ECONOMIC AND SECTORAL IMPACTS OF ENERGY EFFICIENCY TARGETS: A GENERAL EQUILIBRIUM APPROACH FOR PORTUGAL

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Overview

Energy efficiency has been identified as a key variable for in energy and climate policies. It contributes to reduce carbon intensity and to rise energy security in those countries with a low endowment of energy resources. Moreover, increased efficiency may reduce final energy demand, which is one of the targets of the European Commission (EC) climate change strategy.

Portuguese energy efficiency, measured as the energy intensity of primary energy (which relates energy consumption and GDP), is in line with the EU average. Nonetheless, this is not the case for energy intensity of final energy consumption. This weak performance derives, above all, from the high energy intensity of economic activities, which was in 2013 almost 30% above the EU average. To overcome this gap, the National Energy Efficiency Action Plan 2016 (NEEAP; Council of Ministers Resolution No 20/2013) defines a set of policy instruments to promote energy efficiency focused on final energy consumption. The ultimate goal is to achieve a 25% reduction in primary energy consumption by 2020, and corresponds to the national objective on energy efficiency within the '20-20-20' EU targets.

In this paper we analyse the costs of compliance with the national target defined in terms of energy savings. In addition, we simulate the impacts of a similar reduction in energy intensity as long as some policy makers in the EC are considering the convenience of defining, instead, intensity targets for energy efficiency goals.

Methods

We use a static computable general equilibrium (CGE) model for a small open economy, which comprises 31 production sectors (4 energy sectors and 27 non-energy sectors) and three institutional sectors (the public sector, the private sector and the foreign sector). The model considers primary production factors (capital and labour), intermediate goods and three primary fossil fuels (coal, natural gas, petrol). Labour market imperfections are captured by the model and, thus, involuntary unemployment exists. The model simulates CO2 emissions resulting from fossil-fuel combustion in production and consumption. CO2 enters the model in fixed proportions with the fossil-fuel use, in a way that a specific CO2 coefficient is associated to each fossil fuel according to its carbon content.

As usual in applied CGE models, the model was calibrated to a base year which reflects the initial/benchmark equilibrium – these base year data, together with exogenous elasticities, determine the parameters of functional forms that characterize the model. The core dataset is a Social Accounting Matrix for the year 2008, which was built on the most recent symmetric Input-Output tables available for Portugal. Unemployment data was taken from official statistics. Elasticities of substitution were taken from empirical estimates available in literature.

Results

Considering the 2020 Portuguese goals regarding energy efficiency, as well as the national context as abovementioned, we simulate a set of policy scenarios which provide us with the costs of compliance with the national targets, taking the Portuguese economy structure in 2008 as the reference scenario (this year predates the effects of the crisis and, hence, portraits the 'typical' structure of the economy).

We simulate the costs of compliance with a 25% reduction in primary energy consumption, along with a decrease in final energy consumption and final energy consumption by production sectors. In addition, we simulate the costs of compliance of a 25% reduction in energy intensity regarding primary and final energy consumption (in total and in production sectors). Expected results encompass a reduction in energy use in all sectors, with asymmetric sectoral impacts at such that energy-intensive sectors will face higher costs of compliance.

Conclusions

Within the Portuguese political framework (NEEAP), the 2020 energy efficiency target is defined in terms of primary energy consumption. Such a measure is a function of the economic pace and structure and, therefore, the target can be attained as a result of economic slowdown, irrespective of any efficiency improvement. For this reason, we simulate the costs of compliance with a similar reduction in energy intensity, which avoids the indicator dependency on economic growth.

The obtained results provide policy-makers with useful insights about the sectoral impacts of national targets regarding energy efficiency, as well as with the effective weight of energy use in the economy – captured by energy intensity instead of energy use (as considered in the PNAEE 2016). Hence, this study contributes to the design of future National Efficiency Plans as well as to the broader Portuguese energy and climate policies.

References

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