literature have used partial, limited general and general equilibrium frameworks (see Coady (2006) for a discussion about the merits and demerits of these three approaches). The approach adopted for this study is the partial equilibrium approach, where both fuel and non-fuel consumer prices are allowed to be impacted. As shown in Cockburn et al. (2014) – where both partial and general equilibrium models are used – while the partial equilibrium approach captures only the consumer price effects (direct and indirect) in a manner which is fairly consistent with the results obtained using a computable general equilibrium model, it fails to capture the efficiency gains. As we are interested in a static and short-term analysis (that is, immediate welfare effects of the fuel subsidy reform, where price effects are likely to be predominant), we opted for a partial equilibrium framework.

4.1. Assessing the direct and indirect effects on household welfare

4.1.1. Direct effects of the fuel price increase. Let \( w_i = \frac{(p_i q_i)}{y} \) be the share of expenditure devoted to fuel good \( i=1,\ldots,k \) in the total budget \( y \), and \( p_i \) and \( q_i \) represent price and quantity consumed of fuel good \( i \), respectively. The budget share provides the ‘first-order’ estimate of the direct real income effect of a price increase. It can also be seen as a ‘short-run’ estimate since it is assumed that households do not switch from fuel consumption to the consumption of other products. Alternatively, it provides the upper bound for the impact on the households in the long-run (see for instance, del Granado, Coady, and Gillingham (2012)). Formally, we have:

\[
    w_i = \frac{\partial \log y}{\partial \log p_i},
\]

which shows the budget share as the price elasticity of real income or the total consumption given that the volume of demand is constant. The direct effect (DE) on welfare following a change in the price of fuel good \( i=1,\ldots,k \) is expressed below as:

\[
    \text{DE} = \sum_{i=1}^{k} w_i \times \partial \log p_i,
\]

where \( k \) is the number of fuel products consumed by the household.

4.1.2. Indirect effects of the fuel price increase. The calculation of the price changes is more complicated than shown above for the direct effect. Indirect effects on household welfare are estimated using the price-shifting approach of Coady and Newhouse (2006):

\[
    \text{IE} = \sum_{j=1}^{K} w_j \times \partial \log p_j,
\]

where \( K \) is the number of non-petroleum goods consumed by the household, and \( \partial \log p_j \) is the relative price change resulting from the increase in fuel prices. This requires information on the production structure of the economy that is easily obtained from input–output tables. The price-shifting approach implicitly assumes that goods are non-traded, such
that there are constant returns to scale in domestic production and that demand is price inelastic. The sum of the direct and indirect impacts then provides the total impact of the increase in fuel prices.

4.1.3. Price-shifting approach to calculate the indirect effects. Coady and Newhouse (2006) suggested the following three broad categories of commodities according to the relationship between higher production costs and output prices:

- **Cost-push sectors**: these consist of sectors where higher input costs are passed on to the final prices paid by households. These are non-traded commodities such as government services, public utilities, construction, trade and transportation, as well as retail and wholesale trade. The relationship between consumer and producer prices is given by:

  \[ p_u^{cp} = p_p^{cp} + t_{cp}, \]  

  where \( p_u^{cp} \) is the price paid by consumers, \( p_p^{cp} \) is the price received by producers and \( t_{cp} \) is the tax imposed by the government.

- **Traded sectors**: the trade sectors compete with internally traded goods and output prices are determined by prices on the world market as well as the import or export tax regimes prevailing in the country. Since prices are determined in the world market, higher input costs are not transferred onto output prices.

  \[ p_u^{ts} = p^{world} + t_{ts}, \]  

- **Controlled sectors**: these include industries that are controlled by government and thus government fixes the prices. Any price changes in this sector largely depend on whether the government adjusts prices. In the absence of price adjustments, any higher input costs are borne by factor prices, profits or government revenue. To keep the analysis simple, taxes are set to zero.

  \[ p_u^{c} = p^* \]  

The subscripts \( cp, ts \) and \( c \) denote cost-push, traded and controlled sectors, respectively.

The changes in consumer prices in the traded and controlled sectors can be computed as:

\[ \Delta p_u^{ts} = \Delta p^{world} + \Delta t_{ts}, \]  

\[ \Delta p_u^{c} = \Delta p^*. \]  

Any changes in \( \Delta p_u^{c} \) are exogenous and depend largely on price adjustments announced by government. Similarly, \( \Delta p_u^{c} \) is exogenously determined through changes in trade taxes and world prices.
The changes in the cost-push sectors are relatively more involved. The changes in the cost-push sector can be computed as:

$$\Delta p_{cp} = \Delta p_{cp} + \Delta t_{cp}. \quad (7)$$

The term $\Delta p_{cp}$ depends on factor prices of all intermediate goods and can be written as $\Delta p_{cp} = f(P)$, where $P$ denotes the price vector of all goods and services.

The aggregate commodity categories are produced with a share of each of the above sectors; that is, cost-push, traded and controlled sectors (Coady and Newhouse 2006). These shares are given by $\alpha, \beta$ and $\gamma$, respectively, and the sum of the shares are equal to one for each sector ($\alpha + \beta + \gamma = 1$; $s = 1, \ldots, S$). An input–output coefficient matrix ($A$) for output $j$ is given by $a_{ij}$ for input $i$, and $A$ captures the production technology of domestic firms. Given the input–output coefficient matrix and fixed factor prices, the change in the price of output $j$ can be written as:

$$\Delta p_{cp} = \sum_{s=1}^{S} \alpha_i a_{ij} \Delta p_{cp} + \sum_{s=1}^{S} \beta_i a_{ij} \Delta p_{ts} + \sum_{s=1}^{S} \gamma_i a_{ij} \Delta p_{c}. \quad (8)$$

In a more compact form using matrix notation, Equation (8) can be written as:

$$\Delta p_{cp} = \Delta p_{cp} \cdot \alpha \cdot A + \Delta p_{ts} \cdot \beta \cdot A + \Delta p_{c} \cdot \gamma \cdot A, \quad (9)$$

where $A$ is an $n \times n$ input–output coefficient matrix, $p$ is a vector of prices and $\alpha, \beta$ and $\gamma$ are $n \times 1$ diagonal matrices. The indirect effect can now be calculated by substituting Equation (9) into (7) and using the resulting change in prices in (2) above.

