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PRICE DYNAMICS IN STAGES OF LONG-TERM CYCLIC FLUCTUATIONS OF CONJUNCTURE OF THE WORLD AGRO- FOOD MARKET

DYNAMIKA CEN W DŁUGOOKRESOWYCH WAHANIACH KONIUNKTURY NA ŚWIATOWYM RYNKU ROLNO-SPOŻYWCZYM

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Streszczenie. Globalny rynek rolno-spożywczy charakteryzuje się dużą zmiennością cen. Zmienność ta zmienia się, w różnych okresach czasu, pod wpływem czynników zarówno endogenicznych jak i egzogenicznych. Analiza zmienności cen w okresie długoterminowym, ujawniła prawidłowości i cechy koniunktury cen na rynku rolno-spożywczym. Obejmowały one trzy długofalowe cykle w rozwoju globalnego rynku rolno-spożywczego. Określono przyczyny zmian długoterminowego trendu spadkowego cen oraz trendu wzrostowego w trzecim etapie rozwoju koniunktury. Określano czynniki wzrostu poziomu cen na początku dwudziestego pierwszego wieku. Zidentyfikowano mechanizm wahań cen oraz przyczyny ich gwałtownego wzrostu w warunkach kryzysu finansowego i gospodarczego.

Key words: demand, price shocks, supply, trend, volatility.

Słowa kluczowe: podaż, popyt, szoki cenowe, trend, wahania.

INTRODUCTION

Shocks of prices in the global food market in 2006–2012 intensified the process of research trends and future prospects (Anderson 2010, Witzke 2009, 2010, FA 2011). At the same time, investigated processes occurring in this market remain insufficiently with respect to short-term, medium-and long-term periods. Many studies are empirical. They do not have a sufficient scientific theoretical foundation.

During the twentieth century and the early part of the first decade of this century the price situation on the world agro-food market was characterised by multi-directional and, at first sight, chaotic changes. A wide variety of factors causing either increasing or decreasing prices was influenced by this market at different periods of time. All of these factors are the factors affecting market conjuncture, factors affecting supply and demand, factors affecting the changes in their balance. Changing balance between supply and demand was an important cause of price changes. However, changes in the prices in the analysed market were not only the result of changes of market conjuncture, not just the result of changes of balance of supply and demand. They had a converse effect on the quantity of supply and demand, which is a factor in the cause of the formation and development of specific trends in this market. High food prices limit the increase in the quantity of demand and accelerate the growth of the value proposition. As a result, the global agro-food market is once again returning to the state of relative over-production. It is typical in this situationfor, on the one

hand, the "surplus" of food, and on the other - under-consumption and hunger. Conversely, in condition of lowering prices there will be a tendency to limit the growth in supply and for some acceleration of growth in demand. In addition to internal factors associated with changes, in conditions of the world agro-food market on the price dynamics within this market, it is often impacted by a number of external factors. The influence of exogenous factors on the price volatility is evident during the world wars, during the financial-economic crisis (Fig. 1).

The observed influence suggests the importance of research and scientific analysis of changes occurring in the global prices of agricultural and food market.

The objectives of this paper are:

- Disclosure the essence of market phenomena related to changes of prices in the global agro-food market, with the increase of their volatility;
- Identification of patterns and features of these changes, periodisation of the development the conjuncture agro-food market, establishing the correlation of this periodisation with long-term cycles of conjuncture, with the change of technological structures;
- Determination of the causes of the identified long-term trends of price movements in the global agro-food market and the theoretical justification for the mechanism of their effects on market conjuncture.

Analysis of the dynamics of price conjuncture of the world food market over a long period of time (the past and the beginning of this century) in figure 1 allows, even from the first superficial glance at the chart, one to identify a number of trends and characteristics in its development:

1. The trend of increasing price volatility, the increase amplitude of their oscillations.
2. The downward trend of prices within the food market throughout the twentieth century.
3. The sharp change in the early twenty-first century and long-term downward trend in world food prices and the trend reversal in the direction of the dynamics of a sharp increase.
4. Periodicity of price shocks and their relation to the change of long-term cycles of the market, with the change of technological structures.

TRENDS OF INCREASING PRICE VOLATILITY. PRICE SHOCKS

Dynamics of prices on the world food market are characterised by persistent fluctuations. Non-price factors cause changes, fluctuations in supply and demand (shifting supply and demand curves). Fluctuations in supply and demand cause changes in terms of market equilibrium and in the price of market equilibrium. Develops the volatility of not only current market prices, but also market equilibrium price. Volatility can build to price shocks under the influence of some external factors of supply and demand on world food markets (Fig. 1).

