Removing Fossil Fuel Subsidies to Help the Poor

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Abstract

Phasing out energy subsidies may increase the price of energy and adversely affect the poor. However, the households may benefit from the redistribution of the revenue from this policy in the economy. Here, we investigate the impacts of phasing out energy subsidies and direct transfer of the policy revenue to households. Employing a Computable General Equilibrium model, we measure the impacts on labor-leisure choice and on labor supply. Considering the Foster-Greer-Thorbecke index and the Food Ratio Method, we construct several poverty indices: the Gini index, the ratio of none-food expenditures to food expenditure, the ratio of income of the richest decile to the poorest decile, and the ratio of income of the two richest deciles to the two poorest deciles. We analyze the effects of an increase in energy prices and direct transfer of revenues to the households in the Iranian economy. The findings suggest a considerable improvement in income distribution and a significant improvement in food to non-food ratio. The results also show an improvement in rural-urban income distribution.

Keywords: food security; income distribution; poverty; computable general equilibrium

INTRODUCTION

Several studies employ different approaches to evaluate the benefits from phasing out these subsidies in various countries (Araghi and Barkhordari, 2012; Aydın, 2016; Burniaux and Chateau, 2014; Dartanto, 2013; Dennis, 2016; Mirshojaeian Hosseini et al., 2015; Ouyang and Lin, 2014; Rentschler, 2016; Roos and Adams, 2019; Shahmoradi and Honarvar, 2008; Solaymani and Kari, 2014; Wang et al., 2016; Wesseh Jr et al., 2016). This study will focus on income distribution.

Since 2010, the government decided to remove fossil fuel subsidies and pay the revenue to the households in direct cash transfers. The goal of this policy was to replace energy subsidies with targeted cash payments. One of the most important goals was to achieve a more equitable distribution of income and to reduce poverty. It was expected that the cash subsidy will be more effective for the poor. This paper will numerically evaluate the impacts on income distribution and poverty. The poor may have higher purchasing power from cash transfers, while the rich may face a reduction in real income. However, the overall impacts on income are not clear without numerical calculations.

The policy affects income distribution and poverty through several channels. On one hand, cutting subsidies may increase the effective price of commodities and may reduce the purchasing power of the households. On the other hand, cash subsidy payment may raise nominal income but may reduce the supply of labor. The basis of this theory is the labor-leisure choice model. According to this model, individuals must make two key labor supply decisions; whether to work (participate in the labor market); and how much to work. Each individual maximizes a utility function subject to an income budget constraint (labor and non-labor income). Examples of non-labor income are an inheritance, a lottery prize, investment income, or a government transfer payment such as cash subsidy. Suppose that an individual obtains a new source of non-labor income; for example, cash subsidy in our study. It would cause the income budget to shift. In this case, the individual chooses to be at a higher level of utility, more leisure time and a decrease in labor supply. So, a key theoretical prediction is that the supply of labor may decrease when non-labor income increases (Mulligan, 2002). However, as the prices may increase due to the energy policy, the real income may change.

This study employs a computable general equilibrium model (CGE) to quantify the impacts. Employing a Computable General Equilibrium model, we measure the impacts on labor-leisure choice and labor supply. Considering the Foster-Greer-Thorbecke index and the Food Ratio Method, we construct several poverty indices: the Gini index, the ratio of none-food expenditures to food expenditure, the ratio of

income of the richest decile to the poorest decile, and the ratio of income of the two richest deciles to the two poorest deciles. We analyze the effects of an increase in energy prices and direct transfer of policy revenues to the households in the Iranian economy.

The rest of the paper is organized as follows. The second section introduces the method and presents the algebraic features of the model and the data used. Section three presents the results. Section four provides discussions and limitations. And section five concludes.

