
# Price Subsidies Reform and Child Poverty in Arab Countries: A Comparative CGE-Microsimulation Analysis of Egypt and Jordan

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# Price Subsidies Reform and Child Poverty in Arab Countries: A Comparative CGE-Microsimulation Analysis of Egypt and Jordan[1]

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# 1. Introduction

A key stated motivation behind energy subsidies is to protect household purchasing power, especially among poor and vulnerable groups. However, they present a number of important drawbacks. They generally are ineffective tools of social protection. Unlike food subsidies, universal fuel price subsidies generally disproportionately benefit the rich more than the poor, as they consume much more fuel. This is referred to as leakage in the targeting jargon. Furthermore, fuel subsidies can distort energy consumption by reducing incentives for its efficient use and discouraging use of alternative energy products. In this sense, they are directly counter to current global efforts to reduce carbon emissions. Third, subsidies are likely to divert resources from other social expenditures (education and health care in particular), which may be more cost-effective at protecting the poor. Finally, the sustainability of these subsidies has been questioned in recent years due to mounting subsidy costs and greater budget constraints faced by many governments. In response, many Arab countries have started to reform their price subsidy policy, especially for energy products.
However, reforming the subsidy system raises a number of issues. Although reforming fuel subsidies can improve a countries' macroeconomic performance and ease fiscal pressures, the associated price changes can generate direct and indirect adverse impacts on the welfare of vulnerable groups and consequently on poverty. Indeed, subsidy cuts imply higher prices for energy products (electricity, gas, petroleum, coal, etc.) directly consumed by households and, perhaps more importantly, higher prices for non-energy products resulting from increased energy input costs. Given these adverse effects on household welfare and the popularity of the subsidies, many governments find it too politically dangerous to reduce or eliminate them. A possible solution is to target compensatory policies to protect the most vulnerable and limit the potential political instability. The question is thus how to reconcile subsidy reform and poverty alleviation efforts, given that the resulting price increases (both direct and indirect) will impact the poor to some degree?

The objective of this study is to simulate the poverty impacts of energy subsidy cuts where a share of the budget savings are channeled to the most vulnerable – children living in poverty – through the introduction of new child benefits. In order to do this, we develop a dynamic CGE-micro model that is able to reconcile the large and complex general equilibrium effects of energy subsidy cuts – where energy is a major household consumption good, production input and direct source of employment – and the individual- and household-specific poverty and inequality effects of the resulting changes in wage rates, employment, self-employment income and consumer prices. The model is then used to compare the results obtained in a baseline scenario without energy subsidy reform and a series of alternative policy scenarios developed through discussions with local authorities. The analysis makes use of the most recent available data from Egypt and Jordan.

The study reveals a number of important findings concerning the debate and, crucially, the decision to reform energy subsidies. First, a reform is necessary. The reform of the energy subsidies clearly reduces the fiscal deficit, while boosting investments and increasing economic growth. Second, the reform of energy subsidies without a 'safety net' is bound to further exacerbate child poverty, especially in the short term, through direct and indirect price increases. While the fiscal health of the country would improve and generate more growth, this is insufficient to offset the poverty impacts. In fact, it takes a few years for the impact of cumulative fiscal savings and increased investments to outweigh that of the price increase. Finally, the analysis shows that it is possible to reconcile subsidy cuts with the commitment to reduce child poverty.

This study simulates the effects of real proposed (by local policy makers) price subsidies reforms in each country. Consequently, results are not always directly comparable between Egypt and Jordan. Indeed, the products directly affected by the reform as well as its size and the implementing time path in the two countries differ substantially. Egypt has planned to cut subsidies on diesel, gasoline, fuel oil, natural gas and liquefied pure gas over the period 2012/13-2017/18 passing from 7% to 0.7% of GDP. Jordan has planned to cut electricity subsidies by differentiating across sectors and agents over the period 2014-2018 passing from 4% to 1.2% of GDP. However, some interesting differences between the two countries nonetheless emerge. In Egypt, the reform has strong impacts on prices: by the end of the simulation period in 2018, the price of energy products in the reform scenarios is on average 50% higher than in the no-reform scenario, while the consumer price index is 8.5% higher. In contrast, while the increase in electricity prices directly raises intermediate input costs in Jordan, falling aggregate demand more than offsets this so that most consumer price indices fall (the consumer price index decreases by 0.45% by the end of the period with the exception of services). In Egypt, the real wage rates and the unemployment rates do not differ significantly from the baseline scenario, while they both deteriorate in Jordan as a consequence of the subsidy reform. In the latter, rising electricity prices translate into higher input costs, especially in the services and manufacturing sectors, which depresses labour demand. This increases unemployment rates by up to one percentage point, while reducing real wage rates by over one percentage point.

In terms of the driving forces of poverty changes, there are also some important differences. In Egypt, the substantial improvement in factor income (i.e. higher wages and profits) that follows fuel subsidy reform is not enough to offset the increase in consumer prices. In Jordan, the poverty increase resulting from the subsidy cut is primarily driven by unskilled wage reductions and an increase in the cost of living (through the rise in the cost of housing and water, which is largely affected by the increase in the price of electricity).

The paper is structure as follow: we first provide a brief literature review on past studies on price subsidies reform around the world and, in particular, in the MENA region. We then present the methodology adopted in this study, the data and the baseline and simulation scenarios. The discussion of the macro- and micro-economic results follows. Some final considerations close the paper.

# 2. Literature review and context

There is a large empirical literature analysing the impact of energy subsidy reforms on households and the economy as whole (see Bacon et al, 2010, for a recent review). Generally speaking, this literature can be classified according to the following questions: (i) What are the distributional impacts of energy subsidies across population and income groups? (ii) What is the impact of reforming subsidies system on the welfare of households?

In a recent study reviewing energy subsidy experiences from a selection of developing countries from different regions of the world, Coady et al (2010) show a very clear pattern of regressivity in energy subsidies (i.e., the richest quintile benefits an average of five times more than the poorest quintile)[5]. While subsidies are generally regressive, their distribution across income groups differs by product. As might be expected, subsidies for gasoline and diesel (used generally for transportation) are the most regressive. The problem is less pronounced for kerosene, which is largely used by the poor for cooking and heating. In the MENA region, according to the World Bank, 75% of Morocco's diesel and petroleum energy subsidies accrued to the top quintile, whereas only 1% accrued to the poorest. In Jordan, according to the Sdralevich et al. (2014), the richest 20% of the households capture 40% of subsidies. In Egypt, Cockburn et al. (2014a) found that subsidies for gasoline/diesel (just 1% of subsidies go to the poorest quintile) and electricity (about 11% going to the poorest quintile) are the most regressive, whereas those for kerosene and for LPG are the least regressive (16 and 20% of subsidies go to the poorest quintile respectively). It is also noteworthy that, whereas kerosene and LPG subsidies are progressive in rural areas, their incidence is clearly regressive in urban zones, reflecting that the poor consume kerosene and LPG proportionately more in rural areas. A similar picture emerges for Jordan, except for subsidies for electricity are less regressive than in Egypt (17% go to the poorest quintile).

A decrease in energy subsidies has both direct and indirect effects on household welfare. The *direct* effect on real household income results from higher fuel prices for cooking, heating, lighting and private transport. Beyond this, higher energy prices *indirectly* carry through to production costs and, consequently, consumer prices across the entire economy. According to Granado et al (2012), the simulated increases in fuel prices in various regions of the world induce a substantial reduction in real household incomes: from 3.3% in South and Central America to 7.4% in the Middle East. The indirect effects on real household income account for more than half of the total effect on average. The sources of negative effects on real household income vary considerably across regions, mainly depending on consumption patterns and the relative importance of each energy source in household budgets. In Africa and Asia-Pacific, price increases for kerosene induce the greatest negative direct effect, as opposed to the Middle East and Central Asia, where gasoline and electricity price hikes hit household welfare hardest.

The empirical literature analysing the impact of energy subsidy reforms on households and the economy as a whole is quite extensive[6]. Many studies have also assessed the impacts of changes

[5] The review of incidences patterns of energy subsidies highlights the fact that there are more efficient alternative instruments that can be used to protect the poor than the universal energy subsidies. Alternatives policies based on direct cash transfers or proxy-means tested fee waivers for public services could be more efficient to deliver benefits to low income population. Komieves et al. (2007), using data from 37 country case studies, show that while the subsidy benefits for electricity are generally regressive, cash transfers and near-cash transfers programs were progressive in 82% of cases.

[6] See Kojima (2010) for an exhaustive review.

in oil prices using CGE models[7]. However, the literature dealing specifically with the Egyptian economy is not very abundant[8]. In Jordan, to our knowledge there are no previous studies on price subsidies reform using CGE models; some discussion on price subsidies in Jordan and the proposed reforms can be found in International Monetary Fund (2011) and World Bank (2011a, 2011b and 2013).

