

FACTORS SHAPING AGRI-FOOD PRODUCT TRADE IN POLAND

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Abstract

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The objective of the paper is to recognize the role of internal and external factors in the trade balance. The analysis of the trade balance is useful to help formulate goals and premises of economy policy to properly allocate production means to eliminate the negative effects of trade liberalization. The authors have studied data about trade of agricultural commodities in the years 2000–2010. To measure the impact of macroeconomic variables used a regression model. The macroeconomic factors included: X_1 (inflation), X_2 (investment in agriculture and hunting), X_3 (GDP) and X_4 (exchange rate) and X_5 (FAO food price index). We wanted to recognize the impact of macroeconomic factors on: Y_1 (total export), Y_2 (total import), Y_3 (trade balance).

Keywords: agri-food products, trade, macroeconomic factors, policy

INTRODUCTION

Poland joined EU with other countries in 2004 and this experience caused a technological shock linked with joining to new markets and financing development of agriculture and other sectors of economy (Ferreira Lopes, Neves Sequeira, 2014).

One of the most important factors shaping the development of agriculture is the demand by internal and export markets. The integration of Poland with EU in 2004 changed the conditions of agri-food product trade because it abolished tariffs between all countries in the Common Market. Before integration Poland was a net importer of agri-food products, whereas after integration it became net exporter. The exports to current EU countries increased by 4.4 times in the years 2000–2007, whereas imports increased as well, but only by 2.6 times, which created a 2003 trade surplus of 2 mld euro (Stańko, 2008).

The increasing processes of liberalization of trade, the increased openness of the Polish

food economy to the world, and the inclusion in Common Market and acceptance of common tariffs of trade changed the conditions for trade of Polish agri-food products (Poczta, Pawlak, 2008). Some changes that happen in the world caused by globalization which have an impact on the demand and supply of food on a global scale, too. The basic factor shaping the increase of global food demand is the increase of population in developing countries and the increase of GDP per capita in many countries. These factors will cause an increase in the structure of consumption in developed countries (Szymanowski, 2009). In developing countries the structure of food consumption will change by a decreased consumption of cereal and rice and the increase of meat, vegetables, fruits and milk products. Some parts of agriculture production will be devoted to biofuel production, which will cause the increase of agricultural product prices (Czyżewski, Poczta-Wajda, 2008).

The changes of regulation of trade after Polish accession to EU stem out mainly from taking all instruments and rules of Common Trade Policy to other countries, mainly common tariffs, non-tariff instruments and increasing conventions with trade partners from EU. As a consequence Polish entrepreneurs gained the same conditions in exporting as exporters from other EU countries (Pawlak, 2014).

The agri-food products trade has is an important component of global trade in Poland. The contribution of exports of agri-food products in global export increased from 8% before integration to 13% in 2013. On the other hand, the contribution of imports of agri-food products in global import increased from 7% before integration to 9.2% in 2013. The agri-food products sector is a branch of the national economy which gained positive balance of trade (Szczepaniak, 2014).

This article is organized as follows. First, we discuss the trade balance of agriculture. Then we present the data and model of analysis. The purpose is to estimate the impact of macroeconomic factors on foreign trade. The next part of the paper describes the macroeconomic factors such as: agri-food products trade, GDP, investments in agriculture, and inflation. The final section presents the impact of chosen macroeconomic factors on Polish agri-food products trade. At the end the authors present conclusions.

Foreign Trade in the Literature

The theories of international trade have macroeconomic character. These theories are based on access of information in the production and do not include the costs of product preparation and purchasing technology. Therefore, technological advantage and technology transfer were not discussed, nor is the role of enterprises included in these theories (Gorynia, 1998).

A very important trade theory was mercantilism. The surplus of trade could be achieved by the export of manufactured goods and the import of resources. This approach encouraged the introduction of tariffs on foreign products (Landreth, Colander, 2005). The wealth of a country was the result of a trade surplus with other countries. This meant the benefits were achieved by one country, while other countries suffered losses (Stankiewicz, 2007).