The fuel products are mostly consumed within the non-traded goods and transport sectors. Thus, the effect on traded goods is most likely to occur through rising transport prices (Coady and Newhouse 2006). The following assumptions are assumed to hold in our analysis: (1) all fuel products are in the controlled sector, (2) all other products are in the cost-push sector and (3) there is no substitution away from fuel by households. The assumptions are not very restrictive. Given that the interpretation of the estimates here are short-run effects, no major adjustments to the consumption of the fuels are expected within the short-run. Especially, in the urban areas such substitutions are limited given that the majority of households adapt by reducing consumption of the fuels. In rural households, many households already use very little diesel, petrol and LPG, thus we expect very minimal substitution to take place. The key area where such substitutions are likely to take place is in the consumption of kerosene – where households may switch towards charcoal and firewood.

Despite the limitations of input–output analysis – homogeneous output, fixed production technology, absence of scale economies, exogenous inputs and final demand – the approach is easier to implement and requires a lower level of information and data compared to more data and modelling intensive approaches such as the dynamic computable general equilibrium framework.

4.2. Data and household level analysis

The major source of data for our analysis is the Ghana Living Standard Survey (GLSS) 5 collected in 2005–2006, a comprehensive and nationally representative typical dataset on
household expenditure and incomes. Additional data include the consumer price index from the Ghana Statistical Service (GSS), projected GDP and inflation data from the 2013 national budget, and population data from the 2010 national census. Population projections for 2013–2016 are based on the UN population database while the GDP projection for 2016 is from the IMF’s World Economic Outlook database. The data on the subsidies per unit are available from the National Petroleum Authority (NPA).

The decomposition of household consumption is based on the aggregation of commodities in the input–output matrix. The various fuel products that can be identified from the Ghana Living Standards Survey (GLSS) include, LPG, kerosene, petrol, diesel and other fuel and power. The remaining items of household expenditure are aggregated according to the input–output sectoral breakdown in the 2005 social accounting matrix (SAM) of Ghana. There are 13 sectors in the aggregated SAM, namely: agriculture and livestock; cocoa; forestry; fishery; mining; manufacturing and industry (this includes petrol and diesel); construction; water and electricity; trade; transport and communication; business and real estate; community services and public services (GSS 2007b provides further details). Household expenditure data are finally adjusted so that spatial and temporal price differences are taken into account. This is done by using the regional price index (with Accra prices normalised to one) reported in the GLSS5 survey.

Household expenditure data and the poverty line are recalculated at 2013 prices (using the national consumer price index between 2006 and 2013). Household expenditure patterns over the period are not expected to have changed considerably (especially comparing the previous surveys, changes occurring in household consumption patterns have been minimal). Additionally, household sampling weights are adjusted based on the 2013–2016 population projections provided by the UN population database.

4.3. Assessing the mitigating impacts of the national cash transfer programme

As outlined in the background section, assuming that the removal of the fuel subsidy negatively impacts household poverty, this article aims to estimate the mitigating effect of expanding social protection. This article examines three scenarios for expanding the national cash transfer programme (LEAP) to 150,000, 300,000 and 500,000 households in 2014, 2015 and 2016, respectively.

The poor are identified using scores generated from a proxy means regression that relates the log of household equivalent consumption to a set of measurable characteristics of the household. The household characteristics, dwelling characteristics and household assets chosen as proxy indicators are such that households cannot easily manipulate them to increase their chances of selection. The proxy regressions are not estimated in this study; the existing LEAP scoring is used on the variables contained in the GLSS5 to identify the poor households eligible for the LEAP transfers. Tests of the targeting performance of the cut-off scores and the LEAP variables in both the GLSS5 and LEAP surveys have been shown to be satisfactory (see, for example, Tsimpo and Wodon (2012)).

5. Results

5.1. Incidence of fuel subsidy benefits across quintile groups in Ghana

Regarding how each income group benefited from the fuel subsidies, the results of our analysis show that subsidies across all fuel products are regressive. Similar to evidence in
In the literature, the richest quintiles benefit the most from fuel subsidies – the more a household spends on the product, the more subsidy benefits it receives. About 85.5, 92.8 and 96.5 per cent of LPG, petrol and diesel subsidies accrue to the richest quintile (see Table 3). The poorest quintile receives less than 1 per cent of these subsidies. For kerosene, the share of subsidies accruing to the richest quintile is lower. They receive approximately 36.4 per cent of the kerosene subsidies, while the poorest quintile receives just 10.7 per cent.

The budget shares of fuel expenditure in Table 4 indicate that the poorest households spend less than 1 per cent of their budget on petrol, diesel and LPG. However, they spend the largest share (4.4% of their total spending) of all the quintile groups on kerosene. In contrast, the richest quintiles spend the largest share of their budget on diesel, petrol and LPG. Although more than a third of the kerosene subsidy accrues to the richest group, they spend the lowest share of their budget on kerosene, less than 1 per cent.

