# Welfare and distributional effects of the energy subsidy reform in the GCC countries: The case of Sultanate of Oman

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ABSTRACT

The Gulf Cooperation Council countries (GCC) have recently embarked in an energy subsidy reform following the drastic drop of international oil prices in 2014. The reform consists of increasing energy prices (fuel, electricity, gas) in order to gradually phase out the subsidy and rationalize government expenditure. Governments however are concerned about the adverse effects of high energy prices on inflation, economic growth and the welfare of low-income households. The objective of this paper is to assess the economy wide effects of the energy price increase in Oman focusing in particular on income distribution as reflected in the Gini-coefficients and other inequality indicators. The study uses an extended version of the general equilibrium GTAP Model (MyGATP) in which the single regional household was splitted into a government account and 8 household types based on the income and expenditure survey of Oman. Results indicate the effects of reducing the energy subsidy by 50% would lead to a slight increase in the GDP by 0.62% , an increase in government saving by 2.9 billion US $ and a reduction in household welfare by about 3% due mainly to the increase in the price index of private consumption (general inflation). The effect on the Gini coefficient is however very small showing little sensitivity in the short run of income inequality to the subsidy reform.

Key words: Energy subsidy, MyGATP, Oman

## 1. Introduction:

The Gulf Cooperation council countries (GCC) have recently embarked in an energy subsidy reform following the drastic drop of international oil prices in 2014. The reform, was designed to reduce fiscal pressure and rationalize government expenditure with view of phasing out subsidies on all forms of petroleum products. Prices of a wide range of fuels including natural gas, gasoline, Diesel, electricity as well as water have witnessed an increase in the 6 GCC countries[1] albeit at different pace. For example Oman in January 2015 has doubled its natural gas price for industrial producers and the power sector to $3/mmbtu[2] with the provision to increase it by 3 % annually in subsequent years. In 2016, fuel prices at the pump have increased by 33% and the government implemented a formula pricing on the basis of crude oil international prices. Similarly, in the 2015 Saudi Arabia increased it gas prices for industrial user from $ 0.75/mmbtu to $1.75/mmbtu (130% increase) and gasoline (unleaded) price from $0.16/l to $0.24/l, a 50% increase (APICORP, 2016).

The provision of low energy price in the GCC has historically constituted part of the wealth distribution social contract between the government and its citizens (Charles et al. 2014). The policy has also served to initiate industrialization and achieve rapid economic growth and other social and economic objectives. However the fiscal and social cost of energy subsidies have increased considerably and have raised concerns about the sustainability of this low price energy development model. In this context, the IMF has estimated that the energy subsidy in the Middle East region stood at $237 billion in 2011, which represented 48 % of the total subsidy in the world, 8.6 % of the GDP and 22 % of government revenues[3]. These figures are considerably high compared to the world averages, where the subsidy to the GDP and revenue ratios amount to 0.7 % and 2.1 % respectively, and are particularly acute for oil exporting countries (Griffin et al, 2016)[4].

Although, the energy subsidy reform is considered a right move toward economic sustainability GCC governments are however concerned about the adverse effects of high energy prices on inflation and welfare of low-income households[5]. Higher energy prices reduce household welfare both directly by raising the price of fuel, electricity and water and indirectly by increasing the price of other energy-using goods. The non-consideration of these adverse effects has in many experiences led to a reform reversal under the pressure of social opposition to the subsidy reform (Sdralevich et al., 2014). A gradual implementation of the reform accompanied with well-targeted social safety nets is often advised to cushion the impact of the energy price increase on lower income groups (IMF, 2013).

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[1] The GCC countries include Saudi Arabia, Bahrain, Qatar, Kuwait, Unities Arab Emirates, and Oman.

[2] mmbtu stands for one million British Thermal Units (BTU).

[3] Subsidies on a —pre-tax basis for petroleum products, electricity, natural gas, and coal. The methodology used by the IMF to estimate subsidies is the price gap approach where the price paid by users is compared to a benchmark price, which is the international price for internationally traded products. For non-traded products (electricity), the benchmark is the cost recovery price (IMF, 2013).

[4] About 44% of the global energy subsidies goes to petroleum products subsidies, of which 50% comes from the MENA countries (Krane and Monaldi, 2017).

[5] The concern is also on the likely adverse effect on the international competitiveness of domestic industries, particularly the energy intensive sectors (i.e. aluminum, petroleum refining, chemicals, plastic, etc…) as the increase in energy prices would increase production costs.

The objective of this paper is to assess the economy wide effects of the energy price increase in Oman focusing in particular on household welfare, government budget and income distribution as reflected in the Gini-coefficient and other inequality indicators**.** With low level of oil reserves compared to other GCC countries, Oman is quite vulnerable to declining oil prices and most in need to economic reforms to diversify government revenues and reduce government deficit (APICORP, 2016)[6]. It is expected that the reform in the energy prices will in the near term reduce household welfare but the increase in government saving (due to subsidy reform) can be used partially to mitigate the negative effects on households (Kotgama and Boughanmi, 2016). Policy makers however need quantified information on the degree of these effects in order to design the appropriate schemes of compensation. The analysis of the subsidy reform effects requires a general equilibrium approach which takes into consideration, in particular, the linkage between markets, sectors and government spending**.**

The next section reviews the literature on the energy subsidy issue and the specific regional effects. Section 3 provides an overview of the Omani economy and section 4 discusses the prevalence of the energy subsidies in Oman. Section 5 presents the methodological framework and the data base. Section 6 discusses the results, and section 7 concludes.