Adam Smith believed that trade contributed to the increase in sales of surplus production and helps align prices of factors of production between trading partners. Adam Smith prepared the theory of absolute costs. He claimed that it is better for the country to import cheaper goods than to produce them at higher costs and to export goods in which the country is the lower-cost leader. Specialization is the key for achieving competitive advantage. The theory explained that international trade is the result of an unequal distribution of national resources in the world (Kacperska, 2012).

Other important contributors to the theory of international trade were classical economists, such as David Ricardo, who was the originator of relative costs theory. He claimed that the necessary conditions to extend trade were the differences in technologies of production and workforce achievement. This theory has one drawback, in that it does not explain the sources of workforce efficiency, which is the basis of relative costs. David Ricardo claimed that absolute difference in cost production is not necessary to trade. The relative advantage in production of at least one good is necessary. The country will export the goods in which relative costs of production are lower than in another country.

However, one of the most important economists of international trade theory, Bertil Gothard Ohlin (1899–1979), elaborated the theory called the theory of abundant resources and its balance was different endowment in basic production factors: capital and workforce (Kundera, 2004).

MATERIALS AND METHODS

The objectives of the study are to: i) describe the macroeconomic factors and ii) estimate the impact of macroeconomic factors on the total agri-food products trade. This paper concentrates on the analysis of macroeconomic variables, using data from the Statistical Yearbooks of Agriculture and Rural Development and Eurostat Yearbook. We estimated the productivity of Polish agriculture. Consider, for simplicity, a single output-single input industry (Ray, Desli, 1997).

The average productivity (AP) of this firm at time t is:

$$AP_k^t = \frac{Y_k^t}{X_k^t}. \quad (1)$$

Thus, a productivity index for this firm at time $t + 1$, with period t treated as the base will be:

$$\Pi_k = \frac{AP_k^{t+1}}{AP_k^t} = \frac{\frac{Y_k^{t+1}}{X_k^{t+1}}}{\frac{Y_k^t}{X_k^t}}. \quad (2)$$

We also wanted to answer the question how to address the competitiveness of the Polish agricultural sector's reaction to macro forces. In order to determine the impact of macroeconomic variables on the balance trade, a multiple regression approach was used, which is described by the following formula (Sobczyk, 2005):

$$\gamma_i = \beta_0 + \sum_{j=1}^K \beta_j X_{ij} + \varepsilon_i, \quad (3)$$

where

γ_i the i th observation on the dependent variable
($i = 1, 2, \dots, n$),

x_{ij} the i th observation on the j th independent variable belonging to the set of explanatory variables, and

$\beta_0, \beta_1, \dots$ structural parameters of the regression equation.

We used the method of stepwise regression. It is based on sequential adding to the model of those variables that have the most important impact on dependent variable trade balance. The model assumes another step by step joining the list of explanatory variables included in the model those variables that have the greatest impact on the dependent variable.

The following variables were sequentially explained: Y_1 (total exports of agricultural products), Y_2 (total imports of agricultural products), Y_3 (total trade balance). The most important factor having an impact on the balance of exports and imports according to Stefański (2010) are: the economic situation, exchange rate, investment and taxes. According to Stańko (2009) the following factors have an impact on the market situation, mainly: GDP, inflation, the exchange rate, and changing population and environmental factors. However the authors of the paper, based on literature and experience, claim that, the explanatory variables were successively: X_1 (inflation), X_2 (investment in agriculture and hunting), X_3 (GDP), X_4 (exchange rate) and X_5 (FAO food price index). We presented the data in the years 1995–2010. We used the descriptive and statistical methods to describe the changes in analyzed data. The authors used data from the Main Statistical Office (MSO).

The estimated values of regression, standard error, t test to evaluate the regression equation and the level of importance ($p = 0.05$ most important).

