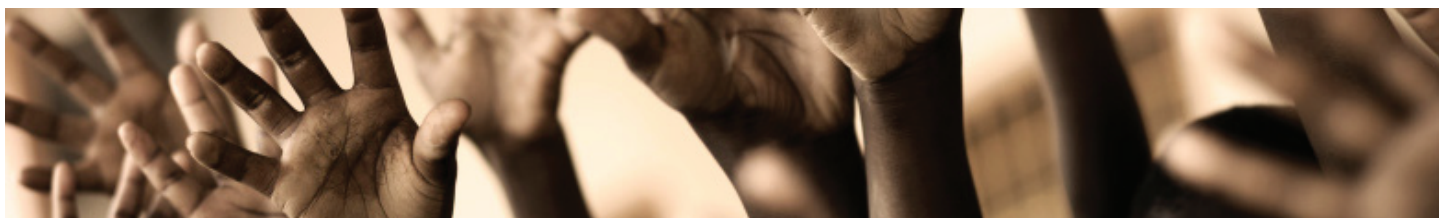


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**Estimating the impact on poverty of Ghana's fuel
subsidy reform and a mitigating response**

Edgar F.A. Cooke
Sarah Hague
John Cockburn
Abdel-Rahmen El Lahga
Luca Tiberti

January 2014





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Authors

Edgar F.A. Cooke
University of Sussex
appianti@yahoo.com

Sarah Hague
UNICEF Ghana
shague@unicef.org

John Cockburn
Partnership for Economic Policy (PEP)
Université Laval

Abdel-Rahmen El Lahga
University of Tunis

Luca Tiberti
PEP, Université Laval

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Executive Summary

Governments across Africa have faced increasing challenges to maintain fuel subsidies over recent years. In Ghana, in the face of a near 12% fiscal deficit in 2012, their burgeoning cost has drawn attention to questions of fiscal sustainability as well as their overall efficiency and effectiveness. In 2013, the Ghanaian Government would have spent cost 2.4 billion GHS (approximately 1.2 billion USD) on fuel subsidies, equalling 3.2% of GDP and more than half of Ghana's allocation to the entire education sector.

Fuel subsidies around the world have been proven to be generally regressive, benefitting largely the richest group with very little reaching those living below the poverty line. In Ghana, **this paper finds that almost 78% of fuel subsidies benefited the wealthiest group, with less than 3% of subsidy benefits reaching the poorest quintile.** 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.

In early 2013 the Ghanaian Government introduced the removal of fuel subsidies over the first half of the year. Prices of petrol, kerosene, diesel and LPG saw rises of between 15% and 50%, until prices reached their market level in mid-September 2013.

Following the subsidy removal and before the 2013 budget was finalised, the Government welcomed the initiation of this research in order to assess the impact of the reform on the poor and to ensure a mitigating response in the form of a social safety net. Based on recent studies of social protection in Ghana this paper identifies the national cash transfer programme, LEAP, as being well targeted, having positive impact, and functioning at national scale with immediate plans for expansion.

This report builds on UNICEF technical support to reform fuel subsidies and scale-up social protection to respond to rising inequality. It aims to provide evidence of the magnitude and the distribution of the impacts of the 2013 fuel subsidy reforms on household welfare in Ghana, and to determine to what extent an expansion of social protection, through the LEAP cash transfer programme, is an effective mitigating measure.

We show that **the removal of the fuel subsidies, by causing an increase in prices, results in a negative impact on household welfare. We see that the negative effect is worst for the poorest group who experience a reduction in their total consumption of 2.1%.** Given that people in the poorest quintile are living in chronic poverty with no margin for manoeuvre, such a decline in their consumption would have a long-term negative impact on their health, education, nutrition and their consequent ability to contribute productively to development.

As a result, Ghana's poverty rate would rise by 1.5 percentage points, meaning that an additional 395,180 people were pushed into poverty by the reform. The depth and severity of national poverty would also worsen. Since the subsidies were regressive, removing them causes a subsequent reduction in inequality, which declines by 0.6 percentage points.

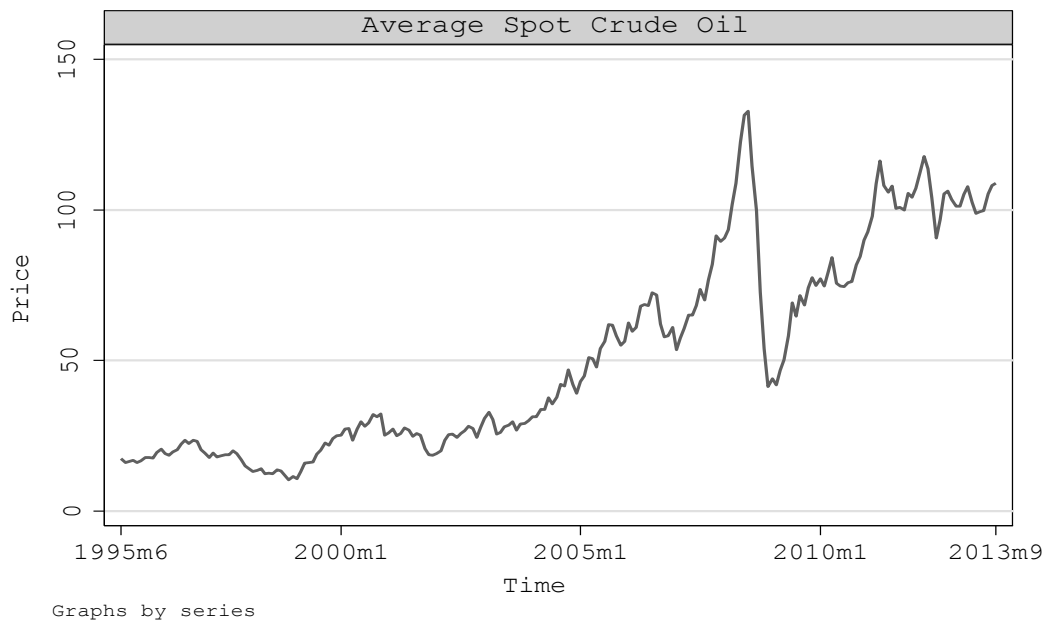
The simulation of expanding Ghana's cash transfer programme, LEAP, in response is promising and shows that it could entirely reverse the national impact of the reform on the poor. We show that a minimum expansion to 150,000 households is needed to reverse the impact of the fuel subsidy removal alone, reducing poverty by 1.6 percentage points. Providing the LEAP benefits to 500,000 extreme poor households, would reduce poverty by 2.3 percentage points. The expansion of LEAP has the added benefit of also reducing national inequality levels. We note that the costs of the projected cash transfers are considerably lower than maintaining fuel subsidies, costing just 0.13% of GDP for the half million households in 2016.

The removal of fuel subsidies in Ghana appears to be a welcome policy reform allowing the Government to reduce its growing fiscal deficit and to reduce excessively regressive expenditures. However, the poor and vulnerable would be negatively affected the most by the reforms and are the least able to cope. At the national level, his negative impact could be mitigated by scaling up Ghana's national cash transfer programme LEAP.

1. Introduction

Similar to the prices of other commodities, 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 (see Figure 1 below) have forced a re-examination of this policy.