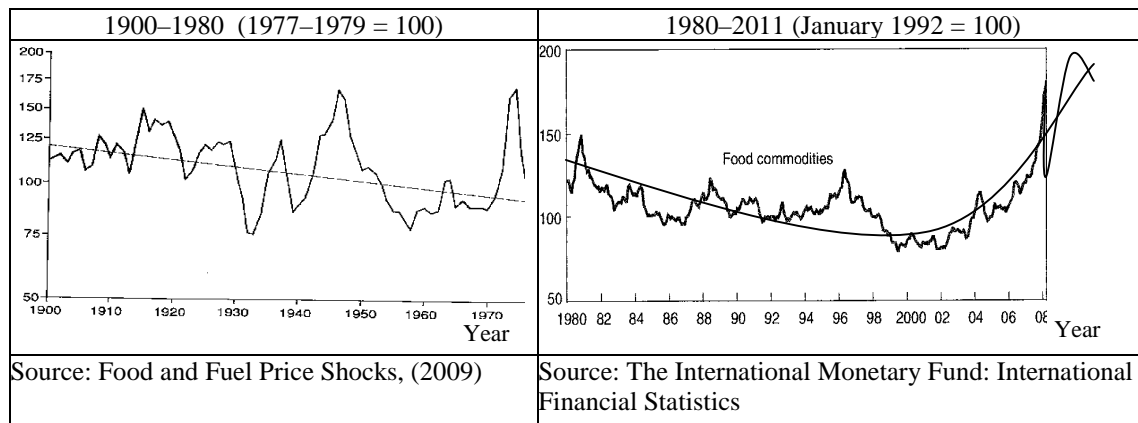


Fig. 1. The dynamics of price conjuncture of the global food market (price index)

Analysis of the process of volatility in food prices on world markets allows us to reveal some trends, features of the variability of market conjuncture. Periods with low volatility are interrupted by price shocks. Price shocks are characterised by a sharp increase and decrease in the size of variation - the difference between maximum and minimum prices indices (R , Table 1, Fig. 2).

Table 1. The size of variation of the index of world food prices (2002–2004 = 100)

Index	1990–2000	2001–2011	
The maximum index (J_{\max})	137.3 (05.1996)	224.4 (06.2008)	234.9 (04.2011)
The minimum index (J_{\min})	88.3 (07.1999)	141.3 (02.2009)	210.3 (12.2011)
The size of variation ($R = J_{\max} - J_{\min}$)	49.0	83.1	24.6

Data source: FAO, Monthly real food price indices, (2012)

Comparison of the last two decades (Table 1, Fig. 2) shows that the degree of variation of the index of world food prices in 2008–2009 amounted to 83.1 percentage points. This is 1.7 times greater than the amplitude of variation in 1996–1999. All this indicates a significant and unprecedented increase in the volatility of world food prices. The amplitude of the fluctuations in the price begins to take a divergent explosive character. This can lead to an increase in devastating consequences. These consequences may cause sudden catastrophic worsening of the food problem in the world, if effective measures are not taken at the international level. The maximum level of prices in 2011 surpassed the 2008 level by 1.06 times. The minimum post-crisis price level in 2011 was higher than in 2009, by 1.49 times.

As a result of price movements, while the size of variation fell to 24.6, the average level of prices (of trend) rose sharply. In general, as seen in Figure 2, the fluctuations in the 2010–2011 span of variation in prices take place against the backdrop of a rising trend line. This is the result of the range of variation in prices not growing by the growth of uniform oscillations with the same horizontal trend. The size of variation grows by the increase of fluctuations and is accompanied by an increase in both maximum and minimum values of the price index for each variation. However, in the last century it was the opposite. Minimum price index was decreasing at the time of a lower rate of decrease of maximal index. With such dynamics, there was a tendency to lower prices.