## 2. Literature review

The most supporting argument behind subsidization is usually poverty alleviation (Fattouh and Al Katiri, 2013). However the economic justification of the subsidy reform is quite strong and a large number of studies have underscored the urgency of these reforms. Subsidies distort the markets, which results in poorer allocation of productive resources and reduction in national welfare. Distorted market signals lead to overconsumption, discourage energy efficient innovation, cause negative environmental impacts and encourage smuggling across neighboring regions[7]. In oil exporting countries, excessive subsidization lead to the development of energy inefficient and energy intensive industries with little employment capacity and little ability to compete in international markets. Subsidies drain fiscal resources and overcrowd public investment on general infrastructure, education and health (Vagliasindi, 2012). Finally subsidies are regressive in nature as most of the benefits are captured by high-income groups.

At the global level empirical investigations on energy subsidies have focused on a variety of issues related to their evaluation and their macroeconomic, environmental and distributional effects (see OECD; Kojima and Koplow, 2015; Coady et al., 2015; Clemens et al., 2013). Some other studies have focused on the effect (ex-ante) of the subsidy reform implemented or planned by a number of developing and oil exporting countries. The IMF (2015) have addressed the concern of a number of GCC governments in relation to the effect of the energy price on inflation, household welfare and economic growth. The results suggest the inflationary impact of higher energy prices in the GCC is likely to be small, given the low weight of energy products in the CPI[8]. The near term effect on growth is assessed to be somehow negative but over the long term the growth benefits should be positive. The gains in percent of GDP are estimated to be in

[6] Budget deficit in Oman stood OR 4.5bn in 2015 and projected to reach OR 3.3bn in 2016 (APICORP, 2016)
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[7] As energy prices are lower in Oman than UAE, anecdotic stories are told about UAE nationals driving across border to fill up gasoline from neighbouring Omani provinces.

[8] Second round effects (non-energy goods price) should also be limited if inflation expectation is well anchored (IMF, 2014)

the range of 0.4-0.7 in Oman, 0.1-0.2 in UAE, 1.5-2.1 in Saudi Arabia, and 1.6-2.2 in Kuwait[9] (IMF, 2015).

Numerous empirical studies have shown that energy subsidies are highly inequitable as high income households tend to be the main beneficiaries of low energy prices (see IMF, 2013; IMF, 2015; IAE, 2011; Dartanto, 2013; Anand et al, 2013 ). For example in Egypt the poorest 40% received only 3% of the subsidy allocated to gasoline, 7% to natural gas, and 10% to diesel (IMF, 2015). In Jordan consumption subsidies received by the richest quintile were about 20 percentage points higher than those received by the poorest quintile (IMF, 2013). Worldwide, the richest 20 percent of households in low- and middle-income countries capture 43% of the fuel product subsidies, while the poorest 20% receive 7%. In most studies gasoline is shown to be the most regressive where the leakage to high income population is the most pronounced.

However while subsidy are inequitable, a sudden sharp increase in energy prices would have a significant negative effect on the real income of poorer households. Dartanto (2013) by using a CGE model for Indonesia estimated that removing 25% of the fuel subsidy would increase the incidence of poverty by 0.26%. Anand et al. (2013) reported that eliminating fuel subsidy in India would result in 4% decrease in real household income. Siddig et al. (2014), using the GTAP framework for Nigeria reported that a reduction of fuel subsidy would overall increase the Nigerian GDP but would have a detrimental impact on the income of poor households. Coady et al. (2015) estimated the welfare impact of increasing fuel prices in a number of countries and reported that a 0.25 $/liter increase in fuel prices would on average result in 5.5% decline in household real income and about 7% in the MENA countries. Finally, Kotagama and Boughanmi (2016) used a partial equilibrium simulation model to estimate the impact of increasing fuel prices on poverty incidence in Oman. Their results indicate that increasing fuel prices by 33% increases poverty incidence by 1%. They reported however that the financial transfer required to neutralize the 1% poverty incidence is lower than the savings made by phasing down fuel subsidies.

Because of the short term poverty incidence of the energy subsidy reform, most studies have underscored the necessity to develop parallel safety net measures to insure the success of the reform (i.e. IMF, 2013; IMF 2015; Fattouh and Al Katiri, 2013; APICORP, 2016,) ). For the GCC countries the IMF (2015) recommends to phase in the subsidy at a gradual pace and provide if needed temporary financial support to the competitive tradable productive sectors. In addition the reform should be clearly communicated to stakeholders and a transparent rule-based mechanism of setting prices should be developed. For the case of Oman, Kotagama and Boughanmi (2016) argues that the government could use the existing mechanisms of social security provisions to provide financial transfers to low-income households who are adversely affected by phasing down of fuel subsidies.

## 3. Overview of the Oman Economy

Oman is an oil exporting country and a member of the Gulf Cooperation Council (GCC) since 1980. It has a land mass of about 309500 Square Km and a population of 4.65 Million, of

[9] The analysis used a partial equilibrium approach assuming an energy consumption price elasticity in the range of (-0.3, -0.5). Estimated gains represent the efficiency gain for the economy from increasing domestic prices to an international benchmark (US pre-tax prices). The authors reported that the gain will be much larger if the income gain from the reform in the GCC is reinvested.

which 45% are expatriates (NCSI). It is classified by the World Bank as a developing upper – income country with per capita income of US$18000 in 2015. Oil and Gas revenues account for 46% of the GDP, 60% of exports and 68% of government revenue in 2016. The share of oil &gas revenue declined from 84% in 2012 to 68% in 2016 following the decline in oil prices (Central Bank of Oman, 2017) (Table 1). Economic growth in Oman has been sustained by high oil prices, growing oil production, and an open and transparent foreign trade regime (WTO, 2014). Compared to its wealthier neighbors, Oman Finance has been hit hard by the plunge of oil price since 2014. In 2016, the budget deficit amounted to 22 % of GDP, up from 16.5% in 2015. At the same time the current account, for the second year, plunged into a deficit (Fig 1) amounting to 17% of GDP in 2016 (IMF, 2017). In 2015-2016, the government took important policy measures to consolidate its finance, including fuel subsidy reform.

