



The role of coal consumption in the economic growth of the Polish economy in transition

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ABSTRACT

The main goal of this paper is an analysis of the causal links between quarterly coal consumption in the Polish economy and GDP. For the sake of accurate computation an additional variable – employment – was also taken into account. Computations conducted for the period Q1 2000 to Q4 2009 by means of recent causality techniques confirmed the neutrality of hard coal usage with respect to economic growth. On the other hand, calculations for the pairs lignite-GDP and total coal consumption-GDP showed the existence of a significant nonlinear causality from coal usage to economic growth. This is clear evidence for claiming that lignite plays an important role in the economic growth of the Polish economy. Furthermore, each coal-related variable was found to have a nonlinear causal impact on employment. Because of the relatively short length of available time series we additionally applied bootstrap critical values. The empirical results computed by both methods did not exhibit significant differences.

These results have important policy implications. In general, our findings support the hypothesis that closing hard coal mines in Poland should have no significant repercussions on economic growth. However, this does not seem to be true for lignite mines.

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1. Introduction

The demand for coal stems mainly from its application to the generation of electricity and the production of steel. Although Poland had abundant supplies of some natural resources, including coal, the centrally planned system caused a false allocation of those resources and of investment funds to economic sectors. In addition, the cutting off of the most important industrial inputs from the former Soviet Union made a radical restructuring and rebalancing of all sectors, especially hard coal mining, inevitable.

In 1990 about 90% of the country's energy production was based on hard coal and lignite. By the end of 1991, however, the Polish coal industry was in serious economic trouble. Fifty six out of sixty seven mines showed losses in 1991 and only seven exhibited profits and were able to cover all their obligations. In 1998 still more than 66% of primary energy supplies in Poland originated from coal. Although Polish mining output has been continuously decreasing in relation to total industrial production in the transition period, it still accounted in 2003 for 4.5% of industrial production (at current prices). Also other indicators

show that Poland has remained one of the world's largest coal producers and consumers. Poland's fuel and energy profile was dominated by coal, the only domestic energy source in abundance. The share of the coal sector (hard coal and lignite—often referred to as brown coal) in 2003 amounted to 3.4% of total industry sales but made up 8.1% of all industrial employment in that year. The deep-coal mining industry in Poland has been significantly reduced under market pressure since beginning of the transition process. The main reason was decreasing demand (i.e. an excess supply of coal). The most important customers of the coal industry in Poland are power stations. Their demand for coal between 1990 and 2003 reduced approximately by 36%. In this period labor costs and employment in the sector remained high, despite the sector's bad financial state. The main reason for this situation was the strength of the trade unions in the coal sector. Because of serious problems in the coal industry over next years the program of restructuring this industry (the closure of inefficient mines and workforce reduction) has been continued. In November 2003, the government introduced a second program in order to consolidate and reform Poland's coal sector—the Program of Restructuring the Hard Coal Mining Sector for 2003–2006. The program planned to close more inefficient mines and reduce employment on a voluntary basis. The government provided miners who voluntarily left the coal sector with other private sector employment and support such as early retirement

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pensions, retraining and social hardship allowances. The World Bank helped Poland in restructuring its mining industry with a loan. The plan conducted by the Polish government in cooperation with the World Bank led to a further deep fall in employment in the coal industry. The output of hard coal has decreased from a pre-transformation level of 193 million tonnes in 1988 to 101 million tonnes in 2004. The privatization of mines was, however, stopped by the Polish government in 2006. The World-Bank-supported restructuring program had been suspended by the Polish government by 2006. The reason was that the coal industry had that year become more profitable. Therefore only two mines had been closed through the project. The Polish government made a decision that any further mine closures would be handled by the mine companies. This was contrary to the former regulation where the Mine Restructuring Company was responsible for making decisions. The rise in demand in the following years protected the Polish coal industry from a sharp decrease in coal production.

In 2009 Poland produced 135.14 million tonnes of coal, i.e. 1.65% of the world total. In the same year Polish coal consumption amounted to 53.85 million tonnes oil equivalent, i.e. 1.64% of the world total. Poland is one of the largest consumers of coal in Europe. Coal recently (in 2009) accounted for 89.5% of the country's primary energy production and over 70% of total consumption. The greater part (55.84%) of coal-fueled power generation is based on hard coal and the remainder is from lignite-fired capacity at mine-mouth captive power plants.

