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ANALYSIS OF THE INTERNATIONAL AGRICULTURAL TRADE AS A FACTOR OF THE WORLD ECONOMY GROWTH

ABSTRACT

The liberalisation process of the international trade, followed by numerous negotiation rounds within the GATT and WTO, represents a part of the global plan on liberalisation of the world's trading system. The aim of such a plan implies the elimination of all the obstacles that are limiting the free market competition and the free flow of goods on the global market, thus constraining the global economic growth. Agricultural trade counts as one of many factors that can affect the growth of an economy, but is often suppressed within the conditions of fast growing technological progress, especially at the global level. In this regard, the paper aims to give a founded answer to the following question: could international agricultural trade be considered as a relevant factor of the world economy growth and to what extent? Bringing these two values into a functional relation, based on continuing time series of data and using the LSM-method with exclusively statistical and econometric criteria, it has been proceeded with testing the model. Results of the analysis have shown that the international agricultural trade does not represent a relevant factor of the global economic growth but in some extent, however, exerts its impact.

1. INTRODUCTION

International trade, observed through the prism of transformation and integration of individual national economies into one global market framework, in the last fifty years is increasingly gaining its significance. It was largely contributed by the international trade of agricultural products, which in the period after the World War II emerged as a necessary consequence of the lack of food, but today it represents an instrument of the welfare of many countries, especially those in which agricultural production is still a dominant source of income.

According to the theory of international trade, both classical and neoclassical, economic progress is determined by the free movement of goods. In this context, it is possible to talk about the expediency of strengthening the international flow of goods as one of the key moments in the process of globalization. International trade was for many years obstructed by the instruments of agricultural protectionism and by the emergence of different national subsidy policies as well, especially in Europe. Therefore, the liberalization of global agriculture has become critical issue of many negotiation rounds within the GATT and later also within the World Trade Organization, when noticeable movements on global agricultural liberalization were made.

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The trend of global liberalization in agriculture should contribute to a more equal world economic development, especially in view of the development of underdeveloped countries where the agricultural sector counts as one of the key branches of the economy. Undoubtedly, the impact of agricultural trade on the GDP in these countries is very strong. But, in what extent does agricultural trade influence the world economy as a whole? This paper should give a founded answer to this question, determined by following hypothesis: *International trade of agricultural products affects the growth of the world gross domestic product.*

In order to verify the stated hypothesis, it would be necessary to determine the impact of international agricultural trade on the world economy growth, by applying the regressive analysis. In this regard, time series data of 57 consecutive years will be used in form of annual growth rates to ensure their stationarity. Research will be conducted through several interrelated phases, starting with presentation of the theoretical background up to setting up and testing the functional relationship between variables.

2. THEORETICAL BACKGROUND

Historical experience has shown that developed countries, in particular Western ones, have obtained their economic development by a transition from agrarian to an industrialized and service based society. In much of the development literature, the belief is that economic modernization follows a natural process of evolution, with agricultural development coming first and providing the pre-condition for industrial revolution. As is well known, Lewis (1954; 1958) presents a two-sector model to investigate the expansion of the capitalistic or industrial sector. The so-called "Lewis model of growth" is a theory of development emphasizing rapid industrial growth which is fuelled by the agricultural sector. Thus, industrial expansion is possible by means of cheap food and surplus of labour from the subsistence or agricultural sector (Lewis, 1954). He defines the situation where the marginal product of labour is zero as surplus labour, Lewis suggests that surplus labourers will primarily be associated with the agricultural sector, but not exclusively (many petty traders and casual workers have a marginal product approaching zero). In the Lewis model the process of economic growth begins when capitalists absorb surplus labour into the industrial workforce. Profits are assumed to be reinvested, so the process of structural change will continue until the marginal product of labour is equalized across the two sectors. Economic growth is therefore the result of workers being transferred from the agricultural to the industrial sector.