Before moving to the methodology adopted in this study, it is useful to briefly describe context of these two countries. First of all, in 2012 Egypt was one of the countries in the MENA region with the largest subsidies (as rate of GDP) for diesel and gasoline, while this was the case for Jordan for electricity in 2011 (Sdralevich et al., 2014). Egypt is in the midst of a period of profound change and political unrest since 2011. In response, the Egyptian government has implemented major policies: extended subsidies, public wage increases, tax cuts and infrastructure work. However, this spending has resulted in increased fiscal deficits and the depletion of fiscal reserves. Consumption subsidies represent a particularly heavy fiscal burden, recently reaching 10% of GDP (Ministry of Finance, 2012). Petroleum subsidies increased by 26% to reach EGP 120 billion (or 6.2% of GDP) in 2012. This contributed to an increase in the overall budget deficit to GDP ratio to 13.8% in FY13 (Ministry of Finance, 2013). Of total subsidies allocated to energy products in 2010, 53% are for petroleum products, followed by 32% for electricity and 15% for natural gas. In 2013, the government established and began to implement a plan to progressively rationalize these subsidies. At the same time, spending on health and education, as a share of GDP, has been relatively constant over the last few years at around 1.4% and 4%, respectively. Public investment was negatively affected by the popular uprising, falling to 1.9% of GDP in FY12, down from 3.2% in FY10 and 2.4% in FY11. In contrast, spending on subsidies has risen from 7.8% in FY10 to 8.8% in FY12, driven primarily by an increase in both food and energy subsidies.

In Jordan, where subsidies represented roughly 6% of GDP in 2011 (Sdralevich et al., 2014), the government has started to reduce or eliminate subsidies on water, cooking fuel, food and electricity since 2008. In 2012, the government eliminated subsidies on petroleum products—namely, gasoline (Octane-90), diesel and kerosene except LPG gas cylinders which are mainly used for cooking. The elimination of these petroleum subsidies resulted in a 14 to 33 percent increase in petroleum prices. On the other hand, in 2011, the government provided sales tax exemptions on products and services that account for a large share in the household's consumption basket or those that were deemed as vital inputs to production process.

[7] See Naranapanama and Bandara (2012), Essama-Nssah et al (2007), Clements et al (2003), Bresinger et al. (2010), PROVIDE (2005), Energy Sector Management Assistance Program (ESMAP) (2004), Abouleinein et al. (2010), Chitiga et al. (2010), Kancs, A. (2007), Twimukye E. and J. M. Matovu (2009)

[8] The most recent examples are Lofgren (1995), and Abou El Enein, Kheir El Din and El Laithy (2009).

# 3. Methodology and Data

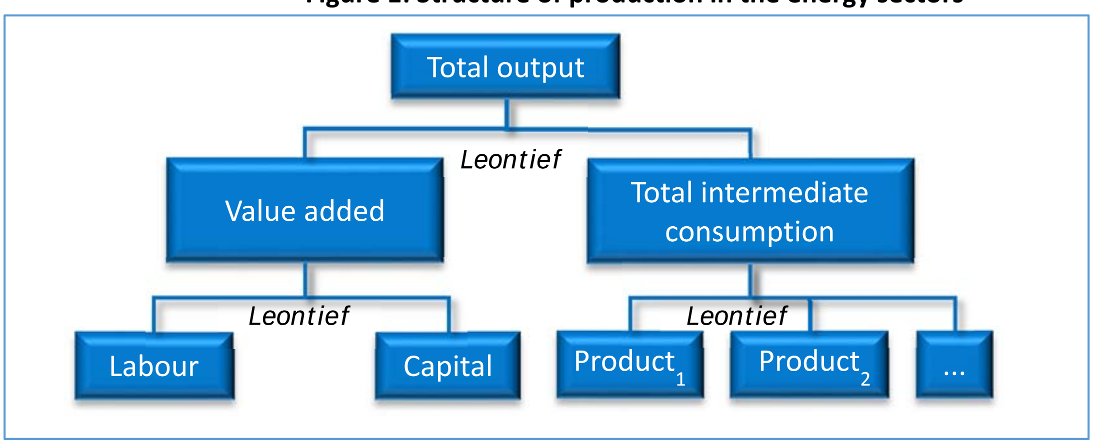
For both countries we use a combined computable general equilibrium (CGE)-microsimulation model to analyse the impacts of price subsidy reforms on poverty and inequality terms under various policy scenarios. The model is designed to capture the strong economywide impacts of these major reforms and their many direct and indirect impacts on household income and consumption. These results are then used to study how poverty and inequality evolves in the short and medium terms. Here we provide a brief description of the macro and micro models[9].

## 3.1. Macro

The macroeconomic simulations make use of a recursive dynamic computable general equilibrium model, based on the PEP 1-t standard model[10] adapted to each country's economy and to the issues to be tackled. The model presented below is the one for Egypt[11] and only modifications made to PEP 1-t are presented below.

Industries are distinguished between energy sectors and others, as their production processes are assumed different. In the case of the *energy sectors*, which are all highly capital intensive, we assume that total production is directly determined by the stock of capital (proportional relationship) and that there are no substitution possibilities between inputs. Over time, the production of the energy sector grows according to capital investments made in these specific sectors, where investment in each sector depends mainly on its profitability relative to the other sectors. Figure 1 below depicts the structure of production for the energy sectors.

**Figure 1: Structure of production in the energy sectors**




Production is modelled differently for the *non-energy sectors*. Energy consumption is assumed to be related to the capital used; in other words, the quantity of energy consumed depends on the equipment used. Energy sources are assumed to be imperfect substitutes to capital, and

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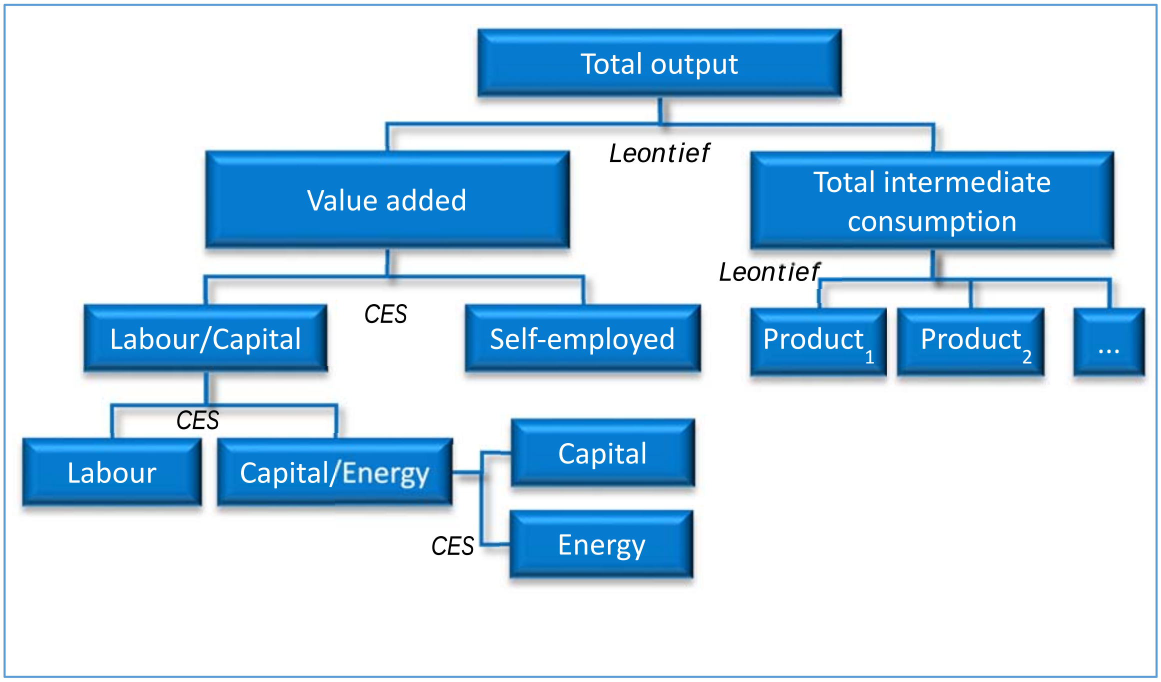
[9] Full details of the two models are provided in Cockburn et al. (2014b) (sections 8 and 9)
[10] www.pep-net.org/programs/mpia/pep-standard-cge-models
[11] Although the model for Jordan differs from that of Egypt, the overall structure is similar.

productive activities can use less energy per unit of output if they invest in less energy-intensive technologies. The relative price of energy to capital is thus crucial in determining the incentive to use energy-intensive equipment. The imperfect substitution possibilities between different input is characterized by a CES (Constant elasticity of substitution), as depicted in Figure 2. The producer chooses the combination of input that minimises total costs, subject to the price of each input and the substitution possibilities.