Table 1: Trends of government revenues-Oman 2012-2016 (RO Million)

| | **2012** | **2013** | **2014** | **2015** | **2016** |
|---|---|---|---|---|---|
| Net oil revenues | 9831.3 | 10429.5 | 10205.5 | 5656.2 | 3651.2 |
| Gas revenues | 1583.7 | 1495.3 | 1687.6 | 1484.4 | 1536.6 |
| Tax and Fee revenues | 909.9 | 943.1 | 1082.9 | 1099.1 | 1141.0 |
| Non-tax revenues | 1123.7 | 987.9 | 900.8 | 766.0 | 783.8 |
| Net grants | | | | | 188.8 |
| Capital revenues | 13.0 | 30.2 | 15.8 | 4.0 | 15.8 |
| Capital repayments | 12.8 | 21.6 | 215.2 | 47.8 | 291.0 |
| TOTAL REVENUE | 13474.4 | 13907.6 | 14107.8 | 9057.5 | 7608.2 |
| Share of oil & gas (%) | 85 | 86 | 84 | 79 | 68 |

Source: CBO

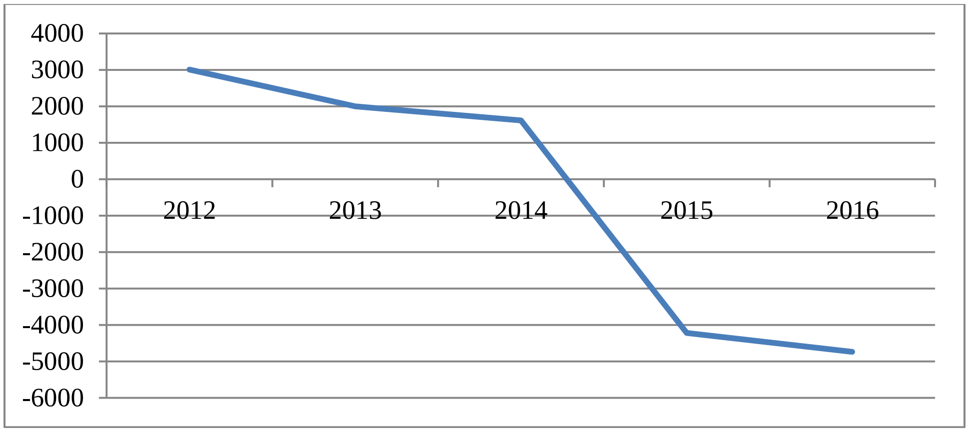


Fig 1: Trend of Oman current account (Million Omani Rials) 2012-2016
Source: CBO

## 4. Energy Subsidies in Oman

Despite being lower than GCC average, Oman has one of the highest relative energy subsidization rate in the world (IEA, 2017). The government intended policy objectives of energy subsidies include the distribution of wealth among citizens, the promotion of domestic industries and the achievement of development goals. The sole energy sources in Oman are oil and gas with production amounting to 368 Million Barrels (BBL) and 1445381 Million cubic meters respectively in the year 2016 (CNSI, 2017).

The size of the energy subsidy in Oman was estimated to be in the range of 1.2 to 9.5 billion US dollars[10] depending on the benchmark price used in the definition of the subsidy (Deloitte & Touche, 2016). For example, The IEA and the IMF uses the world price as a benchmark for calculating the subsidy (the price-gap approach) while the OPEC and a number of GCC countries use the cost of production as a reference price (IISD, 2016). The subsidy calculated with reference to the cost of production represents the fiscal cost; this method however misses the revenue forgone incurred by the exporting country. For Oman, The IMF (2016) reported that the fiscal energy subsidy cost amounts to 2.2 billion US dollars representing around 3.7% of the GDP (Fig 2)[11]. On the basis of the opportunity cost, the estimates in 2015 amount to 2.8 billion US dollars (4.7% of GDP) compared to 5.8 billion in 2014 (7.5% of GDP) (Table 2). This substantial decline in the subsidy cost in 2015 reflects the increase in energy prices implemented by the government following the drop in global oil prices.