Extensions of the Lewis model have tended to assume that surplus labour is confined to the agricultural sector (Ranis and Fei, 1961). They clearly brought out the importance of the agricultural surplus in initiating and sustaining the process of capital accumulation in the industrial sector in the context of the dual economy models. The dual economy models can, thus, be seen to lead to a view of economic development which suggests that agricultural development is in some sense a prerequisite to industrial development and that it is agriculture which must necessarily provide resources for industrialization. This is, of course, a highly respected view with a long tradition, whose root can be traced to Ricardo (1817) and which, in our time, not only underlies the construction of all dual economy models (Jorgenson, 1967; Lewis, 1954; Nurkse, 1959; Ranis and Fei, 1961), but is also generally thought to be supported by the history of today's industrialized countries, the prime examples cited being England and Japan.

These historical ideas, however, have undergone considerable revision in recent years and on the basis of recent research it would appear that, if anything, it is more appropriate to say that it was in fact industrial development which contributed to substantial agricultural development in today's industrialized countries, rather than the other way around. Sinha

(1984) provides a succinct summary of the available evidence from which it is fairly obvious that the role of agriculture in both England's and Japan's industrialization has been vastly exaggerated by the earlier historians. A recent estimate, for example, put the annual rate of growth of agricultural output in England between 1760 and 1780, the period when industrialization really began, at only 0.10 % (Crafts, 1983; Sinha, 1984). Sinha also draws attention to the fact that, from the time industrialization began in earnest until well into the nineteenth century, domestic agricultural production in England failed to keep pace with population growth and the high rate of growth of agricultural productivity, which ultimately overcame the Malthusian problem, was a nineteenth and not an eighteenth century phenomenon.

There has been much subsequent debate as to whether surplus labour really does exist in developing countries. However, for labour transfer to generate economic growth it is only necessary that the marginal product of labour be higher in the industrial sector than in the agricultural sector. For developing countries anyway, it seems reasonable to assume that this will be the case. Productivity differentials between the agricultural and non-agricultural sectors are identified by Kuznets (1971) and also by Chenery and Syrquin (1975). Evidence of a productivity differential between the agricultural and non-agricultural sectors is also found in the multi-sector growth model literature. These models allow for the possibility that a different aggregate production function applies to different sectors of the economy. This is incorporated in the empirically estimated equations in the form of a variable allowing for productivity differentials between sectors. Robinson (1971) finds some evidence of a productivity differential between the agricultural and non-agricultural sectors using data for a sample of developing countries. Feder (1986) finds evidence of a productivity differential between the industrial and non-industrial sectors using data for semi-industrialized countries. Dowrick (1989), using data for OECD countries, finds that labour in the agricultural sector has a lower marginal product than labour in the industrial or service sectors, Dowrick and Gemmell (1991) also find evidence of a productivity differential between the agricultural and industrial sectors for a sample of developed and developing countries. All of these studies conclude that resource transfer is a significant source of economic growth.

Another study, which was carried out by Wichmann (1996), has analysed the role of agriculture in a neoclassical framework. However, the empirical work was based on an ad hoc equation consistent with the neoclassical growth model. The proportion of the labour force working in the agricultural sector in 1960 is found to be negatively correlated with subsequent economic growth. Wichmann suggests that this may be because technology is typically backward in the agricultural sector in less developed countries. Today's development economists are less sanguine about the desirability of paying such heavy emphasis on rapid industrialization (Todaro, 1997). They argue that the role of the agricultural sector and the rural economy in the economic development process must be dynamic and possess leading elements rather than playing a passive and supporting role. This is the case for the vast majority of Third World Countries.

And finally, one aspect of the international trade in relation to agriculture has recently attracted significant research attention, deals with the impacts of exchange rate volatility on trade. There is a study which was motivated by an increase in protectionist pressures, large exchange rate fluctuations among the major currencies and significant slowdown in world trade recorded in the early 1980s and during the 2001–03 period (Clark et al., 2004). Clark et al. argue that there is no empirical evidence showing a systematic and definitive negative link between the volume of world trade and exchange rate volatility. They noted that it is possible for huge exchange rate fluctuations to have impacts on the economy through other channels. Although the evidence so far is at best conflicting, policymakers and the general public are still concerned about the effects of huge exchange rate movements. So, significant research