### Table 3. Benefit incidence of fuel subsidies accruing to each quintile (in %).

<table>
<thead>
<tr>
<th>Quintile</th>
<th>1 (poorest)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (richest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>0.12</td>
<td>0.63</td>
<td>1.45</td>
<td>1.33</td>
<td>96.46</td>
</tr>
<tr>
<td>Petrol</td>
<td>0.90</td>
<td>1.35</td>
<td>1.62</td>
<td>3.35</td>
<td>92.78</td>
</tr>
<tr>
<td>LPG</td>
<td>0.16</td>
<td>0.69</td>
<td>2.17</td>
<td>11.43</td>
<td>85.55</td>
</tr>
<tr>
<td>Kerosene</td>
<td>10.69</td>
<td>13.88</td>
<td>18.06</td>
<td>20.96</td>
<td>36.42</td>
</tr>
<tr>
<td>Total</td>
<td>2.97</td>
<td>4.14</td>
<td>5.83</td>
<td>9.27</td>
<td>77.80</td>
</tr>
</tbody>
</table>

Source: Own calculations based on GLSS5. Incidence calculated is the share of subsidy received by each quintile in the total subsidies received by all households (based on individual sample weights).

### Table 4. Budget shares and per capita subsidy amount per quintile.

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Budget shares for fuel (in %)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel</td>
<td>0.00</td>
<td>0.01</td>
<td>0.07</td>
<td>0.02</td>
<td>0.35</td>
<td>0.09</td>
</tr>
<tr>
<td>Petrol</td>
<td>0.40</td>
<td>0.29</td>
<td>0.19</td>
<td>0.34</td>
<td>1.22</td>
<td>0.49</td>
</tr>
<tr>
<td>LPG</td>
<td>0.01</td>
<td>0.02</td>
<td>0.05</td>
<td>0.15</td>
<td>0.33</td>
<td>0.11</td>
</tr>
<tr>
<td>Kerosene</td>
<td>4.37</td>
<td>2.97</td>
<td>2.31</td>
<td>1.62</td>
<td>0.96</td>
<td>2.45</td>
</tr>
<tr>
<td>Total</td>
<td>4.79</td>
<td>3.29</td>
<td>2.62</td>
<td>2.12</td>
<td>2.87</td>
<td>3.14</td>
</tr>
<tr>
<td><strong>Subsidy per capita (GHS per year)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diesel</td>
<td>0.00</td>
<td>0.01</td>
<td>0.06</td>
<td>0.03</td>
<td>2.02</td>
<td>0.42</td>
</tr>
<tr>
<td>Petrol</td>
<td>0.17</td>
<td>0.21</td>
<td>0.19</td>
<td>0.51</td>
<td>7.32</td>
<td>1.68</td>
</tr>
<tr>
<td>LPG</td>
<td>0.01</td>
<td>0.04</td>
<td>0.17</td>
<td>0.71</td>
<td>3.12</td>
<td>0.81</td>
</tr>
<tr>
<td>Kerosene</td>
<td>2.05</td>
<td>2.74</td>
<td>3.14</td>
<td>3.11</td>
<td>3.40</td>
<td>2.89</td>
</tr>
<tr>
<td>Total</td>
<td>2.23</td>
<td>2.99</td>
<td>3.55</td>
<td>4.35</td>
<td>15.86</td>
<td>5.80</td>
</tr>
<tr>
<td><strong>Household size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household size</td>
<td>6.37</td>
<td>5.14</td>
<td>4.40</td>
<td>3.71</td>
<td>2.51</td>
<td>4.01</td>
</tr>
<tr>
<td><strong>Expenditure per capita (GHS per year)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure per capita</td>
<td>995.92</td>
<td>1550.96</td>
<td>2013.17</td>
<td>2604.33</td>
<td>4242.89</td>
<td>2280.90</td>
</tr>
</tbody>
</table>

Note: Own calculation based on GLSS5. Budget shares are the mean shares for each quintile. Subsidy per capita is the subsidy times the quantity of fuel consumed normalised by household size.
As a result, the amount of the subsidy received per capita by quintile shows a similar pattern. For all fuels, the amount of subsidy received per capita is higher for the richest households – they receive GHS 2.02 per person per year for the diesel subsidy alone. For petrol, the richest households receive almost 43 times as much subsidy per capita than the poor – GHS 7.32 per year compared to just GHS 0.17 for the poorest group. Even for kerosene, used so much more by the poor, the richest households receive GHS 3.40 per capita compared to the poor’s GHS 2.05.

Overall, the provision of a universal subsidy to fuel products has primarily served to subsidise the consumption of the richest quintile.

5.2. Impact of fuel subsidy removal on household welfare

To estimate the total impact of the fuel subsidy reform on household welfare, the complete elimination of this subsidy was simulated. The resulting increases in fuel prices of 28.22 (diesel), 29.39 (petrol), 76.07 (LPG) and 38.06 (kerosene) per cent were used in our analysis.

The results are presented in Figure 2 and show that the removal of the subsidies has the biggest impact on the household welfare of the poorest quintile. These households experience a 2.1 per cent decline in their real spending. The other quintiles also experience a total decline in their spending of between 1.56 and 1.86 per cent.