METHODS

There are several related studies based on CGE modeling in Iran (Farajzadeh and Bakhshoodeh, 2015; Gahvari and Taheripour, 2011; Gharibnavaz and Waschik, 2015; Jafari et al., 2014; Jensen and Tarr, 2003; Karami et al., 2012; Manzoor et al., 2012, 2010; Shahnoushi et al., 2012). The core part of our model is developed in a team of economists and is employed for a wide range of analysis. The model considers interactions between different activities, households, and agents through numerous markets of goods, services, and factors of production (Manzoor et al., 2009, 2010; Shahmoradi et al., 2011; Manzoor et al., 2012). For income distribution, we consider 10 income deciles for each urban and rural households (Haqiqi and Mortazavi Kakhaki, 2012; Mortazavi Kakhaki et al., 2013; Haqiqi et al., 2014, 2017b). Regarding capital input, we assume a sector-specific capital as well as a mobile capital (Manzoor et al., 2013; Haqiqi et al., 2013b; Haqiqi and Mirian, 2015). As fossil fuel sector has significant role in the Iranian economy, we considered the revenue of fossil fuel resources and its flow in the economy (Haqiqi et al., 2013a; Manzoor and Haqiqi, 2012). We also considered the interconnections to international markets via exports and imports (Haqiqi and Bahador, 2015; Haqiqi and Bahalou Horeh, 2013). We also considered sectoral energy demand as well as sectoral production support by the government (Manzoor et al., 2011; Manzoor and Haqiqi, 2013; Haqiqi et al., 2017a). For labor supply we consider a leisure-labor optimization problem by income level (Haqiqi and Bahalou, 2015; Bahalou and Haqiqi, 2016). Each household has an initial endowment of labor. Households' utility optimization determines the demand for each commodity and supply of labor. Here we only describe the labor-leisure choice of the model. The optimal of consumption and leisure is obtained from:

$$MaxU_h = \left(\omega_{c,h}^{\frac{1}{\chi_h}} . C_h^{\frac{\chi_h - 1}{\chi_h}} + \omega_{z,h}^{\frac{1}{\chi_h}} . Z_h^{\frac{\chi_h - 1}{\chi_h}} \right)^{\frac{\chi_h}{\chi_h - 1}}$$

$$s.t.\ TE_h = Z_h + L_h$$

$$C_h = (1 - s_h)(w.L_h + r.K_h)$$

where U is utility of h household, C is consumption of goods and services, Z is leisure, TE is the index of household's time endowment, L is labor, r is the rate of return of capital, K shows the capital stock of households, ω is the share parameter, w is wage of labor force, and s is saving rate. The optimum labor supply and leisure time will be:

$$D_{z,h} = \omega_{z,h} WL\ \bar{E}_h \left(\frac{\left(\omega_{c,h} CPI_h^{1-\chi_h} + \omega_{z,h} PZ_h^{1-\chi_h} \right)^{\frac{1}{1-\chi_h}}}{PZ_h} \right)^{\chi_h}$$

$$D_{c,h} = \omega_{c,h} WL\ \bar{E}_h \left(\frac{\left(\omega_{c,h} CPI_h^{1-\chi_h} + \omega_{z,h} PZ_h^{1-\chi_h} \right)^{\frac{1}{1-\chi_h}}}{CPI_h} \right)^{\chi_h}$$

We construct various poverty indicators based on FGT (Foster et al., 2010, 1984) with an α parameter. The higher the value of α, the greater the weight on the poorest individuals. An increase in the FGT statistic, means more poverty is in an economy. In this study, we've applied decile information instead of individuals to construct the index. The income of each urban and rural decile separately is derived from the model solutions of this study. To calculate FGT indices, we need poverty line information. In this study, we use the absolute poverty that is measured based on the subsistence costs method. We use the data of the Statistical Center of Iran based on the daily minimum caloric requirement of each person. For non-food costs, we use the Angel method. (Table 1)

Table 1: Poverty line estimation for urban and rural annual income in 2010 in US dollar

# People in Household	1	2	3	4	5	6	7
Urban	2642	4428	5487	6339	7028	7534	8920
Rural	1312	2396	3287	3910	4549	4973	6215

According to the average of household's size which is reported by the Statistical Center of Iran and table 1, we calculated a poverty line for urban and rural households in 2010. Then we used the "the share of current cost" for calculating the poverty lines for 2004 (the benchmark for the data base). It means, we divided "poverty line of 2010" by "annual cost of households in 2010" to calculate the 2004 poverty line. Then we multiply this share by the income of deciles. At last, we calculated the poverty line in 2010 for urban household $6,404 and for rural $2,029. With $\alpha = 0$, the formula of FGT indices reduces to the headcount ratio. It shows the fraction of the population of the economy that lives below the poverty line. With $\alpha = 1$, the formula indicates the poverty gap index which estimates the depth of poverty by considering how far the poor are from that poverty line. We also use $\alpha = 2$ version, which is the lowest parameter to weigh income inequality along with poverty. We also consider other metrics including the income ratio of the richest decile to the poorest decile, the ratio of none-food expenditures to food expenditures, and the Gini Index.

