The effects of changing patterns of growth, production, consumption, trade and energy use on CO_2 emissions in Poland in 1995-2009

Climate change is a serious threat to the current global environment. The major cause of climate change is growing concentration of greenhouse gases in the atmosphere, especially carbon dioxide (CO_2). Many countries are aiming at reducing GHG emissions and transform their economies towards low-carbon intensive. Especially active in this regard is the European Union, which most recently agreed to cut 40% of GHG emissions below the 1990 level by 2030. This target should ensure meeting EU's long-term goal, which is cutting domestic greenhouse gas emissions by at least 80% by 2050. Poland is the member of the EU since 2004 and often attempted to lower the level of the ambition of the EU climate policy. This is due to its coal-based energy system and anxiety about depending on Russia for natural gas. These specific circumstances constitute a substantial challenge for Poland in the process adaptation to the new EU climate regime.

Despite many efforts, which are needed to switch the Polish economy to the low-carbon growth track, the GHG emissions in Poland shrank notably during last decades. Between 1990 and 2009 the domestic CO_2 emissions in Poland was falling annually by 1% on average. At the same time the average GDP annual growth amounted to 4%. It is known, that the Polish government did not take distinct efforts aimed at reducing greenhouse gas emissions and the reduction was rather a by-product of the transformation from communist economy towards market-based economy. Hence, the identification of drivers of change in CO_2 emissions in Poland during this period has the practical value in the view of realisation of the new EU climate policy objectives.

The paper seeks to identify changes of patterns in growth, production, consumption, trade and energy use in Poland and to measure their effects on CO_2 emissions in 1995-2009. The scope of analyses covers a set of 35 sectors of the Polish economy, which are sources of CO_2 emissions from fuel combustion. Emissions were analysed on a year-to-year basis between 1995 and 2009. This period includes the majority of Polish transformation to market-oriented economy. The research material constitutes comparable, latest available dataset from the World Input-Output Database, which consists of input-output tables and data on fuel use in individual sectors of Polish economy (Timmer 2012).

The methodological framework of the analysis constitutes the standard input-output model of W. Leontief (Leontief 1941). The implemented method is structural decomposition analysis,

which can be defined as the analysis of economic change by means of a set of comparative static changes in key parameters of an input-output table (Rose and Miernyk 1989). The method of decomposition employed in the study is based on Syrquin's decomposition of changes in growth and economic structure [Kubo, Robinson and Syrquin 1986].

The results of the analysis capture 12 drivers of change in CO_2 emissions in the Polish economy, which are grouped in three categories of factors. The first category encompasses the economic growth factor. It covers the effect of expansion of all economic sectors growing at the proportional rate to the average economy growth. The second category includes structural factors, which result from changes of production, consumption and trade patterns. Changes in production consist in technological change as well as changes in import rates in intermediate demand. Changes in consumption cover changes in four components of final demand: final consumption, final gross fixed capital formation, government spending and exports. The third category includes factors related to energy use i.e. changes in energy intensity of sectors and changes in energy-mix used by sectors.

In the course of analysis, it was found that structural changes had the critical impact on CO_2 emission changes between 1995 and 2009 in Poland. These changes contributed to a significant reduction of CO_2 emissions and offset the positive effect of economic expansion on emission growth. Changes of patterns of exports is the only one structural factor, which caused an increase in the cumulative emissions in this period. However, the total impact of trade pattern changes resulted in a decrease of greenhouse gas emissions in Poland. The strongest impulse for CO_2 emissions reduction triggered the decrease of energy intensity and technological change. Factors associated with domestic final demand in comparison with other factors had little effect on changes of CO_2 emissions in Poland.

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