Analysis of Fossil Fuel Subsidies in Kazakhstan

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1. Introduction and Objectives

During the last decades the topic of fossil fuel subsidies has been gaining importance in the policy discussion. International Energy Agency (IEA) (2011) estimates that the total global fossil fuel subsidies in 2010 amounted to $409 billion. Kazakhstan is energy-rich country with significantly high subsidies on fossil fuels. Fossil fuel subsidies are a distortion which causes inefficient use of energy and natural resources, high CO2 emissions, distort the energy markets, put pressure on the state budget, and hinder investments into energy sector and renewable energy and thus long-term sustainable development in Kazakhstan. Removing fossil fuel subsidies could be in the long-term beneficial for Kazakhstan.

The main research question is to analyze macroeconomic effects of removing current distortions in the energy market using the computable general equilibrium model (CGE), GTAP. The specific objectives are to understand the issue and the extent of fossil fuel subsidies in Kazakhstan, analyze implications of these subsidies, and provide general policy suggestions on this topic. This paper first presents main data on fossil fuel subsidies, energy and environment in Kazakhstan, literature review, methodological approach suitable for this research and expected results.

Subsidization of fossil fuel consumption in Kazakhstan dates back to the Soviet Union times. Kazakhstan however is one of the many countries that provide high fossil fuel subsidies. International organizations such as IEA, OECD and IMF provide good data on the subsidies in developing and developed countries. Approximately two-thirds of the total subsidies are in the oil exporting countries (IMF, 2013). Among other former Soviet Union countries (FSU) that have high subsidies are Kyrgyzstan, Russia, Uzbekistan, Turkmenistan and Ukraine. For example, Uzbekistan has average subsidization rate of 60%, and fossil fuel subsidy account for 28.1% as a total share of GDP. Turkmenistan has average subsidization rate of 61%, and total fossil fuel subsidies account for 22.7% as a total share of GDP (IEA, 2012)

Total share of subsidies in Kazakhstan as a share of GDP in 2011 was 3.3%. The average subsidization rate was 32.6% and the subsidy per person amounted to $ 359.3. (IEA, 2012). Kazakhstan has artificially lower end user prices that are below full cost of supply and significantly lower the world market prices (IEA, OPEC et.al. 2011). Average subsidization of 32.6% means that consumers in Kazakhstan pay only 67.4% of the full price. As the table below shows subsidies in Kazakhstan are mostly targeted towards oil and electricity, and observing the dynamics since 2007 the total subsidies have been increasing.

Table 1. Subsidy by Fuel in Kazakhstan 2007-2011 (billion dollars)

	2007	2008	2009	2010	2011
Oil	1.29	1.65	0.41	2.03	3.19
Electricity	0.29	0.77	0.73	1.69	1.75
Natural Gas	0.17	0.29	0.21	0.22	0.33
Coal	0	0	0.47	0.38	0.58
Total	1.76	2.71	1.81	4.31	5.84

Source: IEA, 2012

Kazakhstan has second largest oil reserves and second largest oil production among the FSU countries. Kazakhstan has approximately 30 billion barrels proven oil reserves as of 2012 and is 13th largest exporter of oil in the world (U.S. Energy Information Administration, 2012). Total oil production in Kazakhstan has been steadily growing. Oil and electricity consumption in Kazakhstan has sharply declined in the 1990s due to economic decline, but since 2000 has been increasing.

CO2 emissions in Kazakhstan have declined in the 1990s and started to increase since 2000. Annual emissions inventory report prepared by Kazakhstan for United Nations Framework Convention on Climate Change (UNFCC) shows that energy activities are the main source of emissions.