The commercially workable hard coal reserves are located in the Upper Silesian and the Lublin basins in the east of Poland (Bogdanka mine), with the Upper Silesian coalfield accounting for approximately 93% of the total. Lignite deposits in Poland are exclusively mined by opencast methods. Two of these operations are located in the center of the country and a third one in the south-western region of Poland. In 2009, total lignite production in Poland dropped because of a fall in demand from 56.9 in 2008 to 54.4 million tonnes. Approximately 99.7% of this production was used by mine-mouth power plants. Lignite-fired power stations generated in 2009 33.66% of total power generation in Poland. Lignite mines in Poland are willing to maintain their production capacity of 65–70 million tonnes per year. Moreover, lignite is expected to play an important role in the Polish energy sector until about 2035.

The main goals of the energy policy of the Polish government in recent years were the following: to assure the energy security of the country; to assure the growth of competitiveness and energy efficiency of the national economy; to protect the environment against the negative impact of the energy sector. In the framework of the third goal the need for sustainable development, i.e. the achievement of a balance between social, economic, technical and environmental conditions in the process of development, was established as a priority in the national energy policy. Eleven percent of Poland's surface is considered to be severely environmentally endangered (the most polluted region in Poland, designated *an area of the ecological disaster* is the Upper Silesia and Cracow region). However, approximately 27 percent of Polish land remains in an almost natural state. These circumstances demand a diverse regional and decentralized approach to environmental protection in the context of energy policy in Poland. Moreover, although fossil fuel power plants in Poland (old and using high sulphur brown coal) are a major source of industrial air pollution, coal smoke is also a cause for serious concern.

The mentioned general goals of energy policy in Poland are to be achieved by improving the legal and regulatory instruments of a balanced structure of the primary energy supply with a preference for using domestic coal and lignite resources. This

usage should fulfill ecological requirements and assure a rational level of energy costs in the national economy through increasing its efficiency, also in the energy sector. Energy policy should combine the interests of energy consumers and suppliers in order to support security and the quality of the energy supply.

As we see from this short review the coal sector is still one of Poland's largest industries and employers. Therefore it is fully justified to ask about coal's importance for the economic growth of Poland in the language of causality notion. Also, converse questions concerning the impact of economic growth on the size of coal production may be of interest to the Reader. Many mines are or were subsidized by government. Thus, according to our prediction in times of fast economic growth the mines can receive more money from government as public help and in consequence can produce more coal. From a theoretical point of view also feedback cannot be excluded.

Evidence on the direction of causality may have a significant impact on policy. The results of the research presented in this paper should be helpful in judging which of the four hypotheses (Payne, 2009) tested in previous papers holds true in the case of the Polish economy:

Growth hypothesis—this implies that causality runs from energy consumption to economic growth. This suggests that energy consumption plays an important role in economic growth. Any reduction (increase) in energy consumption could lead to a fall (rise) in GDP growth.

Conservation hypothesis—this is based on unidirectional causality running from economic growth to energy consumption. This indicates that a country is not dependent on energy for growth and development and thus energy conservation policies will have little or no effect on economic growth. Furthermore, a permanent increase in economic growth may result in a permanent rise in energy consumption.

Feedback hypothesis—this asserts that there is two-way (bidirectional) causality between energy consumption and economic growth, i.e. energy and economic growth are interdependent and act as complements to each other.

Neutrality hypothesis—this would be supported by the absence of a casual relationship between energy consumption and economic growth, which means that neither conservative nor expansive policies in relation to energy consumption have any effect on economic growth.

Therefore, it is important to ascertain empirically whether there is a causal link between energy consumption and economic growth. The existence and directions of these causalities have crucial implications for energy policy and have been intensively examined by many authors. Some of the most important studies will be reviewed in the next section.

2. Literature overview

The early contributions concerned with relations between economic growth and energy demand were conducted predominantly for the US economy (e.g. Kraft and Kraft, 1978; Akarca and Long, 1979; Yu and Choi, 1985; Stern, 1993, 2000; Cheng, 1995, 1997). Kraft and Kraft (1978) investigated the interdependency between economic growth and energy demand. These authors on the basis of US data for the period 1947–1974 found that there is a relationship between GNP growth and energy consumption. They established that the increase in national income is the reason for the rise in energy consumption. Yu and Choi (1985) estimated the causal interdependency between the energy usage and gross national product (GNP) of five countries. The authors concluded that there was unidirectional causality from energy consumption to GNP in the Philippines, and causality in the

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