The indirect impact, as obtained using the input–output matrix, for each sector includes price rises in public transport and communication (8.06%); trade, restaurants and hotels (1.2%) and fisheries (2.06%) (see Table A1 in the appendix). The impact on electricity is minimal given that electricity prices were regulated. Similarly, we find that the change in food prices is low: this might be due to the fact that own-production is still a predominant source of food consumption for most households (still living in rural areas) and that, especially in rural areas, food products are prevalently sold in nearby markets (so, the higher cost for transportation does not affect substantially the price of food). The indirect effects reduce...
household welfare for all five quintile groups of less than 1 per cent, varying from 0.32 per cent (poorest quintile) to 0.81 per cent (richest quintile). The direct effects on the other hand, are above 1 per cent for the poorest, second and richest quintiles.

The results above indicate that households with several children would suffer the most – resulting in rising child poverty. As poor households, most of them living in rural areas, spend substantially less than richer (urban) households on public transportation to work or school, the indirect price effects on the poorest quintiles is found to be low.

Conversely, urban households are more likely to be affected by the indirect costs as they rely substantially more on public transportation and higher direct costs for households owning vehicles and motor cycles. However, the reliance on kerosene by poor households as a fuel for cooking and in some cases as a fuel for kerosene lamps to provide light in their homes forms the bulk of the direct costs.

5.3. Impact of fuel subsidy removal on poverty and inequality

The results of the poverty simulation show that the fuel subsidy removal leads to an increase in national poverty of 1.5 percentage points (Table 5), meaning that 395,180 people would be pushed into poverty by the reform in 2013. Ghana’s poverty rate is then simulated to increase from 28.5 per cent in the GLSS5 to 30 per cent as a result of the fuel subsidy removal. Similarly, both poverty depth and poverty severity worsen as well. The increase in the poverty depth is approximately 0.5 percentage points. This implies that the poverty depth increases nationally from 9.6 per cent, in GLSS5, to 10.1 per cent. The severity of poverty also increases by approximately 0.28 percentage points (from 4.6 per cent). Finally, we found a decline in the overall inequality of 0.6 percentage points from a Gini coefficient of 41.4 prior to the reform to 40.8 following it.

Figure 3 shows that the increase in the incidence of poverty is robust over a relatively large range of poverty lines. Similarly, Figures 4 and 5 show that the estimated increases in Ghana’s poverty depth and poverty severity are also robust. Finally, Figure 6 shows the estimated difference in inequality before and after the reform.

6. Mitigation of impact: cash transfer scenarios

In this section, based on the review of social protection programmes in Ghana mentioned in Section 2, we consider the effect on national poverty of expanding Ghana’s national cash transfer programme (LEAP) from its current scale of 72,000 households. We estimate three expansionary scenarios over 3 years as follows: (1) 150,000 households in 2014, (2) 300,000 households in 2015 and (3) 500,000 households in 2016. The LEAP transfers are provided on a bi-monthly basis, and current delays in payments, which must be addressed, have not been factored into the model. The modelling of the scenarios below are shown for monthly adult

| Table 5. Change in poverty and inequality due to Fuel Subsidy Reform (percentage points). |
|------------------------------------------|--------|
| Poverty headcount                        | 1.5    |
| Poverty depth                            | 0.5    |
| Poverty severity                         | 0.3    |
| Gini                                     | -0.6   |

Note: Own calculation based on GLSS5.
Figure 3. Simulation of changes in the poverty headcount following the increase in fuel prices.

Price changes of 28.22%, 29.39%, 76.06% and 38.06% for diesel, petrol LPG and kerosene respectively.
Source: Authors’ calculations based on GLSS5 and 2005 SAM

Figure 4. Simulation of changes in the poverty depth following the increase in fuel prices.

Price changes of 28.22%, 29.39%, 76.06% and 38.06% for diesel, petrol LPG and kerosene respectively.
Source: Authors’ calculations based on GLSS5 and 2005 SAM
Figure 5. Simulation of changes in the poverty severity following the increase in fuel prices.

Price changes of 28.22%, 29.39%, 76.06% and 38.06% for diesel, petrol LPG and kerosene respectively.
Source: Authors’ calculations based on GLSS5 and 2005 SAM

Figure 6. Simulation of changes in inequality following the increase in fuel prices (variation in the Lorenz curve).

Price changes of 28.22%, 29.39%, 76.06% and 38.06% for diesel, petrol LPG and kerosene respectively.
Source: Authors’ calculations based on GLSS5 and 2005 SAM
equivalent expenditure and the poor are identified using a monthly poverty line based on the official lower and upper poverty lines in 2006—288.47 and 370.89 GHS per year, respectively—divided by 12 months.

The results from simulating the cash transfers are shown in Table 6. In the previous section, we saw that the rise in fuel prices led to an increase in the poverty headcount of 1.5 percentage points. This section compares these new, higher poverty rates with that following the LEAP simulations so as to investigate how well LEAP reduces the impact of the fuel price increase. The results show that, on average, the cash transfers successfully reverse the impact of the fuel price increase and reduce poverty at the national level by 1.6–2.3 percentage points.

In 2014, as LEAP is simulated to double to reach 150,000 households, the simulations indicate a decrease in the poverty headcount of 1.6 percentage points. The scale-up of LEAP in 2016 to reach 500,000 households provides the greatest impact on poverty, producing a reduction of 2.3 percentage points in poverty, which more than offsets the increase in poverty due to the rise in fuel prices.

Similar effects are observed for the poverty gap and severity of poverty. The poverty depth reduces by 0.9 percentage points in 2014 and 1.6 percentage points in 2016. Similarly, poverty severity declines by 0.7 (2014) and 1.2 (2016) percentage points. Together with the projected additional annual costs of the LEAP scale-up (Table 7), we can estimate that reducing the poverty rate by 1 percentage point through scaling-up the LEAP programme would cost GHS 159 million.