Figure 1: International crude oil prices 1995 - 2013



In an IMF review carried out in 2006 it was found that only 16 developing countries of the 48 studied could be said to have a liberalised fuel price, the majority using some form of price control¹. 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 21st 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. According to the 2013 Regional Economic Outlook for Africa from the IMF, African governments are spending about 3% of GDP on average on fuel subsidies; equivalent to the region's average spending on healthcare. In Ghana, had reform not taken place, fuel subsidies would have cost 2.4 billion GHS (approximately 1.2 billion USD) in 2013; more than half of Ghana's allocation to

¹ The Magnitude and Distribution of Fuel Subsidies: Evidence from Bolivia, Ghana, Jordan, Mali and Sri Lanka. 2006. IMF Working Paper

the entire education sector. According to the IMF, the “post-tax” full cost of subsidies in Ghana before their reform was equal to 3.2% of GDP².

Aside from their cost, there is also persuasive evidence from a number of countries around the world that subsidies largely benefit the wealthiest groups. The IMF estimates that around 70% of the benefits from subsidies on gasoline in Africa go to the wealthiest quintile, whereas just 2.2% accrue to the poorest quintile, meaning that they are regressive³. Even for those fuel products that are supposedly ‘pro-poor’ such as kerosene, on average in Africa just 16% of the subsidy benefits go to the poorest quintile.

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 purse⁴.

Ghana’s fiscal deficit approached 12% of GDP in 2012 due to a range of overspends (largely arising from a new salary structure). Following the new 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, RFO and LPG saw rises of between 15% and 50%, until prices reached market level in mid-September 2013.

Despite the inherently regressive nature of fuel subsidies, the poorest are clearly the least able to cope with increases in the cost of living due to their removal. Rapid and preliminary analysis of a fuel and utility subsidy removal (carried out by the World Bank Ghana office using the last household survey data from 2006) estimated that the real loss of income to the poorest households could be as much as 7%. This result factors in both the direct effect of rising fuel products and transport costs, as well as the indirect costs of the inevitably rising cost of other prices, such as food. Clearly, for those households that live below or close to the poverty line, a 7% drop in real income would have dramatic and negative effects on wellbeing, causing the possible initiation of damaging coping strategies, such as withdrawing children from school, sending them to work, or reducing healthcare use or diet variety. The question then arises, if fuel subsidies so inadequately reach the poor, but the poor are negatively affected by the policy’s removal – what other programmes are more effective, proven to reduce poverty and vulnerability, and can be scaled up effectively to mitigate the negative impact of fuel price rises? As a result, an additional focus of this paper is to estimate the possible mitigating potential of scaling up the social transfer programme estimated to be the best targeted in Ghana – the LEAP cash transfer programme.

This paper builds on UNICEF technical support to reform fuel subsidies and scale-up social protection. UNICEF led Development Partner discussions with the Government of Ghana immediately following the subsidy removal and before the 2013 budget was finalised. GoG

² Energy Subsidy Reform in Sub-Saharan Africa: Experiences and Lessons. April 2013

³ The Unequal Benefits of Fuel Subsidies. 2010. IMF Working Paper 202

⁴ The Magnitude and Distribution of Fuel Subsidies. 2006. Coady et al.

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 paper in order to confirm the preliminary results of the impact assessment on the poor of the fuel subsidy's removal. In the interim, and in light of preliminary discussions, the new budget for 2013 integrated a scaled-up allocation to social protection, including a more than doubling of the budget for LEAP and a tripling of the school feeding programme.

The focus of this paper 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.

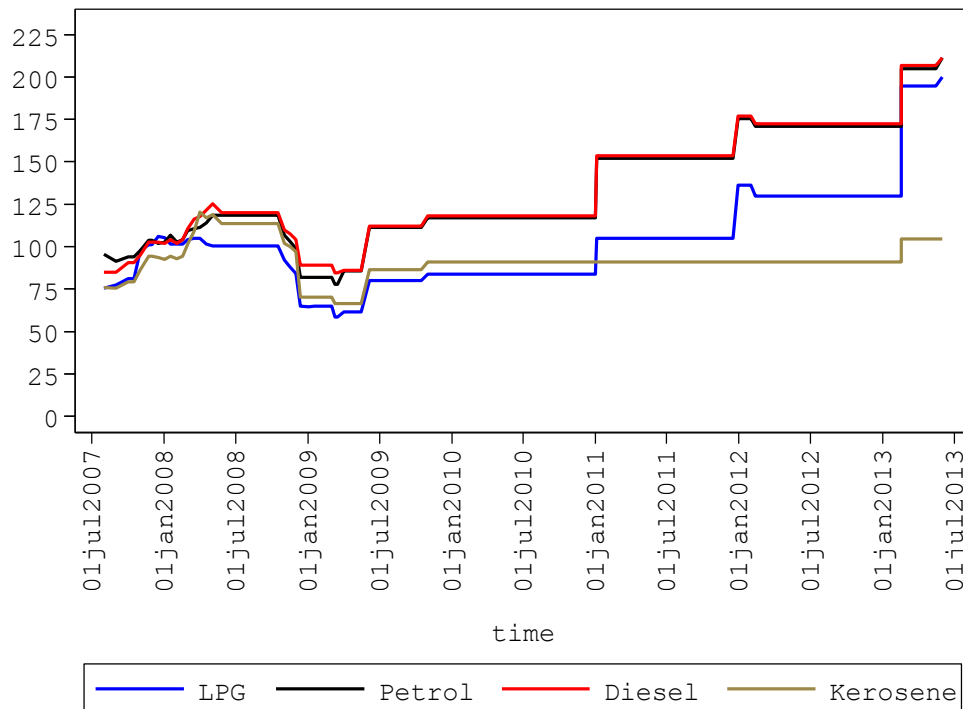
2. Background

Fuel Subsidies in Ghana

The first attempt to liberalise Ghana's subsidised fuel prices occurred in early 2001 with the establishment of an automatic price setting mechanism that linked domestic prices to international ones. The mechanism was abandoned toward the end of the following year and the price of petrol came under government control again. The mechanism was reintroduced in early 2003, causing an almost doubling of the domestic price of petrol. However, the formula was again abandoned following public pressure and by 2004 the cost of fuel subsidies had risen to 2.2 per cent of Ghana's GDP. As the fuel subsidy became an even greater drain on public resources, an impact analysis study was carried out by the IMF (Coady et al. 2005) to examine the impact on the poor of the subsidy removal. Finding a significant negative impact on the poor, the study made recommendations to expand social transfer programmes in order to mitigate the impact, several of which were subsequently adopted. The need to remove the subsidy and reintroduce the price formula was communicated to the general public, and President Kufour himself made a public announcement. As a result the price formula was reintroduced in early 2005 and a National Petroleum Authority was set-up to oversee the deregulation of the sector. However, the cycle did not end there. Fuel subsidies were restored briefly in 2008 and then reinstated in 2009 after the Presidential election. Fuel prices subsequently underwent significant upward adjustments in mid-2009, early 2011, and early 2012, as can be seen in the graph below, culminating in the latest total removal of subsidies in early 2013 after the most recent Presidential election. As this background suggests, fuel prices often featured as a key

political gambit, often rising after elections, and efforts to decouple the price of fuel from the political cycle were unsuccessful.

Figure 2: Retail price of fuels in Ghana, 2007-2013



Source: National Petroleum Authority

This cycle is currently reflected across Sub-Saharan Africa. Following many years of fuel subsidies, governments are acknowledging that their fiscal cost is now unsustainable. As Ghana’s fiscal deficit approached 12% of GDP, the need to undertake a set of fiscal adjustment reforms, including the removal of fuel subsidies, became necessary.