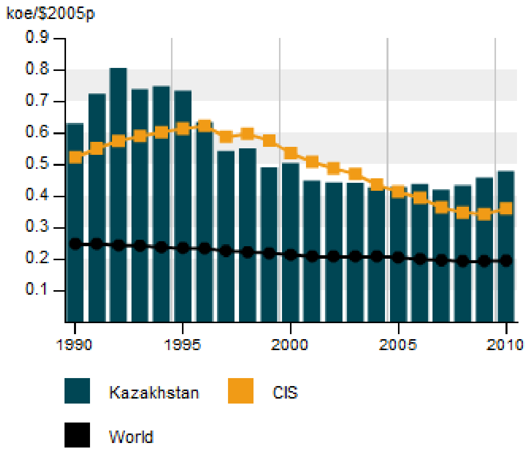
Table 2. CO2 Emissions by Sector in Kazakhstan 1990-2011 (million ton CO2 equivalent)

Sector	**1990**	**1995**	**2000**	**2005**	**2008**	**2009**	**2010**	**2011**
Energy	299,58	180,55	144,11	190,45	198,08	222,22	244,61	232,23
Industrial Processes	17,92	8,14	10,23	13,26	14,38	13,60	15,11	17,16
Agriculture	38,14	23,12	14,53	19,09	21,26	21,99	22,30	21,43
Land-Use, Land-Use Change and Forestry	-2,17	-7,29	-10,12	-2,86	-2,47	-2,48	-2,89	-3,09
Waste	2,74	3,11	3,09	3,47	3,74	3,84	3,95	4,07
Total with Land-Use, Land-Use Change and Forestry	356,21	207,63	161,85	223,41	235,00	259,17	283,08	271,80
Total without Land-Use, Land-Use Change and Forestry	358,38	214,92	171,96	226,27	237,47	261,65	285,97	274,89

Source: Ministry of Environment of Kazakhstan. National Inventory Submission, 2013

Total energy intensity in Kazakhstan is among highest in the world, where energy intensity is an indicator of total amount of energy necessary to generate one unit of GDP. Most of the FSU countries have high energy intensity and analyzing the figure below one can observe that the energy intensity is much higher than the world average.

Figure 1. Energy Intensity of GDP at Constant Purchasing Power Parities in Kazakhstan



Source: Enerdata, 2010

There is quite vast literature on the issue of subsidies in the energy and fossil fuel markets. Most international organizations advocate for the reform of fossil fuel subsidies. Energy subsidies are defined as "any government action that lowers the cost of production, raises the revenue of energy producers or lowers the price paid by energy consumers" (IEA,OECD, World Bank, 2010:5). There are various implications of fossil fuel subsidies on the economy, environment and society. Subsidies according to the Joint Report of IEA, OECD and World Bank (2010) "encourage wasteful consumption, exacerbate energy price volatility by blurring market signals, incentivize fuel adulteration and smuggling, and undermine competitiveness of renewable and more efficient energy technologies" (2010:9). Among the major effects that IMF (2013) identifies are fiscal burden on the state budget, wasteful consumption of energy, creating market distortions, negative impact on the environment, decreasing investments in energy infrastructure, less incentives to invest into renewable energy, rapid depletion of natural resources decreasing energy exports in case country is energy exporting, etc. Though subsidies are meant to protect consumers, most subsidies benefit high-income consumers (IEA et.al. 2011).

There is a limited scholarly literature that focuses on the analysis of Kazakh economy using CGE models. Most of the studies that implement general equilibrium models for Kazakhstan research trade and WTO accession issues. As to the author's best knowledge there are no studies that focus on the economy-wide effects of distorting subsidies in Kazakhstan using CGE or GTAP models.

Several quantitative studies on the issue of energy and fossil fuel subsidies and case studies on specific countries have been published. Most of them focus on the impact of removing fossil fuel/energy subsidies. Burniaux and Chateau (2011) point out that most non-OECD countries provide consumer energy subsidies. Using ENV-Linkage model they simulate removal of subsidies which shows positive economic and environmental effects. Though oil-exporting countries face real income reductions, however this is compensated by welfare gains achieved through subsidy reforms. Birol, Aleagha and Ferroukhi (1995) look at the impact of the subsidy phase out and conservation policies in oil exporting countries such as Algeria, Iran and Nigeria. Both policies bring significant positive savings. Moreover the income from removal of subsidies could be used specifically for the lower income households. Lin and Li (2012) by simulating various policy options of removing fossil fuel subsidies come to the conclusion that the macroeconomic effects would be regionally disproportionate, with negative externalities for China, and positive for the rest of the world. Lin and Jiang (2011) using CGE model simulate reform of energy subsidies in China. The simulations show that the energy demand in China will significantly fall and the macroeconomic variables will be negatively impacted.