RESULTS

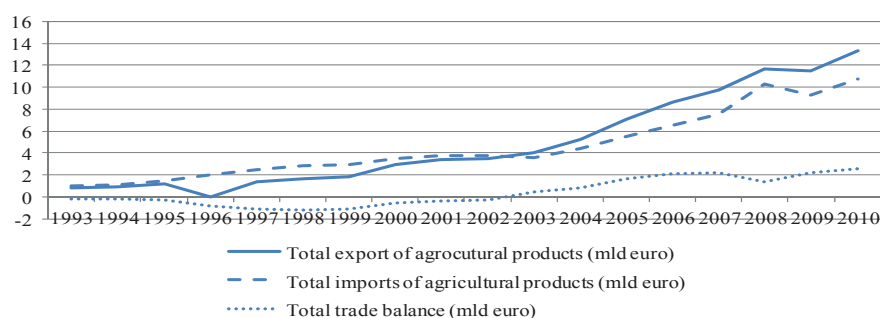
One of the factors influencing the situation in the agricultural market is trading in agri-food products. This issue was the subject of interest to many economists, i.e., Keynes, who pointed out the positive aspects of foreign trade and economic development of the country in this situation (Kacperska, 2012).

Polish integration with the EU has created greater opportunities for trade in agri-food products. EU markets are open for agricultural products from Poland, as the EU's.

The main reason for trade is variable costs of production of the same products in different countries and different relationships between the major market forces, i.e., supply and demand (Krzemiński, 2012). The data presented on Fig. 2 show that Poland has a positive balance of total trade of agri-food trade. Until 2003 Poland had a negative balance of total agri-food trade. It was the effect of trade isolation of Polish economy before integration with European Union.

In exports to European Union, Polish food improved its competitive position. The biggest increase took part in 2004 and a little more in 2005. But, of course, the competitive position of Polish food might worsen. It can be expected that the changes of the external situation and appreciation of PLN will have an impact on exports products from Poland, as the EU's internal market allows the free movement of labor, capital and products (Barteczko, Przystupa, 2006).

The data presented in Tab. I show that Poland has a negative trade balance in agri-food products to EU countries. Among the products that are the subject of foreign trade in 2010, a positive net balance was observed for processed foods, and live animals and products of animal origin. Traditionally, Poland has been a major exporter of dairy products, powdered milk, fruits and vegetables and beef and pork. A negative trade balance was recorded for products of plant origin and fats and oils. Improving the turnover of trade in agri-food products requires increased efforts to promote Polish food, which is characterized by its flavor and healthfulness, and a relatively low price compared to foreign food. Trading agro-food articles is critical to the balance of trade and the value of the Polish currency. A positive development in Polish foreign trade is made possible by the improved economic situation in the EU countries that are our major partners (Handel Zagraniczny Produktami Rolno-Spożywczymi – Stan i perspektywy, 2011). One of the most important trade groups are meat products. The export of meat increased eight times to 3,02 mld Euro in the years



1: Total agri-food products trade in the years 1993–2010 (mld euro)

Source: own elaborations based on The Statistical Yearbook of Agriculture and Rural Areas, MSO, 1993–2012, Warsaw

I: *Agri-food products trade (in million PLN) to EU countries (current prices)*

Product	2000	2002	2005	2008	2009	2010
Imports	213.072	224.816	328.192	497.028	463.383	536.221
Prepared foodstuffs	5.177	6.481	9.339	13.936	16.559	18.142
Live Animals and Animals products	2.495	2.335	4.961	8.827	11.035	11.856
Vegetable products	5.441	4.946	6.758	11.161	10.739	11.647
Fats and oils	734	823	1,096	2,005	1,761	2,002
Exports	137.909	167.338	288.781	405.383	423.242	481.058
Prepared foodstuffs	5.124	6.051	12.037	18.024	22.729	24.854
Live Animals and Animals products	3.339	3.723	10.709	14.240	15.667	18.033
Vegetable products	2.953	3.543	5.766	7.498	10.116	9.804
Fats and oils	157	85	403	1.061	1.105	1.289
Trade balance	-75.163	-57.478	-39.411	-91.645	-40.141	-55.162

Source: The Statistical Yearbook of Agriculture and Rural Areas, MSO, Warsaw

2000–2011, but import increased thirteen times to 1,57 mld Euro in this period of time. The structure of meat products' export was determined by: pork (39%), poultry (37%) and beef (24%) in 2011. The import structure of meat products was represented by: pork (86%), poultry (11%) and beef (3%) in 2011. The most important partners of agri-food products trade of Poland are EU countries.

The other factors limiting exports of agri-food products include Russia's embargo and the uneven quality of some Polish products. It is worth mentioning that Poland is the fourth largest producer of milk, vegetables and other food products in the EU (Statistical Yearbook Of Agriculture, 2011).