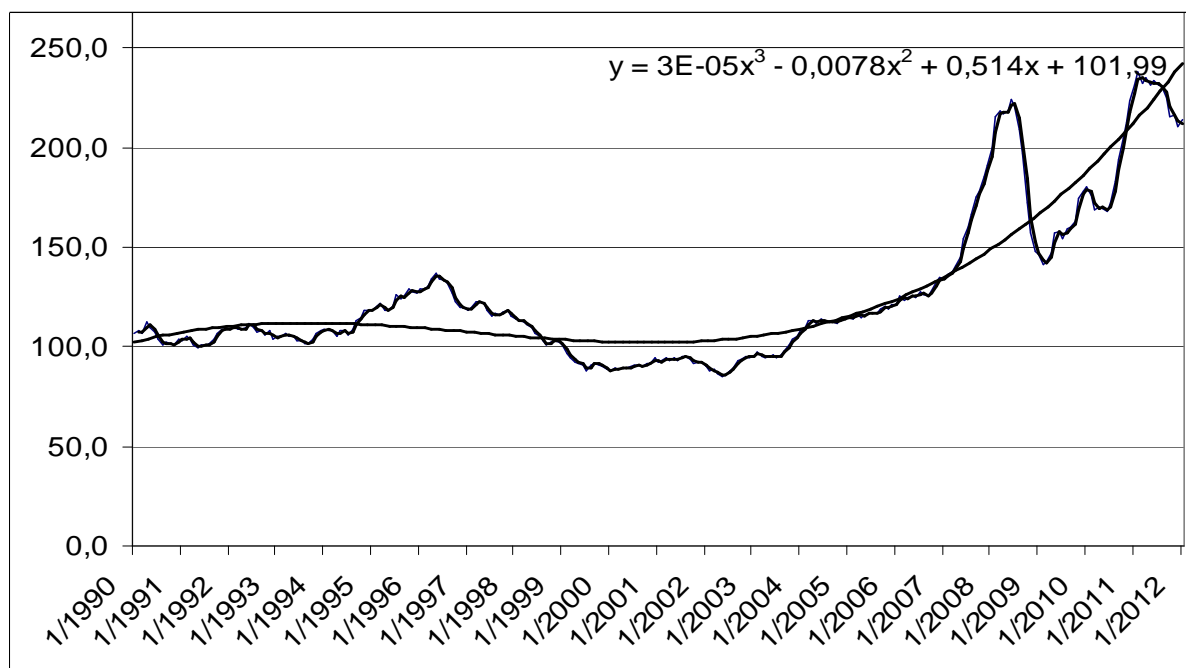


Fig. 2. Food Price Index
Data source: FAO, Monthly real food price indices (2012).

In certain periods the volatility of prices takes an explosive character: during the First World War, during the "Great Depression" 20–30s, during the second world war, in times of crisis 70s, in 2004–2011 (Fig. 1). If we abstract from the explosive price shocks caused by exogenous factors during the world wars, then there are three price shocks with a large size of variation. Each of these price shocks gives the beginning of new cyclic wave of long-term development of the agro- food market.

The trend (the trend of price changes) to the decreasing is typical for the two long waves (phases) originating in the late 20s and late 70s (the first and second stages). This indicates advancing growth in the global market supply relative to demand (Fig. 1, 2, 3). During the last third wave, which began in the twenty-first century, the price trend in the global agro- food market changed and began to grow rapidly due to a substantial increase in demand and other factors (Fig. 1 and 3). Some of the factors that caused a sharp increase in the price level and volatility at the beginning of the XXI century are analysed later in this article.

The specificity of formation and change of price conjuncture of price volatility has significant differences in the short-, medium-and long-term (Kondratiev 1989). Conjuncture in these periods is differed by factors causing its fluctuations, by the changes in its resulting indicators and by the balance between supply and demand.

The medium-term fluctuations of conjuncture unlike the short-term are characterised by the changes of no current market prices, but the changing of their trend during an 8–12 year cycle. The researchers of the medium-term market fluctuations mark different non-price factors, including the duration of the oscillations of solar activity, as the cause of the oscillations. Most often, the researchers associate the medium-term cyclical fluctuations of the market conjuncture in agriculture with this factor.

Fluctuations in the price conjuncture in the long-term period are characterised by length of waves, ie large cycles of long-term conjuncture. Long-wave conjuncture was discovered N Kondratiev in industry and the economy as a whole (Kondratiev 1989).