**Figure 2: Structure of production in the non-energy sectors**




In some sectors, value added, includes wages, capital income and mixed income. The latter is assumed to reflect the presence in these sectors of self-employers, whose income is a mix of wages and profits. Self-employer labour is thus considered to be a substitute to composite capital and salaried workers. Again, a CES represents the imperfect substitution between the two inputs and, cost minimization subject to the price of each input yields relative demand.

On the supply side, most energy sectors produce only one output, i.e. crude oil, natural gas or electricity. Refineries, however, produces different types of fuels: gasoline, kerosene, LPG, gas oil (diesel), and fuel oil. A barrel of crude oil can only yield a certain quantity of each type of fuel and thus it is assumed that the production of each fuel by the refineries is a fixed proportion of total output. As we mentioned before, total local supply is fixed and determined by installed capacity. Hence, at the regulated price, if local demand exceeds local supply, the difference will be imported (at world prices) and sold on the market at the regulated price. Conversely, if local supply exceeds local supply, the difference will be exported (at world prices). As prices are assumed to be fixed, even on the domestic market, subsidies are thus implicit and are determined such that the price received by the producer (inclusive of the subsidy) covers the costs of production (and/or imports).

Modelling of the supply side for the non-energy commodities is pretty much standard. Each sector can sell either on the domestic market or export at world prices; commodities sold on each market are assumed to be heterogeneous and the quantity sold on each market depends on prices and on the ease for the producer to switch from one destination to the other. The representative producer is assumed to follow a CET (constant elasticity of transformation) function in allocating sales between the domestic market and exports, which is consistent with the hypothesis that producers react to prices they receive on each market. Prices are determined by equilibrium between supply and demand, with world prices assumed fixed.

Imports are modelled symmetrically. Commodities are assumed to be heterogeneous according to their origin, i.e. the quantity purchased on each market depends on prices and on the degree of substitutability for consumers between the commodities. On the domestic market, prices adjust in order to clear markets and world prices are assumed to be exogenous.

Most of the time, CGE modellers assume that there is no or fixed unemployment and that the wage rate adjusts to clear the labour market. In the case of the two countries included in this study, though, this hypothesis might not be suitable as variations in unemployment and, most of all, under-employment is a major concern there (e.g., Egypt experienced a sharp deterioration between 2010 and 2012 from 9.8 to 13, Cockburn et al., 2014a))). Nonetheless, there are only a few minor differences in the modelling of the labour market in the two countries. In Egypt, for example, it is assumed that there can be unemployment on the market for wage workers, which is negatively related to the real wage rate (wage-curve). Salaried workers who cannot find a job add to the supply of self-employed workers. Here, too, it is assumed that there can be unemployment that is negatively related to the real wage rate. This makes it possible to capture labour movement from one category to another (i.e. from wage worker to self-employed), possibly passing through unemployment, as seems to be sometimes the case in Egypt. In Jordan, it is assumed that there can be unemployment on the market for all workers and that unemployment is negatively related to the real wage rate (wage-curve). However, there is no movement of workers between categories.

## 3.2. Micro

The distributive and welfare effects of the price subsidies' reform, as well as of social protection schemes, are estimated using a microsimulation model, which is combined with results from the CGE model. The microsimulation component makes it possible to identify which individuals are most likely to be affected by the macroeconomic changes. This is particularly relevant as the main focus of our analysis is a specific population group, children, and because the CGE alone cannot look at the evolution of within-group inequality.

We follow a top-down macro-micro simulation framework with explicit modelling of microeconomic behaviour. Some behaviour (notably labour force participation, employment status and consumption choices) is, indeed, likely to be sensitive to macroeconomic changes.

Macro results on variations in prices, employment and revenues from labour activities serve as the key inputs to the microeconomic analysis policy.

The microsimulations are composed of two main modules: income generation and real consumption. We start with the income generation module, aiming first to identify those individuals who, according to their predicted probabilities, are most likely to migrate between different occupational choices in response to the macro shocks, and then to estimate the new vectors of wages and revenues for all workers. For both the labour supply model and the wage and profit estimations, we estimate reduced-form models to recover the relevant stochastic terms, which is then used to run the simulations. The stochastic terms are estimated by following the methodology proposed in Bourguignon, Fournier and Gourgand (2001) for the multinomial logit labour supply model (as for Egypt), or the procedure described in Gourieroux et al. (1987) for the probit labour supply model (as in Jordan). In the wage and profit models (estimated through standard Mincer and Cobb-Douglas functions respectively), the residual term is drawn randomly from a normal distribution with their respective observed variance. In Jordan, in accordance with the macro data and mode, occupational and income models are run separately for skilled and unskilled workers.

At the end of this income-generation module, we obtain the new total household income for each year of simulation. The absolute change in income, relative to the base year, is then added to total household consumption, assuming fixed total savings. After some necessary adjustments (household composition, and spatial and temporal differences in prices), we use real per adult equivalent household consumption for poverty and distributive analysis. The household specific price deflator is derived from a Cobb-Douglas utility function. We abstract from all issues of intra-household allocation which, while justified, go beyond the scope of this study. Instead, we assume that a child is poor if s/he lives in a household that is poor (i.e., below the country official poverty line – 3076 LE in Egypt[12], 813.7 JOD per annum in Jordan). In this study we only look at the monetary dimension of poverty.

According to the methodological framework we follow, fuel price subsidy reform is expected to affect child well-being through changes in employment, income and prices (consumer prices and wages) that their households face. The final impact depends on the relative size and direction of these changes, but also on household initial income, factor endowments and consumption preferences.

The microsimulation module also serves to model the different compensatory social protection schemes proposed below.

[12] Egypt has three definitions of poverty lines, estimated at the regional level. Their average (national) level is roughly equivalent to 2061 LE (food poverty line), 3076 (lower poverty line) and 4003 LE (upper poverty line). In the analysis below we use the lower poverty line, as recommended by local experts.

## 3.3. Data

The CGE model in Egypt is built on a SAM that was constructed for 2009/2010[13], based on the national accounts[14] (NA; Ministry of Planning) and on the 2008/2009 Supply and Use Tables (SUT; CAPMAS). Additional data on the sources of government income and its expenditures were used to complete the SAM and economic projections from IMF, released in April 2013, serve to describe the evolution of the economy over time.

In addition, given that the purpose of this analysis is to assess the impact of reducing subsidies on specific energy commodities, we could not treat subsidized fuels as one homogenous commodity. It was agreed that the refined petroleum commodity should be disaggregated into multiple fuels, i.e. LPG, kerosene, gasoline, gas oil, and fuel oil and other products. To do so, we used data on production and consumption from CAPMAS, data on subsidy per fuel from MoF, data from IEA and a SAM for 2006/2007 (Abouleinin et al. 2009).

The Jordanian CGE model uses a newly constructed 2006 SAM of Jordan as its benchmark data. This SAM represents the actual structure of the economy for the year 2006 and takes into account fiscal instruments such as subsidies on products and activities. To understand the economy-wide effects of energy price reforms, the SAM disaggregates output of the petroleum refining sector into five commodities (namely, LPG, Gasoline, Kerosene, Diesel, and Other petroleum) and subsidies for each fuel type. The Jordanian SAM also distinguishes labour by skill level (skilled, unskilled). The 2006 SAM was updated to 2012 using available data on economic growth and population changes. This updated SAM serves as the base year for the analysis in Jordan.

The dataset used for the micro analysis in Egypt is the nationally representative 2010/11 Household Income, Expenditure and Consumption Survey (HIECS), which includes around 15500 households and 68000 individuals. For Jordan, the 2010 national Household Expenditure and Income Survey (HEIS) is used. This survey includes around 11200 households and 73800 individuals. All surveys also provide sampling weights, which are used to extrapolate to national totals[15].

# 4. Simulation scenarios

The model presented above is used to simulate various scenarios in order to better understand the short- and medium-term impacts of fuel subsidy reform and various possible designs of a

[13] Year 2009/2010 was chosen following discussions with MoF, who suggested that this would be representative of a "standard" period, i.e. not influenced by the worldwide crisis or revolution.
[14] www.mop.gov.eg/PDF/2009-2010.pdf
[15] For Egypt, according to internal rules, CAPMAS only provides to the public with a representative 25% random selection of the full sample. These results should thus be interpreted with some caution.

child cash transfer program as an accompanying measure. For Egypt, simulations are run from 2009/10 to 2017/18; for Jordan, from 2013 to 2020.

## 4.1. Reference scenario

The reference scenario depicts the evolution each country's economy as it would be without any changes in the energy policy. In Egypt, total energy subsidies are predetermined (by government projections) for the 2009/10 to 2012/13 period and are thereafter assumed to maintain a fixed ratio to GDP. The distribution of subsidies between types of fuel is assumed to be the same as 2009/2010 throughout. Predictions from the IMF[16] were used to estimate the average real GDP growth rate for the simulation period. It is important to note that GDP forecasts from the IMF vary from one year to the other, as they take into account, among other things, political and economic aspects that are not fully accounted for in a CGE model. Labour supply is assumed to grow at the same rate as CAPMAS estimates for Egypt's total population[17]. We further assumed that current and investment public spending would grow at the same rate as GDP.

