Energy Policy 79 (2015) 177–188

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

The effects of the energy price reform on households consumption in Iran

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HIGHLIGHTS

- The effectiveness of the recent energy price reform in Iran is analyzed.
- Energy demand elasticities for households in different income groups are estimated.
- A two-stage optimization model was applied to estimate the system of equations using micro-data for 2001–2008.
- The price elasticities are small and income elasticities rather large, but responses are heterogeneous.
- A price and non-price reform policy package is needed for different income groups and regions.

ARTICLE INFO

Article history:
Received 9 September 2014
Received in revised form
6 January 2015
Accepted 8 January 2015
Available online 24 January 2015

Keywords:
Energy
Price reform
Subsidies
Elasticity
Households
Iran

ABSTRACT

The substantial subsidizing of energy prices over the years has led to high energy consumption, inefficiencies, fiscal pressures, and environmental problems in Iran. To address the increasing socio-economic problems associated with the energy subsidies, the government embarked on an aggressive energy price reform through which energy subsidies were removed and cash handouts were given to all households in 2010. In this paper, I analyze the effectiveness of the energy price reform in Iran by estimating energy demand elasticities for households in different income groups. I apply a two-stage consumer optimization model and estimate the system of energy expenditures shares using the household budget survey data for the period 2001–2008. The results show that the overall price elasticities of demand are small, but income elasticities are close to one. The results also indicate heterogeneous responses to energy price and income changes in different income groups. Specifically, the urban households show stronger response to price changes, but rural households, particularly mid-income households, to income changes. These findings suggest that the current policy of price increases would not solely be able to reduce energy consumption and, therefore, it should be geared towards increasing energy efficiency through a series of price and non-price measures.

1. Introduction

Energy subsidies in developing countries, particular energy-rich countries, have recently been at the center of research in academia as well as the IMF, World Bank, and IEA (Guillaume and Zytek, 2010; Dube, 2003; Baig et al., 2007; Dartanto., 2013; IMF, 2008; World Bank, 2010; IEA, 2010, 2011). Energy subsidies tend to promote industrialization and diversification, avoid inflation and price volatility, and distribute resource income to the population (Fattouh and El-Katiri, 2013). However, the socio-economic costs of energy subsidies have proven significant and unsustainable. Energy subsidies have increased energy consumption growth along with energy intensity and inefficiency, crowded out social spending by government, reinforced inequality, thus making energy price reform inevitable (Lipton, 2013). Although priorities differ from one country to another, the main objectives of price reforms have been to curb energy consumption, ease fiscal pressure, and redistribute income to benefit the poor (Vagliasindi, 2012; Arze del Granado et al., 2012).

Energy price reform policies have faced many serious economic, political, and social challenges and setbacks in implementing countries, leaving outcomes unclear. One of the main difficulties with uniformly applied subsidies and price reforms is that households do not benefit equally from subsidies nor do they

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http://dx.doi.org/10.1016/j.enpol.2015.01.012
0301-4215/

respond similarly to price and income changes. Advocates of energy price reform implicitly or explicitly assume homogeneous and strong response to energy price changes by households.[1] Therefore, raising energy prices is viewed as an effective solution to the socio-economic problems associated with the energy subsidies. However, if household energy price elasticity of demand is low, particularly among households with the highest energy consumption, removing the subsidy may not have significant effect on energy consumption and the environment, although it would generate extra revenues for government and ease fiscal pressure.

Furthermore, the subsidy removal policy may be regressive as the expenditure share of energy will increase proportionally more in low-income households than high-income households (Zhang, 2011). To mitigate the effects of higher prices on household budgets and to improve income distribution, energy price reforms sometimes include compensatory payments to households. However, if the reform does not lead to significantly lower energy consumption and, at the same time, feeds into unfavorable macroeconomic conditions such as higher inflation and unemployment rates, the poor may not benefit. It is, therefore, important to estimate energy demand elasticities taking into account household heterogeneities to better assess the effectiveness of energy price reforms, especially those with the primary objective of curbing energy consumption.