efforts have been devoted to understanding the effects of exchange rates on agricultural trade flows in various parts of the world (Kargbo, 1995, 2005; Tsikata, 1999). A common characteristic of past trade studies is that supply relationships have generally been handled by assumption. Typically, the 'small country case' is assumed when a country's actions do not influence world prices. Thus, the import and export supply price elasticities faced by a particular country are taken to be infinite, or at least large. However, this assumption is inadequate when applied to the supply of exports of a large country. Kargbo (2005) and Lopez et Thomas (1990) argue that import demand models which do not include variables on relative prices, income and foreign exchange constraints are likely to yield biased estimates as a result of the omission of relevant variables or the simultaneity of import volumes and relative prices. Kargbo's (2006) empirical findings about agricultural export supply function and an import demand relationship for agricultural products in a 'large country case' show strong links between exchange rates, prices and other variables in the economy. In effect, changes in relative prices, real exchange rates, domestic production capacity, the change of government, trade policies and real incomes have a significant and persistent impact on agricultural trade. His estimates show the potential impact of policy reforms and the fairly swift response by market participants to shocks on exchange rates and other variables that determine international agricultural trade.

3. DEVELOPMENT OF THE INTERNATIONAL TRADE, WORLD ECONOMY AND AGRICULTURE

Since the times of mercantilism, international trade was subject of intensive theoretical debates. But more serious development of the economic thoughts on international trade began in the 18th century, at the time of Adam Smith and David Ricardo, representatives of the British school of classical political economy, which was advocating its standpoint regarding the neutrality of state in view of its market intervention (so-called laissez-faire), pointing out the benefits of the free trade, based on the theory of comparative advantages. It was in opposite with the traditional mercantilists' understanding of international trade, which reposed on the importance of the state intervention and the import restrictions, aiming at the achievement of positive trade balance. All the well standing countries, such as England, soon began to accept the concept of the theory of free trade, especially in late 19th century, by appearance of the neoclassical economic thought, when the position of the "classicists" has been mathematically formalized. In the last fifty years we are witnessing the strong penetration of neo-liberalism into the global economy, especially in high developed countries. However, the agricultural sector remained one of the most protected sectors of the world economy, a fact that goes against the majority of the developing countries, where agriculture is still the leading sector of the economy, suffering from limited access to the markets of developed countries. For example, the average tariff on manufactured goods during the 90's was globally dropped to almost 5%, while the tariffs on agricultural products were not going below 40% (Griswold, 1999). It seems that at the institutional level things are going in accordance with the declared guidelines, while in practice the world trade is facing the opposite (Watkins et al., 2002).

Table 1

Average growth rates of the world trade and production volume

Period	World trade	World production
1950 - 1963	7.7	5.2
1963 - 1973	9.0	6.1
1973 - 1990	3.8	2.6
1990 - 2000	7.0	2.5
2000 - 2007	5.5	3.0

Source: WTO (2001, 2008). *International Trade Statistics*, Annual publication of the World Trade Organisation, Geneva

In accordance with the principles of comparative advantage, liberalization of the world trade should ensure the achievement of the effects of specialization, not only in developed countries but also in developing countries. According to available data on global production and trade during the last fifty years, the volumes of international trade and production are diverging in their dynamics of growth since the 70's (Table 1). Similarly, trade of agricultural products, as part of the world trade, is also following this trend in relation to the world agricultural production, as it is shown in Table 2.

Table 2

Average growth rates of the world agricultural trade and production volume

Period	Agricultural trade	Agricultural production
1950 - 1963	4.5	2.9
1963 - 1973	4.0	2.5
1973 - 1990	2.4	2.3
1990 - 2000	4.5	2.0
2000 - 2007	4.0	2.5

Source: WTO (2001, 2008). *International Trade Statistics*, Annual publication of the World Trade Organisation, Geneva

Looking the available data for observed periods between 1950 and 2007, it can be noted that despite the gradual degression of the growth rates, the world production of agricultural products in the last thirty years recorded almost an identical growth as the total world production. Much in the past, only half of the total world production growth rate has been achieved. Namely, after World War II industrial production experienced a sort of sudden boom, contributing much more to the growth of world production than the agricultural production did. Consequently, the agricultural trade provided lower growth rates in relation to the total growth of world trade, partly obstructed by the global agricultural protectionism policy, supported by GATT in a time when agricultural products have been excluded from the General Agreement on Trade and Tariffs for many years. The mentioned relationship between different rates of growth within the total volume of world trade is graphically represented with Graph 1, which is based on trading growth indexes data for key sectors of the world economy.