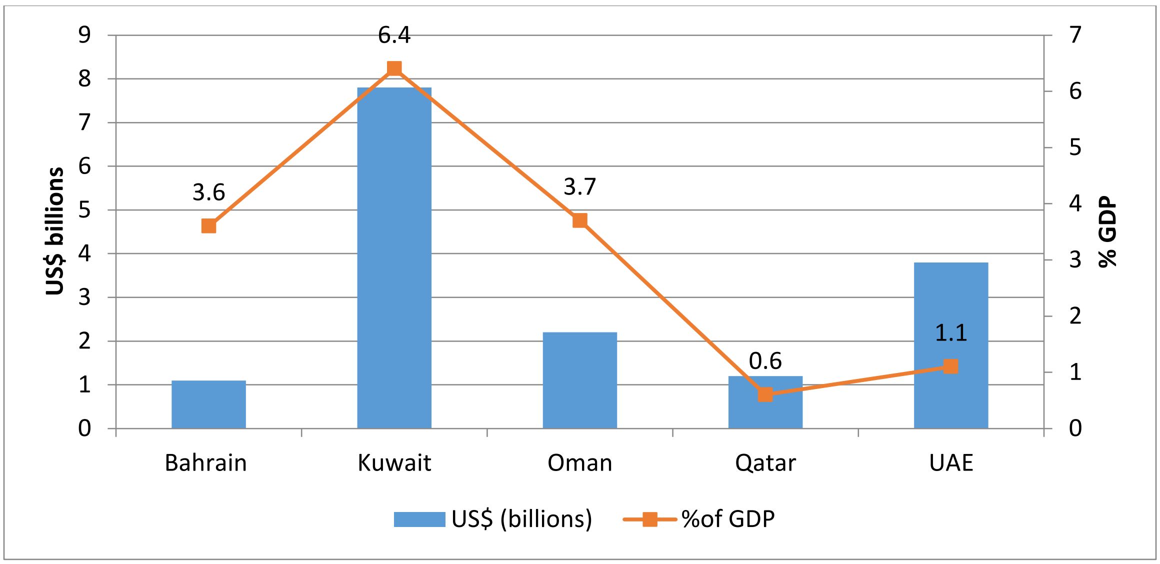


Fig 2: Fiscal cost of low energy prices, 2015
Source: IMF (2016)

Table 2: Energy Subsidies on the basis of the opportunity cost (benchmark: USA pretax-prices)

| | 2013 | | 2014 | | 2015 | |
|---|---|---|---|---|---|---|
| | US$( billion) | % GDP | US$( billion) | % GDP | US$( billion) | % GDP |
| Bahrain | 2.1 | 6.4 | 2.5 | 7.3 | 1.6 | 5.1 |
| Kuwait | 12 | 6.8 | 112.7 | 7.4 | 9.3 | 7.2 |
| Oman | 5.2 | 6.8 | 5.8 | 7.5 | 2.8 | 4.6 |
| Qatar | 8.7 | 4.3 | 10.6 | 5 | 7.7 | 4 |
| SA | 66 | 8.9 | 69.9 | 9.4 | 47.3 | 7.4 |
| UAE | 8.3 | 2.1 | 9.6 | 2.4 | 3.8 | 1.1 |

Source: IMF (2016)

[10] The upper bound represents the post-tax subsides which includes the environmental, health and other damages caused by energy use.
[11] In the approved budget 2016, the government estimated the subsidy for petroleum products, electricity and other goods around OR 400 Million, down 64% from the 2015 budget (APICORP).

Most of the energy subsidy in Oman goes to electricity, natural gas and fossil-based transport fuel (gasoline and diesel) where prices at the point of consumption are controlled. Doilette &Touches (2016) estimated that approximately 53% of the 2015 subsidy went to electricity, while the rest is captured by natural gas (22%) and oil (25%)[12]. Subsidies have caused the domestic demand for energy to rise too quickly, fueled primarily by increased demand for transportation, electricity, and water desalination. The total demand for electricity in Oman has increased over the last decade by more than 170% with the industrial demand increasing by 570% and residential demand by 170% (Fig 3). The main source of electricity generation is natural gas. The main consumer of the electricity in Oman is the residential sector (45%), which makes the price reform in this sector socially challenging. However the continuation of the historical growth in electricity demand will not be sustainable as the domestic supply of natural gas will fall short of meeting the increasing demand (Krane, 2013).

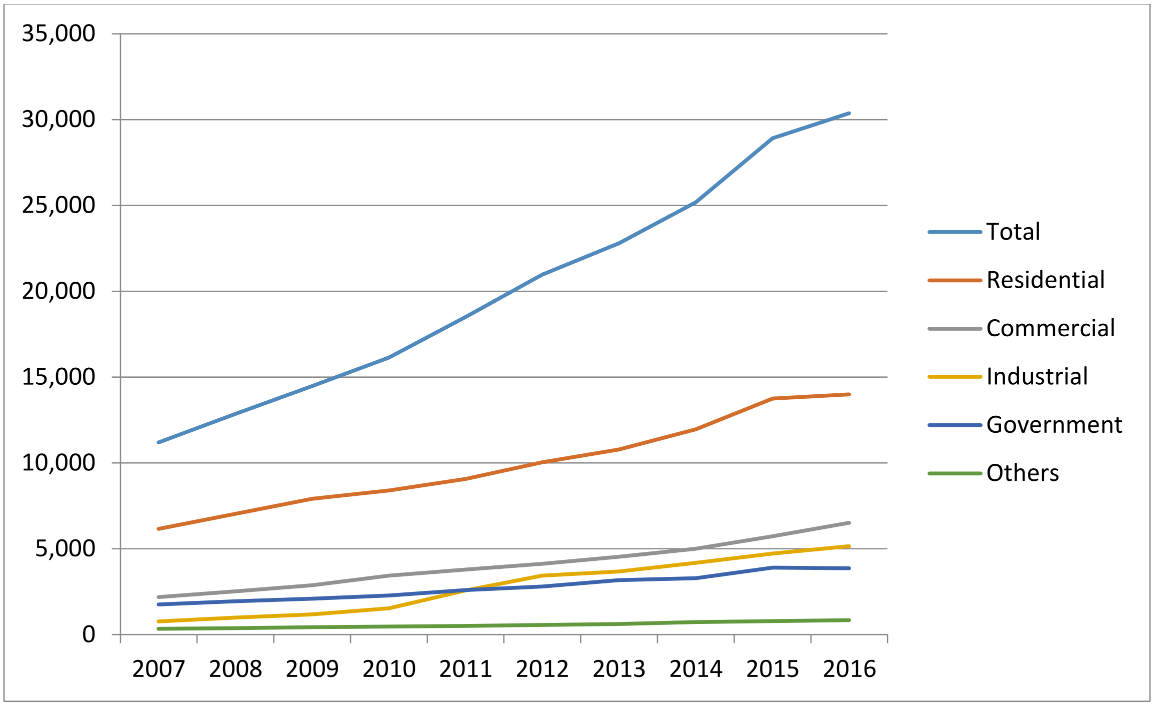


Fig 3: Oman electricity consumption (GW/H)
Source: Statistical Year Book 2017, NCSI

Similarly, Consumption of petroleum products (Gasoline, Diesel, others excluding gas) has grown during the last decade by an annual growth of 7% reaching 44 million barrels in 2016 (NCSI, 2017)[13]. The demand for of petroleum products has shown some decline in 2016 and 2017 compared to the year 2014 (Fig 4). Apparently the slowdown in economic activity due to the decline in crude oil prices and the fuel price reform introduced in 2015-2016 have impacted the demand growth of petrol and diesel (MuscatDaily.com) .