Data

The model is calibrated based on the 2004 Micro Consistent Matrix (MCM) of the Iranian economy. This matrix is a rectangular form of Social Accounting Matrix which includes 56 commodities and production sectors, rural and urban households by income deciles.

Policy scenario

In this study, we use the proposed scenario of an increase in the energy prices and payment of cash subsidies in the Iranian economy. We assume that energy prices have changed according to table 2. The prices on table 2 are according to the first phase of the Iranian fossil fuel pricing reform in 2010.

Table 1: Increase in Energy Prices in 2010 (USD)

	Old Price	New Price	Change Percentage
Electricity	0.159	0.393	148%
Gas (Pipe)	0.109	0.578	432%
Gasoline	0.962	3.846	300%
Kerosene	0.159	0.962	506%
Gas oils	0.159	1.442	809%
Fuel oils	0.091	1.923	2005%
Liquid gas (LPG)	0.028	1.923	6797%

Some calculations are required for scaling cash subsidies to use them in our model. For calculating each deciles cash subsidy, we use the annual cost of each decile. In other words, we've included subsidy as "the

share of current cost" in the calculations. In the policy, all households were given a monthly cash transfer of about $44 per person as a subsidy. It means $528 is paid per person each year. Since the household size is different in rural and urban deciles, the amount of subsidy in each decile is calculated. The policy has been implemented in the middle of 2010. Therefore, Surveys of Household Expenditure and Income in 2010 are biased by having part of the effects. Note that the Iranian calendar is different from the Western calendar, by having the first day of spring as the first day of the year. To separate the cost of energy shock, we assume the cost structure of households was like the 2009 structure. Then, this index is adjusted by the average inflation in the first 9 months in 2010 and the cost in 2010 is calculated without considering the policy (Table 3). In the end, we calculate the ratio of subsidy to cost per households in each decile. You will see these calculations on table 3 for urban deciles and on table 4 for rural deciles.

Table 3: Inflation rates and partial adjustments

	Rural	Urban
Index of Inflation in Feb.2010	285.15	71.89
Index of Inflation in Nov.2010	324.13	81.59
Index of Inflation in Feb.2011	390.52	88.83
Inflation in nine months	13.67%	13.49%
Inflation in 12 months with considering the policy	36.95%	23.56%
Inflation in 22 Dec.2009 to 20 Mar.2010	20.48%	8.87%
*Inflation in 12 months without considering the policy	18.22%	17.99%

Source: Authors calculations based on the Central Bank of Iran

Table 4: The Ratio of cash subsidy to cost of each household for urban deciles

Urban income deciles	Households size	The Ratio of cash subsidy in the expenditure of each household
1	2.79	61%
2	3.53	42%
3	3.73	34%
4	3.71	28%
5	3.87	25%
6	3.90	21%
7	4.08	18%
8	4.05	15%
9	4.06	12%
10	4.11	7%
Average	**3.78**	**18%**

Source: Authors calculations

Table 5: The Ratio of cash subsidy to cost of households for rural deciles

Urban income deciles	Households size	The Ratio of cash subsidy in the expenditure of each household
1	2.57	119%
2	3.41	79%
3	3.98	68%
4	4.08	55%
5	4.23	47%
6	4.41	41%
7	4.60	35%
8	4.73	29%
9	4.99	24%
10	5.37	14%
Average	**4.24**	**33%**

Source: Authors calculations

RESULTS

The results suggest an improvement in all poverty indicators. The headcount ratio for urban poor households will remain constant. However, this ratio for the rural poor household is decreased from 0.40 to 0.30. Also, the poverty gap in urban households decreases from 0.12 to 0.09, a 26.85% reduction. And in rural households, we see a 37.59% percent decreases. In other words, on average 26.85, percent of urban households and 37.59 percent of the rural households have become above the poverty line after the policy. In addition, FGT2 shows a 44.66 percent reduce (improvement) in poverty for urban deciles and it shows 52.20 percent reduction for rural households.We find that the policy causes a decline in the purchasing power of the rich as expected, and a rise in the purchasing power of the poor. This is presented in table 6.