The removal of fuel subsidies largely occurred in February 2013 and prices of petrol, kerosene, diesel, marine diesel, RFO and LPG saw price rises of between 15 and 50%. Premix, used by fishermen, remains subsidised. Further gradual increases occurred later in the year until the price of petrol finally stood at its market rate of 222 GHP/litre, up almost 30% in total from 170.80 GHP/litre at the beginning of the year.

Poverty in Ghana

Ghana is renowned for its stability, good governance and relatively well-developed institutional capacities that support the advancement of human rights. Having experienced steadily increasing economic growth of over 5% p.a. on average since 2006, Ghana attained lower-middle income country status in 2010. Income from offshore oil reserves discovered in 2007 began to flow in 2011, creating double-digit growth for the year. Accompanying income growth has been a rapid reduction in monetary poverty from around 50% in 1990 to

28.5% of the population by 2006, putting Ghana on-track to meet the MDG 1 target⁵. Likewise the poverty gap halved over the same period.

However, as growth has accelerated, inequality has worsened, with the Gini coefficient rising from 37% in 1992 to 42% in 2006. The richest 20% of the population now hold almost half of Ghana's income, whilst the poorest group have seen their income share decline from 6.9% of the total in 1992 to 5.2% in 2006. Inequality between the north and the south of the country has dramatically worsened, for example the contribution of rural areas in the north of the country to national poverty levels increased from 37% to 49% between 1999 and 2006 and the depth of poverty for those in the poorest region (in the far north) actually increased between the 1990s and 2006⁶. These accompanying increases in inequality have slowed down the impact of growth on poverty reduction⁷.

Table 1: National poverty indicators for Ghana 1992-2006.

	Poverty Incidence (P ₀)	Poverty depth (P ₁)
1992	51.7	18.5
1999	39.5	13.9
2006	28.5	9.6

Source: GSS 2007

Although poverty has reduced significantly on average, that of children remains much higher⁸. We estimate that child poverty (that amongst individuals under the age of 18) in 2006 was 39.4%, meaning that more than 1 in 3 children live in poverty. Approximately 77% of all poor households have at least one child. This significant difference between the poverty levels of adults and children is due to the tendency of poorer households to have more children (Table 2). In households with 6 or more children, the child poverty rate is around 60%.

Table 2: Poverty incidence for children (0 - 17 years), total and by household size

	Headcount Poverty	Child population Share (%)
Total	39.4	100
1 Child	14.4	4.2

⁵ Data from Ghana's latest Living Standards Survey should be available in early 2014.

⁶ Pattern and Trends of Poverty in Ghana 1991-2006. 2007. Ghana Statistical Service

⁷ Ibid

⁸ The reported adult equivalence scales provided in the GLSSV are used in the poverty analysis presented in the report (for further details, see GSS, 2007). 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 appendix B, Table B1)

2 Children	21.1	11.3
3 Children	26.7	18.3
4 Children	33.9	19.3
5 Children	41.3	15.4
6 or more	59.1	31.4

Source: Own calculations based on GLSS V

Looking at non-monetary indicators⁹, Ghana has made impressive progress in many areas but has witnessed stagnation and widening inequities in several others. The mortality rate of children under the age of 5 has decreased from 155 deaths per 1000 live births in 1988 to 82/1000 in 2011. However, this does not put Ghana on track to meet the MDG target on child mortality as progress has been held back by the indicator's recent stagnation for the very poorest group, particularly for neonatal mortality. The proportion of underweight children has declined from 23% in 1993 to 13% in 2011, although almost 1 in 4 children (23%) are still stunted from malnutrition. Education, while having experienced important improvements in enrolment (primary net enrolment is now close to 90%), is now suffering in terms of quality. And while access to clean water has improved substantially (to 79% in 2011) to meet the MDG target, sanitation facilities remain very poor with just 15% of households using an improved toilet facility.

Social Protection in Ghana

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. Reflecting this, Ghana implements a wide range of programmes including in-kind transfers (i.e. school uniforms, school meals), cash transfers (LEAP), public works programmes, and fee waivers for certain groups and social services (i.e. 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 USD every two months to extreme poor households which also include an elderly person, an orphan or vulnerable child, or a disabled person who cannot work. As can be seen in table 3 below, it is rated as the best targeted programme in a recent targeting assessment of transfer programmes in the country as the majority of its benefits reach directly the poorest quintile. In addition, it is the only social protection programme in Ghana with a complete and

⁹ Figures for 2011 are all taken from the MICS 2011, GSS and UNICEF.

independent evaluation, the results of which have shown LEAP to have important positive impacts on schooling, food security, savings, and debt reduction. Furthermore it has strong political support and is operative at national scale in 100 districts of all Ghana's regions, though still on a limited scale, reaching 72,000 households in 2013. To improve implementation the programme is undergoing important revisions to refine its targeting, payments, communications, and monitoring. Issues such as delays in payments are thought to adversely affect the programme's results and should be urgently addressed.

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% of benefits to the poorest fifth of the population compared to LEAP's 57.5%.

Table 3: The targeting efficiency of social protection programmes in Ghana (percentage of each programme benefits that reach the poorest quintile)¹⁰

Table 1: Summary results on the share of the benefits from various programs accruing to the poor		
	Share of outlays benefiting the poor	Simulated vs. actual
Well or potentially well targeted programs		
LEAP (Livelihood Empowerment Against Poverty)	57.5	Actual (good data)
NHIS indigent exemption	>50.0	Actual (partial data)
Free School uniforms for primary schools in poor areas	49.9	Simulated
Labor intensive public works in poor areas	>43.2	Simulated
Proxy means-tested conditional cash transfers for JHS	42.2	Simulated
Programs/subsidies benefitting the population fairly evenly		
General funding for primary education	32.2	Actual (good data)
General funding for health service delivery by CHAG	30.8	Actual (good data)
Potential connections subsidies for electricity	29.4	Simulated
Free maternal (ante- and post-natal) and child care	29.1	Actual (good data)
General funding for kindergarten education	27.2	Actual (good data)
General funding for JHS education	24.0	Actual (good data)
General funding for health care	22.4	Actual (good data)
Ghana School Feeding Programme	<21.3	Actual (partial data)
Kerosene subsidies	20.7	Actual (good data)
Programs and subsidies with limited benefits for the poor		
General funding for vocational (TVET) education	19.0	Actual (good data)
Fertilizer subsidy scheme	15.8	Actual (partial data)
General funding for SHS education	15.1	Actual (good data)
PURC pilot access to safe water through tankers in cities	13.1	Simulated
National Youth Employment Program (NYEP)	12.7	Simulated
NHIS general subsidies	12.4	Actual (partial data)
Poorly targeted programs and subsidies		
Tax cut on imported rice during food price crisis	8.3	Actual (good data)
Electricity subsidies embedded in tariff structure (in 2005/06)	8.0	Actual (good data)
General funding for tertiary education	6.9	Actual (good data)
Subsidies for petrol and diesel products (except kerosene)	>2.3	Actual (good data)

Source: Authors using various sources of data including GLSS5 and 2003 CWIQ.

¹⁰ "Improving the Targeting of Social Programs", June 30, 2010.