[12] Estimated on the basis of opportunity cost and calculated as the difference between the international price and domestic price multiplied by consumption.
[13] Total sale in 2016 is made up of 15% M-91 gasoline, 41% M-96 (unleaded), 41% Diesel, and 4 % others products (i.e Kerosene)

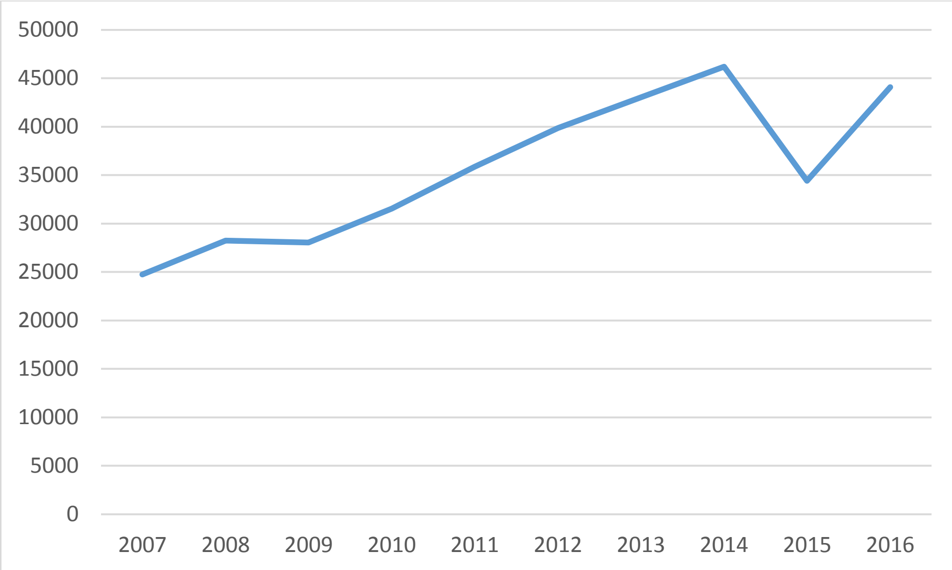

Fig 4: Total sale of petroleum products-Oman (1000BBL)
Source: CNSI

The fuel price reform in Oman started early 2016 and prices for both regular and Super have shot up by almost 80% as of today[14]. Fuel prices were fixed based on international price of crude oil and announced monthly. Because of the negative effects that the subsidy removal had on low income-household, the government introduced a more targeted national subsidy scheme in which registered eligible consumers would be subsidized for the price gap beyond Bs180 (regular fuel only). However despite fuel price liberalization in Oman, petrol prices are still below international prices (Fig 5).

[14] By January 2018

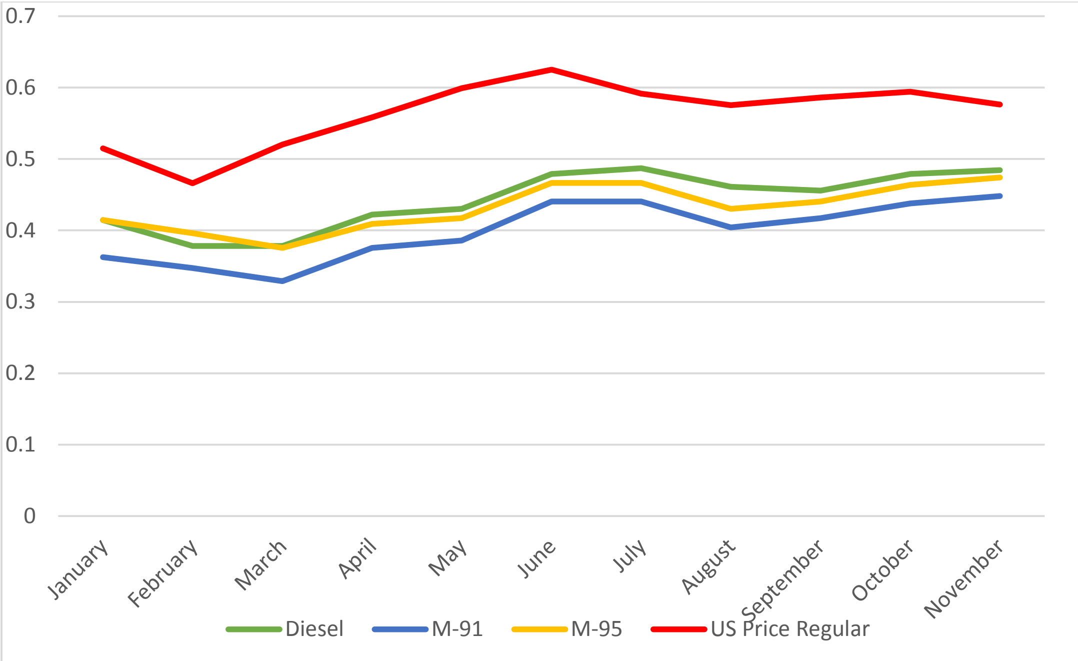


Fig 5: 2016 monthly gasoline prices in Oman compared to US price (US $/liter)
Source: NCSI; IEA

## 5. Methodology

This research used the newly developed MyGTAP model (Walmsley and Minor, 2012) to track the general equilibrium effects of the energy subsidy reform in Oman. MyGATP is an extended version of the standard GTAP model (Hertel and Tsigas, 1997) in which the single regional household is replaced by a separate government and private household. In addition the single private household is replaced with multiple households to allow for the analysis of policy impact on different households and the implied distribution effects (i.e. poverty). The new model also provides more flexibility to trace out the effects of policy changes on government income and expenditure and therefore the effects of subsidy removal on the government budget[15].