The projected scale-up to 150,000, 300,000 and 500,000 households yields costs for the LEAP programme ranging from GHS 94.7 million to GHS 365.9 million per year. This is clearly lower than the estimated cost of fuel subsidies for 2013 of 2.4 billion GHS. In terms of the projected scale-up costs, these range from 0.04 per cent in 2013 to 0.13 per cent of projected GDP in 2016.

Finally, the scale-up of the LEAP programme brings about a further reduction in national inequality of approximately 0.5 percentage points in 2014 and one percentage point in 2016. Additional information on the coverage and targeting performance of the cash transfers are presented in the appendix. In general, the transfers are progressive and provide good coverage and targeting results.

### Table 6. Impact of the LEAP programme on poverty measures.

<table>
<thead>
<tr>
<th>Headcount</th>
<th>Poverty gap</th>
<th>Severity</th>
<th>Gini</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty before fuel subsidy reform</td>
<td>28.5</td>
<td>9.6</td>
<td>4.6</td>
</tr>
<tr>
<td>Poverty after reform (A) %</td>
<td>30.0</td>
<td>10.1</td>
<td>4.9</td>
</tr>
<tr>
<td>Poverty after reform with monthly LEAP transfer(B) %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>28.4</td>
<td>9.2</td>
<td>4.2</td>
</tr>
<tr>
<td>2015</td>
<td>28.0</td>
<td>8.9</td>
<td>4.0</td>
</tr>
<tr>
<td>2016</td>
<td>27.7</td>
<td>8.5</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Difference in poverty due to expansion of the LEAP programme (B – A) (percentage point)

| 2014 | -1.6 | -0.9 | -0.7 | -0.5 |
| 2015 | -2.0 | -1.2 | -0.9 | -0.7 |
| 2016 | -2.3 | -1.6 | -1.2 | -1.0 |

Note: Own calculations based on GLSS5 (2006). Results are based on monthly adult equivalent consumption and poverty lines.
Additionally, the case where all extreme poor households (those households living under Ghana’s lower poverty line, 18% of the population in 2006) are targeted is presented. If all extreme poor households were covered by LEAP, the annual cost would amount to GHS 628.8 million (this does not include administrative costs). In terms of projected GDP figures this amounts to 0.7 per cent of GDP in 2013.

### 7. Conclusion

In 2013, the Government of Ghana removed almost all fuel subsidies in an effort to reduce the fiscal deficit. However, estimates of the reform’s impact on poverty were not available and this research article was required to estimate the potential impact of both the reform and the mitigating measure of expanding the national cash transfer programme. We show that the fuel subsidies were indeed highly regressive, with the richest quintile benefiting from 77.8 per cent of the fuel subsidies as a whole. Conversely, the poorest quintile received the lowest share of the subsidies in all four fuel products, at just 2.97 per cent. The richest quintile of the population received 15.86 GHS per year from the fuel subsidies per capita, while the poorest received just 2.23 GHS per capita.

By the use of a partial equilibrium approach aiming at capturing the short-term effects of the 2013 fuel subsidy reform, our analysis shows that the impact of the fuel subsidy removal on household welfare is the greatest for the poorest households. It reduces their consumption by 2.1 per cent as a result of the direct and indirect price effects. As a consequence, Ghana’s poverty rate would rise by 1.5 percentage points, meaning that recent gains towards reaching the MDG to reduce poverty would be reversed. In terms of numbers, this would mean that additional 395,180 people were pushed into poverty by the reform. The depth and severity of national poverty would also worsen, while the overall impact on inequality is a decline of 0.6 percentage points.

In terms of mitigating these negative impacts on household welfare, the simulation of expanding Ghana’s cash transfer programme, LEAP, is promising and show that it could entirely reverse the national-level impact of the reform on the poor. If the LEAP programme were provided to 500,000 extreme poor households, it would reduce the national poverty by 2.3 percentage points, greater than the increase brought about by the reform. We note that the costs of the projected cash transfers are considerably lower than maintaining fuel subsidies.

In summary, the reform of fuel prices in Ghana would reduce the sizeable fiscal deficit and reduce large regressive expenditures. However, the poor and vulnerable would be negatively affected by the reforms and are the least able to cope. The impact of increased fuel prices (both directly from higher prices on fuel products themselves and indirectly

### Table 7. Costs of projected transfers.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of households</th>
<th>Annual (GHS)</th>
<th>Annual (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>71,957</td>
<td>42,268,214.40</td>
<td>21,080,352.30</td>
</tr>
<tr>
<td>2014</td>
<td>148,992</td>
<td>94,733,151.60</td>
<td>47,246,098.25</td>
</tr>
<tr>
<td>2015</td>
<td>299,500</td>
<td>204,928,294.80</td>
<td>102,203,528.40</td>
</tr>
<tr>
<td>2016</td>
<td>497,593</td>
<td>365,897,523.60</td>
<td>182,483,429.06</td>
</tr>
<tr>
<td>All extreme poor</td>
<td>1,077,135</td>
<td>628,821,811.60</td>
<td>313,611,197.20</td>
</tr>
</tbody>
</table>

Note: 1 18% of the 2013 population. Households targeted in the table are based on household weights adjusted with population projections from the UN population database. LEAP amounts are adjusted for inflation and the household size.
from higher prices of products that use fuel in their own production) is to reduce household consumption, thereby reducing household welfare. Poor and vulnerable households are unable to accommodate easily the higher prices and might be forced to spend less on education, health and nutrition resulting in negative long-term effects.