Table 6: Percentage of changes in purchasing power after the policy

Deciles	rural	urban
10	-7.10%	-5.60%
09	-5.40%	-2.10%
08	-4.30%	0.00%
07	-3.20%	2.20%
06	-2.10%	4.90%
05	-0.40%	7.10%
04	0.80%	10.70%
03	3.00%	16.40%
02	7.50%	21.10%
01	17.10%	41.00%

Source: research findings

After implementing the policy, the purchasing power of two rich deciles (1&2) for rural households will decrease. Also, the purchasing power of six top deciles (rich) for urban households is declined, and the purchasing power of others will rise. The result reveals that the percentage of improvement in purchasing power for rural households is more than the percentage of improvement in purchasing power for urban households.

We also report the changes in labor supply after phasing out fossil fuel subsidies. As shown in table 7, labor supply will decline with the highest decline for the poorest rural households (they face the highest rise in purchasing power). This is surprising but in line with the reports by the Statistical Center of Iran (2014).

Table 7: Percent Change in labor supply for urban and rural households after the policy

deciles	Urban	Rural
1	-35.30%	-66.50%
2	-24.30%	-43.80%
3	-19.50%	-37.80%
4	-16.70%	-31.10%
5	-15.20%	-26.80%
6	-13.20%	-23.80%
7	-11.80%	-20.60%
8	-10.20%	-17.60%
9	-8.80%	-15.10%
10	-6.20%	-10.20%

Source: research findings

Table 8 summarizes other metrics. The income ratio of the riches to the poorest decile is decreased in both rural and urban households. As shown in table 9 this decline in rural households is more than urban households. The ratio of none-food expenditures to food expenditures is increased (Increasing in this ratio probably means that the people become richer and because of that the ratio of food cost is falling in their basket). Usually, when this ratio is increasing, it shows an improvement in the welfare level. The Gini index decreases for both rural and urban households.

Table 8: Indices of the income distribution

Income Distribution Indices	Rural		Urban	
	Before	After	Before	After
Share of 10% of the poor	0.0203	0.0283	0.0297	0.0361
Share of 10% of the rich	0.3291	0.3039	0.2937	0.2801
The richest decile to the poorest decile	16.20	10.71	9.87	7.75
Share of 20% of the poor	0.0496	0.0637	0.0633	0.0735
Share of 20% of the rich	0.5023	0.4710	0.4646	0.4471
The ratio of non-food to food expenditure	5.611	5.883	8.898	9.301
Gini Index	0.4358	0.3922	0.4037	0.3774

The results for FGT is reported in table 9. According to the FGT index, poverty may improve when the ratio of food cost in total consumed the cost of household reduces. This index shows a slightly decrease in the ratio of food from 0.101 to 0.097 (with considering 3 decimal digits) for urban household and for rural households it also shows a slightly decrease from 0.151 to 0.145 (with considering 3 decimal digits).

Table 9: Poverty Indices

Poverty Index	Urban, Base	Urban, After the Policy	Rural, Base	Rural, After the Policy
FGT(α=0)	0.40	0.40	0.40	0.30
FGT(α=1)	0.12	0.09	0.17	0.11
FGT(α=2)	0.04	0.02	0.09	0.04
Angel theory	0.101	0.097	0.151	0.145

DISCUSSION

In this research, we find a possible decrease in labor supply after the policy. Without considering this change, the distributional analysis of the policy will be biased. Considering the impact on labor supply is one of the contributions of this study. Multi-sector approach and analysis of the direct and indirect effects of the policy are also the strengths of this research. However, each study has its own limitations. Here are the limitations of this study.

We employed income deciles in this study, a more precise approach would be the use of household surveys data. After the policy, some households may move up or down of the poverty line. Here we did not consider such dynamics.

According to the results of this study, we realize that the policy has the potential to improve income distribution and poverty. Several factors may prevent it. Trade sanction and the way of financing the government budget deficit are an example of those factors. We didn't consider the effects of the government's budget deficit and trade sanctions. The way of financing of government budget deficit could affect the inflation and prices and it can change the purchasing power of households

CONCLUSION

We employ a CGE model with 56 commodities and production sectors as well as urban and rural households. We also considered a trade-off between consumption and leisure. The multi-sector approach of the CGE model and the rich details on goods and services help us to consider the effects of the policy on purchasing power and income distribution. Using this multi-sector, multi-household computable general equilibrium model, we analyze the impact of an energy price increase and direct cash subsidy transfer on purchasing power, labor supply, the demand of food, poverty indices and income distribution of urban and rural deciles in Iran. The results show that while the policy may reduce the supply of labor, it improves income distribution and poverty in Iran. Therefore, we found that this policy has the potential to improve income distribution and poverty.

