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Macroeconomic, sectoral and fiscal implications of decreasing energy intensity of the Polish economy

Abstract

For several decades, there has been a gradual decline in the energy intensity of the world economy, i.e. the amount of energy needed to produce a unit of product. Therefore, this process implies a separation of energy use and economic growth rates. It is extremely important to fully understand the socio-economic consequences of this phenomenon, which go far beyond the reduction of expenditures on energy products. The reduction of per unit energy use spills over the entire economy, triggering a number of positive chain reactions in a form of the so-called second round effects.

Against this backdrop, the aim of this paper is to assess the consequences related to the ongoing improvement in energy efficiency of production and consumption within the economy of Poland – a country that is one of the leaders in reducing energy intensity since the nineties of the twentieth century. This analysis is carried out using a multi-sector, recursive-dynamic, computable general equilibrium (CGE) model, calibrated for the Polish economy and called GEMPOL (*General Equilibrium Model for Poland*). To the best of the author's knowledge, this analysis is the first attempt of a comprehensive measurement of the multiple, long-term economic effects of the decreasing energy intensity In Poland, taking into account macroeconomic, sectoral and fiscal dimensions.

Based on the obtained results, several conclusions can be drawn. Firstly, a further decline in energy intensity of the Polish economy, modelled as a positive technological shock, will result in an increase in the overall level of economic activity. Secondly, due to the heterogeneity of initial level of energy intensity and its expected changes in particular industries, there will be a significant change in the sectoral composition of the economy. A decline in production of fossil fuel and energy-related branches together with an increase in activity of energy-intensive industries should be expected. This process will be accompanied by capital and labour flows from the “shrinking” industries towards the fastest growing branches of the economy. Thirdly, the product structure of foreign trade – both exports and imports – will change significantly. For a given level of trade balance, the fall in domestic demand for fossil fuels and energy-related products will cause a reduction in their imports and an increase in exports of their domestic production. This will enable a redirection of expenditure streams, spurring an increase in imports of non-energy goods and services, while the increased domestic demand will reduce the scale of exports of such products. Improved competitiveness of domestically produced, energy-intensive goods will result in an increase in their exports. However, high import intensity of energy-intensive industries will also lead to an increase in imports of such products. Fourthly, a relatively small decrease in the percentage share of energy-related expenditures in total household and government spending will be observed. Moreover, due to the increase in overall economic activity and incomes, an increase in the absolute value of energy-related, private and public expenditure will take place. Fifthly, the energy efficiency improvement will lead to lower budget revenues from energy products taxation. As a result, revenues from excise duty and other product taxes will be significantly reduced. However, this loss will be more than offset by higher revenues from other sources, resulting from the increase in the overall level of economic

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activity: public capital remuneration, taxation of labour and capital, as well as the Value Added Tax. Consequently, the government spending – both consumption and investment – will increase. Sixthly, a decrease in total energy use will be observed. In relative terms, the total decrease in energy consumption will however be lower than the decrease in energy intensity, which implies the occurrence of the rebound effect in energy use.

Keywords: computable general equilibrium, energy intensity, energy efficiency

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