Riipinen (2003) simulated full energy liberalization in the FSU region using the GTAP model. The results show that energy market liberalization in FSU is beneficial to the EU, however FSU incurs welfare losses and at the same time increase in exports. Kerkela (2004) using GTAP model and database analyzes effects of energy price liberalization in Russia. The liberalization would have positive effect on GDP, increase trade between Russia and the rest of the world, increase welfare and decrease output for most energy products, except oil.

2. Methodological Approach and Data

This analysis is based on the CGE model GTAP, developed by Global Trade Analysis Project of Purdue University. CGE models have been increasingly gaining importance in the analysis of environmental and energy policies. The changes in energy policy have economy-wide effects, therefore it is important to take into account the activities of all agents and sectors in the economy, thus the CGE model seem to be the most appropriate in this case.

The GTAP model is a static, multi-sector, multi-regional model. Standard GTAP model is described in detail in Hertel (1997). GTAP model has a competitive economic environment, and a profit and utility maximizing behavior of consumers and producers. The GTAP model is based on two set of equations; accounting relationships and behavioral equations. The model is represented by main economic agents; regional household, private household, producer and government. Standard GTAP model is characterized by perfect competition in all markets, utility and profit maximizing behavior of producers and consumers. Private consumption behavior is represented by constant difference of elasticities. Government consumption is presented by Cobb-Douglas utility function. Trade flows are represented by bilateral matrices handled with Armington assumption. Variables such as population, technical change, policy variables, supply of endowment, numeraire-world price of endowment, slack variables and distribution parameter are exogenous in the model. Taxes and subsidies are the policy instruments in the model. They represent the connections between different market prices in the model which are agent, market and world prices. Quantities and prices are endogenous in the GTAP model.

The model is solved by General Equilibrium Modeling Package (Gempack) produced by Center of Policy Studies at Monash University. This software allows solving large non-linear equations models.

The following study is based on the GTAP data base Version 7 with 2004 as a reference year. The GTAP data base 7 includes bilateral trade, transport and protection matrices for 57 sectors and 113 regions. The Version 7 of data base is the first one that includes input-output table for Kazakhstan which enables to separately aggregate Kazakhstan. The data base for the purpose of this study was aggregated into six regions and eight sectors indicated in the table below.

Table 3. Model Regions and Sectors

Sectors	Regions
Wheat	Kazakhstan
Grains and Crops	Russia
Meat, Livestock and Fish	China
Processed Food	EU
Energy	FSU
Heavy Manufacturing	Rest of the World
Other Industrial Manufacturing	
Services	

In order to analyze and quantify economic effects of energy liberalization in Kazakhstan two set of scenarios based on standard GTAP model will be conducted. The purpose of these scenarios is to analyze partial and full energy liberalization and the economy-wide effects of such policy scenarios. The policy variables in GTAP model such as output tax/subsidies, consumer tax/subsidies, import tariffs, export taxes based on GTAP database are of the main interest in developing the scenarios.

3. Expected Results and Conclusion

The Gempack software provides a number of output results. The focus in this study is the effects of simulations on GDP, welfare measured in equivalent variation, trade, import and export and output quantity changes. Moreover effects on such sectors as agriculture, food sector and manufacturing are important to consider. The liberalization scenarios are expected to be overall positive for Kazakhstan. The results are expected to be overall positive, though slight decreases in welfare and GDP are possible. Energy prices are expected to increase, which implies that the demand for energy will decrease, therefore one could assume that there would be slight increase in the export of fossil fuels. Further, the impact of policy changes on Kazakhstan's main trading partner countries will be considered as well.

Kazakhstan actively promotes environmental and energy programs as a part of its general policy. Such national programs and strategies as Transition to Sustainable Development by 2024, Development of National Energy Saving Program, Program of Energy Development by 2030 and others emphasize the importance of developing energy efficiency, reducing energy intensity, reducing CO2 emissions, promoting renewable energy and sustainable growth. In order to achieve all these goals and get on a path towards sustainable development a functioning energy market, policies and institutions are necessary that provide incentives towards investments into new technologies, energy efficiency and renewable energy.

This paper lays ground for the further analysis of the complex issue of subsidies in Kazakhstan. The next steps would be to produce final results possibly with an updated tax and subsidies data for Kazakhstan and analyze it within the existing literature.

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