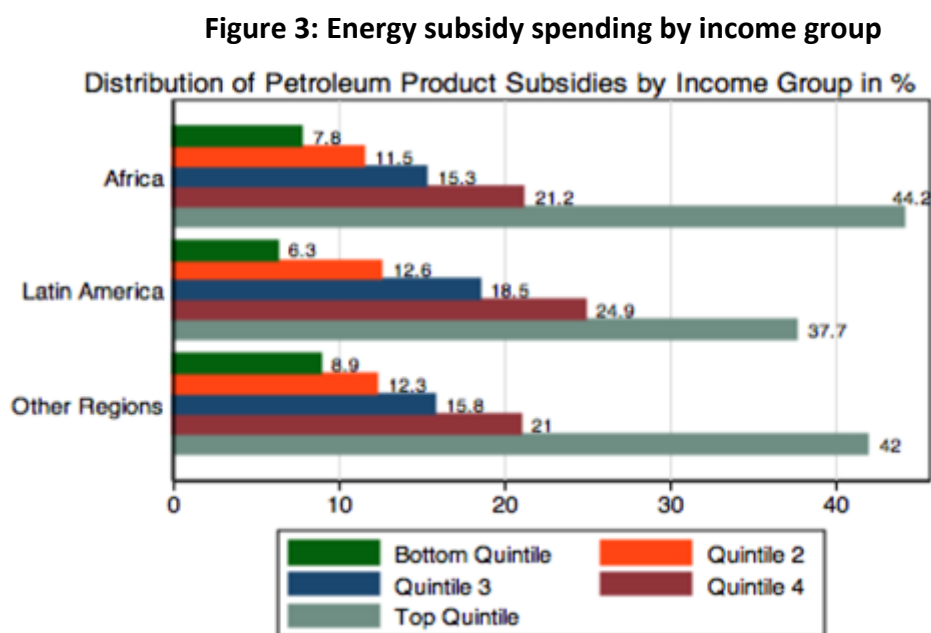
3. Literature review on the distributive effects of fuel subsidies

Globally, fuel subsidies have been found to be generally regressive with some variation among products. Evidence in the literature suggests that fuel subsidies benefit the richer quintiles of a country's population significantly more than the poorest¹¹. Arze del Granado et al (2010) estimate that, on average, the top income quintile receives six times more subsidies than the lowest quintile.

The incidence of subsidies varies across fuel products. Kerosene, for example, is mostly consumed by poorer households in developing countries and benefits are more equally distributed between quintile groups. Arze del Granado et al (2010) show that the bottom 20% of the population receives 19% of kerosene subsidies, while the richest 20% of the population received 20.1% of kerosene subsidies.

Petrol subsidies are the most regressive. The top four quintiles receive approximately 97 cents out of every dollar spent on petrol subsidies (Arze del Granado et al, 2010).

Figure 3 summarises spending on fuel subsidies by each income group for Africa, Latin America and other regions. In all three cases, the subsidy is regressive with the top quintiles obtaining around 40% of the subsidies; about 6 times what the poorest receive.



Source: Constructed from Arze del Granado et al, 2010

¹¹ See, for example, Anand et al., 2013; Bacon et al., 2010; Baig et al., 2007; Coady and Newhouse, 2006; Coady et al., 2006; El-Said and Leigh, 2006; Vagliasindi, 2013; Arze del Granado et al., 2010; IMF, 2013; Kpodar and Djiofack, 2009.

Focussing on Ghana, Coady and Newhouse (2006) and Coady et al (2006) show 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 4 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, who witness a 9.1% decline in their welfare. Clearly this is a major impact for such families who all already live under the poverty line.

Table 4: Household budget shares and real income effects of subsidy withdrawal in Ghana (in %)

Quintile	Household Budget Share			Real Income Effect		
	Petrol	Kerosene	LPG	Direct	Indirect	Total
1-Bottom	0.1	5.9	0	2.9	6.2	9.1
2	0.1	4.1	0	2	6.6	8.7
3	0.2	3.4	0	1.7	6.7	8.5
4	0.2	2.4	0.1	1.3	6.9	8.2
5-Top	2.1	1.6	0.2	1.4	6.8	8.2
Total	0.6	3.5	0.1	1.9	6.7	8.5

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%, 49%, 67%, 50% and 108% for a litre of petrol, kerosene, diesel, fuel oil and LPG (per kilo), respectively.

4. Methodology and data

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.

A subsidy on fuel products is the difference between the domestic ex-pump (retail) price and an international reference price. This is referred to as the 'price-gap approach' in the literature (IEA, 1999). Koplow (2009) has discussed the relative merits and demerits of using this approach. For this report, the data on the subsidies per unit is available from the National Petroleum Authority (NPA).

The focus of the analysis in this report 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.

Similar impact analyses in the literature have used partial, limited general and general equilibrium frameworks. Coady (2005) discusses the merits and demerits of these three approaches. The approach adopted for this study is the partial equilibrium approach. Given our data requirements, the partial equilibrium approach is most suitable to the analysis at hand. Additionally, it is less intensive and can be completed within a short time, thereby

providing timely information about the impact of fuel subsidies on households. All the technical details are attached in the appendix of the report.

Assessing the direct and indirect effects on household welfare

Removing fuel subsidies increases the prices paid for fuel products. Higher fuel prices have both a direct and an indirect effect on household welfare. The direct effects on household consumption result from higher prices spent on fuel for cooking, heating, lighting and transportation. Indirect effects occur through the increase in production costs of goods and services that have fuel as a production input. Producers pass on their increased production costs to households by putting up the retail price of these products. The evaluation of these effects can be complicated and requires knowledge of household consumption patterns and production technology for the whole economy. Household consumption patterns can be obtained from household surveys, while production input data can be obtained from an input-output matrix for the entire economy.

Based on this approach, this report adopts a price shifting model developed by Coady and Newhouse (2006). The direct effects are calculated for each population quintile by multiplying their respective budget shares for each of the fuel products purchased by the price rise in fuel. The indirect effect is based on the price-shifting approach using input-output data combined with a formulation of the household's demand for each product.

The combination of the direct and indirect effects provides the total effect of the price increase on household consumption. New poverty measures following the subsidy removal are then compared to the baseline welfare scenario to measure the impact of the price rise on poverty.

The fifth round of the Ghana Living Standards Survey (GLSS)¹² provides the required information at the household level to perform this analysis. 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 to 2016 are based on the UN population database while the GDP projection for 2016 is from the IMF's World Economic Outlook database.

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 paper aims to estimate the mitigating effect of expanding social protection. This paper examines three scenarios for expanding the national

¹² GSS (2008) contains a description of the dataset. This is a representative sample of 8678 Ghanaian households across all the 10 regions of Ghana and all districts created at the time of the survey. The 6th Ghana Living Standards Survey is currently underway and data and analysis will be updated in the second quarter of 2014.

cash transfer programme (LEAP) to 150,000, 300,000, and 500,000 households in 2014, 2015 and 2016 respectively¹³.

This second part of our analysis relies on the social protection module of the ADePT¹⁴ software developed at the World Bank. Household equivalent consumption, poverty line and cash transfers are converted from annual to monthly values. In measuring the impact on poverty, the poverty headcount, poverty gap (depth) and severity indices are calculated. These indices are compared to the new poverty indices following the programme's expansion calculated based on the simulated equivalent monthly consumption including the monthly transfers to beneficiary households.

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 household¹⁵. 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 scoring¹⁶ is used on the variables contained in the GLSSV to identify the poor households eligible for the LEAP transfers. Although very similar, the scoring is not based exactly on the original LEAP scoring, which comes from a separate LEAP survey. The GLSSV does not have information on some characteristics that are reported in the LEAP survey. Despite this, the scores based on the GLSSV are similar to those based on the LEAP survey. Tests of the targeting performance of the cut-off scores and the LEAP variables in both the GLSSV and LEAP surveys have been shown to be satisfactory (see, for example, Tsimpo & Wodon, 2012).