**Graph 1: Movement of the international trade growth by sectors
(from 1950 to 2007)**
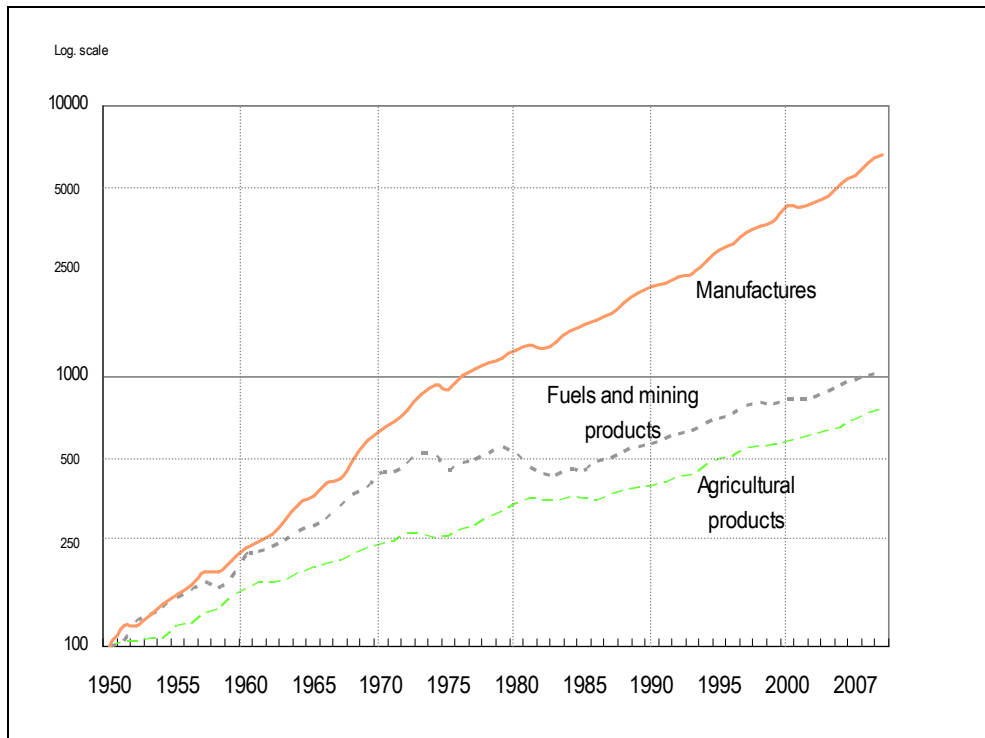
Source: WTO (2008). *International Trade Statistics 2008*, Annual publication of the World
Trade Organisation, Geneva

After many years of supporting the global agricultural protectionism, there was an initiative of the World Trade Organisation to open up the process of liberalizing the agricultural markets worldwide. It was the time when, after the fall of the Berlin Wall, interest in economic liberalism newly revived, becoming very soon a sort of global trend. So, the importance of reaching the level of higher economic openness remained an objective for all the countries participating in the open global market. In this context, the so-called "Index of Economic Freedom" emerged as an indicator for measuring the openness level, as it is shown in Table 3. Growth of the global agricultural trade, which is expected to arise within the liberalization process in the forthcoming period, will most likely depend on the opening speed of national economies and their agricultural sectors in relation to the global market. Many theoreticians argue that the strengthening of economic freedom encourages investments and enables further development (Hank et Walters, 1997). Therefore, the degree of economic freedom could be regarded as an institutional key factor of economic progress (Powell, 2003). For example, countries within Table 3 are ranked by Index of Economic Freedom, showing that the first ten places are occupied by developed countries. Various investigations have also shown that a higher degree of economic freedom generates some positive effects on social and economic development, such as: lower unemployment and lower infantile mortality (Grubel, 1998), higher life expectancy (Esposto et Zaleski, 1999), more equal income distribution (Berggren, 2003), lower level of poverty (Grubel, 1998) and better ecological perspectives (Norton, 1998). Given that agriculture represents an interrelated link between people-earth-environment-living standard, higher degree of economic freedom means a greater prosperity not only for farmers and their families, but also for the sustainable development of a country as well.