For Jordan, the reference scenario is based on the IMF's economic projections for Jordan's GDP growth rate from 2013 to 2020. Labour supply is assumed to grow at the same rate as UN Population Fund estimates for Jordan's total population. We further assume that current and investment public spending would grow at the same rate as GDP. Consistent with current government policy, fuel derivatives subsidies are removed in 2013 and accompanied with the mitigating measures already in place (Jordan established in 1986 a mean-tested cash transfer program). This reference scenario thus includes the current fuel subsidy reform.

## 4.2. Policy scenarios

*Egypt*

In all simulations, energy subsidies are gradually reduced following a reform plan suggested by the MoF. Simulations start from 2012-2013. At the end of the reform, fuel subsidies are almost entirely eliminated (the full details of the simulated reform are provided in Cockburn et al., 2014a, Table 13). The plan put forth indicates very specific policies regarding prices and are assumed to yield specific savings in terms of subsidy costs. However, in the model, prices and subsidies cannot be both fixed at the same time. Either the proposed changes in prices are introduced and the subsidy cost is endogenously calculated, or the subsidy is reduced by a given amount and the prices are determined by the model. Given the general equilibrium effects, it is

[16] Downloaded from www.imf.org/external/pubs/ft/weo in April 2013 (1.78% for 2010; 1.96% for 2011; 3.03% for 2012; 4.51% for 2013; 6.00% for 2014; 6.49% for 2015 and 6.51% for 2016).
[17] Specifically, we applied the following annual population growth rates: 2.09 for 2009, 1.81% for 2010, 1.75% for 2011, 1.71% for 2012, 1.67% for 2013, 1.63% for 2014, 1.58% for 2015, 1.54% for 2016, 1.54% for 2017. Also note that in the microsimulation model (for the three countries), this is done by following a common "static ageing" technique, as proposed by Deville and Särndal (1992).

to be anticipated that the measures suggested will not produce the exact amount of subsidy reduction. It is hence assumed that the subsidy for each fuel is reduced by the expected amount and the regulated prices adjust accordingly. Furthermore, some policies would require a more disaggregate model. For example, gasoline is not distinguished by octane level and, consequently, we cannot introduce an increase in the price of one specific octane level. In these cases, the policy is implemented on the aggregate commodity and will thus influence the average price for all octane levels. In contrast, some policies are not specific. For example, it is assumed that "non-identified reforms" would further reduce the cost of energy subsidies. In this case, we assume that this would be achieved through a proportional reduction in subsidies for all fuels. Finally, it is not possible to reduce subsidies on fuels that were not initially subsidized. The plan that is implemented in the model hence does not take into account reforms affecting "other petroleum products".

As suggested in the reform, the price paid by the electricity sector for fuel oil and natural gas increases over time, thus increasing production costs for that sector. If electricity prices are maintained at their current levels, then the government would need to subsidize this sector by the exact same amount that is proposed as fuel subsidy savings, or the electricity companies would make less profits, which would in turn translate into reduced income for the government. In other words, maintaining current electricity prices would simply cancel out the savings suggested by the government. Hence, the only way the government can indeed save the proposed amount is by letting the price of electricity increase, which is what is done in the macro model. We present here two of the four policy scenarios originally agreed with the staff of the Ministry of Finance and UNICEF Egypt (the other two consist of targeted or universal cash transfers with a low budget). In the first (SIM1), the government would only implement the above subsidy reform, without any compensation scheme. In the second (SIM2), a compensating measure is introduced in order to mitigate the potentially negative impacts of the fuel subsidy reform on poorer households with children. Hence, part of the subsidy savings is used to introduce a child focused cash transfer. Specifically, 10 percent of the total fiscal savings is invested in a proxy-means targeted cash transfer for poor children. Twenty percent of the total resulting budget is deducted to cover implementation costs[18]. In all simulations, fiscal savings from the subsidy reform, net of transfers when applicable, is entirely used to reduce the fiscal deficit.

*Jordan*

In the first policy scenario (SIM1), electricity prices increase over a period of 4 years beginning in 2014, without additional compensating measures.[19] The price increase is specific to the type of product. As suggested by the Ministry of Social Development and UNICEF Jordan, we simulate no increase in the price of electricity consumed by households and the food sector, a 5%

[18] See Grosh et al., 2008 for the implementing costs of targeted and universal cash transfers.
[19] The planned increase in electricity prices will only affect households whose electricity consumption is greater than 600 watts.

increase for the "other services" sector, a 7.5% increase for the mining and crude gas sectors, and 15% for all remaining sectors.

In the second scenario (SIM2), we replicate SIM1 coupled with universal child cash transfers to mitigate the impact of subsidies removal with pro-child and more efficient social protection. The budget allocated to cash transfers corresponds to 10% of the savings from subsidy reform.

# 5. Results

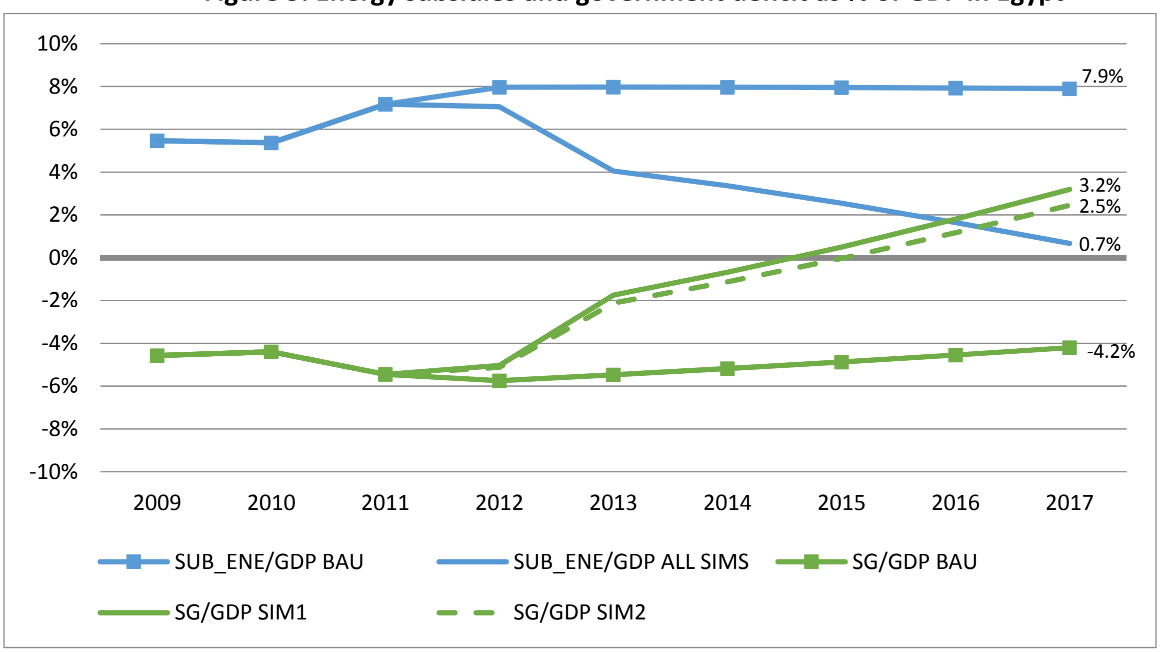
## 5.1. Macroeconomic impacts

*Egypt*

In the reference case (BaU), the cost of subsidies on energy (SUB_ENE) increases steadily and reaches about 8% of nominal GDP in 2012/13, as observed in reality (Figure 3). This level is assumed to remain constant subsequently. This creates pressure on the government's budget and the current deficit[20] - the negative of government savings (SG) - exceeds 4% of GDP throughout the period.

Simulations of the proposed reforms show that they markedly reduce the budget allocated to energy subsidies (SUB_ENE/GDP ALL SIMS), thus relaxing fiscal pressure and allowing the deficit to GDP ratio (SG/GDP) to fall significantly and even leading to projected fiscal surpluses by 2014-15.