5. Results

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 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% of LPG, petrol and diesel subsidies, respectively, accrue to the richest

¹³ 72,000 households in 2013 provide the baseline for the analysis

¹⁴ Available at <http://go.worldbank.org/UDTL02A390>

¹⁵ 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 type of facility, number of persons per room, ownership of land and livestock, ownership of assets and regional indicators for urban and rural areas.

¹⁶ Contained in "Proxy Means Tests for Targeting of Safety Nets in Ghana". 2012. World Bank draft note.

quintile (see table 5). The poorest quintile receives less than 1% of these subsidies. For kerosene, the share of subsidies accruing to the richest quintile is lower. They receive approximately 36.4% of the kerosene subsidies, while the poorest quintile receives just 10.7%.

Table 5: Benefit incidence of fuel subsidies accruing to each quintile (in %)

	Quintile				
	1 (Poorest)	2	3	4	5 (Richest)
Diesel	0.12	0.63	1.45	1.33	96.46
Petrol	0.90	1.35	1.62	3.35	92.78
LPG	0.16	0.69	2.17	11.43	85.55
Kerosene	10.69	13.88	18.06	20.96	36.42
Total	2.97	4.14	5.83	9.27	77.80

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

The additional table below provides information on the budget shares of each fuel product, expenditure per capita, subsidies per capita and household size for each quintile.

The budget shares of fuel expenditure in table 6 indicate that the poorest households spend less than 1% 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%.

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 forty-three 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.

Table 6: Budget shares and per capita subsidy amount per quintile

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

Source: Own calculation based on GLSSV. 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.

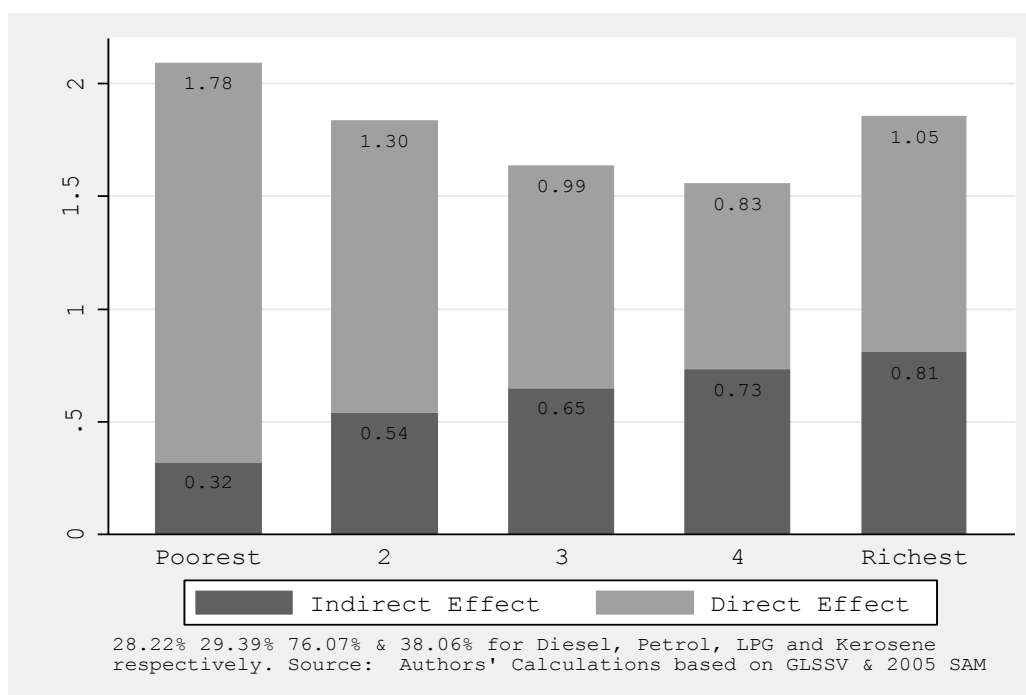
Impact of fuel subsidy removal on household welfare

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%, 29.39%, 76.07% and 38.06% for diesel, petrol, LPG and kerosene, respectively, were used in our analysis.

The results are presented in Figure 4 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% decline in their real spending. The other quintiles also experience a total decline in their spending of between 1.56% and 1.86%.

The indirect impact, as obtained using the input-output matrix, for each sector includes price rises in transport and communication (8.06%); trade, restaurants and hotels (1.2%) and fisheries (2.06%). The indirect effects reduce household welfare for all five quintile groups less than 1%, varying from 0.32% (poorest quintile) to 0.81% (richest quintile). The direct effects on the other hand, are above 1% for the poorest, second and richest quintiles.

Figure 4: Impact of the reform on household spending following the increase in fuel prices (%)



Impact of fuel subsidy removal on poverty

The results of the poverty simulation show that the fuel subsidy removal leads to an increase in national poverty of 1.5 percentage points, meaning that 395,180 people would be pushed into poverty by the reform. Both poverty depth and poverty severity also worsen. Table 7 below summarises the main impacts of the reform on poverty. Figures 5-7 illustrate these impacts on the three poverty indicators

Table 7: 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

Source: Own calculation based on GLSSV.

Figure 5 shows the difference between the initial poverty headcount and the poverty headcount calculated after the removal of the subsidy. The dark continuous line is the estimated difference between the two poverty headcounts. The confidence interval is shown on the diagram in grey shading. The difference between the two is positive at all levels of the poverty line. This indicates that some households fall below the poverty line and, consequently, the incidence of poverty in Ghana increases, as a result of the fuel subsidy removal. The impact on poverty of the removal of the subsidy is an increase of the headcount index by 1.5 percentage points. This means that Ghana's poverty rate is simulated to increase from 28.5% in the GLSS5 to 30% as a result of the fuel subsidy removal.

Similarly, figures 6 and 7 show that the estimated increases in Ghana’s poverty depth and poverty severity are also positive, indicating a worsening of conditions for poor households. This means that for those households that continue living in poverty, they are now living even further below the poverty line. The increase in the poverty depth is approximately 0.5 percentage points. This implies that the poverty depth increases nationally from 9.6%, in the GLSSV, to 10.1%. The severity of poverty also increases by approximately 0.28 percentage points (from 4.6%).

The final figure (Figure 8) in this section adds the inequality dimension to the discussion. The figure shows how inequality among households is affected by the increase in fuel prices. The Lorenz curve is used in this case. The results show that there is likely to have been a decline in inequality overall of 0.6 percentage points from a Gini coefficient of 41.4 prior to the reform to 40.8 following it.

Figure 5: Simulation of changes in the poverty headcount following the increase in fuel prices