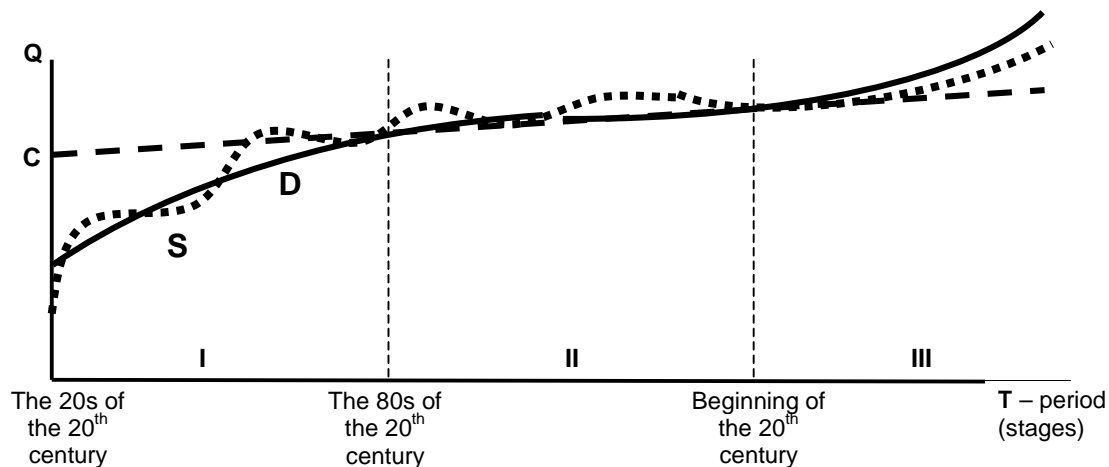


Fig. 3. Cyclic waves (the stages) of development of the conjuncture of the agro-food market in developed countries:

I – the stage of unstable conjuncture with unsaturated needs (the stage of the incomplete market saturation, the stage of state and market regulation);

II – the stage of low conjuncture with saturated needs (the stage of the complete market saturation, the stage of the market liberalism)

III – the stage of the growing conjuncture in foreign markets of food and biofuel

C – the level of absolute needs (rational rates of consumption); D and S – the demand and supply

Source: author's scheme, hypothetical data (Gaysin...1998, 2003, 2007, 2010)

In the agricultural sector, a long-term market conjuncture is quite different from the Kondratiev long waves. The specificity of long-term fluctuations in the agricultural sector, in contrast to the industrial manifests itself in the long term and sustainable trend deviation of market equilibrium prices from the trend of prices effective competitive equilibrium. This indicates the ineffectiveness of the mechanism of competitive equilibrium in the agrarian sector of the economy. In the agro-food market, there is not a long-term equilibrium (Gaysi 2010).

The volatility of prices for the agricultural and food market is characterised by long-wavelength fluctuations indices of supply and demand, which have decisive influence on the dynamics and volatility of prices in both the long and short periods. At the beginning of the transition from one stage to another of long-wave oscillations takes place an increase of the volatility of prices.

Increased price volatility is due to the influence of many exogenous and endogenous factors. Every price shock that occurs at the beginning of the above three long-wave oscillations is caused by a specific set of factors. But in all three cases, the common endogenous factor causing an increase in volatility is such a factor, as the effect on the price situation "law of Gregory King".

The effect of this law shows that an increasing degree of saturation of the needs and reduced elasticity of the demand for food causes an increase in volatility, the amplitude of price fluctuations, respectively, and the income of producers of food. This is due to the fact

that with an increasing of level of saturation for needs in food is decreased the elasticity of demand on prices, increases "price flexibility" and begins to act the law King. The effect of this law shows that even a small change in the volume of sales, associated with a change in supply (production), can cause a significant change in prices.

Society produces and actively uses measures, neutralizing the action of "law of King." They include the application of agro technological measures to reduce the fluctuations in agricultural production along years. This smooth's out fluctuations in sales of agricultural and food products on the market. On the other hand, the use of an active policy of "buffer stocks" wide development of speculative operations in the private sector and the state contribute to the stabilisation and alignment of product offerings over the years and seasons to the agro-food market, according to the dynamics of supply and demand. These measures have largely neutralised the impact on the price conjuncture "law of Gregory King" and mitigated the volatility of prices. At the same time during the last global financial crisis, speculative transactions in the form of futures trading began to give the opposite effect - instead of mitigating the volatility in food prices it began to contribute to its increase.. This is discussed in more detail in the last paragraph of this article.

CYCLICAL FLUCTUATIONS OF PRICING CONJUNCTURE IN THE XX CENTURY: DOWNTREND OF PRICES

Figure 1 shows that in the twentieth century, the trend of prices in the global food market is characterised by a downtrend of prices. This conclusion is confirmed in other research papers (Anderson 2010, Witzke 2009, 2010, FAO 2011)

Such price dynamics indirectly suggest that in the last century there was a trend towards progressive growth of supply compared with an increase in food demand. This trend can be characterised as a tendency to the formation of excess supply (production) in the world market above the demand. But this "overproduction" was relative. It is characterised by an excess of food at one extreme and an acute shortage - on the other, over-production in advanced economies with hundreds of millions of hungry people in the world, with hundreds of thousands of children dying from starvation. Even in developed countries with a high level of saturation of food to population, there are a lot of people who consume inadequate amounts of food. In general, the global market is characterised by overproduction and the fact that there was a surplus of food supply is not on the absolute needs, but over the demand of the needs of the solvent (Fig. 3).