**Figure 3: Energy subsidies and government deficit as % of GDP in Egypt**

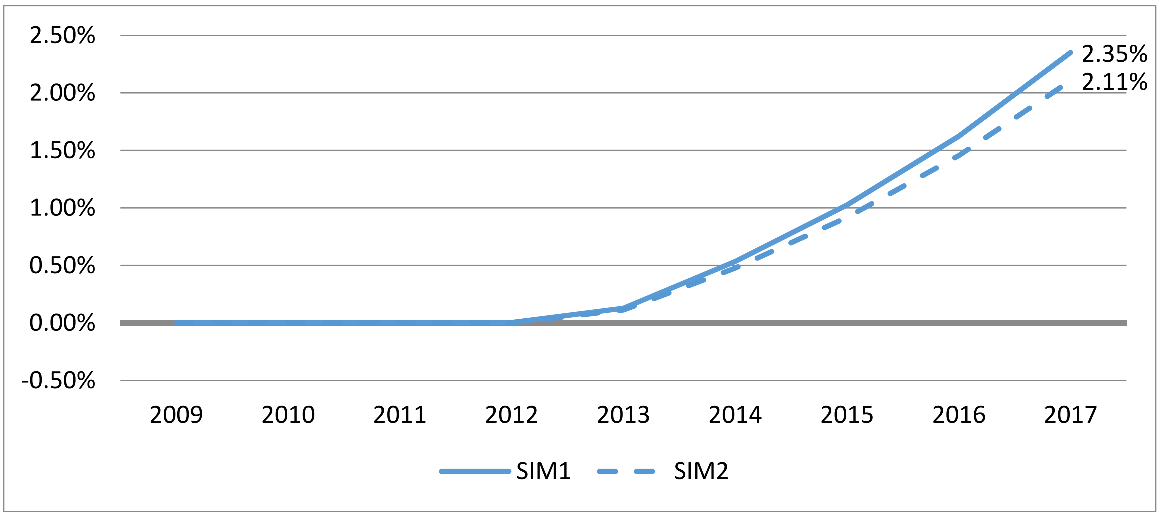



[20] The current deficit is the difference between current expenditures and government revenues.

*Source: Author's computations.*

Smaller deficits translate into greater funds available for private investment and thus real investment is far above what it would have been in the reference. Greater investment translates into higher GDP growth rates, and thus into a greater real GDP: up to 2% more compared to BaU levels in 2017. This performance is not significantly diminished if the government redirects some of these savings to finance cash transfers (SIM2). In other words, the better economic performance introduced by gradually eliminating the fuel subsidy would still prevail, even if the government decides to compensate poorer households. In all scenarios, unemployment levels are not affected significantly.

**Figure 4: Impact on real GDP (% change from BaU) in Egypt**




*Source: Author's computations.*

As can be anticipated, gradually reducing energy subsidies leads to an increase in fuel prices paid by household, by 50% on average by the end of the simulation period, in comparison with the case where the reforms would not have taken place (i.e. BaU scenario). LPG and gasoline prices rise most, whereas natural gas prices are only minimally affected. As the subsidy reform implemented in both scenarios is the same, the impacts on fuel prices are similar, regardless of the simulation scenario (SIM1-2).

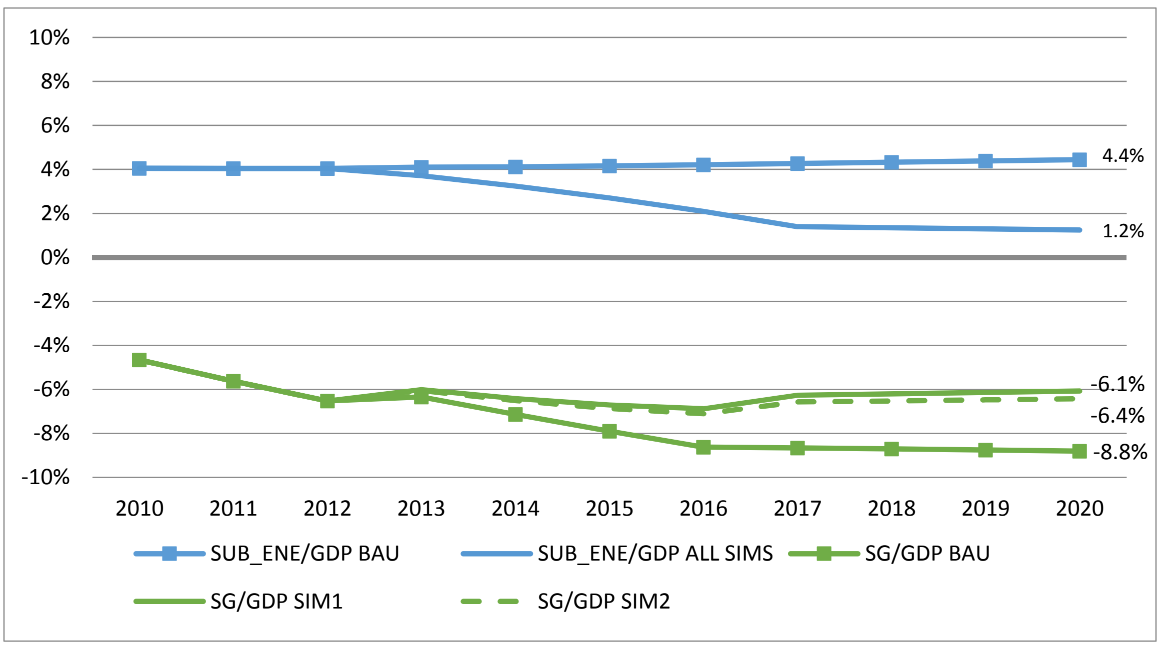
As energy is used in the production of other commodities, it is not surprising to see prices for non-energy commodities rise by roughly 5% by the end of the simulation period. Food prices are affected slightly more than non-food manufacturing goods and services. The consumer price index, which factors in the increase in both energy (5% of total consumption) and non-energy prices, is 8% higher in 2017/18 compared to what it would have been under the BaU scenario. In response to rising prices, demand for fuel products decrease over time. Indeed, producers switch away from energy-intensive equipment to less intensive techniques of production, and households switch away from more costly commodities to more affordable ones. Overall, thus, total demand for energy falls. LPG and gasoline demand fall most, as their prices increased the most, while demand for natural gas falls least.

*Jordan*

The low fixed prices for electricity under the subsidy regime result in losses for the national electric company – NEPCO – which are covered through transfers from the government. In the reference case (BAU), these transfers rise slightly from their base of 4% of nominal GDP in 2010. This level is assumed to remain constant subsequently. Simulations of the gradual reduction of these subsidies beginning in 2013, with (SIM2) or without (SIM1) a cash transfer, show that this would markedly – and identically – reduce these transfers.

As in the case of Egypt, the reduction in government transfers to NEPCO relaxes fiscal pressure and reduces the current public deficit[21] to GDP ratio significantly (Figure 5). Whereas it was projected to rise to nearly 9% by 2020 in the base scenario, the elimination of electricity subsidies beginning in 2013 stabilizes it between 6 and 7%. The introduction of universal cash transfers (Sim2) only marginally reduces these savings. Note that the small reduction in the government deficit in 2013 is due to the elimination of fuel derivatives subsidies, which is included in all three scenarios.

**Figure 5: Energy subsidies and Government deficit as % of GDP in Jordan**



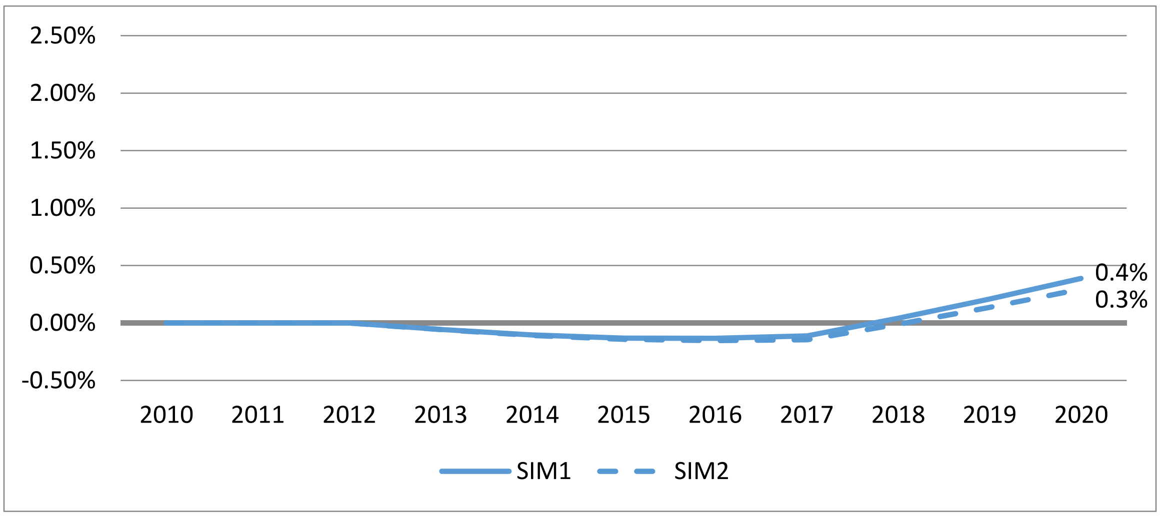

*Source: Author's computations.*

As we observed in Egypt, smaller deficits translate into greater funds available for investment and thus increased growth rates. However, as shown in Figure 5, the impact on the deficit to

[21] The current deficit is the difference between government revenues and current expenditures.