Acknowledgements
This article forms part of United Nations Children’s Fund (UNICEF) Ghana’s technical support on fuel subsidy reform and scaling-up social protection. Following the reform, UNICEF led dialogue with the Government of Ghana which indicated that no analysis of the scale of the reform’s impact was available, making it difficult to quantify the effect and the mitigation required. As a result, the government of Ghana welcomed the initiation of this research and subsequently, the budgets for 2013 and 2014 integrated a scaled-up allocation to social protection, including a more than quadrupling of the budget for LEAP. The authors are very grateful to Leonardo Menchini (UNICEF), Dena Ringold (World Bank), Peter Ragno (UNICEF) and three anonymous referees for having reviewed the article and providing useful comments as well as Edward Abrokwa and Abass Ibrahim Tasunti (NPA) for discussions on aspects of the pricing formula and other important information pertaining to the local economy. The views represented in this report are those of the authors and do not necessarily represent the views of UNICEF, PEP, Ashesi University College or University of Tunis. Any errors or omissions remaining are those of the authors.

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No potential conflict of interest was reported by the authors.

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Notes
1. GHS is the abbreviation of the Ghanaian currency, the Ghana Cedi. GHp stands for the Ghana Pesewa, USD is used to represent the United States Dollar.
2. Other strategies, noted by Essuman and Tonah (2004, 94) include working more in the informal sector, engaging in legal and illegal means to obtain social service and patronise street food rather than cook at home. Also, see Narayan et al. (2000) for examples from Egypt, Ethiopia.
3. Data from Ghana’s latest Living Standards Survey should be available in the early 2014.
4. The reported adult equivalence scales provided in GLSS5 are used in the poverty analysis presented in the report (for further details, see GSS 2007a). The adult equivalence scale adjusts consumption to account for the differences in caloric requirements among adults and children as well as their gender. The equivalence scales are based on the daily recommended dietary allowances (see GSS 2007a).
5. The conversion of the LEAP transfer to US dollars is based on the October 2013 average interbank exchange rate (GHS 2.0051/USD) (www.bog.gov.gh).
8. See the appendix for a detailed description of the methodological approach undertaken.
9. This second part of our analysis relies on the social protection module of the ADePT software developed at the World Bank. 72,000 households in 2013 provide the baseline for the analysis.
10. Similar to the LEAP methodology, the measurable characteristics include household characteristics (household size, members older than 65 years, share of household members below 18 years, whether household head is an employee in the formal sector, whether household is self-employed in agriculture), the materials used in constructing the dwelling, presence of utilities (electricity and source of drinking water), presence of toilet facilities and the type of facility, the number of persons per room, ownership of land and livestock, ownership of assets and regional indicators for urban and rural areas.


12. There is also a lifeline tariff to ensure that poor households have a minimum amount of electricity consumption guaranteed. Tariff rates above this are higher as electricity consumption rises above the minimum amount.

13. Since 2013, world fuel prices have experienced a significant decline from $116 (February 2013) to $46.87 (January 2015) per barrel representing a decline of approximately 60 per cent. If the government had allowed domestic fuel prices to decline in proportion to world prices, this would have partially compensated households for the removal of the subsidies. However, most of this reduction was not passed on to consumers, as domestic prices were maintained above world prices to allow government to reimburse an accumulated debt of GHS 412 million in unpaid subsidies to the bulk oil distribution companies (BDCs) (National Petroleum Authority: www.npa.gov.gh). On average, across all four fuel products, domestic market prices experienced reductions of only 2.1 per cent (October 2014) and 10.6 per cent (January 2015). LPG prices were reduced twice in January (10.2% and 1.5%) and increased by 1.5 per cent in March 2015.

14. The ADePT toolkit of the World Bank was used in the various simulations of the impact of the cash transfer on the poor. In the base case, household adult equivalent expenditure includes transfers. The simulation then removes it and assumes that household expenditure is reduced by the full value of the transfer.

15. As an anonymous referee suggested, it might be argued that ‘the savings from subsidy reform is subject to the volatility of international prices, while the cost of expanding social safety nets represents a permanent increase in spending’. This volatility can be seen as an argument for removing subsidies – for which the budget implications are volatile – in favour of more predictable and targeted (to the poor) cash transfer mechanisms, and might further suggest that these mechanisms could eventually be indexed in some way to the cost of living of the poor.

16. Projected GDP estimates obtained from the 2013 Budget. The 2016 projected estimate is however obtained from the IMF’s World Economic Outlook. The projected GDP values (in millions) are GHS 88,764, 109,547, 135,598 and 141,107 for 2013, 2014, 2015 and 2016, respectively.

References


Appendix

Table A1. Price changes from the input–output analysis (in %).

<table>
<thead>
<tr>
<th>Sector</th>
<th>Price change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; livestock</td>
<td>0.26</td>
</tr>
<tr>
<td>Cocoa</td>
<td>0.22</td>
</tr>
<tr>
<td>Forestry</td>
<td>0.27</td>
</tr>
<tr>
<td>Fishery</td>
<td>2.06</td>
</tr>
<tr>
<td>Mining</td>
<td>0.93</td>
</tr>
<tr>
<td>Manufacturing &amp; industry</td>
<td>0.39</td>
</tr>
<tr>
<td>Water &amp; electricity</td>
<td>0.25</td>
</tr>
<tr>
<td>Construction</td>
<td>0.33</td>
</tr>
<tr>
<td>Transport &amp; communication</td>
<td>8.06</td>
</tr>
<tr>
<td>Trade, restaurant &amp; hotels</td>
<td>1.20</td>
</tr>
<tr>
<td>Business &amp; real estate</td>
<td>0.49</td>
</tr>
<tr>
<td>Public services</td>
<td>0.25</td>
</tr>
<tr>
<td>Community services</td>
<td>0.55</td>
</tr>
<tr>
<td>Diesel</td>
<td>28.48</td>
</tr>
<tr>
<td>Petrol</td>
<td>29.65</td>
</tr>
<tr>
<td>LPG</td>
<td>76.32</td>
</tr>
<tr>
<td>Kerosene</td>
<td>38.31</td>
</tr>
</tbody>
</table>

Note: The percentage changes in prices are based on Coady and Newhouse’s (2006) price shifting method. The last four rows provide the changes in fuel prices that result in the price increases in the remaining sectors.