One important factor in agri-food product trade is the exchange rate. The exchange rate is characterized as price of some other currency explained in national currency. The increase of exchange rate of PLN to the euro is defined as depreciation of Polish currency, whereas the decrease of exchange rate of PLN to euro is called appreciation of the Polish currency (Stefański, 2006).

The most important determinant of Polish agri-food product trade is the Euro exchange rate. The relation between the exchange rate and the trade is twofold. First the exchange rate impacts exports, but the volume of exports impacts the exchange rate. After 2004 the exchange rate for the euro remained at high level however it was highly volatile.

There are many factors having an impact on the exchange rate. The most important is the possibility of development and peace on market. The current situation does not guarantee a low exchange rate as the economic and political situation in the EU and outside is unstable. The Ukraine crises have a negative impact on food markets, too. The embargo on EU products creates unstable situation and changes exchange rates for the Euro.

Another factor having an impact on exports and imports is global food prices, measured here as in index developed by FAO of the United Nations. The FAO global food price index shows big changes in the prices of products and the value of most

products increased in recent years. Index changes in world market prices underlie part of the economic crises, the blockade of eastern markets and increased supply of products. The analysis of global food price index enables an evaluation of the short and long time risk and helps predict the domestic market situation.

The economic development of a country (GDP) determines its situation in the agricultural market. GDP at market prices is the sum of the whole value added created during the period of individual production process. GDP is explained by the sum of four components:

- Value of goods and services purchased by domestic households for consumption purposes (individual consumption, the actual consumption).
- Gross investment is the sum of goods (items of capital equipment) on services purchased by domestic entities conducting business activities (planned investment).
- State expenditures for goods and services, financed from the proceeds of the final sector, meaning goods forming part of GDP, which were acquired by the state.
- Net exports, which is the difference between exports and imports.

A better economic situation of the country favors the development of the agricultural sector. Improving GDP in the economy is important for consumers because, as they provide the GDP growth by 1 percentage point food consumption grows by 0.5 percentage points.

The share of agriculture in GDP is lower in more developed countries. In underdeveloped countries, the share of agriculture in GDP is greater. In the most developed economies of the world, e.g., the U.S. share of agriculture in GDP is below 1%. Although it seems extreme, it does not reduce the importance of agriculture in the economy. Instead what happens is that farmers substitute capital for labor and consumers buy more value-added products. The U.S. food system is about 10% of the economy. Polish is more labor intensive and

employs nearly 17% of the population, and provides the raw materials for the processing sector.

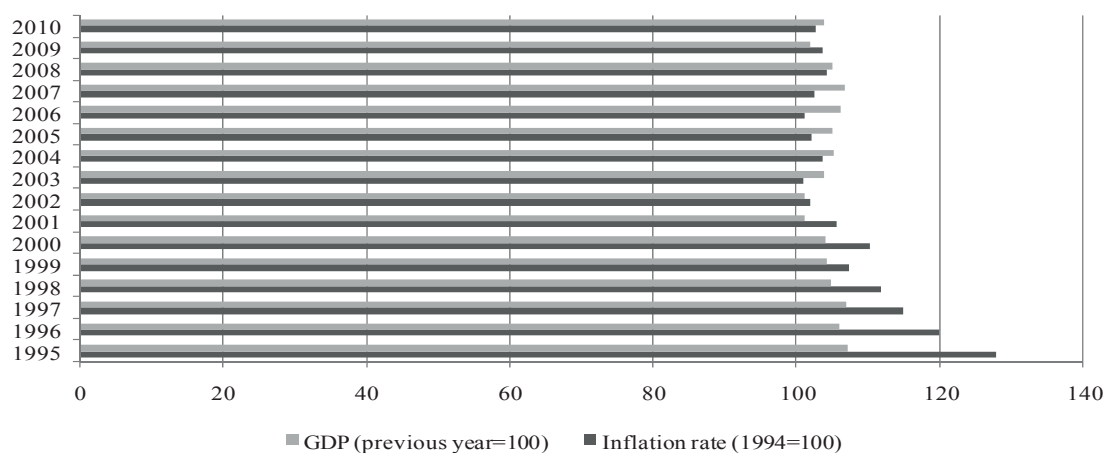
Poland has a positive rate of economic growth, but it has weakened in recent years. In 2009, GDP in Poland was 8,100 Euro/person and was lower than the EU average (23,600 Euro/person). For comparison, the GDP calculated per person in the U.S. in 2009 was 32,300 Euro (Eurostat Yearbook, 2011). Despite the lower level of per capita GDP, Poland is one of the fastest growing economies in the EU. Poland recorded an annual growth of GDP as compared to previous years, although this is no longer the economic downturn, while to the Eurozone crisis has created huge problems in some member countries (Fig. 2). An important factor for the development of agriculture is inflation. On one hand, output prices of agricultural products are higher, but so are input prices. Recently, agricultural input prices have outpaced prices for agricultural products. This means that in order to purchase agricultural inputs, farmers must sell more agricultural products. There are many causes of inflation in Poland and other countries, including the United States. Among the most important (Weise, 2012) are a low unemployment rate, the conviction and the fact that the existing inflation has little to do with the monetary policy of the country. Other factors affecting the increase in inflation may be too much of an increase in average wages, easy credit availability and the increase in fuel prices. In addition, the share of agriculture in GDP is declining. On average in the EU countries the agriculture share does not exceed 5%. Germany and the United Kingdom have the lowest share of agriculture in GDP (Wąs, Małażewska, 2012).

