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Welfare implication of reforming energy consumption subsidies ☆

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HIGHLIGHTS

- A model of energy subsidy reform with direct compensation is proposed.
- Feasibility of the reform is related to three key parameters.
- An illustrative example using data from the recent Iranian reform is discussed.

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ABSTRACT

Reforming energy consumption subsidies, in particular for fossil fuels, has been frequently referred to as a quick-win policy to enhance environmental mitigation. In addition, the removal of such subsidies may release a sizeable portion of a country's national budget for use on more productive targets. One of the most recognized challenges of such reform is "selling" the new energy prices to citizens, particularly those with a more fragile purchasing power. Several empirical and technical studies have prescribed that the reform might be supported by a direct compensation mechanism in order to ensure feasibility.

This is what was done during the recent energy subsidy reform in Iran. However, the compensation mechanism implemented in Iran's reform was successful at the beginning, but did not proceed as expected. This has raised questions about the feasibility and sustainability of the direct compensation mechanism, and even of the reform policy itself.

In this paper, we consider a stylized model where direct compensation is the instrument proposed to restore consumers' utility against increased energy prices. We find that, when prices of Other Goods are affected by the announced reform policy, the feasibility of a subsidy reform critically depends on the value of certain parameters: the initial subsidization rate, the share of energy in the consumers' bundle, and the energy portion of price of Other Goods.

1. Introduction

An energy subsidy is defined as any regulation or government action that lowers the price paid by energy consumers, lowers the cost of energy production or raises the income received by energy producers (IEA, 2015). Governments have been distributing subsidies through various actions, such as limits on market access or price, credit transfers, tax refunds or reductions, as well as trade restrictions. In this paper, we are focusing on subsidies that promote over consumption by reducing the price of energy paid by consumers.

Various voices have spoken out in favor of cutting or modifying energy subsidies. An important example is the 2009 Group of Twenty Summit, where major economies committed to "reduce fossil-fuel subsidies while preventing adverse impact on the poorest" (World Bank, 2010), a commitment that was emulated by Asia-Pacific Economic Cooperation leaders in the same year (Beaton et al., 2013). According to the 2014 *World Energy Outlook* (IEA, 2014), at least 27 countries among the 40 fossil-fuel-subsidized economies have implemented partial reforms. Although such claims for reform have been established, the International Energy Agency's (IEA) latest estimate (IEA, 2015) indicates that, in 2014, the amount of world subsidies directed to fossil-fuel consumption alone is around $493 billion. To offer a better understanding of the opportunity cost of such subsidies, this amount is more than four times higher than the amount of subsidies to renewable energies and four time higher than the amount invested globally to improve energy efficiency. According to an estimate by the International Monetary Fund (Clements et al., 2013), simply removing energy consumption subsidies could result in a 13% decline in worldwide CO_2 emissions.

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Governments' main motivation for implementing a subsidy reform, aside from environmental considerations, is to increase national welfare by eliminating the gap between domestic and reference energy prices. As such, one of the first issues that must be addressed by an administrative body is determining a target level of regulated prices after a reform. If the demand for energy is price elastic, the closer the current price approaches the reference price, the lower is the energy consumption in the domestic market, which both decreases national energy expenditures and mitigates local and global environmental damage. For instance, Pineau (2008) gives an example of a North American energy market where modifying regulated electricity prices could generate a substantial additional revenue, even if the consumption of low-income households were to remain almost unchanged. In the literature on carbon taxation, there are even more examples showing how redistributing the revenue of a reform may benefit low- and even middle-income citizens (see for instance Williams et al. (2014), who analyze the question for the U.S.; and Zhang and Baranzini (2004), who consider it more globally). Although the aforementioned publications document theoretical benefits from decreasing energy subsidies, there still exist several risk factors that may jeopardize the success of such a reform (see for instance Clements et al., 2013; Ellis, 2010).

One of the most important challenges is the implementation of a compensatory mechanism to win over the consumers (particularly from low-income households) to the reform. Indeed, in many energy-subsidized countries, the domestic prices of energy carriers are controlled directly by governmental bodies or their affiliated companies. In the absence of a competitive domestic market, cheap energy has been prevalently used for decades to foster public support, and such a persistent addiction can probably not be resolved without mitigating measures. For instance, El Katiri and Fattouh (2015) examine the situation and recent experiences in various energy-subsidized countries and advocate that subsidy reform be accompanied by enabling factors. Many researchers have suggested reinvesting the revenue derived from the reform into health care, education and green technologies, in order to increase national welfare (see for instance Laan and Beaton, 2010). In that way, the benefits of a subsidy reform is *anti*cipated to reach households, though probably with some delay. However, citizens are quite sensitive to energy pricing, and may not be sufficiently patient or confident to foresee the benefits of the policy makers' plan. Another classical recommendation (Clements et al., 2013) is to redistribute a portion of the reform revenue directly to needy households, in order to protect their fragile purchasing power. Still, challenges remain in how to target such households and how to provide them with their compensation.