Table A2. Budget shares.

<table>
<thead>
<tr>
<th>Quintile</th>
<th>1 (poorest)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (richest)</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; livestock</td>
<td>42.42</td>
<td>37.59</td>
<td>35.44</td>
<td>33.29</td>
<td>31.45</td>
<td>36.04</td>
</tr>
<tr>
<td>Forestry</td>
<td>0.51</td>
<td>0.74</td>
<td>1.06</td>
<td>1.28</td>
<td>1.27</td>
<td>0.97</td>
</tr>
<tr>
<td>Fishery</td>
<td>9.01</td>
<td>11.05</td>
<td>10.37</td>
<td>9.16</td>
<td>7.43</td>
<td>9.40</td>
</tr>
<tr>
<td>Manufacturing &amp; industry</td>
<td>25.96</td>
<td>24.87</td>
<td>25.13</td>
<td>26.05</td>
<td>27.21</td>
<td>25.84</td>
</tr>
<tr>
<td>Water &amp; electricity</td>
<td>1.25</td>
<td>2.14</td>
<td>2.49</td>
<td>3.19</td>
<td>3.18</td>
<td>2.45</td>
</tr>
<tr>
<td>Construction</td>
<td>0.92</td>
<td>1.07</td>
<td>1.14</td>
<td>1.28</td>
<td>1.58</td>
<td>1.20</td>
</tr>
<tr>
<td>Transport &amp; communication</td>
<td>1.42</td>
<td>2.77</td>
<td>3.45</td>
<td>4.84</td>
<td>6.36</td>
<td>3.77</td>
</tr>
<tr>
<td>Trade, restaurant &amp; hotels</td>
<td>3.75</td>
<td>5.92</td>
<td>6.64</td>
<td>7.2</td>
<td>7.87</td>
<td>6.27</td>
</tr>
<tr>
<td>Business &amp; real estate</td>
<td>3.85</td>
<td>2.81</td>
<td>2.65</td>
<td>2.68</td>
<td>2.88</td>
<td>2.97</td>
</tr>
<tr>
<td>Public services</td>
<td>6.01</td>
<td>7.44</td>
<td>8.59</td>
<td>8.47</td>
<td>7.45</td>
<td>7.59</td>
</tr>
<tr>
<td>Community services</td>
<td>0.13</td>
<td>0.31</td>
<td>0.42</td>
<td>0.45</td>
<td>0.45</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Note: Own calculation based on GLSS5. Cocoa and mining shares are nil.
Table A3. Undercoverage and leakage rates of the LEAP (scale-up) programme.

<table>
<thead>
<tr>
<th>Year</th>
<th>Coverage of the poor (1)</th>
<th>Under-coverage (2)</th>
<th>Leakage (# of beneficiaries) (3)</th>
<th>Leakage (benefits) (4)</th>
<th>Targeting differential (5) = (1) – (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>22.22</td>
<td>77.78</td>
<td>38.18</td>
<td>35.47</td>
<td>−15.96</td>
</tr>
<tr>
<td>2015</td>
<td>32.62</td>
<td>67.38</td>
<td>49.83</td>
<td>48.48</td>
<td>−17.21</td>
</tr>
<tr>
<td>2016</td>
<td>45.00</td>
<td>55.00</td>
<td>54.75</td>
<td>54.65</td>
<td>−9.76</td>
</tr>
<tr>
<td>2014</td>
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<td>82.18</td>
<td>21.28</td>
<td>20.16</td>
<td>−3.46</td>
</tr>
<tr>
<td>2015</td>
<td>28.22</td>
<td>71.78</td>
<td>28.61</td>
<td>27.83</td>
<td>−0.39</td>
</tr>
<tr>
<td>2016</td>
<td>39.44</td>
<td>60.56</td>
<td>33.02</td>
<td>33.30</td>
<td>6.42</td>
</tr>
</tbody>
</table>

Note: Undercoverage represents the percentage of poor households that do not receive the transfer. Leakage is the share (in %) of households that are not poor but receive the transfer. The coverage rates of the poor increase as the LEAP beneficiaries are scaled up (and conversely, there is a decline in undercoverage as well). The leakage rates also tend to increase with the LEAP scale up. In 2016, the targeting differential is positive and the coverage of the total poor is higher than the percentage of non-poor households receiving the transfer. The targeting differential provides the difference between the coverage rate and the leakage rate.
Detailed description of household level analysis

The analysis at the household level adopts the Stone–Geary preferences for calculating real expenditure of each household. The results from the simulations are used to predict changes in real expenditure of households and variations in poverty and social welfare indicators. The procedure is outlined below.

Let,

(1) \( y_r = (y_{r,1}, \ldots, y_{r,h}, \ldots, y_{r,H}) \) be a vector of household expenditures in the base period (before the reform) from the 2006 Ghana Living Standards Survey of \( H \) households and \( N \) individuals \( (N = \sum_{h=1}^{H} n_h) \), where \( n_h \) is the size of household \( h \).

