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Distributional effects of higher natural gas prices in Russia☆

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ABSTRACT

This paper analyses the distributional effects of eliminating the implicit subsidy on natural gas consumption in Russia. The analysis is based on a computable general equilibrium model with multiple households and a detailed power generation sector. It is found that using additional government revenues from higher domestic gas prices to increase the income of low- and middle-income households could improve the welfare of these households and alleviate income inequality in Russia, e.g., total private consumption of the poorest decile could increase by 3%. Nevertheless, the most efficient revenue-recycling policy would be to invest in the energy efficiency of buildings, which have the largest energy savings potential in Russia. In the long term, investing in the energy efficiency of buildings could reduce greenhouse gas emissions by 240 million tonnes of CO_2 equivalent per year and increase the welfare of low- and middle-income households, e.g., total private consumption of the poorest decile increases by 1%. It is also found that increasing the regulated domestic gas price could lead to windfall profits for non-Gazprom producers. Hence, to increase government revenues, the gas-price reform could be supplemented by an increase in the capital income tax in the gas sector.

1. Introduction

Domestic natural gas (hereafter: gas) prices are regulated in Russia and they are substantially lower than export netback prices (The Russian Government, 2010; Gazprom, 2015). For example, in 2015, the average domestic price for gas sold by Gazprom in Russia was approximately \$59/1000 m^3, whereas the average export netback price for gas exported to the Western Europe accounted for \$246/1000 m^3 (Gazprom, 2015). The regulation of domestic gas prices operates as an implicit subsidy. Although the Russian government has planned to increase the domestic price level in the long term (the Russian Government, 2010), the gas-price reform has been postponed for a long time because of increases in the oil price and the economic crisis.

Adverse income distributional effects and the loss in the competitiveness of energy-intensive industries are two main concerns related to an increase in gas prices in Russia. Because poor households spend a larger fraction of their income on gas, electricity, and heating, than rich households do, the poor are expected to be most adversely affected by an increase in energy prices. While subsidising the consumption of gas for poor households might be justified on the ground of income distribution, setting a low gas price for middle- and high-income households is very controversial. Moreover, the implicit gas subsidy implies a high efficiency cost, e.g., foregone export revenues. Increasing the regulated domestic gas price might raise substantial funds, which could be invested in energy efficiency. While having a large energy savings potential, in particular in residential and public buildings, the Russian economy certainly lacks private and public investments in energy efficiency. Nevertheless, it is unclear whether additional government revenues invested in energy efficiency would be sufficient to offset the adverse impacts on poor households. Increasing the domestic gas price could lead to windfall profits for non-Gazprom producers, meaning that the Russian government might not receive the entire profit resulting from higher gas prices. Moreover, higher domestic gas prices could induce significant impacts on factor income and prices of other commodities, as the Russian economy relies heavily on natural gas.

The objective of this paper is to analyse the distributional effects of eliminating the implicit gas subsidy in Russia. In many other similar studies (e.g., the literature on energy and environmental taxation), additional tax revenues are recycled into a reduction in distortionary taxes. In contrast, we compare two revenue-recycling policies, such as investments in the energy efficiency of buildings and transfers to low- and middle-income households. The results from policy simulations aim to shed light on how to design an optimal gas-price reform in Russia, which would encourage economic and energy efficiency, and, at the same time, would not exacerbate income inequality. Increasing energy efficiency and reducing emissions became even more important for Russia after it signed the Paris Agreement in 2016. Although this paper focuses on Russia and Russia's gas market, the results from our analysis

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could be relevant for many other countries that impose explicit or implicit energy subsidies, while having a large energy efficiency gap.

Because the gas sector plays an important role in the Russian economy, we need to take into account general equilibrium effects (e.g., changes in factor and output prices), which can be consistently depicted in a general equilibrium framework. Therefore, our analysis is based on a dynamic, multi-region, multi-sector computable general equilibrium (CGE) model. Due to a vital role of the power generation sector, which heavily relies on gas in Russia and hence plays an important role in determining the incidence of the gas-price reform, we calibrated our model around an electricity-detailed extension of Version 9 of the Global Trade Analysis Project (GTAP9-Power) database (Aguiar et al., 2016; Peters, 2016). Furthermore, we disaggregated the representative household into a government account and 10 household groups. We also estimated demand elasticities for gas in Russia by using a panel-data regression model. The remainder of the paper is organised as follows. Section 2 gives a brief literature review. Section 3 provides some statistics on income and consumption expenditures by Russia's private households. Section 4 reveals Russia's energy savings potential and associated investment costs. Section 5 gives a brief description of the model and database. Section 6 deals with the results from policy simulations and sensitivity analyses. The last section presents the study's conclusions and a number of policy recommendations.