In this study, I estimate the energy demand by households to shed light on the effectiveness on Iran's energy price reform, which focuses on increasing energy prices and distributing cash handouts. Previous studies that have estimated energy price elasticities in Iran have used aggregate time series data, or data for specific energy type in a specific area (Ahmdian et al., 2007; Zaranejad and Ghapanchi, 2007; Keshavarz Hadad and Mirbagheri Jam, 2007; Moshiri and Shahmoradi, 2005; Zavar, 2005; Lotfalipour and Bagheri, 2003). I contribute to the energy price reform literature by showing the significance of the heterogeneous effects of changes in energy prices and household income on energy consumption using a micro-model. Specifically, I estimate energy price and income elasticities for different energy services and different income groups in urban and rural areas using the household budget survey data over eight years (2001–2008). Although the period examined came prior to the subsidy reform of 2010, and the results, therefore, do not directly pertain to the 2010 reforms, they might be used to explain the disappointing post-reform outcomes in terms of energy demand in Iran.[2] As far I know, this is the first study to use large micro-data over a relatively long period to estimate the price and income elasticities of demand for electricity, natural gas, and gasoline by different income groups in urban and rural areas in Iran. Using the large micro-data over time has an advantage over the aggregate time series mainly because it allows for controlling heterogeneity in the household responses to price and income changes. This leads to more precise estimations.

The results show that energy demand is overall inelastic with respect to prices, but unit elastic with respect to income. Furthermore, there is a great heterogeneity in price and income elasticities across energy types and households. This implies that, although the energy price reform will increase government revenues significantly, it may not reduce energy consumption. These findings suggest that although subsidy removal is necessary for any energy price reform, it is by no means sufficient. Some complementary policies such as non-price reform policies are called for to encourage energy conservation and efficiency. The results of this study also provide valuable insights to other countries, particularly oil-exporting countries in the region that might consider an energy price reform but are concerned about its economic and socio-political impacts.[3]

1.1. A background on energy price reform in Iran

Iran, one of the major oil-exporting countries, is an energy-rich country with the world's 3rd and 2nd largest oil and natural gas reserves, respectively. However, its own rapidly growing energy consumption (about 6 percent per year over the past 30 years) has raised concerns about the country's ability to continue to export oil in the next decade. The main driving forces behind the rising trend of energy consumption are economic growth (5 percent over the past 40 years), population growth (about 2 percent), and heavily subsidized energy markets, costing the government about 12 percent of the GDP (Iran Energy Balance, 2010; Iran Central Bank). These, combined with poor management, lack of investment, and a large share of economic activities controlled by government have led to inefficient use of energy.

The energy intensity index in Iran has been rising on average by about 3.4 percent per year over the past 40 years. As Fig. 1 shows, it is 50 and 100 percent higher than that in the Middle East and European Union countries, respectively. Furthermore, the increasing cost of subsidizing energy prices over the years has burdened the government budget leading to macroeconomic imbalances and has degraded the environment. The direct energy subsidy has increased from 2 percent to 8 percent of the government budget since 2004. Energy consumption produced 480 million tons of CO_2-equivalent emissions in 2012, a figure that is expected to double by 2030 if the current trend continues (Moshiri et al., 2012). The high concentration of pollutants and the ensuing costs and risks, especially in high population density areas, have become a major concern to the public and to policy makers.

Problems posed by energy subsidies are more prominent in the case of gasoline consumption which receives one third of all energy subsidies. In 2010, gasoline was about 10 cents per liter, about one fourth of the Persian Gulf price and about one fifteenth of European prices. The very low price of gasoline has encouraged a high level of gasoline consumption in large urban areas, especially in Tehran. It has increased, on average, 10 percent annually from 2001 to 2008, reaching more than 70 million liters per day. It has also led to a high concentration of air pollutants along with other social and economic problems. To accommodate the rapid growth in gasoline consumption, the government drew on the Oil Reserve Fund to import about 40 percent of domestic consumption in 2007. This made Iran the second biggest gasoline importer in the world after United States.

In June 2007, the government instituted a gasoline rationing system to curb consumption. The rationing system allowed the owner of each private passenger car to purchase up to 30 l gasoline per month at the fixed price of $0.10 /l and $0.40/l above the quota. The rationing scheme did not have any significant effect on

[1] For instance, Guillaume et al. (2011) use a simple optimization model for a representative household, which results in an energy price elasticity of 0.25. They also calculate the amount of compensatory payment required to restore the utility level equal to 450,000 rials, which is exactly the same amount used in the Iranian energy price reform.

[2] The estimation sample does not cover the post-reform data since it is available only for one year and includes a lot of noises caused by political and economic shocks, which are difficult to isolate. Rising domestic political tensions as well as tightening sanctions on Iranian oil exports and financial system, particularly the Central Bank, by the UN, US, and EU members led Iranian currency (rial) to fall by about 3 times and inflation to jump to more than 40 percent. There are also concerns about the reliability of the data for the immediate post-reform period because of possible manipulations in the data processing system. One needs to wait at least for a few more years to be able to have a meaningful comparison between the pre- and the post-reform periods.

[3] The IMF study led by Clements (2013) and Gupta et al. (2000) reports many cases of energy price reform in developing countries.