(2) \( W = (w_1, \ldots, w_h, \ldots, w_H) \) be a vector of household weights. Then, \( N = \sum_{h=1}^{H} w_h n_h \) provides an estimate of the population size.

(3) \( p_r(p_{r,1}, \ldots, p_{r,h}, \ldots, p_{r,H}) \) be a vector of \( K \) prices in the base period prevailing before the reform.

(4) \( q_r(q_{r,1}, \ldots, q_{r,h}, \ldots, q_{r,H}) \) be a vector of \( K \) quantities of commodities purchased by the household \( h \) in the base period.

(5) \( \eta_h \) be the number of equivalent adults living in a household.

(6) The living standards of a household \( h \) in the base situation is then given by \( x_{r,h} \), the expenditure level per equivalent adult:

\[
\frac{y_{r,h}}{\eta_h}, \tag{10}
\]

where \( x_r = x_{r,1}, \ldots, x_{r,h}, \ldots, x_{r,H} \) is the vector of income per equivalent adult.

Household preferences are assumed to be based on a \( K \)-commodity Stone–Geary preference with the following indirect utility function.

\[
v(p, x) = \frac{x - \sum_{k=1}^{K} p_k \gamma_k}{\prod_{k=1}^{K} p_k^{\beta_k}}, \tag{11}
\]

where \( \sum_{k=1}^{K} \beta_k = 1 \), \( \gamma_k \) is the subsistence requirement for the commodity \( k \) and \( \beta_k \) is the proportion of the residual income (that is, \( x - \sum_{k=1}^{K} p_k \gamma_k \)) allocated to the consumption of \( k \) after \( p_k \gamma_k \) is spent. The equivalent income function for household \( h \) given scenario \( s \) is as follows:

\[
\Gamma_k(p_r, p_s, x_{s,h}) = \sum_{k=1}^{K} p_k \gamma_k + \frac{x_{s,h} - \sum_{k=1}^{K} p_{s,k} \gamma_k}{\prod_{k=1}^{K} \left( \frac{p_{s,k}}{p_{r,k}} \right)^{\beta_{s,h}}}. \tag{12}
\]

The equivalent income function now has a clear interpretation in terms of real income. If \( \sum_{k=1}^{K} p_{s,k} \gamma_k \) represents the subsistence requirement, then the residual income \( x_{s,h} - \sum_{k=1}^{K} p_{s,k} \gamma_k \) is available for discretionary allocation and it is deflated by the household-specific consumer price index

\[
\pi_{s,h} = \prod_{k=1}^{K} \left( \frac{p_{s,k}}{p_{r,k}} \right)^{\beta_{h,k}},
\]
to express it in the reference price system. Adding the initial cost of subsistence requirements to real residual income provides the equivalent income.

An advantage of assuming Stone–Geary preferences is that, the inference of the household-specific price index is made simple. In the Stone–Geary case, $\beta_{k,h}$ cannot be computed if the level of $\gamma_k$ is unknown. Drawing on the consumer theory, $x_{r,h}$ should not be lower than $\sum_{k=1}^{K} p_{r,k}\gamma_k$ and $q_{r,k,h}/\eta_k$ should not be less than $\gamma_k$, allowing household demand to be derived from constrained utility maximisation. These conditions are fulfilled by setting $\gamma_k$ to the minimum consumption level per equivalent adult for each commodity $k$ across households.

$$\gamma_k = \min \left( \frac{q_{r,k,1}}{\eta_1}, \ldots, \frac{q_{r,k,h}}{\eta_h}, \ldots, \frac{q_{r,k,H}}{\eta_H} \right), k = 1, \ldots, K.$$ 

The values of $\beta_{k,h}$ are then calculated in the following way:

$$\beta_{k,h} = \frac{p_{r,k} \left( \frac{q_{r,k,h}}{\eta_h} - \gamma_k \right)}{x_{r,h} - \sum_{k=1}^{K} p_{r,k}\gamma_k}.$$ 

Using the above framework, the potential effects of the subsidy reform and the scaling-up of cash transfers can be predicted.

**Incidence and LEAP analysis**

Consider an $N$-household population divided into $K$ groups, indexed by $i = 1, \ldots, K$. In the foregoing, we consider a population subdivided into poor (P) and non-poor (NP) households. A similar analytical approach can be used for partitioning the population into other categories such as income deciles or quintiles, area of residence, occupation and gender of the head of household.

The Foster, Greer and Thorbecke (FGT) poverty indices can be applied to real incomes after the application of the cash transfers. The FGT index is:

$$p_{\alpha} = \frac{\sum_{i=1}^{N} \left( 1 - \frac{y_i}{z} \right)^{\alpha} I(y_i \leq z)}{N}, \alpha = 0, 1, 2,$$

where $y_i$ is real income, $z$ is the poverty line, $N$ is the number of households and $I(.)$ is an indicator function taking the value 1 if households are below the poverty line and zero otherwise. When $\alpha = 0$, the poverty head count index is obtained, while $\alpha = 1$ and $\alpha = 2$ capture the poverty gap (depth) and severity of poverty, respectively.

The LEAP households selected for the cash transfer each year are based on a proxy means score following closely the approach used by the Government of Ghana in selecting the beneficiaries (see Wodon 2012 for more details). The cut-off score used in identifying the beneficiary households is then obtained using updated weights (based on a linear calibration which updates the weights based on the estimated population. The calibration allows for an update of the gender, regional, rural and urban populations as well.) Since the update of the weights in subsequent years lead to changes in the numbers of beneficiaries selected – we assumed that the share of beneficiaries in 2006 weights and the 2013–2016 weights are the same – to maintain consistency with the 2006 survey used.