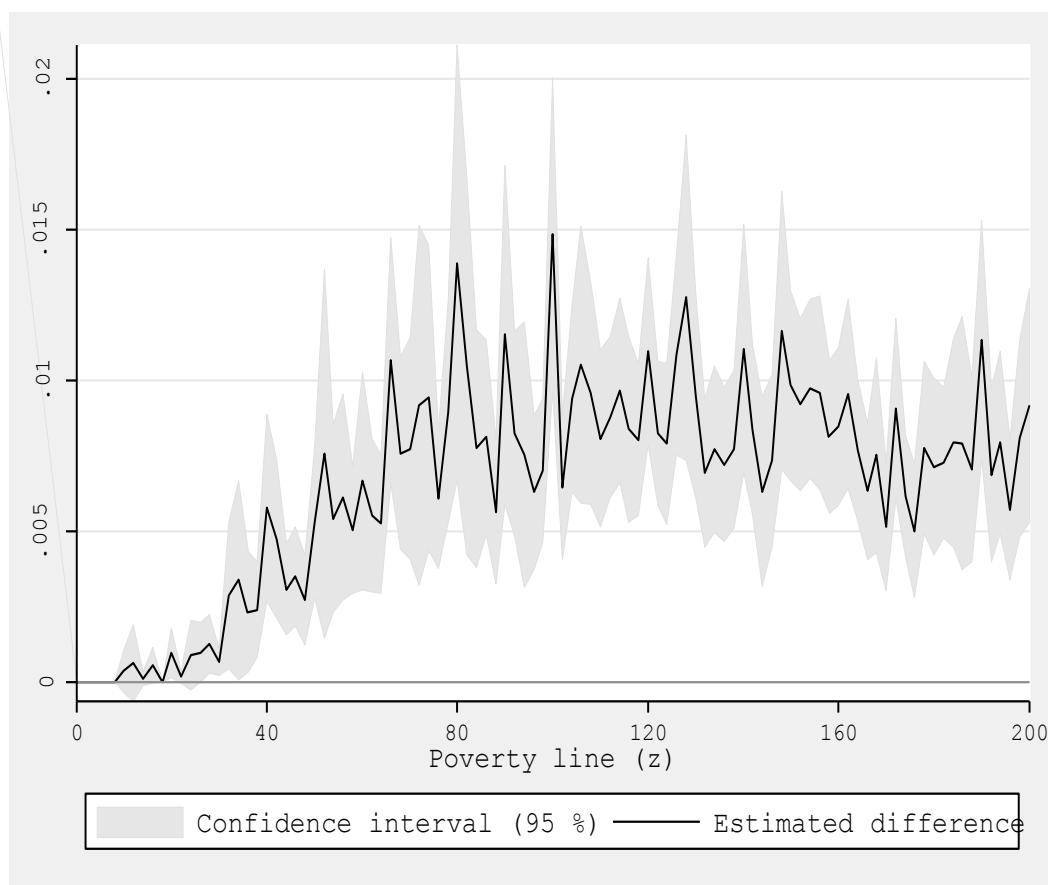


Figure 6: Simulation of changes in the poverty depth following the increase in fuel prices

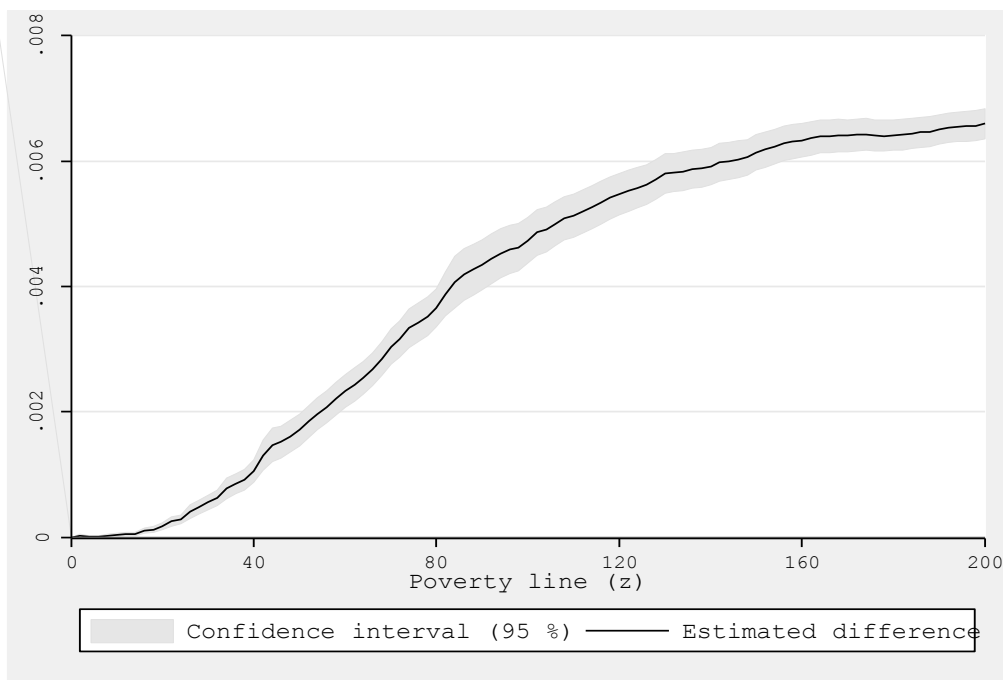


Figure 7: Simulation of changes in the poverty severity following the increase in fuel prices

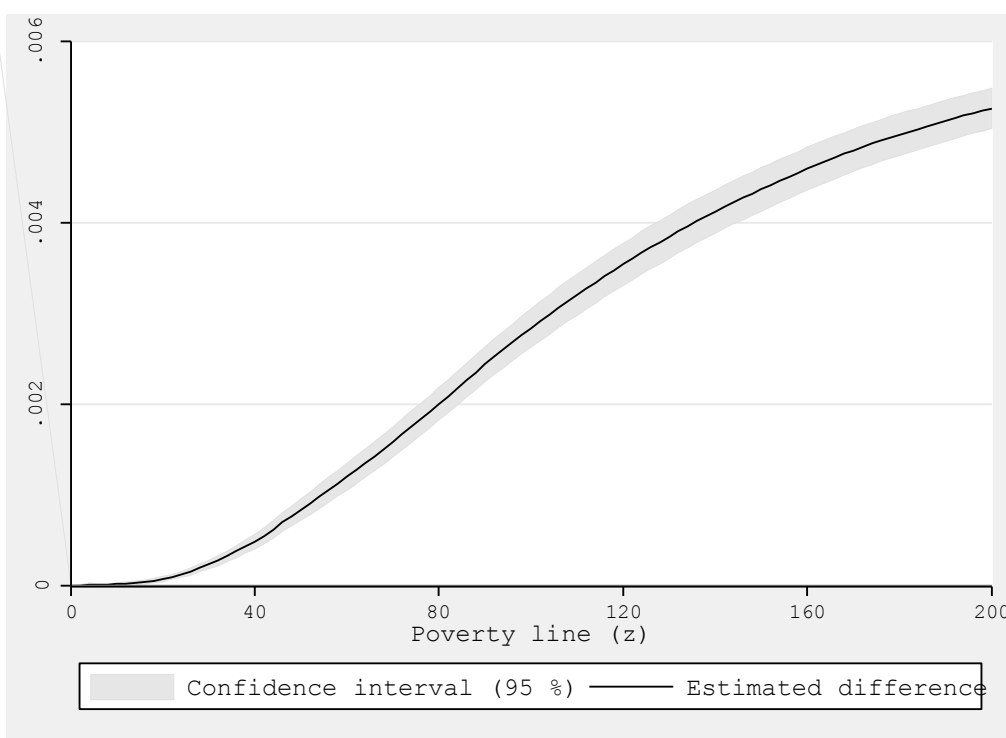
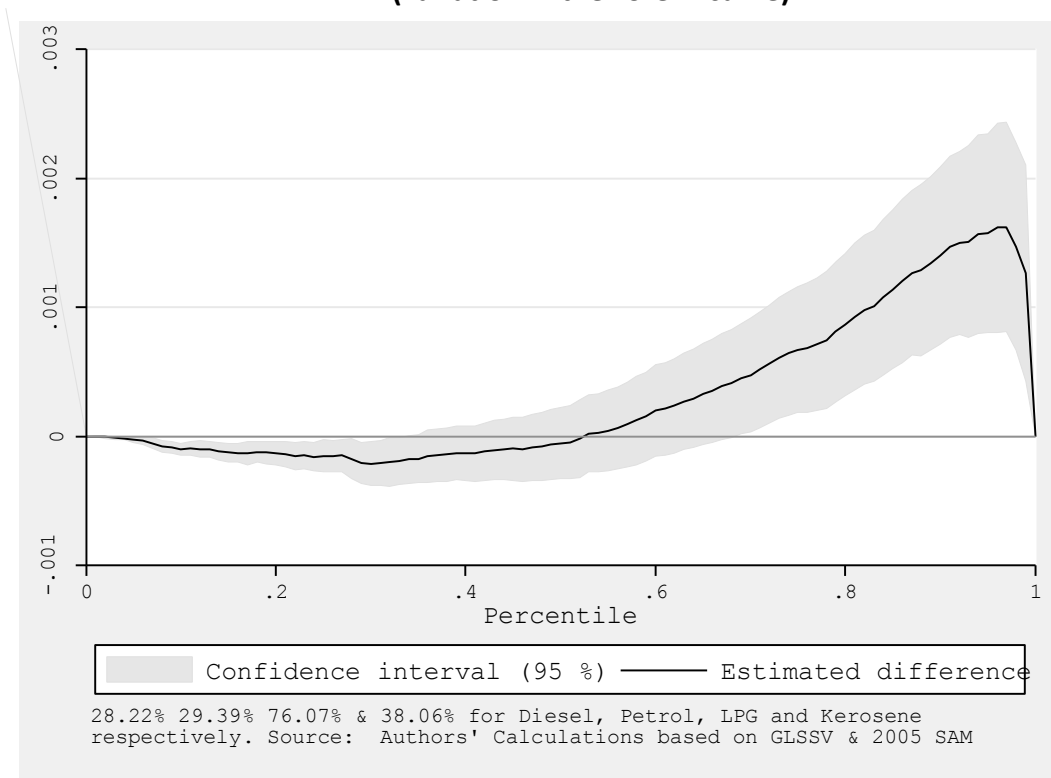