The relative overproduction – is an excess of supply over demand, or over the level of consumption, which is achieved in the data money incomes of population and has not yet reached the level of absolute need. For example, supply in a given country is on average 50 kg of meat and meat products per year per person. Demand (and consumption) is 45 kg. If the average per capita income had been much higher, demand (and consumption) of meat and meat products would be at 80 kg per year (approximately at the level of absolute

needs – at the level of rational consumption norms). This hypothetical example would amount to a relative overproduction of 5 kg per year per head of population (50–45), with an absolute shortfall of 30 kg (80–50). If the supply in the country per capita were 100 kg with 80 kg of demand, it would be absolute overproduction. In 2009, Russia consumed meat and meat products per capita per year, of about 61 kg in Germany – 88, in Poland – 71, Ukraine – 50 kg (Social status 2011).

A significant part of the population has extremely low degree of saturation of needs for food because of its physical and economic inaccessibility. If in the countries with developed economies, the degree of saturation of the absolute needs for essential food (the needs of relevant evidence-based rational consumption rates) is on average close to 100%, in developing countries for a number of major food items, it may be lower than 50%.

In accordance with the law of saturation of the needs of marginal utility of food goods, will be much higher in developing countries. This is reflected in the fact that the relative value of food, respectively, and their relative price in these countries will be much higher. The relative value of food – is the ratio of their nominal prices to per capita income. The relative price reflects of the ratio values or of the ratio marginal utilities. The relative price of meat for buyers in various regions of Russia per 100 rubles of per capita income is equal to: in Moscow – 0.48, in St. Petersburg – 0.75, Ivanovo Oblast – 1.69, in the Republic of Kalmykia – 2.13, in Russia on average – 1.00 (Soc. collection, Rosstat, p. 506). Relative values of food products are also significantly different by countries. It is very high in developing countries, which indicates a high level of share costs of population to food in the total amount of their income, the low economic and physical availability of food for their population. In developed countries, the relative value of food is low. In the structure consumption, expenditure of household share of expenditure for food in developing and middle-developed countries is much higher than in developed countries. In Russia in the structure of final consumption share of food is 29%, in the UK – 7, Germany – 9, France – 10.7, USA – 6.2, Japan – 12.2%. This indicates that the market for the food retail trade in Russia has not yet reached the saturation point. (Social sphere 2010). In developing countries, the proportion of income, which is spent on food is even higher. For example, in Bangladesh, Malawi, Vietnam, it is more 60% in Ghana, Pakistan, Tajikistan – more than 70% (FAO: How does 2011).

For the average global trends in an excess of supply over demand and the downward trend in prices (Fig. 1 and 3) significant differences between the developed, moderately developed and developing countries are hidden. Overproduction of food in developed countries takes place at a high degree of saturation of demand for major food products. In the twentieth century, in the first cyclic wave of the evolution of the agro-food conjuncture in the developed countries, needs were not completely saturated yet (Fig. 3, Table 2). Overproduction was relative. However, the level of the saturation of needs was rather high. With increasing saturation of needs, the elasticity of demand for food falls. Inelastic demand is no longer responsive to market signals (revenue and price). A slowing growth of demand in an almost completely saturated market begins to lag consistently behind the growth of supply.

Production (supply) has been growing faster than population growth and the increase in its demand for food. This is largely due to the fact that the scientific and technological revolution in the twentieth century began to develop agriculture. In addition, growth in production was due and a number of factors related to the peculiarities of agricultural production and the peculiarities of supply in this branch (Gaysin 2010). Demand for food in the developed countries grew slowly and lagged behind the growth in supply because, the saturation of the needs of its elasticity decreased significantly. In developing countries, it also grew slowly. However, there were other reasons for this. Demand for food in these countries grew slowly due to low and slowly increasing income levels of population.

Overproduction in the first and especially in the second wave becomes stable and lengthy. This causes a tendency to the formation of market prices at a lower level compared to the price of effective competitive equilibrium, a downward trend in these prices. Shortness of market regulation inelastic demand calls needs of using of public policy of expansion demand. The high level of saturation of needs and the absolute nature of overproduction become particularly characteristic of developed countries in the second stage (cycle) of development of the long-term conjuncture of the agro-food market (Fig. 3). In the transition from one cycle to another in 70 – 80 years, the countries of EU surpassed the milestone of 100 percent sufficiency of foodstuffs (Table 2).