It is assumed that the government collects incomes from taxes and foreign aid, and spends on government purchases, transfers to households, foreign aid, and subsidies. Private households receive income from their factors endowments, plus net foreign labor remittances, net foreign capital income, transfers from other households, and transfers from the government. Household income is spent on consumption and saving.

The additional features of MyGTAP (multiple households, factors and transfers) require additional data mainly as a result of splitting the single household into multiple ones and linking those to factor incomes and taxes (Wamsley and Minor, 2013). The additional data required can be derived for a specific country from Social Accounting Matrices (SAM) or household income and expenditure surveys. The data obtained are to be added to the GTAP data base.

[15] New feature of MyGTAP also includes inter-regional transfers such as remittances, foreign income and aids which could be relevant to developing countries.

### *5.1 Incorporating Multiple Households in Oman*

The GTAP Database 9a (Aguiar et al. 2016) and the latest Omani household income and expenditure survey (NCSI, 2012) are used in the analysis of the subsidy reform. The GTAP database contains a globally consistent data base for the year 2011, comprising 140 regions and 57 sectors for every region. Keeping in view the objective of our study and the relevance to Oman, the regions have been aggregated into 20 regions and the commodities/sectors to 08 commodity groups. Table 3 shows the sectoral aggregation used in this study.

Table 3: Sectoral aggregation

| Commodity groups | GTAP sector code |
|---|---|
| Food | Pdr, wht, gro, osd, c_b, pfb, ocr, pcr, v_f, Ctl, oap, rmk, wol, cmt, omtm, fsh, Vol, mil, sgr, ofd, b_t |
| Non-Food | Frs, coa, oil, gas, omn, Lum, ppp, fmp, mvh, otn, omfm, gdt, crp, nmm, i_s, nfm, ele, ome, omf |
| Clothing | Tex, wap, leather |
| Petrlproducts | P_c, oil |
| Natgas | gas |
| Tourism | ros |
| Services | ofi, isr. obs, osg, dwe |
| Electricity | ely |

Source: Author's own aggregation using GTAP 9a Data Base

The 2011 Omani income and expenditure survey contains income and expenditure of 8 household types based on Governorate (Willayat). The latest GTAP 9 database (Aguiar et al. 2016) is modified by breaking down the regional household into 8 households using MyGTAP data tool- series of GEMPACK Programs (Minor and Walmsley, 2013) and the information provided by the income and expenditure survey. Table 4 and Fig 6 show the detailed information of Household types used in this study. As shown the highest household annual income recorded is in the Governorate of Muscat while the lowest is in Al Wusta Region.

Table 4: Omani Household Income, Expenditure and Saving as % of Total Income (2011)

| Household Types | Annual Income (US$) | Annual Expenditure (US $) | Annual Saving (US$) | Saving as % of Total income |
|---|---|---|---|---|
| Muscat Governorate | 34530 | 25584 | 8947 | 26 |
| Al Batinah Region | 25374 | 16848 | 8527 | 34 |
| Musandam Governorate | 20065 | 16973 | 3092 | 15 |
| Al Dhahirah Region | 22692 | 17815 | 4877 | 21 |
| Adakhiyah Region | 28038 | 18626 | 9417 | 34 |
| Asharqiyah Region | 21989 | 14758 | 7232 | 33 |
| Al Wusta Region | 16555 | 11918 | 4636 | 28 |
| Dofar Region | 21973 | 18876 | 3097 | 14 |

Source: Author's own calculation based in Oman Income and Expenditure Survey.