As partially reflected by Ellis (2010), energy consumption subsidies are particularly prevalent in developing countries, where there is no reliable and updated information infrastructure about household income. In addition, discrimination in compensatory payback may induce citizens to understate their income, or even provoke them into positioning themselves against the reform. In that context, a convenient solution may be a lump-sum direct deposit to all consumers, as proposed by Jensen and Tarr (2003). They claim, after studying the case of Iran, that even if the reform revenue was redistributed equally among households, the average welfare would increase considerably. This claim was put to the test in the ambitious reform launched by Iran in December 2010, when the most energy-subsidized economy at that time decided to dramatically adjust its low-priced energy carriers. To avoid making the millions of low-income households suffer from this reform, the government committed to a direct deposit to all households, a provision that was also endorsed by international organizations (Moshiri, 2015). The reform was accepted peacefully by all income classes, beyond even the most optimist predictions. However, after a smooth beginning, a number of difficulties were encountered, and consequently, the second phase of the reform was temporarily postponed. These difficulties, ranging from an excessively large national budget deficit to extraordinary inflation and devaluation shocks, were not solely attributable to the reform (as reported in Moshiri, 2015, international sanctions played a significant role in destabilizing the economy after the reform), but still raised some significant doubts about the prescribed compensatory mechanism.

In this paper, we explore the net welfare effect of an energy subsidy reform using such a compensatory mechanism. Using a stylized partial equilibrium model, we analyze the feasibility and optimality of a price-adjustment reform accompanied by a lump-sum cash payment to all consumers to compensate them for the increase in their energy cost. We study three different scenarios, distinguished by the pricing policy of the suppliers of Other Goods (OG). In the first scenario, the change in domestic energy price due to the reform does not have any effect on the price of OG. In the second scenario, we assume that the reform does not have a side effect on non-energy production costs, but does affect the energy component of the production cost of OG. In the third scenario, we expand the reform's side effect to include non-energy-based production costs.

Findings in the literature on the impact of removing an energy subsidy in countries such as Iran conclude that the net welfare effect is positive, although different methods and assumptions are applied. A first category of papers, as for instance Birol et al. (1995), focuses on the price of energy goods in the domestic market and does not consider any potential impact on the price of non-energy goods. The authors simply assume that any energy saved due to a price increase can be exported to the global market and therefore results in a positive national welfare. This corresponds to our first scenario. A second group of papers, for example Jensen and Tarr (2003) and Farajzadeh and Bakhshoodeh (2015), incorporate an extra supply cost from the other sectors, based on the direct share of energy in the production cost; that is, the price of OG and services increases as a result of the increase in the price of energy used for their production. This corresponds to our second scenario. Finally, Saboohi (2001) assumes that an increase in energy prices may result in an expectation of inflation in the transportation sector, and that therefore, OG prices may increase beyond the extra energy-based cost of production. This corresponds to our third scenario, where we assume that the reform has an inflationary side effect that is proportional to its severity. Our paper contributes to this literature by providing a simple unifying model where the various scenarios are characterized by parameter values.

We find that the net welfare effect of a reform is not necessarily positive when OG prices increase beyond the increase due to their energy content; We show how such an inflationary effect could result from market imperfections; We derive the required conditions for a reform to be feasible in that case, and we show that a feasible reform should not consist of removing all subsidies. Finally, our results are applied to the Iranian reform case.

The rest of the paper is organized as follows. Section 2 presents the stylized model used to represent an economy where the price of energy is subsidized (before and after a reform). The optimal reform ratio and the welfare implications of such a reform are analyzed under three contrasting scenarios in Sections 2.1, 2.2 and 2.3, while a motivating example for the third scenario to occur is provided in Section 2.4. An illustrative example using data from the Iranian reform in 2010 is provided in Section 3. Section 4 concludes. Analytical developments are provided in the Appendix.

2. Our model and its implications

There are several methods to address and quantify the impact of energy consumption subsidies. In this paper, similarly to