The authors report that in 1990–2010 the share of agriculture in GDP declined in Lithuania from 34% to 3.5%. For comparison, in Poland, the share of agriculture in GDP in 1993 was 6.3% and in 2010 3.1% (Statistical Yearbook of Agriculture, 2011). Since joining the EU, Poland has become a net beneficiary of EU funds, which greatly accelerated rural investment. Increasing investment in the

economy has a positive impact on the development of the country because it reduces unemployment, creates new jobs and improves the overall economic situation. Investment is a change in fixed inputs used in a production process. In the narrowest definition, investment is the change in the physical capital that has a useful life of one year or longer (Zepeda, 2006). However, Eisner (1985) estimated that less than 20 percent of total growth in the United States comes from physical capital formation. Rosenzweig and Binswanger (1993) found that agricultural investment behavior of farmers reflects their risk aversion, with poorer farmers accepting lower returns in exchange for lower risk to smooth their consumption. The main groups of investment in agriculture and hunting are: buildings and structures, machinery, equipment and tools, and means of transport (Tab. II). In the period 2005–2010, the fastest growth rate of investment has been in machinery, technical equipment and tools (69.3%), followed by building and construction (52.1%) and transportation (49.3%).

The investment structure was dominated in 2010 by investment in machinery, equipment and tools (38.3%), buildings and construction (34.5%). The data show that agriculture is mostly rebuilding machinery and buildings. To increase the volume of production, however, the best solutions are productive investments and the purchase of land. The current structure of investment may lead to an increase in the value of fixed assets and freeze funds in machines, which in turn carry a high risk of depreciation.

The competitiveness is closely linked with international markets and open economy taking part in international work division. The topic of international competitiveness is an interest of many scientists, mainly in the context of European Integration and globalization processes, which seek to find factors having an impact on international trade off. That is why it is important to recognize theoretical and practical aspects of competitiveness.



2: GDP and inflation rate for Poland

Source: The Statistical Yearbook of Agriculture and Rural Areas, MSO, Warsaw

II: *Investments in agriculture (current prices)*

Specification	2005	2006	2007	2008	2009	2010
Total (million zł)	2.398	2.959	3.555	3.929	3.710	3.716
Buildings & structures	843	1.163	1.401	1.449	1.316	1.282
Machinery, technical equipment and tools	841	955	1.150	1.346	1.355	1.424
Transport equipment	362	459	565	656	566	541
Total (In percent)	100	100	100	100	100	100
Buildings and structures	35	39	39	37	36	35
Machinery, technical equipment and tools	35	32	32	34	37	38
Transport equipment	15	16	16	17	15	15

Source: The Statistical Yearbook of Agriculture and Rural Areas, MSO, Warsaw, p. 118