Table 3

The ten best and worst ranked countries by index of economic freedom (IEF) in 2008

Rank (10 best)	Country	IEF	Rank (10 worst)	Country	IEF
1	Hong Kong	90.3	148	Venezuela	45.0
2	Singapore	87.4	149	Bangladesh	44.9
3	Ireland	82.4	150	Byelorussia	44.7
4	Australia	82.0	151	Iran	44.0
5	USA	80.6	152	Turkmenistan	43.4
6	New Zealand	80.2	153	Myanmar	39.5
7	Canada	80.2	154	Libya	38.7
8	Chile	79.8	155	Zimbabwe	29.8
9	Switzerland	79.7	156	Cuba	27.5
10	UK	79.5	157	North Korea	3.0

Source: The Heritage Foundation & The Wall Street Journal Publication: Index of Economic Freedom 2008

During the 70's, most of the countries already reached significant degree of its economy liberalization. Between 1985 and 2005 there were only a few countries that haven't increased their level of economic freedom. In fact, some studies have shown that greater economic freedom strongly correlates with higher living standards and personal satisfaction of citizens (Gwartney et Lawson, 2005). For example, the ten worst ranked countries at the same time represent the most closed economic systems in the world, like North Korea or Cuba (see Table 3). Studies have also shown that the rank of countries, sorted according to the index of economic freedom, strongly correlates with the height of average income per capita, but also with the degree of literacy, access to water resources or the level of corruption in these countries (Gwartney et Lawson, 2004). Because economies of less developed countries are highly dependent on their agricultural production and trade, market openness of developed countries should provide them better market access for their agricultural products and thus contribute to greater economic prosperity of less developed countries. By comparison, if for example the share of developing countries in world exports would increase by only 5%, they would achieve an income of 350 billion U.S. dollars, or seven times more than they receive within the development aid (Šuman, 2005, 52).

4. DATA AND MODEL CONSTRUCT

In order to construct the appropriate model as a platform for performing the required tests and thus to verify the hypotheses, it is proceeded with setting up of time series, which are based on historical data related to annual growth rate movements of the observed variables, shown in the following chart:

Graph 2

Movement of the annual growth rates of world agricultural trade (AGT) and the world real gross domestic product (GDP) from 1950 to 2007
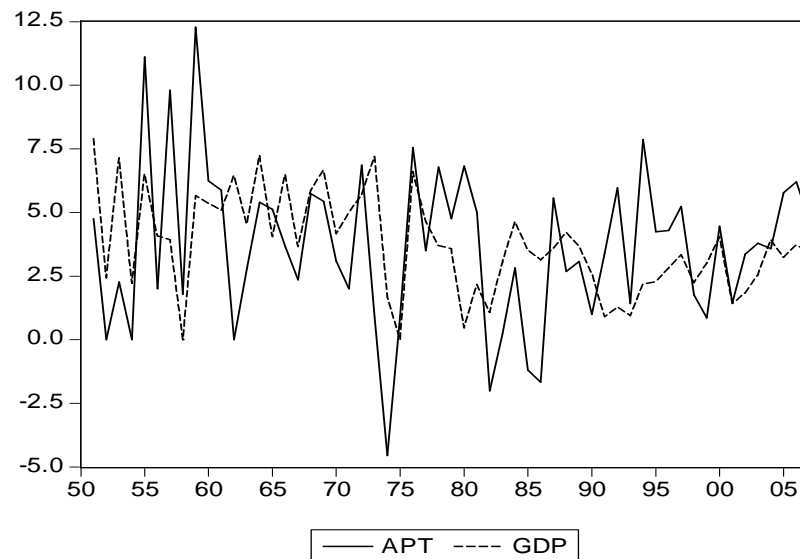
Source: WTO (2008). *International Trade Statistics 2008*, Annual publication of the World Trade Organisation, Geneva