REFERENCES

Araghi, M.K., Barkhordari, S., 2012. An evaluation of the welfare effects of reducing energy subsides in Iran. Energy Policy 47, 398–404.

Aydın, L., 2016. Potential economic and environmental implications of diesel subsidy: A computable general equilibrium analysis for Turkey. Int. J. Energy Econ. Policy 6, 771–781.

Bahalou, M., Haqiqi, I., 2016. A General Equilibrium Model with Labor-Leisure and Domestic-Abroad Choice for Assessment of Labor Migration in a Small Open Economy. University Library of Munich, Germany.

Burniaux, J.-M., Chateau, J., 2014. Greenhouse gases mitigation potential and economic efficiency of phasing-out fossil fuel subsidies. Int. Econ. 140, 71–88.

Dartanto, T., 2013. Reducing fuel subsidies and the implication on fiscal balance and poverty in Indonesia: A simulation analysis. Energy Policy 58, 117–134.

Dennis, A., 2016. Household welfare implications of fossil fuel subsidy reforms in developing countries. Energy Policy 96, 597–606.

Farajzadeh, Z., Bakhshoodeh, M., 2015. Economic and environmental analyses of Iranian energy subsidy reform using Computable General Equilibrium (CGE) model. Energy Sustain. Dev. 27, 147–154.

Foster, J., Greer, J., Thorbecke, E., 2010. The Foster–Greer–Thorbecke (FGT) poverty measures: 25 years later. J. Econ. Inequal. 8, 491–524.

Foster, J., Greer, J., Thorbecke, E., 1984. A class of decomposable poverty measures. Econom. J. Econom. Soc. 761–766.

Gahvari, F., Taheripour, F., 2011. Fiscal reforms in general equilibrium: theory and an application to the subsidy debate in Iran. BE J. Econ. Anal. Policy 11.

Gharibnavaz, M.R., Waschik, R., 2015. Food and energy subsidy reforms in Iran: A general equilibrium analysis. J. Policy Model. 37, 726–741.

Haqiqi, I., Aghanazari, H., Sharzei, G., 2013a. Natural Resources Revenue Allocation: A Dynamic General Equilibrium Approach. University Library of Munich, Germany.

Haqiqi, I., Bahador, A., 2015. Investigating Economic Effects of Oil Export Reduction: A Financial Computable General Equilibrium Approach. University Library of Munich, Germany.

Haqiqi, I., Bahalou Horeh, M., 2013. Macroeconomic Impacts of Export Barriers in a Dynamic CGE Model. J. Money Econ., Journal of Money and Economy 8, 117–150.

Haqiqi, I., Bahalou, M., 2015. A General Equilibrium Analysis of Unskilled Labor Entry and Skilled Labor Exit in Iran. University Library of Munich, Germany.

Haqiqi, I., Bahalou, M., Hamidi, R., 2014. Measurement and Evaluation of Equality of Opportunity: A Numerical Look at Education, Health, and Income Inequality. University Library of Munich, Germany.

Haqiqi, I., Bahalou, M., Shamsaee, A., 2017a. An Economic General Equilibrium Model for Evaluation of Production Support Policies in Developing Countries. University Library of Munich, Germany.

Haqiqi, I., Manzoor, D., Aghababaei, M., 2013b. Impacts of Electricity Efficiency Improvements on Factors Market: A Computable General Equilibrium Approach. University Library of Munich, Germany.

Haqiqi, I., Mirian, N., 2015. A Financial General Equilibrium Model for Assessment of Financial Sector Policies in Developing Countries. University Library of Munich, Germany.

Haqiqi, I., Mortazavi Kakhaki, M., 2012. The Impact of Redistribution of Opportunities on Income Inequality: A CGE Approach. University Library of Munich, Germany.

Haqiqi, I., Shahi, Z., Ismaili, M., 2017b. Impact of Cash Subsidy Transfer in a Nonlinear Programming Model for Economic Input-Output Analysis. University Library of Munich, Germany.