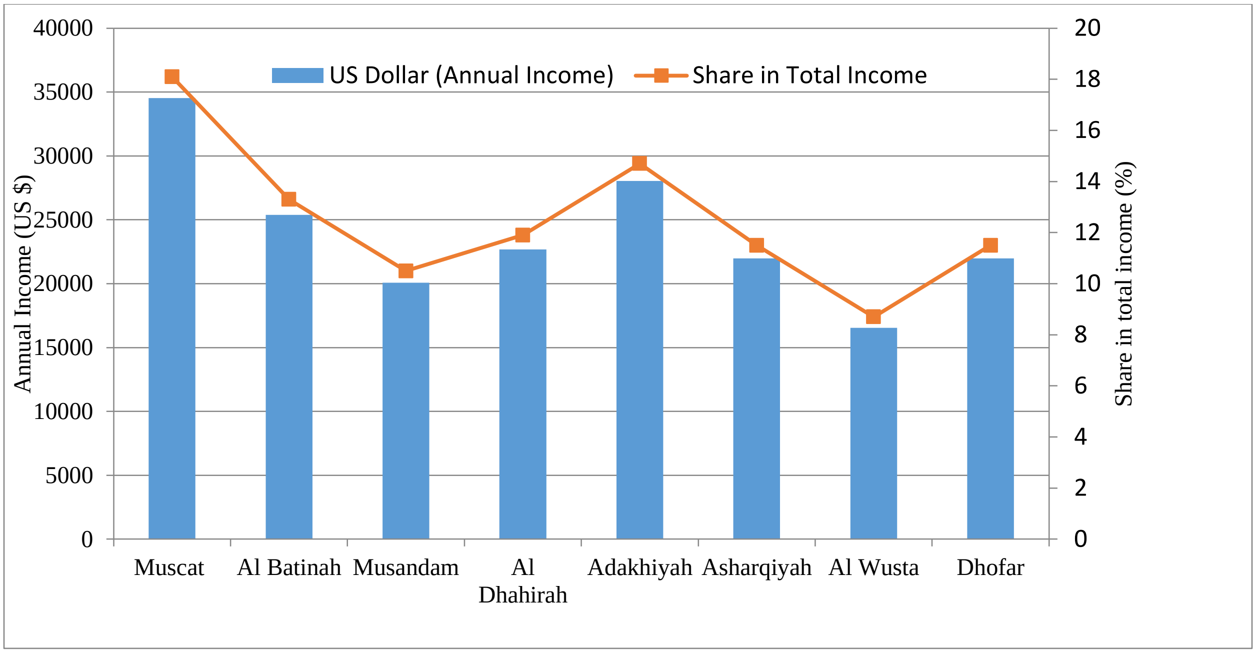


Fig 6: Household Type Share in Total Income (2011)
Source: Author's own calculation based on Oman Income and Expenditure Survey.

In order to implement MyGTAP data program, consumption and factor ownership weights are calculated for each household type and a mapping with GTAP Oman input-output table is created between factor of production, factor incomes, and household factor ownership. The standard GTAP data base is modified by incorporating factor income of each household type, factor use by sector, household consumption by commodity and saving rates. These modifications are made in such a way that the total returns to factors and consumption are consistent with the original GTAP database.

### *5.2 Income Inequality Estimation*

To assess the impact of energy subsidy reforms on income inequality two measures of inequality are used. The first is the *Gini* coefficient which is based on a cumulative frequency curve - Lorenz curve-that compares the distribution of income/expenditure with the uniform distribution representing equality. The coefficient varies between 0 (perfect equality) and 1 (perfect inequality) and can be approximate by the following formula.

$$Gini = \frac{2}{n^2\bar{y}}\sum_{i=0}^{n} i\,(y_i - \bar{y})$$

Where $y_i$ is an observed value, $n$ is the number of values observed, $i$ is the rank value in ascending order and $\bar{y}$ is the mean value.

The second measure is the *Hoover's* inequality measure, known also as the *Pietra* ratio represents the maximum vertical distance from the Lorenz curve to the 45° line of equality. It is interpreted as the proportion of income that must be transferred from those above the mean, to those below the mean, in order to achieve an equal distribution (Atkinson and Micklewright, 1992). It ranges from 0 (perfect equality) and 1(perfect inequality). The *Hoover*'s Index can be approximated by

$$HI = \frac{1}{2}\sum_h \left| \frac{YH_h}{\sum_h YH_h} - \frac{N_h}{\sum_h N_h} \right| \quad (2)$$

### *5.3 Policy Experiment / Simulation Design*

As discussed above, the government of Oman plan is to gradually phase out the subsidies of all energy products with the objective to align domestic energy prices with international prices. To design a realistic scenario, we first update the GTAP Data Base by using updated data of household subsidy rates on petroleum products, natural gas and electricity in Oman (Table 5). These rates were then accounted for in the baseline simulation[16]. A policy scenario was then designed to reduce household subsidies by 50 per cent on petroleum products, natural gas and electricity[17] (Table 5). It is not realistic to assume full price alignment with international energy prices in the current price context conditions of Oman[18] . The standard MyGTAP closure was applied to the subsidy reduction simulation ensuring that all markets are in equilibrium, all firms earn zero profits and all households lie on their budget lines (Walmsley and Minor, 2013).

Table 5: Household Consumption Subsidies rate in Oman (% Ad valorem Rate)

| Energy Sectors | Current Subsidy Rates (%) | Simulation (Reduction in Subsidy Rate @ 50 %) |
|---|---|---|
| | | |
| Oil | 24.5 | 12.25 |
| Electricity | 43.5 | 21.75 |
| Natural Gas | 49.5 | 24.75 |

Source: IAE, Authority for Electricity regulation, OECD

## 6. Results and Discussion

The analysis in this paper will focus on the effect of the subsidy reduction on the macro-aggregates (GDP, Government Revenue) as well as on household income and inequality. As shown in Table 6 reducing the subsidy on energy by 50% would increase the real GDP by a small 0.62%. This indicates that reducing the energy subsidy eliminates a large distortion in the economy and enhance efficiency through proper allocation of resources[19]. These distortions are reflected in the excessive consumption of energy resources, smuggling of fuel, and the encouragement of uncompetitive capital-intensive industries with its negatives consequences on employment and growth[20]. Table 6 also indicates that government income/saving will increase

[16] We employ the Altertax tool of RunGTAP (Malcolm, 1998) to correct the energy subsidy rates of Oman contained in the GTAP 9 database by running a simulation where tax rates are set to their desired value and the saved updated post-simulation database becomes the baseline for our experiments.

[17] In RunGTAP, the Altertax simulation is applied to the household tax on private consumption variable tpdh(c, h,r) for petroleum products, natural gas and electricity.

[18] Kotagama and Boughanmi (2016) estimated that to fully align domestic energy prices to international prices (0.414 Omani Rials) it requires an increase of domestic prices by 344% from the 2016 price base.

[19]The efficiency gain represents the reduction in the deadweight loss associated with removing the distortions created by the energy subsidies.