Table 2. Self-sufficiency countries of EU in basic foodstuffs *

Foodstuffs	1973/74	1985/86	1989/90
Cereals (excluding rice)	91	110	120
Sugar	91	123	128
Fresh vegetables	94	107	106
Fresh fruit (excluding citrus)	82	87	85
Beef and veal	96	107	108
Pork	100	102	104
Poultry	102	105	105

* The ratio of production to domestic consumption in %.

Source: Tracy 1995.

In this connection it should be noted that such a tendency of market development in these countries as a decrease and the stagnation of the elasticity of demand for food during the transition from first to second cycle of long-term conjuncture. Demand, on average reached saturation in food needs in accordance with rational norms of consumption. Demand was almost completely inelastic. The possibilities of supply and food production have increased substantially due to the use of science. This trend is a consequential action of the law of saturation needs and, ultimately, it is manifested in the decreasing marginal utility, and hence, *ceteris paribus*, and in the fall of the relative values and prices of food goods. The long-term downward trend in the real level of world prices of the agricultural and food market during the first and second long-term cycles in terms of faster growth in supply relative to demand, was manifested in the decrease in the relative level of prices for the products of farmers in relation to the prices of industrial products which they buy, that is, in increasing the disparity in prices between industry and agriculture. For example, in the United

States from 1910 to 1995, prices for the products of farmers increased by 6 times, and the prices for resources that farmers buy – 15 times (Gaysin 2010). Because of this disparity, the products had a tendency to fall in real prices more than twice. This is an additional fact confirming the conclusion about the long-term downward trend in prices in the global agro-food market due to rapid growth of supply relative to demand during the first and second long-term cyclic wave in the twentieth century.

In developing countries, despite the general global trends of overproduction and lower prices in the twentieth century, the conjuncture of the agro-food market differs from situation in the advanced economies. The problem of excess supply above extremely low demand is, the problem of the relative overproduction is not so clear and stable here. This is due, firstly, to the fact that a certain share of food entering into consumption and bypassing the market economy does not taking the form of market supply, i.e. the economy of the rural population is in a large part a natural character. Second, even if there is an excess of supply over demand, it happens at a very low degree of saturation of the population needs for food, at very low demand. The reason for low demand and low levels of consumption is a low standard of living and/or extremely low incomes. In contrast to developed countries, the developing countries with a low degree of saturation of populations needs in foodstuffs the demand of the population for food is elastic dependent on changes in income and price levels. It is the most important difference between the action of the law of market demand for food in developing countries and in advanced countries. This regularity is a manifestation of the law of saturation needs and, ultimately, it is manifested to a high marginal utility, and therefore in the high relative value and a higher level of relative prices of food goods in developing countries. However, in the twentieth century and in the developing countries there has been a downward trend in relative prices of food, which was manifested in the increase of the average level of consumption of food and reduction in the number of hungry people in the world. In the past three decades before the global financial and economic crisis of 2007–2008 had tendency to reduce the number of hungry people in the world (FAO, *The state...* 2011).

The stability and duration of the downward trend in prices, caused by the tendency of rapid growth proposals during the two long-term cyclical waves of the agro-food market in the twentieth century, gave reason to conclude the insolvency of the gloomy predictions of Malthus about global demographics and food catastrophes. A group of researchers led by Meadows who prepared, in 1972, the first report of the Club of Rome entitled "The Limits of Growth" (Meadows et al. 1972), concluded in the model of Meadows, that the further development of humanity on the physically limited planet Earth is leading humanity to disaster due to more rapid growth in demand in comparison with the growth of supply. Prevailing trends in the dynamics of conjuncture in the world agro-food market in the twentieth century have not confirmed this conclusion. However, the beginning of the XXI century is characterised by significant changes in the dynamics of supply, demand and prices on the world market.

THE PERIOD OF THE NEW CONJUNCTURE OF THE PRICE (THE BEGINNING OF XXI CENTURY): THE TENDENCY TO INCREASE OF PRICES

As seen in Figures 1 and 2 the downward trend in prices established in the XX century has been replaced at the beginning of the XXI century by the tendency to their increase. This change in the pricing environment may indicate the beginning of a new cyclic wave (stage) conjuncture of the agro-food market in the world (Fig. 3). The conclusion that price conjuncture of the global agro-food market has changed is also confirmed by studies by FAO (FAO, The state... 2011).

Changing trends in global food prices at the beginning of the twenty-first century are connected with various factors. Among the endogenous factors are the most important changes in demand for agricultural raw materials and food. In the above characteristics of the food market in developing countries (low degree of saturation of needs and a high income elasticity of demand) the potential for significant changes in the price conjuncture on the domestic market of these countries is laid, as well as in the global agro-food market. Even a small increase in the rate of economic growth and living standards in developing countries can cause a significant increase in a highly elastic demand for agricultural and food markets within these countries and in the world as a whole. At the beginning of the XXI century, this factor was one of the most important factors that have changed the long-term trend in prices to fall.