GDP ratio falls by less in Jordan (from -8.8% to - 6.1%, i.e. an improvement of slightly less than 3 percentage points, compared to Egypt, where it goes from -4.2% to 3.2%, an improvement of 7 percentage points). It thus takes a few years for the effects of the cumulative savings and investments to outweigh those of the price increase resulting from subsidy cuts. Thus real GDP growth rates initially fall as a result of these cuts, but begin increasing from 2017 on, and real GDP in 2020 exceeds its BaU level by 0.4% (Figure 6). As in Egypt, this performance is not significantly diminished if the government redirects some of these savings to finance cash transfers (SIM2).

**Figure 6: Impact on real GDP (% change from BaU)in Jordan**




*Source: Author's computations.*

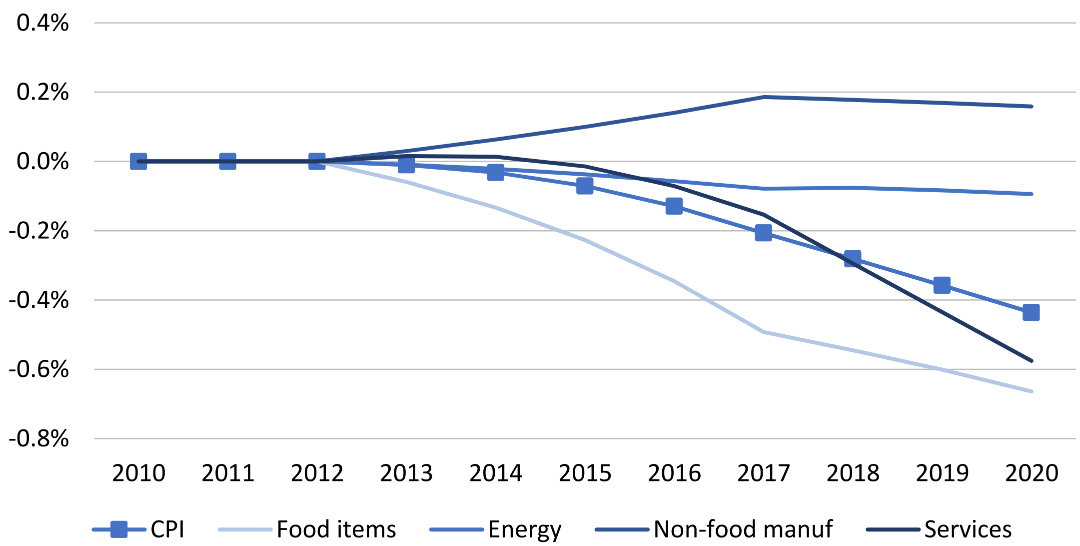
Only the wealthiest households were affected directly by subsidy cuts. Thus, impacts on the labour market and households stem primarily from the fact that the cuts in electricity subsidies apply overwhelmingly to producers, who consume electricity as an input. Subsidy cuts result in substantial increases in input costs, particularly for the services and manufacturing sectors.

As a result, demand for labour falls leading to increases in unemployment and a fall in real wages. Skilled workers are hit relatively more through unemployment than unskilled workers (up to 1.2 vs. 0.9% by 2017), whereas the latter are relatively more affected through wage rates (up to -1.5 vs. -1.4% by 2020). The addition of a mitigating cash transfer mechanism (Sim2) slightly exacerbates the situation.

Thus, while households do not suffer directly from increased electricity prices, they suffer rising unemployment and falling wage rates. The resulting income losses translate into depressed household real consumption (which falls by up 1.6 and 1.4% under Sim1 and Sim2 respectively by 2017).

While the increase in electricity prices directly raises intermediate input costs, falling demand more than offsets this so that most price indices fall in comparison with the case where the reforms would not have taken place (i.e. BaU scenario). The exception is the price index for services, which we recall is the sector that experienced the biggest increase in input costs. The overall CPI falls by just under a half a percent relative to the BAU (Figure 7). It is important to note that services, for which prices increase, represent over 40% of household consumption.

**Figure 7: Price effects (% change from BAU) in Jordan**




*Source: Author's computations.*

## 5.2. Impacts on poverty and inequality

We now turn our attention to the impacts of these price and employment changes on child poverty and inequality.

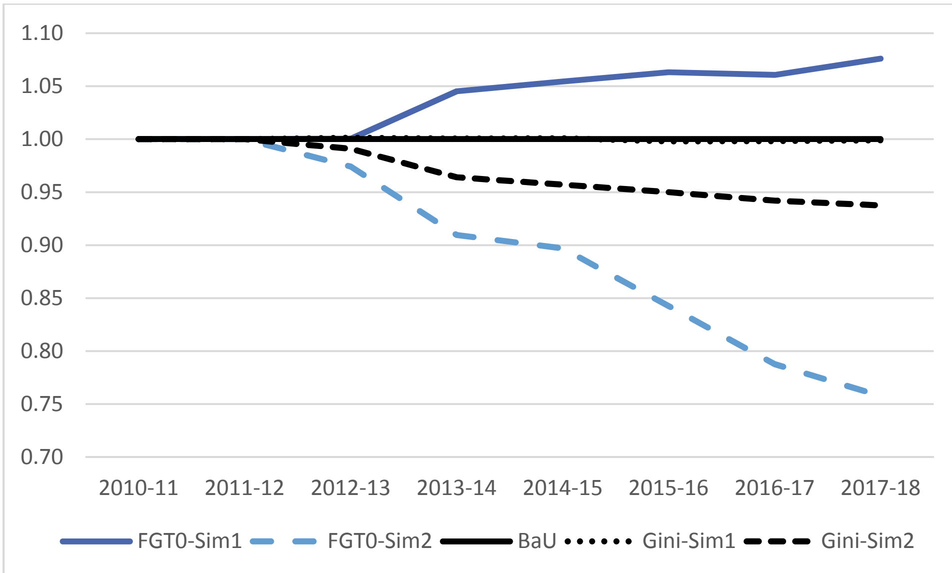
*Egypt*

Overall, we observe a substantial decline in child poverty in the reference scenario (BaU), without fuel subsidy reform, as largely anticipated in the IMF forecasts of economic recovery (used for the simulations). The share of child population living below the poverty line (headcount) falls from 27.11% in 2010/11 to 19.35% in 2017/18, a decline of just over 30%. This decrease (by 7.76 percentage points) is primarily driven by the wage sector (-5.81 points) followed by the improvement in the revenues coming from the self-employment sector (-2.34 points). The evolution of consumer prices only marginally offsets this improvement (+0.39 points)[22]. However, we should note that a significant increase in the incidence of child poverty is simulated for the first year (2011-12). This is mainly due to the increase in unemployment and, thus, to the decrease of revenues from working activities. As shown in Figure 8, without any

[22] This decomposition is not shown here for lack of space.

compensating measures, child poverty rises by up 8 percent, while it decreases by up 34 percent when a protection system is put in place.

**Figure 8: Change in child poverty headcount (FGT0) and Gini (BAU=1) in Egypt**




*Source: Authors' elaboration.*
*Notes: differences with respect to the baseline scenario (BaU) are always statistically significant starting from 2012-13 (when policy scenarios start).*

As said, poverty impacts differ markedly between the simulation scenarios. Energy subsidy reductions alone (Sim1) – without any compensatory cash transfers – lead to an increase in child poverty beginning in 2012/13 and rising to 2017/18 (1.47 percentage point increase in headcount versus the reference scenario). This primarily reflects the increase in consumer prices, which more than offset the inflation in wages and profits (Table 1). However, when as little as 10% of the savings on fuel subsidies are channelled into cash transfers (Sim2), the situation is inversed and child poverty falls significantly with respect to the reference scenario without reforms[23]. This illustrates the possibility to combine government objectives to cut energy subsidies and the fiscal deficit, stimulate investment and growth, while combating poverty. It also underscores the inefficiency of fuel subsidies, vs. cash grants, as a tool to combat poverty. Results are robust (in the sense of stochastic dominance) to a wide range of poverty lines (ranging from the food poverty to the upper thresholds).

While the subsidy cuts alone (Sim1) have a negligible impact on inequality among children, the introduction of cash transfers as a compensatory mechanism generates a substantial improvement. In fact, when cash transfers programs are implemented, inequality falls below the reference scenario for the entire period. When 10% of the savings generated by the subsidy

[23] Simulations not shown here show that – according to our simulations and with the same allocated budget – targeted cash transfers reduce more poverty than a universal program.

reduction are targeted to the poorest children (sim2), inequality practically returns to the initial value observed in 2009/10.