[20] In a study for Saudi Arabia, Adams and Roos (2016) found using a Dynamic CGE model that “removing the energy subsidies eliminates a large distortion in the economy. This improves the efficiency of resource use, such

by 2.9 Billion US Dollar**.** This saving helps reduce the fiscal deficit and reallocate budget resources to other priorities of public expenditure. Part of this saving can be used to compensate low-income population and design transfer programs to mitigate the short term negative effect for the subsidy reform. Kotagama and Boughanmi (2016) estimated with a partial equilibrium model report that the cost saving for Oman from removing partially the energy subsidy amounts to 419 million US dollars, which is substantially greater than the incremental transfer required to bring poverty to base line.

Table 6 shows various indicators in relation to private household welfare. As expected the price index for private consumption expenditure will increase by (4.13%) as a result of the increase in the price of energy products. The increase in the price index leads to the reduction in private expenditure (2.7%), reducing therefore the domestic consumption of energy. The combination of the above effects will lead to a reduction in household welfare by 3.89% as real per capita income declines by (3.95%). This is expected as subsidies constitute a proportionally important part of the real income of most households. It is noted that these negative effects on household welfare is expected in the short run as inflation raises. However, in the medium and long run, lifting subsidies would have a positive effect on efficiency and growth leading to increase in per capita income and employment[21]. Our results albeit with higher magnitude were compatible with other results reported in similar studies. For example Siddig et al. (2013) found for the case of Nigeria that removing fuel subsidy by 50% induce a reduction in real income of all household types by an amount ranging from 0.2 to 1.2%. Griffin et al. (2016) estimated for Egypt that the impact of the 2014 subsidy reform would result in a fall of real consumption (welfare measure) by 1.4% without transfers to the poorer and 1% with transfers. The reform would also reduce the budget deficit by 21% and increase investment by a substantial 13%.

Table 6: Economic Impact on Real GDP and Government Saving in Oman

| | Percent Change from Base (Monetary Change, Million US dollar) |
|---|---|
| Real GDP | 0.62 (415) |
| Government Saving | 102.33 (2971) |
| Price Index for Private Consumption Expenditure | 4.13 |
| Private consumption expenditure | -2.78 |
| Per capita utility from private expenditure | -3.89 |
| Real per capita income | -3.95 |

Source: MyGTAP Results

***Impact on Household Income***

Table 7 indicates that the income of all regional households decline following the reduction in energy subsidies. The decrease in income is highest for Al-Sharqiah household (-3.26%) and

that even though employment and capital in most years fall relative to the base line levels, Real GDP increases." The authors' results show that in the final year real GDP increases by 1% relative to the baseline with efficiency gains accounting for more than 100% of the additional GDP gain.

[21] Efficiency gains are obtained as companies would rely more on efficient technologies to address the increase in energy prices.

lowest for Dhofar household (-2.33%). The decrease in real income is explained by the increase of the overall price index. Other studies using CGE framework have found similar results in relation to the welfare effects of subsidy reforms. For example Solayman et al. (2013) found that the subsidy reform in Malaysia would lead in the short run to a decrease in aggregate household consumption and an increase in the poverty level. Rural households are the mostly affects groups.

Table 7: Impact on household income (%).

| Regiona household | % change |
|---|---|
| Muscat | -3.01 |
| Al Batinah | -3.12 |
| Musandam | -2.84 |
| Al Dhahirah | -2.48 |
| Adakhiliyah | -2.94 |
| Asharqiyah | -3.26 |
| Al Wusta | -2.91 |
| Dhofar | -2.33 |

Source: MyGATAP results

***Effect on Overall Income Inequality:***

The CGE framework can be considered as an ideal tool in analyzing Energy subsidy reforms on income inequality. Due to data limitation the Gini coefficient and the Hoover index figures presented below captures only the inequality between household groups. The Hoover index is the simplest of all inequality measures. The multiplication of the Hoover index with the sum of all resources (i.e. income) directly yields the share of all resources that would have to be redistributed until a state of perfect equality is reached. Table 8 shows that the base Gini Coefficient and Hoover index are about 0.23 and 0.17 respectively indicating that income inequality in Oman is low compared to many other countries. We calculated these base values using the total income and population of 8 types of household from Oman Income and Expenditure Survey 2011. The simulation results show that income inequality slightly decreases with the reduction in energy subsidies, somehow reducing the gap between household incomes. As household income is defined by region, the decrease in the Gini coefficient would suggest a decrease in regional income disparity.

Table 11: Effect on Overall Inequality in Oman

| | Gini Coefficient | Hoover |
|---|---|---|
| Base Index | 0.2347 | 0.175 |
| Simulated index | 0.2344 | 0.1748 |

Source: MyGTAP Results

## 7. Conclusion

This paper uses MyGTAP framework to analyse the macro, welfare and distributional effects of the energy subsidy reform in Oman. This framework is useful to separately identify the government and the household income and expenditure flows, and provide the possibility to integrate multiple households in the analysis. We disaggregated the regional household of the

Standard GTAP into 8 households based on province incomes and analysed a subsidy reform scenario by which the government reduces household subsidies for fuel, natural gas and electricity by 50%. Results indicate that the real GDP increases by a small 0.68% while the government budget income/ saving would increase by 2.1 billion US dollars. However the reform would reduce private expenditure by 2.7% and real per capita income by 3.95%. Income of all household types declined following the reduction in energy subsidies with the highest decrease witnessed in Al-Sharqiah region (-3.26%) while the lowest in Dhofar region (-2.33%).The effect on the Gini coefficient is however very small showing little sensitivity of income inequality to the subsidy reform. Based on the above results and as suggested by numerous other studies, the overall policy implication is that energy subsidy reform should go hand in hand with policies to address the short term negative household welfare effects. Part of the government significant cost saving as shown in this study would serve to support the design of well-targeted safety net measures addressed to low-income population.

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