Putting the two observed values into relation, the functional connection can be determined between the international agricultural trade (AGT), as independent variable, and the world gross domestic product (GDP), as dependent variable. The linear form of their interrelation is:

$$\underline{\mathbf{y = 0,2066x + 2,9787}}$$

From the linear shape of the functional relation between the independent and dependent variable of the constructed model, it is clear that the model fulfils the so-called 'a priori criterion', regarding the prefix of the independent variable, which indicates that the variables are positively correlated.

In order to determine whether the used time series data are stationary or not and to proceed with further regression analysis, the next step is to test the time series on stationarity. The results of these tests showed the following:

Null Hypothesis: APT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.156327	0.0000
Test critical values:	1% level	-3.552666	
	5% level	-2.914517	
	10% level	-2.595033	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: APT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.126605	0.0000
Test critical values:	1% level	-4.130526	
	5% level	-3.492149	
	10% level	-3.174802	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: APT has a unit root
Exogenous: None
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.772358	0.0003
Test critical values:	1% level	-2.606911	
	5% level	-1.946764	
	10% level	-1.613062	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: GDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.271885	0.0000
Test critical values:	1% level	-3.552666	
	5% level	-2.914517	
	10% level	-2.595033	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: GDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.344973	0.0000
Test critical values:	1% level	-4.130526	
	5% level	-3.492149	
	10% level	-3.174802	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: GDP has a unit root
Exogenous: None
Lag Length: 2 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.280705	0.1823
Test critical values:	1% level	-2.608490	
	5% level	-1.946996	
	10% level	-1.612934	

*MacKinnon (1996) one-sided p-values.

From the calculations above, the stationarity of international agricultural trade time series (AGT) in all three types of tests could be confirmed with sufficient level of significance, while the stationarity of world domestic product time series (GDP) could be confirmed in two of the three types of tests.
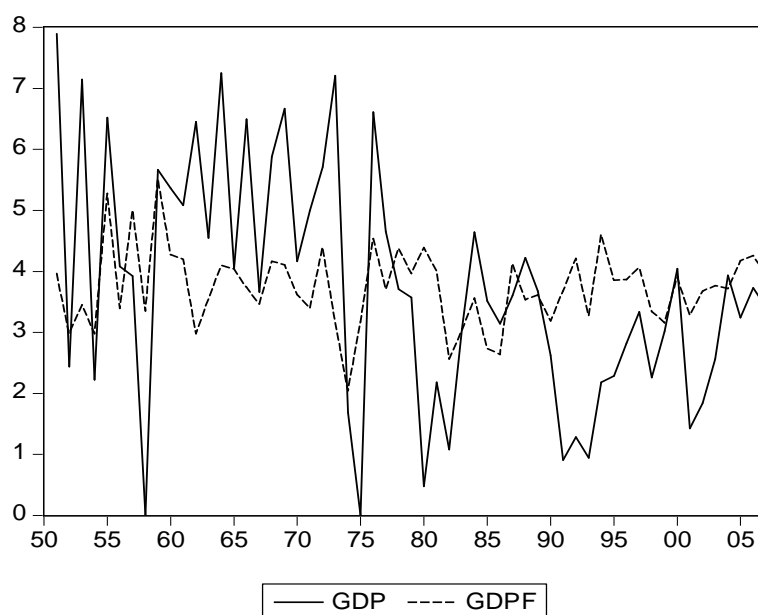
5. RESULTS OF THE ANALYSIS

Using the available time series data, it was proceeded with regression analysis, applying statistical and econometric criteria in order to determine the representativity and the reliability of estimated function and its parameters, as well as other standard tests:

Dependent Variable: GDP
Method: Least Squares
Sample (adjusted): 1951 2007
Included observations: 57 after adjustments
GDP=C(1)+C(2)*APT