Figure 8: Simulation of changes in inequality following the increase in fuel prices (variation in the Lorenz curve)



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 three 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 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 twelve months.

The results from simulating the cash transfers are shown in table 8 below¹⁷. 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

¹⁷ 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.

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 obviously 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.

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 1 percentage points 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 8: Impact of LEAP programme on poverty measures

	Headcount	Poverty Gap	Severity	Gini
Poverty before fuel subsidy reform	28.5	9.6	4.6	41.4
Poverty after reform (A) %	30.0	10.1	4.9	40.8
Poverty after reform with monthly LEAP transfer(B) %				
2014	28.4	9.2	4.2	40.3
2015	28.0	8.9	4.0	40.1
2016	27.7	8.5	3.7	39.8
Difference in Poverty Due to Expansion of 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

Source: Own calculations based on GLSSV (2006). Results are based on monthly adult equivalent consumption and poverty lines.

In Table 9, the annual costs (in GHS and USD) of the LEAP transfers in 2013 and the projected scales of 150,000, 300,000 and 500,000 households in 2014, 2015 and 2016 respectively are shown (note that this does not include any administrative costs). 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 cost per month would amount to GHS 52.4m (this does not include other administrative costs). In terms of projected GDP figures this amounts to 0.7% of GDP in 2013. The projected scale-up to 150,000–500,000 households yields costs for the LEAP programme ranging from GHS 94.7m to GHS 365.9m per year. This is clearly lower than the estimated cost of fuel subsidies for 2013 of 2.4bn GHS. In terms of the projected scale-up costs, these range from 0.04% in 2013 to 0.13% of projected GDP in 2016¹⁸.

Table 9: Costs of projected transfers

Year	# of households	Annual (GHS)	Annual (USD)
2013	71,957	42,268,214.40	21,080,352.30
2014	148,992	94,733,151.60	47,246,098.25
2015	299,500	204,928,294.80	102,203,528.40
2016	497,593	365,897,523.60	182,483,429.06
All extreme poor¹	1,077,135	628,821,811.60	313,611,197.20

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.

7. Conclusions

We show that the fuel subsidies were indeed highly regressive, with the richest quintile benefiting from 77.8% 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%. 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.

The results of our analysis show that the impact of the fuel subsidy removal on household welfare is greatest for the poorest households. It reduces their consumption by 2.1%.

As a result, Ghana's poverty rate would rise by 1.5 percentage points, meaning that recent gains toward reaching the MDG to reduce poverty would be reversed. In terms of numbers, this would mean that an additional 395,180 people were pushed into poverty by the reform. The depth and severity of national poverty would also worsen. 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

¹⁸ 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.

were provided to 500,000 extreme poor households, it would reduce 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 sum, the reform of fuel prices in Ghana appears to be a welcome policy reform allowing the Government to reduce its growing fiscal deficit and to reduce excessively 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 from higher prices of products that use fuel in their own production) is to reduce household consumption, thereby reducing household welfare. This is because poor and vulnerable households are unable to accommodate easily the higher prices. As their costs rise, such households are typically forced to spend less on education, health, and nutrition. As a result, impacts are often long-term as children in such households suffer irreversible damage to their nutrition, learning and overall development, growing up less able to contribute to development and thereby perpetuating the cycle of poverty. As highlighted by the Government of Ghana, this negative impact could be mitigated by scaling up Ghana's national cash transfer programme LEAP that directly targets the poorest households.

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Appendix A

Table A1: Price changes from input-output analysis (in percent)

Sector	Price Change
Agriculture & Livestock	0.26
Cocoa	0.22
Forestry	0.27
Fishery	2.06
Mining	0.93
Manufacturing & Industry	0.39
Water & Electricity	0.25
Construction	0.33
Transport & Communication	8.06
Trade, Restaurant & Hotels	1.20
Business & Real Estate	0.49
Public Services	0.25
Community Services	0.55
Diesel	28.48
Petrol	29.65
LPG	76.32
Kerosene	38.31

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

	Quintile					All
	1 (Poorest)	2	3	4	5 (Richest)	
Agriculture & Livestock	42.42	37.59	35.44	33.29	31.45	36.04
Forestry	0.51	0.74	1.06	1.28	1.27	0.97
Fishery	9.01	11.05	10.37	9.16	7.43	9.40
Manufacturing & Industry	25.96	24.87	25.13	26.05	27.21	25.84
Water & Electricity	1.25	2.14	2.49	3.19	3.18	2.45
Construction	0.92	1.07	1.14	1.28	1.58	1.20
Transport & Communication	1.42	2.77	3.45	4.84	6.36	3.77
Trade, Restaurant & Hotels	3.75	5.92	6.64	7.2	7.87	6.27
Business & Real Estate	3.85	2.81	2.65	2.68	2.88	2.97
Public Services	6.01	7.44	8.59	8.47	7.45	7.59
Community Services	0.13	0.31	0.42	0.45	0.45	0.35

Own calculation based on GLSSV. Cocoa and Mining shares are nil.

Table A3: Undercoverage and leakage rates of the LEAP (scale-up) programme

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

	Extreme poor					Total poor				
	Coverage of the poor (1)	Under-coverage (2)	Leakage (# of beneficiaries) (3)	Leakage (benefits) (4)	Targeting differential (5) = (1) - (3)	Coverage of the poor (1)	Under-coverage (2)	Leakage (# of beneficiaries) (3)	Leakage (benefits) (4)	Targeting differential (5) = (1) - (3)
Direct and indirect beneficiaries										
2014	22.22	77.78	38.18	35.47	-15.96	17.82	82.18	21.28	20.16	-3.46
2015	32.62	67.38	49.83	48.48	-17.21	28.22	71.78	28.61	27.83	-0.39
2016	45.00	55.00	54.75	54.65	-9.76	39.44	60.56	33.02	33.30	6.42

transfer. The coverage rates of the poor increases 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.