**Table 1: Decomposition of the incidence of child poverty in 2017-2018 in Egypt for the different simulation scenarios (*versus* the baseline), by factors (percentage points difference)**

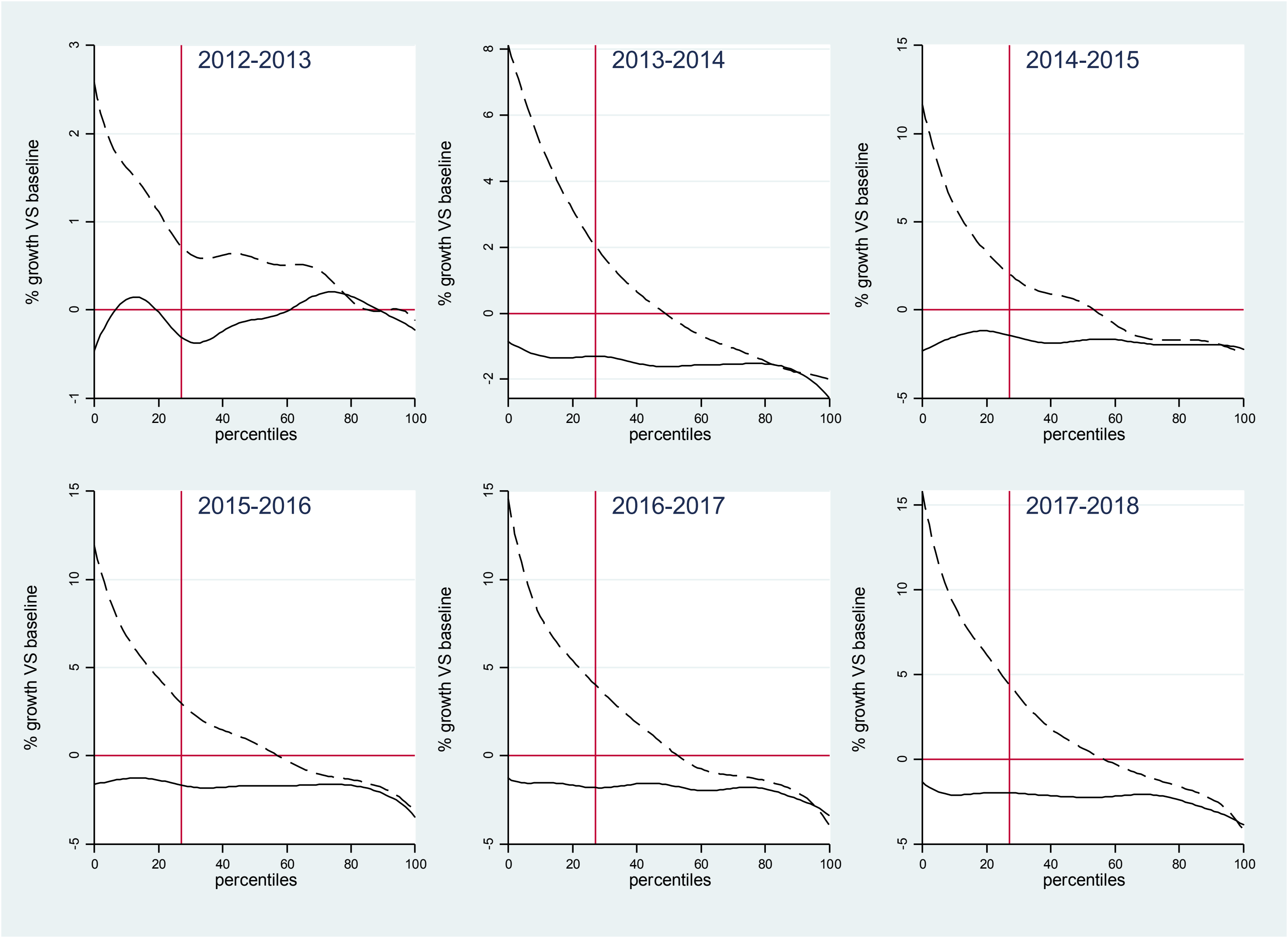
| **Factors** | **Sim1** | **Sim2** |
|---|---|---|
| Wages | -1.42 | -1.42 |
| Profits | -1.90 | -1.59 |
| cash transfer | 0.00 | -6.23 |
| consumer prices | 4.79 | 4.55 |
| total change | 1.47 | -4.69 |

*Source: Authors' estimation*

*Notes: the Shapley/Shorrocks decomposition has been performed with the STATA routine adecomp. Note that the factors "wages" and "profits" include the combined effect on revenues and employment in the wage and self-employment sectors respectively.*

In Figure 9 we analyse the real consumption effects of the various simulations over the whole distribution by using growth incidence curves (defined by children). These curves plot the absolute variation of the logarithm of mean real consumption under each simulation scenario and the BaU in each percentile of the distribution (this closely approximates the percentage change). The horizontal line set at "zero" represents our benchmark (i.e. the BaU) against which the curves associated to sim1 and sim2 are compared. The impacts of the fuel subsidy cuts alone (Sim1) are fairly evenly distributed. This is especially true if the extreme (poorest and richest) percentiles are excluded, as it is normally suggested to do since these extremes can be particularly susceptible to income variations. The only exception is for the first year of the reform (2012/13) when the poorest are affected relatively more by the reduction in fuel subsidies. In contrast, the lump-sum cash transfer is strongly progressive, benefiting the poorest children far more (Sim2). Also, the benefits generated by the targeted transfers are progressively larger over time; this is captured by the distance between the curve associated to Sim1 and that for Sim2. Starting from 2014/15, these policies are simulated to allow children belonging up to (around) the median percentile to improve their well-being to (at least) the reference scenario.

**Figure 9: Incidence growth curves in Egypt**

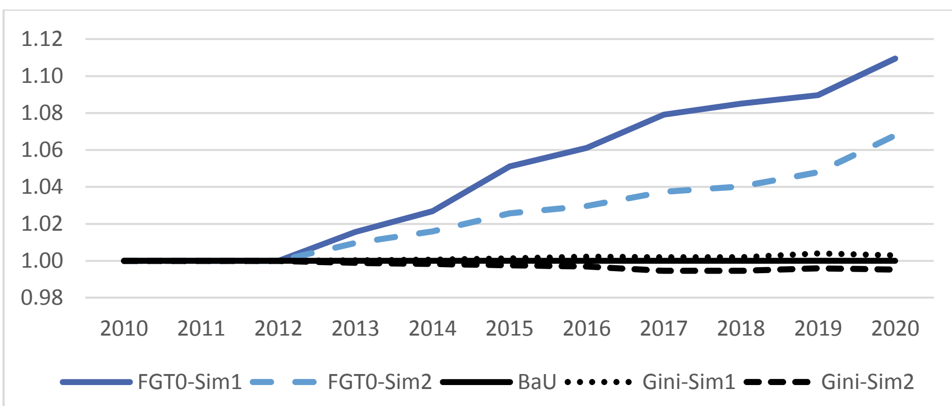



*Source: authors' elaborations. Notes: the incidence growth curves are reported as difference from the baseline scenario (horizontal line set at zero); the vertical line is set at 27.1 (which corresponds to the incidence of poverty). The solid curve represents "sim1" and the dashed curve represents "sim2".*

*Jordan*

In the reference scenario (BaU), where this is no electricity subsidy reform, we observe a substantial decline in child poverty. The share of child population living below the poverty line (headcount) falls from 20.58% in 2010 to 16.62% in 2020, a decline of just under 20%. Poverty impacts differ markedly in the simulation scenarios. The elimination of electricity subsidies (Sim1) – without any compensatory cash transfers – leads to an increase in the incidence of poverty over the entire simulation period, rising to nearly two percentage points by 2020 relative to the BaU (or 11 percent – see Figure 10). A similar pattern is observed in terms of the poverty gap. When 10 per cent of the savings on electricity subsidies are channelled into universal cash transfers (Sim2), the increases in the headcount index, relative to BaU, are cut by roughly one third. This suggests that a larger share of the savings – roughly 30 percent – would be required to fully offset the impact of the cut in electricity subsidies on child poverty. Nonetheless, this would still leave the government with 70% of the savings, illustrating, as in the case of Egypt, the possibility to combine government objectives to cut energy subsidies and the fiscal deficit, stimulate investment and growth, while combating poverty. Results are robust over a wide range of poverty lines. Inequality changes do not differ substantially between the reference and the simulation scenarios, with Sim1 slightly larger and Sim2 just a little lower than the BaU. Given the universal nature of the cash transfer program proposed in Jordan, the mitigating effects on inequality are relatively small. Compared to Egypt, where a proxy-means tested cash transfer is applied, the mitigating intervention in Jordan seems too much dispersed across the population.