High rates of production growth of in China and India have caused a significant increase in per capita income of the population (Fig. 4). GNI per capita in China increased from 1990 to 2000 by \$ 1540, from 2000 to 2010 – by \$ 5,300. In India, the growth of GNI per capita has also increased significantly in the last decade. This increase in per capita income with the elastic demand has caused a high rate of growth demand in per capita. Increasing incomes lead not only to increase the overall demand for food, but also to substantial changes in the structure of demand and consumption. An increase in demand and consumption of livestock products, fruits and vegetables has happened. The increase of consumption of animal products has led to the increasing of demand for livestock feed. For the additional production of 1 kg of meat, 6–8kg of grain is required. In China, meat consumption per capita increased from 14.1 in 1980 to 30.9 kg in 2005 (FAO, Changes... 2009),

China imported 5 million tons of grain, 56 million tons of soybeans, which are used for animal feed in 2011 (Trends 2011).

China and India have more than a third of the world's population – some 2.5 billion people. Their aggregate demand for food has increased dramatically over the past 10 years. The growth in aggregate demand caused not only by rising incomes and demand for food per person, but by also such factors as rapid population growth in these countries. In India population growth over the past 15 years has resulted in, nearly 260 million more people, and in China – 130 million more. That is, almost 400 million people, in these countries, who present an additional demand for food. Thus, high rates of growth of per capita income and high population growth rates in China, India and several other developing countries were

the most important factor in the sharp increase in aggregate demand in the global agro-food market and a significant increase in food prices.

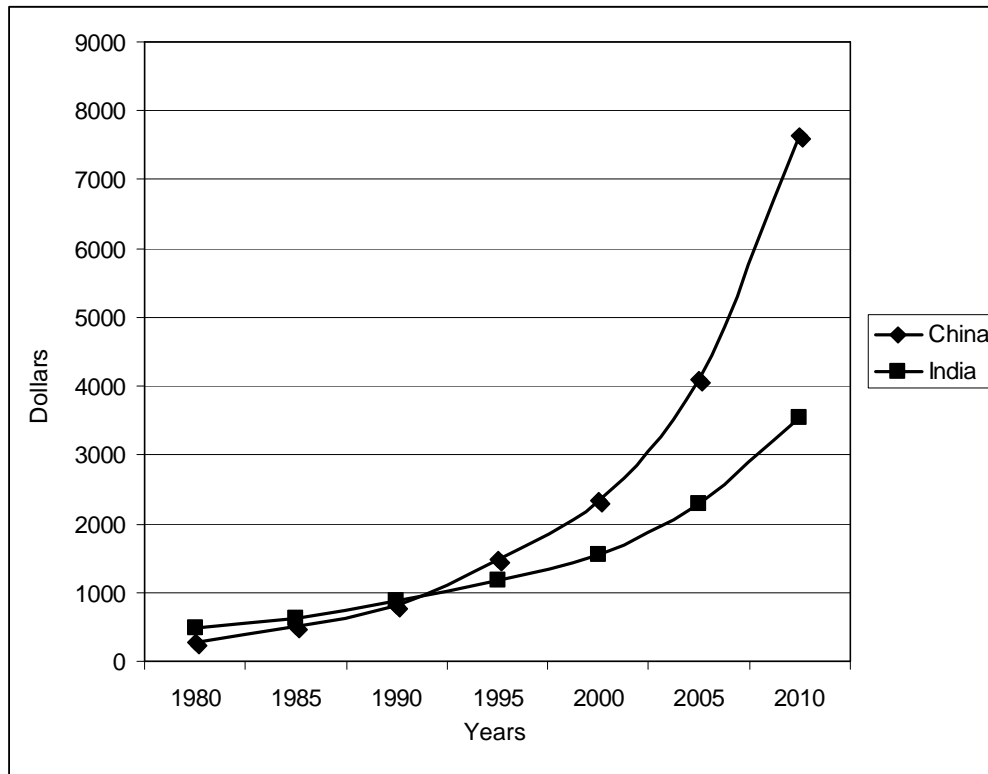


Fig. 4. GNI per capita in PPP dollars
Source: World Bank 2011.

The growth of aggregate demand and rising prices for food and agricultural raw materials was also caused by a new market factor for agro-food, the increased demand for bio-fuel. Increased demand for biofuel has led to a sharp increase in demand for corn and vegetable oil.