Appendix B: Methodological Appendix¹⁹

Direct Effects of the Fuel Price Increase

Let $w_i = \frac{p_i q_i}{y}$ be share of expenditure devoted to good $i(=1, \dots, k)$ in the total budget y , and p_i and q_i represent price and quantity consumed of good i respectively. The budget share provides the direct impact of any price changes on household welfare. This is a “first-order” estimate of the direct real income effect of a price increase. It is also 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 et al., 2010). The budget share is expressed as:

$$w_i = \frac{\partial \log y}{\partial \log p_i}$$

The above relationship shows the budget share as the price elasticity of real income or total consumption given that, the volume of demand is constant. The direct effect is expressed below as:

$$\text{Direct Effect (DE)} = \text{budget share} \times \text{percentage increase in fuel price} \times 100$$

For example, suppose fuel prices increase by 10% and a household’s budget share of fuel in their total budget is 15%, then the direct effect leads to a decline in household welfare equivalent to a 1.5% fall in real household income. Alternatively, if prices increased by 100% then real incomes decline by 5%. This can be aggregated across the petroleum products,

$$DE = \sum_{i=1}^k w_i \times \partial \log p_i \quad (1)$$

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

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):

$$IE = \sum_{j=1}^K w_j \times \partial \log p_j \quad (2)$$

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

¹⁹ The material presented here draws heavily on Coady and Newhouse (2006) and Cockburn, (2013)

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, 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.

Price-Shifting Approach to Calculate the Indirect Effects

Coady and Newhouse (2006) suggest 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 consist of nontraded 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:

$$p_{cp}^u = p_{cp}^p + t_{cp} \quad (3)$$

where, p_{cp}^u is the price paid by consumers, p_{cp}^p 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.

$$p_{ts}^u = p^{world} + t_{ts} \quad (4)$$

- **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 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.

$$p_c^u = p^* \quad (5)$$

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:

$$\Delta p_{ts}^u = \Delta p^{world} + \Delta t_{ts} \quad (6A)$$

$$\Delta p_c^u = \Delta p^* \quad (6B)$$

Any changes in Δp_c^u are exogenous and depend largely on price adjustments announced by government. Similarly, Δp_{ts}^u is exogenously determined through changes in trade taxes and world prices.

The changes for the cost-push sectors are relatively more involved. The changes in the cost-push sector can be computed as:

$$\Delta p_{cp}^u = \Delta p_{cp}^p + \Delta t_{cp} \quad (7)$$

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

According to Coady and Newhouse (2006), the aggregate commodity categories are produced with a share of each of the above sectors; that is, cost-push, traded and controlled sectors. These shares are given by α , β , and γ , respectively, and the sum of the shares are equal to one for each sector ($\alpha_s + \beta_s + \gamma_s = 1$; $s=1, \dots, S$). An input-output coefficient matrix (A) with unit costs of producing one unit of output j given by a_{ij} for input i can be used in capturing the production technology of domestic firms. Given the input-output coefficient matrix and fixed factor prices the change in price of output j can be written as:

$$\Delta p_{cp}^p = \sum_{i=1}^s \alpha_i a_{ij} \Delta p_{cp}^j + \sum_{i=1}^s \beta_i a_{ij} \Delta p_{ts}^j + \sum_{i=1}^s \gamma_i a_{ij} \Delta p_c^j \quad (8)$$

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

$$\Delta p_{cp}^p = \Delta p_{cp} \cdot \alpha \cdot A + \Delta p_{ts} \cdot \beta \cdot A + \Delta p_c \cdot \gamma \cdot A \quad (9)$$

where the “.” operator signifies multiplication, A is an $n \times n$ input-output coefficient matrix, p is a vector of prices and α , β , γ 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, (a) all fuel products are in the controlled sector (b) all other products are in the cost-push sector and (c) 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 consumption of the fuels are expected within the short-run. 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 modeling intensive approaches such as computable general equilibrium frameworks.

Household Level Analysis

The analysis at the household level adopts the Stone-Geary preferences for calculating real expenditure of each household. 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 outline below.

Let,

1. $y_r = (y_1, \dots, y_{r,h}, \dots, y_{r,H})$ 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_k is the size of household h .
2. $W = (w_1, \dots, w_h, \dots, w_H)$ be a vector of household weights. Then, $N = \sum_{h=1}^H w_h n_h$ provides an estimate of the population size.
3. $p_r(p_{r,1}, \dots, p_{r,h}, \dots, p_{r,H})$ be a vector of K prices in the base period prevailing before the reform.
4. $p_s(p_{s,1}, \dots, p_{s,h}, \dots, p_{s,H})$ be a vector of K prices after the reform.
5. $q_r(q_{r,1}, \dots, q_{r,h}, \dots, q_{r,H})$ be a vector of K quantities of commodities purchased by the household h in the base period.
6. η_k be the number of equivalent adults living in a household.
7. The living standards of a household h in the base situation is then given by $x_{r,h}$, the expenditure level per equivalent adult:

$$x_{r,h} \frac{y_{r,h}}{\eta_h} \quad (10)$$

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

The observed household expenditure needs to be adjusted for regional and urban price variations to account for differences in costs of living. One problem with the Ghanaian price data is that there is limited price variation across a number of products. In particular, due to the pricing arrangement all regional and urban-rural fuel prices are the same. One recommendation in this case is to use household specific regional poverty lines. However, officially published regional poverty lines are unavailable. The few products providing variation across regions and the urban-rural divide would allow us to make the necessary adjustments.

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.

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

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

where $\sum_{k=1}^K \beta_k = 1$, γ_k is the subsistence requirement for the commodity k and β_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:

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

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 $\pi_{s,h}^r = \prod_{k=1}^K \left(\frac{p_{s,k}}{p_{r,k}}\right)^{\beta_{k,h}}$ 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 γ_k is unknown. Drawing on consumer theory, $x_{r,h}$ should not be lower than $\sum_{k=1}^K p_{s,k} \gamma_k$ and $\frac{q_{r,k,h}}{\eta_k}$ should not be less than γ_k , allowing household demand to be derived from constrained utility maximization. These conditions are fulfilled by setting γ_k to the minimum consumption level per equivalent adult for each commodity k across households.

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

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 $i=1, \dots, K$. 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 FGT (Foster, Greer and Thorbecke) poverty indices can be applied to real incomes after the application of the cash transfers. The FGT index is:

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

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.

Table B1: Recommended energy intakes

Category	Age (years)	Average energy allowance per day (kcal)	Equivalence scale
Infants	0 - 0.5	650	0.22
	0.5 - 1.0	850	0.29
Children	1 - 3	1300	0.45
	4 - 6	1800	0.62
	7 - 10	2000	0.69
Males	11 - 14	2500	0.86
	15 - 18	3000	1.03
	19 - 25	2900	1.00
	25 - 50	2900	1.00
	51+	2300	0.79
Females	11 - 14	2200	0.76
	15 - 18	2200	0.76
	19 - 25	2200	0.76
	25 - 50	2200	0.76
	51+	1900	0.66

The equivalence scales reported in the last column are the ones used in the GLSS. The scale allows the adjustment of the total food consumption of the household to accommodate the differences in consumption by each household member—by accounting for their gender and age.

Source: GSS (2007) citing Recommended Dietary Allowances, 10th edition (Washington D.C.: National Academy Press, 1989).