Jafari, S., Bakhshi Dastjerdi, R., Moosavi Mohseni, R., 2014. Studying the Effects of Non-Oil Exports on Targeted Economic Growth in Iranian 5th Development Plan: A Computable General Equilibrium Approach. Iran. J. Econ. Stud. 3, 111–130.

Jensen, J., Tarr, D., 2003. Trade, exchange rate, and energy pricing reform in Iran: Potentially large efficiency effects and gains to the poor. Rev. Dev. Econ. 7, 543–562.

Karami, A., Esmaeili, A., Najafi, B., 2012. Assessing effects of alternative food subsidy reform in Iran. J. Policy Model. 34, 788–799.

Manzoor, D., Aghababaei, M., Haqiqi, I., 2011. Rebound Effects Analysis of Electricity Efficiency Improvements in Iran: A Computable General Equilibrium Approach. University Library of Munich, Germany.

Manzoor, D., Haqiqi, I., 2013. Impacts of Energy Price Increase and Cash Subsidy Payments on Energy Demand. University Library of Munich, Germany.

Manzoor, D., Haqiqi, I., 2012. Impact of Energy Price Reform on Environmental Emissions; A Computable General Equilibrium Approach. University Library of Munich, Germany.

Manzoor, D., Haqiqi, I., Aghababaei, M., 2013. Economic Impacts of Investment in the Electricity Industry: A CGE Comparison of Regulated and Free Markets. University Library of Munich, Germany.

Manzoor, D., Shahmoradi, A., Haqiqi, I., 2012. An analysis of energy price reform: a CGE approach. OPEC Energy Rev. 36, 35–54.

Manzoor, D., Shahmoradi, A., Haqiqi, I., 2010. An Assessment of the Impact of Reducing Implicit and Explicit Energy Subsidies in Iran; Using a Computable General Equilibrium Model Based on a Modified Micro Consistent Matrix. University Library of Munich, Germany.

Manzoor, D., Shahmoradi, A., Haqiqi, I., 2009. An Analysis of Energy Price Reform: A CGE Approach, in: IEW. Presented at the International Energy Workshop, Venice, Italy.

Mirshojaeian Hosseini, H., Majed, V., Kaneko, S., 2015. The Effects of Energy Subsidy Reform on Fuel Demand in Iran. J. Money Econ. 10, 23–47.

Mortazavi Kakhaki, M., Haqiqi, I., Mahdavi Adeli, M., 2013. Regional Equality of Opportunities and Income: A General Equilibrium Modeling for Iran. University Library of Munich, Germany.

Mulligan, C.B., 2002. A century of labor-leisure distortions. National Bureau of Economic Research.

Ouyang, X., Lin, B., 2014. Impacts of increasing renewable energy subsidies and phasing out fossil fuel subsidies in China. Renew. Sustain. Energy Rev. 37, 933–942.

Rentschler, J., 2016. Incidence and impact: The regional variation of poverty effects due to fossil fuel subsidy reform. Energy Policy 96, 491–503.

Roos, E., Adams, P., 2019. The Economy-Wide Impact of Subsidy Reform: A CGE Analysis.

Shahmoradi, A., Haqiqi, I., Zahedi, R., 2011. Impact Analysis of Energy Price Reform and Cash Subsidy Payment in Iran: A CGE Approach. University Library of Munich, Germany.

Shahmoradi, A., Honarvar, A., 2008. Gasoline subsidy and consumer surplus in the Islamic Republic of Iran. OPEC Energy Rev. 32, 232–245.

Shahnoushi, N., Danesh, S., Daneshvar, M., Moghimi, M., Akbar, B., 2012. Welfare and environmental quality impacts of green taxes in Iran: A computable general equilibrium model. Afr. J. Bus. Manag. 6, 3539–3545.

Solaymani, S., Kari, F., 2014. Impacts of energy subsidy reform on the Malaysian economy and transportation sector. Energy Policy 70, 115–125.

Wang, Y., Almazrooei, S.A., Kapsalyamova, Z., Diabat, A., Tsai, I.-T., 2016. Utility subsidy reform in Abu Dhabi: A review and a Computable General Equilibrium analysis. Renew. Sustain. Energy Rev. 55, 1352–1362.

Wesseh Jr, P.K., Lin, B., Atsagli, P., 2016. Environmental and welfare assessment of fossil-fuels subsidies removal: A computable general equilibrium analysis for Ghana. Energy 116, 1172–1179.