Significant impact on prices in the food market began to render financial speculators, who concentrated on huge cash flows. Huge masses of surplus cash resources went to the purchase of assets (futures) on the commodity exchanges, including on the exchanges of agricultural and food products. Competitive "game" in the futures transactions was aimed at earning on rise and then at subsequent fall in prices (in crisis).

In the previous periods, futures prices depended on the price on the base product (for example grain). Under the conditions in the forming of the "financial bubbles" price for futures began to determine the price of basic goods. Because the derivatives market has become more powerful than the physical market futures and forward contracts are ten times that of the deal with the supply of goods. A new phenomenon in the global agro-food market - is that the prices are influenced not only by the endogenous market factors associated with changes in consumer demand and demand from manufacturers. The dynamics of world prices to a large extent depend now on the financial market, from the "financial bubbles." They inflated "bubbles" of world food prices. However, speculative inflated prices on

the exchange cannot consistently exceed the actual consumer prices. Therefore, after the rapid growth follows the same rapid fall speculatively inflated prices on the exchange to the level of real prices. The main reason for the sharp increase in price volatility is an exogenous financial-speculative factor. At the same time, the fall in prices after the growth-burst does not reach the minimum point, at which it was before its increase (Fig. 3).

Growth of minimum between the burst growth of level of prices is determined by the factors of supply and demand. Some of them are discussed above. Among many other factors, researchers isolate the nature-climatic, which causes fluctuations in production and supply of products and so they cause fluctuations in price.

A factor in the medium-term plan is investment, investment shocks. They cause cyclic fluctuations in market conjuncture of agro-food market in the medium term.

At the present stage, the possibility of growth in production and supply due to the extensive use of cheap natural resources has become increasingly limited. This is a factor in long-term plan that affects the conjuncture on the agro-food market in the third cyclical wave in the XXI century.

The productive forces reached a level of development, which is the limit for the resource potential of the planet, and their further expansion may cause irreparable damage to the Earth and to mankind inhabiting it. There are still some possibilities of expanding agricultural production in developing countries and the CIS through an extensive increase in production and productivity of land. However, these possibilities are not unlimited. The problem of saturation of the rapidly growing demand by this way cannot be solved. In contrast to the twentieth century the demand will grow faster than supply. "We know that the demand for food on the planet in the first half of the XXI century will double. Half this will be associated with high rates of population growth and half – people with rising incomes in many developing countries, leading to an increase in food consumption," – said Harald von Vitske, who heads an international "think tank" called Humboldt forum for food and Agriculture (Witzke et al. 2010).

CONCLUSIONS

The chaotic dynamics of prices in the global agro-food market three stages (three waves) long-term cyclical fluctuation of conjuncture are quite clearly revealed. The upward wave of each long-term stage begins with a sharp increase in the volatility of prices. During the first two stages, which lasted from the 20s until the end of the last century, there was a tendency to lower the real price level in the analysed market due to rapid growth of supply compared to growth of demand. At the beginning of the XXI century, the downward direction of the trend in world prices has been replaced by an upward direction of their trend. The trend of outstripping growth of supply has been replaced by trend of more rapid growth in demand. The global agro-food market is characterised by increasing volatility with a growing trend.

Extrapolation to the future of the tendency towards a more rapid growth in demand compared to supply, the tendency to a sharp increase in prices allows us to draw a conclusion about the increasing likelihood of Malthusian predictions and forecasts of scientists Club of Rome about the catastrophic exacerbation in the XXI century global food problems.

To prevent such, effective measures on expansion on both national and global levels on the border of production possibilities of the world agro-food economy should be taken. It is necessary to provide the growth of supply according to the growing needs based on the transition to industrial-informational and biotechnological way development of agriculture. At present, it is necessary to stop the growth of destructive price volatility by adopting measures in the following directions: improvement of international institutions of trade in food and agricultural raw materials, the formation of a new effective international system of coordination of inventory levels, establishment of mechanisms and institutions that can prevent the negative effects of speculation in futures markets, improvement of the processes regulating the supply and demand in the international and national agricultural markets.

Drastic measures solving the food problem are associated with the implementation capacity of humanity for the transition to a qualitatively new technological level, to the new non-traditional ways of food production. For this technological revolution in the agrarian sector of the economy, its technotronic content should be complemented by development of biotechnology, nanotechnology, solar energy. From implementation of the technological revolution in agro-food economy depends the possibility the solving future global food problems. Only on this basis will humanity be able to avoid a catastrophic exacerbation of problem food security in the world.

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