III: *Correlation analysis of variables*

Variables	Variables				
	X ₁ (inflation)	X ₂ (investment in agriculture and hunting)	X ₃ (GDP)	X ₄ (exchange rate)	X ₅ (FAO food price index)
X ₁ (inflation)	1.000	-0.5421	0.1956	-0.3514	-0.2854
X ₂ (investment in agriculture and hunting)	-0.5451	1.0000	0.1422	0.5497	0.9047
X ₃ (GDP)	0.1955	0.1422	1.0000	-0.2265	0.2630
X ₄ (exchange rate)	-0.3514	0.5497	-0.2265	1.0000	0.4648
X ₅ (FAO food price index)	-0.2854	0.9047	0.2630	0.4648	1.0000

Source: calculations based on own survey

IV: *The impact of macroeconomic factors on total export of agricultural products, total imports of agricultural products and total trade balance*

Specification	Y ₁ (Total exports of agricultural products)	Y ₂ (Total imports of agricultural products)	Y ₃ (Total trade balance)
R ²	0.9773	0.987	0.965
F	68.7811	119.414	21.377
P	0.000	0.000	0.000
X ₁ (inflation)	-1.500	-0.400	-0.350
X ₂ (investment in agriculture and hunting)	0.667	0.533	0.879
X ₃ (GDP)	-0.600	-0.160	0.131
X ₄ (exchange rate)	0.028	0.048	-0.010
X ₅ (FAO food price index)	0.252	0.455	-0.190

Source: own calculation

We wanted to examine if there is a correlation between variables (Tab. III). We have found a large correlation between analyzed variables. That is why we decided to analyze the individual impact on the efficiency of agriculture. We cannot measure the impact of all variables together on trade balance, exports and imports. The inflation X₁ is correlated with X₂ (investment in agriculture). Exchange rate (X₄) is correlated with X₂ (investment in agriculture) and X₅ (FAO food price index), which suggests common relations in the agricultural economy.

Finally we have measured the impact of macroeconomic factors on total exports of agricultural products, total imports and total trade balance

(Tab. IV). The strongest impact was observed in total imports of agri-food. The R² in the models are high, which suggests that the variables are chosen well. We have used regression analysis to measure the impact of individual variables on the trade balance. We have found some variables were important in the analysis.

The imports of agricultural products was explained by three variables: X₂ (investment in agriculture), X₃ (GDP), and X₅ (FAO food price index). The strongest impact on total exports took: X₄ (investment in agriculture and hunting). The variable, X₁ (inflation), had a negative impact on total trade balance, but X₂ (investment in agriculture)

had a positive impact on total trade balance. That is why we can conclude that the integration with the European Union improved the stabilization of Polish agriculture products because it helped to sell products abroad to the Common Market (Bórawski *et al.*, 2015).

The agricultural sector in Poland in recent years has rapidly changed as it adapted to EU standards. Farms and agricultural businesses must make investments to improve competitiveness. This provides access to direct subsidies and the RDP 2007–2013 (Bórawski *et al.*, 2015).

CONCLUSION

Analysis of the Polish macroeconomic variables shows a general improvement in the economy. Most macroeconomic indicators have improved. However, the GDP growth rate has been weakened in recent years, as the problems for other European countries affect Poland. Especially important are the problems in the euro area.

Foreign trade has increased, with more imports and exports of agri-food products in 2000–2010, showing a stronger bond of the Polish economy to other economies, especially the countries of the EU. There are many tools regulating trade of agri-food products, such as import tariffs for products from outside the EU. Another macroeconomic variable that has done well is the growth in capital expenditures. The fact that the vast majority of capital expenditure involved buildings and machinery and equipment is a drawback. This can cause the phenomenon of over-investment and increasing the cost of living for the farm families. The most important factors having an impact on trade of agri-food products are: X_2 (investment in agriculture) and X_5 (FAO food price index). These results demonstrate that Poland is in a global market and the changes globally have an impact on the situation in these markets. One variable X_1 (inflation) had a negative impact on total trade balance. The volatility of the price of goods, rising costs of transport, and changing rules have negative impacts on trade. It means that global markets develop in times of peace and free market competition.

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