**Figure 10: Change in Headcount poverty (FGT0) and Gini (BAU=1) in Jordan relative to BaU**




*Notes: differences with respect to the baseline scenario (BaU) are always statistically significant starting from 2012-13 (when policy scenarios start) except for Gini index under sim1 in 2013-2015.*

In Table 2, we explore the sources of the increases in the child poverty headcount index noted in Figure 10, focusing on the year 2017. We see that the 1.818 percentage point increase resulting from the subsidy cut – relative to the reference (BaU) scenario – is primarily driven by an increase in the cost of living and unskilled wage reductions (amongst poor workers in the initial year, more than 90% is indeed unskilled and so it is expected that poverty changes are mostly driven by the unskilled sector). Note that the rising cost of living is largely driven by a roughly ten per cent increase in the cost of housing and water, as a result of rising electricity prices. Cash transfers reduce by about 40% the negative effect on child poverty.

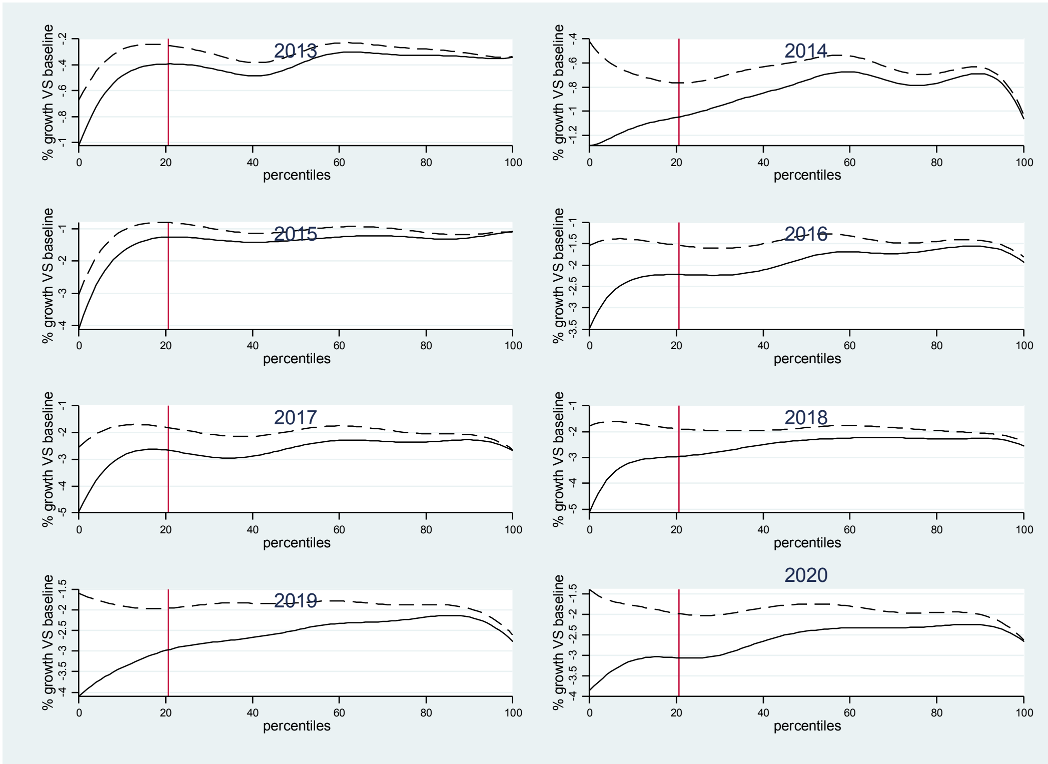
**Table 2: Decomposition of the change in the incidence of child poverty in 2017 (relative to BAU; percentage points difference) in Jordan, by factors (percentage points difference)**

| **Factors** | Sim1 | Sim2 |
|---|---|---|
| Income, skilled | 0.064 | 0.054 |
| Income, unskilled | 0.625 | 0.661 |
| cash transfers | 0.000 | -0.698 |
| cost of living | 1.129 | 1.115 |
| total change | 1.818 | 1.132 |

*Source: Authors' estimation*
*Notes: the Shapley/Shorrocks decomposition has been performed with the STATA routine adecomp. Note that the factors "wages" and "profits" include the combined effect on revenues and employment in the wage and self-employment sectors respectively.*

In Figure 11 we analyse the real consumption effects of the various simulations over the whole distribution by using growth incidence curves. As the results vary somewhat from year to year, we present these curves for the entire 2013-2020 period. The impacts of the electricity subsidy cuts alone (Sim1; solid curve) become increasingly regressive over time, with the biggest real consumption losses concentrating among the poorest percentiles. This is still true even if the extreme (poorest and richest) percentiles are excluded, as it is normally suggested to do since these extremes can be particularly susceptible to income variations. The lump-sum cash transfer (Sim; dashed curve) largely neutralizes this effect.

**Figure 11: Incidence growth curves in Jordan**




Source: authors' elaborations. Notes: the incidence growth curves are reported as the difference from the baseline scenario; the vertical line is set at headcount index of 20.6%, which corresponds to the headcount index in 2010; the solid curve identifies "sim1", the dashed curve "sim2"

# 6. Conclusion

Most of the countries in the Middle East and North Africa region have started to reform their price subsidy systems. Food and, especially, fuel price subsidies are normally found to be regressive and represent a heavy and unsustainable fiscal burden on government budgets. This paper presented two case studies in the region (Egypt and Jordan), where – through a combined CGE-microsimulation model – the effects of price subsidies reforms on growth, child poverty and inequality, as well as mitigating social protection measures, were estimated for the short and medium terms.

In both countries, the simulated scenarios are real proposed (by local policy makers) price subsidies reforms. For this reason, the products affected by the reform as well as its size and the implementing time path in the two cases differ substantially and simulation results are not directly comparable. Nevertheless, CGE-microsimulations of the impacts of fuel subsidy cuts in both countries under various scenarios lead to strong results. First, these cuts substantially improve the fiscal situation in each country, not only reducing the public deficit but, in the case of Egypt, contributing to the emergence of a projected surplus as early as 2014-15. These savings in turn nourish a substantial rise in real investment – reaching 33% in Egypt by 2017/18

– which drives an increase in real GDP of more than 2% in Egypt in the same year. However, in Jordan these impacts take more time – after an initial economic slowdown – and only attain 0.4% by 2020. While in both countries, smaller deficits translate into greater funds available for investment and thus increased growth rates, the impact on the deficit to GDP ratio falls by less in Jordan. It thus takes a few years in Jordan for the effects of the cumulative savings and investments to outweigh those of the price increase resulting from subsidy cuts. For both Egypt and Jordan, economic growth performance is not significantly diminished if the government redirects some of these savings to finance cash transfers.

While the subsidy cuts alone lead to higher prices (with a consumer price index 8% higher in 2017/18 compared to the reference scenario) that increases child poverty and inequality, it is shown that channelling as little as 10% in Egypt of the energy subsidy savings into cash transfers is sufficient to inverse this effect and substantially reduce child poverty and inequality. If these cash transfers are targeted to poor households, the impacts are even greater. In Jordan, a larger share (30%) of savings would need to be channelled into cash transfers to neutralize the poverty impact. The introduction of cash transfers is further shown to not substantially reduce the positive fiscal balance, investment and growth impacts of the energy subsidy cuts in both countries. All results include a reasonable estimate of the administrative costs associated with the introduction of a cash transfer system.

Although its impact is generally found to be fairly evenly distributed among children, the fuel subsidy reform is simulated to generate an increase of 1.47 percentage points (relative to the non-reform scenario) in the child poverty headcount – equivalent to roughly half a million more children living in poverty – in Egypt. The substantial improvement in factor productivity (reflected by higher wages and profits) that follows the fuel subsidy reform is not enough to offset the increase in consumer prices. In Jordan, the increase is even bigger – 2 percentage points (roughly 58,000 children) – as rising electricity prices translate into higher input costs, especially in the services and manufacturing sectors, which depresses labour demand. This increases unemployment rates by up to one percentage point while reducing real wage rates by over one percentage point. As a result, household consumption falls. In both countries, child monetary inequality does not change substantially because after the subsidy reform.

In both countries, channelling part of the savings into cash transfers is shown to be a powerful accompanying measure. In Egypt, when the reform is accompanied by a targeted cash transfer programme for children financed by 10% of the savings on fuel subsidies, up to around 1.6 million of children are expected to exit from poverty. In Jordan, the impact is smaller. The channelling of ten per cent of the energy subsidy savings into cash transfers cuts the increase in child monetary poverty by a third. This is partly due to the more negative impact of subsidy cuts in Jordan and partly due to the fact that the cash transfers here are not targeted specifically to children living in poor households.

The introduction of cash transfers is further shown to not substantially reduce the positive fiscal balance, investment and growth impacts of the energy subsidy cuts in both countries.

These simulations of the various policy scenarios provide evidence that energy subsidy reform, coupled with a modest cash transfer mechanism, has the potential to deliver multiple payoffs in terms of fiscal balance, investment, growth, child poverty and inequality.

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