2. Literature review

Income distributional effects of an energy price reform or price volatility could vary by type of fossil fuel and region. While gasoline taxation in low- and middle-income countries tends to be progressive (Sterner, 2012), an increase in the prices of coal and natural gas typically tends to have regressive redistributive effects, because coal and natural gas are used as heating fuels in power generation. The poor typically spend a larger share of its income on gas, coal, electricity, and heating, than the rich do. Ersado (2012), using aggregate energy consumption data and a nationally representative household survey, analysed the redistributive effects of an increase in import prices for natural gas in Armenia. He showed that the gas price hike led to a significant increase in energy expenditures by poor households. Krauss (2016), using a regression model, estimated the poverty and distributional effects of a natural gas tariff reform in Armenia. He also found that a uniform increase in the consumer price of natural gas in Armenia could be rather regressive. On the contrary, Stockfisch (2007) showed that higher natural gas prices would be roughly progressive in the USA, as middle- and high income households consume relatively more gas and electricity than the poor does. Heyndrickx et al. (2012), using a CGE model, conducted an impact assessment of Russia's incremental gas price reform. They found that an increase in gas prices in Russia would have a small adverse impact on income distribution among households, although they emphasise that revenue-recycling mechanisms have strong redistributive impacts. Orlov (2015) analysed an optimal gas pricing in Russia, and Orlov and Grethe (2012, 2014) and Orlov et al. (2013) analysed the economy-wide effects of carbon taxation in Russia, yet they did not explicitly investigate the income distributional effects of higher gas prices in Russia.

Many numerical studies on energy and environmental taxation emphasise the relevance of the tax revenue recycling. Increasing a tax on fossil fuels would generate government revenues, which might effectively alleviate a possible regressive impact on income distribution (Sterner, 2012). Additional government tax revenues could be spent elsewhere in the economy, e.g., to reduce a distortionary tax. For example, Williams et al. (2014) found that using carbon tax revenues to reduce capital taxes is efficient but regressive, whereas lump-sum rebates or reducing labour income taxes are less efficient but much more progressive revenue recycling strategies. Wang et al. (2016) in their literature review paper also emphasised the trade-off between efficiency and equity of carbon taxation. Felder and van Nieuwkoop

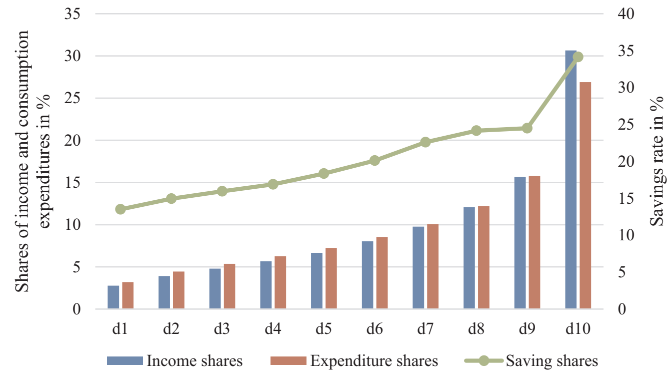

Fig. 1. Shares of income, consumption expenditures, and savings rate by income decile in 2015. d1, d2...d10 stand for income deciles, respectively.
Source: FSSS (2016)

(1996), using a static CGE model, found that adverse distributional effects of a carbon tax in Switzerland can be reversed when tax revenues are transferred to poor households in a lump-sum form or used to reduce the marginal labour income tax rate.

While there is extensive literature on the distributional effects of carbon taxation and gasoline taxation, there are only a few empirical and numerical studies that analyse distributional effects of higher natural gas prices. Furthermore, the existing literature on distributional effects of carbon and gasoline taxation typically focuses on the same revenue-recycling schemes, such as lump-sum transfers, labour and capital income taxes, while redistributive effects of using additional government revenues to invest in energy efficiency improvement has not yet been analysed. However, it is likely that for many economies that have a large energy efficiency gap it would be more rational to invest in energy efficiency instead of reducing pre-existing taxes. Feng et al. (2010) pointed out that carbon tax revenues could be used to fund large-scale retrofitting of households, yet they did not provide any numerical analysis on this revenue-recycling policy.

3. Income and expenditures

The Russian Federal State Statistics Service (FSSS) provides data on income and consumption expenditures by income decile, which represents 10% of the population each (FSSS, 2016). Fig. 1 reveals the shares of income and consumption expenditure, and savings rates by Russia's income decile in 2015. The first income decile (d1) represents the poorest 10% of the population, and the last income decile (d10) comprises the richest 10% of the population, respectively. For example, the poorest income decile of Russia's households received almost 3% of total income of all households in 2015, whereas the wealthiest income decline received approximately 31%. Consequently, rich households have larger consumption expenditures and a higher savings rate compared to low-income households.

The Russian economy is quite energy-intensive, heavily relying on gas consumption (Bashmakov, 2009; OECD/IEA, 2015). Thus, increasing the domestic gas price could have a significant impact on factor markets. The total income of households comprises income from labour, capital, and natural resources (i.e., resource rents). Fig. 2 shows the shares of factor income in total income by decile.[1] Approximately 57% of total income of the poorest income decile comes from unskilled labour, followed by skilled labour (41%) and capital (2%) (Rutherford et al., 2004). In contrast, the share of capital income in total income of the richest income decile is substantially larger, accounting for approximately 42%, while the shares of skilled and unskilled labour

[1] The factor income shares for Russia were estimated in 2004. Due to a lack of data, we use the same factor income shares, given the assumption that the structure of households' income did not change significantly.

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