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	2.978736	0.382066	7.796395	0.0000
C(2)	0.206606	0.079568	2.596594	0.0121

R-squared	0.109201	*Mean dependent var*	3.737172
Adjusted R-squared	0.093004	*S.D. dependent var*	1.952454
S.E. of regression	1.859445	*Akaike info criterion*	4.112891
Sum squared resid	190.1646	*Schwarz criterion*	4.184577
Log likelihood	115.2174	*Hannan-Quinn criter.*	4.140751
F-statistic	6.742302	*Durbin-Watson stat*	1.254156
Prob(F-statistic)	0.012053		

Graph 3: Real and estimated values of the dependent variable (GDP)

Source: According to calculations

Results of the regression analysis indicate the statistical relevance of changes within the international agricultural trade, with respect to the movement of the world gross domestic product. However, the adjustment level of the model is weak. The calculations are also showing the presence of autocorrelation, so that the estimations of the model could not be accepted as relevant.

6. CONCLUSION

As is well known, in high developed industrial countries agriculture is contributing to the gross domestic product in a very small percentage. On the contrary, the less developed countries, but also countries that recently became a part of the European integration, are recording much higher contribution of agriculture to their GDP. Increased world trade in agricultural products, initiated by the process of global liberalization, should lead to more equal development of the world economy for the benefit of less developed countries, where the agriculture represents a key activity of their economy. In these countries, especially there where economies of scale can not be achieved, international agricultural trade is definitely a significant factor of growth. However, this conclusion could not be applied in case of the world economy. Namely, results of the analysis have shown that despite the existence of the statistical significance of changes within the international agricultural trade, with respect to the movement of the world gross domestic product, only 10% of the GDP variation is explained by the international agricultural trade variations, meaning that the estimated function is not sufficiently representative. So there is a general conclusion that the impact of international agricultural trade on the world GDP growth does not represent such a relevant value. Evidently, there are other factors which are affecting the growth of the world GDP more, but are not the subject of this research.

Why the international trade of agricultural products has no significant impact on global economic growth, it could be explained by the fact that due to the progressive technological progress, agriculture in many developed industrial countries insignificantly participates in the volume of GDP, thus largely reflecting the lack of agricultural contribution towards the world gross domestic product. A fact that can also not be ignored is that the global process of agricultural liberalization started some ten to fifteen years ago, so that more significant effects of this process could be expected somewhere in the coming years.

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ANALIZA MEĐUNARODNE RAZMJENE POLJOPRIVREDNIH PROIZVODA KAO ČIMBENIKA RASTA SVJETSKOG GOSPODARSTVA

SAŽETAK

Proces liberalizacije međunarodne razmjene, popraćen brojnim rundama pregovora u okviru GATT-a i Svjetske trgovinske organizacije, dio je plana globalizacije trgovinskog sustava s ciljem obaranja svih prepreka koje ograničavaju konkurentnost i slobodni protok dobara, pa time i globalni ekonomski rast. Razmjena poljoprivrednih proizvoda jedan je od brojnih čimbenika koji mogu utjecati na ekonomski rast gospodarstva, ali se kao takav u uvjetima munjevitog tehnološkog napretka često zanemaruje, posebno na globalnoj razini. U tom pogledu, svrha ovoga rada sastoji se u davanju odgovora na slijedeće pitanje: da li se i u kojoj mjeri međunarodna razmjena poljoprivrednih proizvoda može smatrati relevantnim čimbenikom rasta svjetskog gospodarstva? Dovođenjem ovih dviju varijabli u funkcijski odnos, a na temelju neprekinutog vremenskog niza podataka i uz korištenje LSM-metode te isključivo statističkih, odnosno ekonometrijskih kriterija, pristupilo se testiranju postavljenog modela. Rezultati analize pokazali su da međunarodna razmjena poljoprivrednih proizvoda nije relevantan čimbenik globalnog ekonomskog rasta, ali da u određenoj mjeri ipak ostvaruje utjecaj.

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Ključne riječi: *poljoprivreda, razmjena, globalni rast, svjetsko gospodarstvo*