The value of a barrel of oil saved in Saudi Arabia

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Overview

The Kingdom of Saudi Arabia (KSA) is the largest oil exporting country in the world and, at the same, has one of the highest levels of oil consumption per capita – 45 barrels per year compared to 22 in the US. To curb domestic oil consumption, the KSA has increased domestic energy prices in January 2016 and launched the National Renewable Energy Program to facilitate a shift in generation from oil and gas to renewable technology.

This raises the question of the value of a barrel of oil saved from domestic consumption in Saudi Arabia. This value is not equal to the international market price of oil: firstly, the rest-of-the-world demand for Saudi oil is not perfectly elastic, which impacts the incremental revenues from exporting the oil saved; secondly, domestic agents and sectors buy oil at a price still set by the government below market levels, which leaves room for improving economic efficiency by saving oil.

We estimate the value of oil saved and analyse different policies aiming to reduce domestic oil consumption: increase in the share of natural gas in electricity generation; increase in the efficiency of natural gas power plants; deployment of renewables; increase in the administered price of oil; electricity efficiency programs; improvement in fuel efficiency in the transportation sector and, for the sake of completeness, an increase in oil production.

The question we address has practical implications for decision making: using an estimate for the oil value could allow KSA to decentralize the cost-benefit evaluation of investment projects displacing domestic oil consumption.

Methods

To capture the value of oil saved for the Kingdom as a whole, beyond the interests of any particular sector, we analyze the impact of the different policies through steady-state solutions of a an applied dynamic general equilibrium which represents a small open economy calibrated to Saudi Arabia. This implies that all direct and indirect impacts are taken into consideration. In particular, the rebound effects due to changes in the national income or changes in energy prices are implicitly addressed in the model.

The model has a representative infinitely-lived household who consumes final goods and services and energy services. The household offers his labor in the domestic labor market and save in domestic and foreign bonds. The government owns oil and natural gas resources. Oil production can be either exported or domestically consumed to generate electricity or produce energy services. The domestic price of oil is administered and it is below the international market price. International markets for bond and final goods and services allow the KSA economy to run a current deficit or surplus.

Results

We start our analysis for each of the policies assuming that only one additional barrel of oil is saved and exported with no impact on the international oil price (assumed to be US$ 53.5 per barrel).

The cost of the polices and their impact on economic productivity are the key variables to assess the final effect on societal welafare gains. We find that all policies aiming to curb oil consumption only marginally have a positive impact on welfare and carbon emissions. An increase in oil production, arguably the most intuitive way to increase oil exports, does not produce the greatest welfare gains. An increase in the

domestic price of oil has also a positive impact on welfare, but it ranks low in terms of welfare. Shifting from oil to natural gas in electricity generation has a high positive impact on welfare with a small impact on carbon emissions.

The average positive impact of these policies on consumers' welfare is estimated around $34.7 per one additional barrel, if there is no price reaction. However and given that the international price reacts when more Saudi oil is exported, the average positive impact on welfare of these policies is equivalent to $25.4.

KSA policymakers are however likely to consider the impact of saving significantly more than one barrel a day. A prerequisite is the technical possibility of escalating the amount of oil saved. We find that to increase oil exports beyond 75,000 bpd (around 1 percent of current exports) the government needs to increase production of oil and/or natural gas, or raise the administered domestic price of oil. The additional oil exports potentially generated by the other policies can hardly exceed this amount. When considering additional oil exports of 75,000 barrels per day, the welfare gain of a barrel of oil saved varies between $1.9 and $44.3 depending on the policy.

Of all the policies analysed, renewable technology and productivity of electricity are, according to our model, the best from a policymaker perspective, since they are relatively easy to escalate, increase societal welfare (on average $560 Million per every 75,000 bpd saved) and reduce CO2 emission by 10 Million tons annually.

Conclusions

This study explores the long run impacts of different policies aimed to curb oil consumption in KSA at a macroeconomic scale and eventually increase oil revenues from exports.

The analysis of these policies leads to the following results. First, policies designed to curb oil consumption have positive impacts in terms of welfare and in carbon emissions, although the cost of the program has a critical role. Second, the potential decrease of the international price of oil due to the increase in KSA exports reduces the welfare gains from these policies. Third, we find that, in most of the cases, these policies have a limited scalability and, then, the potential positives impact are relatively small.

In terms of welfare gains per one barrel of oil saved, the average "value" (in terms of welfare gains) of an addtional barrel of oil saved in Saudi thru a set of different policies is $25.4. This figure takes into account the indirect negative impact due to the increase of KSA oil exports. We evaluate that this negative price reaction reduces welfare gains in $9.3.

From a macroeconomic perspective and paying attention to policies aimed to save 75,000 bpd, the deployment of renewable technology and programs that increase electricity efficiency are the most convenient policies, since they are easy to escalate, increase social welfare in around $560 Million and reduce CO2 emissions by 10 Million tons annually.

References

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