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economic and social evolutionary  
processes.**

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**The actuality of Malthus's law in the economic and social evolutionary processes.  
The ecological and economic system go to collapse?**

**1. Growth factors in agricultural markets**

Agricultural market trends reflect the economic and social development of the world. In order to better understand these trends, from production to consumption, it's necessary to identify the chief factors. In a global agro-industrial system with most of the production located in a few countries or macro-regions a pivotal role is played by agricultural policies and international agreements in commerce. WTO has since 1994 supported liberalization in agricultural exchanges through the reduction in import barriers, export subsidies and domestic support.

European Union is adapting its Common Agricultural Policy (CAP) to the process of liberalization, thus the role of the EU as worldwide producer and exporter changes with the shift to decoupled income support, a policy that provides only minor incentive to production and with the opening up towards importation from third countries. On the other hand countries like USA, Brazil, Argentina, China and India increase production.

In Latin America, Asia and Africa demographic growth is a large phenomenon that affects the demand for food.

In North America, as in Europe, the rising concern of consumers about healthiness of food and preservation of the environment encourages sustainable and less intensive cultivation.

The research on renewable energy resources increases the demand for agricultural products. This additional demand, grown in time, competes with the traditional demand for food, producing tension in markets.

<b>Global Commodities Market - 2010</b>			
(billions of tons)	<b>Prod.</b>	<b>Trade</b>	<b>(T/P) %</b>
Bananas	93,4	16,7	17,8
Cacao	4,4	3,0	67,0
Coffee	8,0	5,3	66,3
Bovine meat	65,0	7,6	11,7
Chicken meat	95,7	11,3	11,8
Swine meat	107,0	6,1	5,7
Cotton	23,3	9,5	40,8
Wheat	647,7	121,0	18,7
Milk	710,7	46,0	6,5
Maize	826,2	103,6	12,5
Fish	147,0	55,3	37,6
Rice	466,7	30,3	6,5
Sugar	169,0	45,4	26,9

The basic trends driving international agricultural markets can be identified as follows:

1. The rise in demand for agricultural products, especially in overcrowded countries like China and India, due to income and population growth.
2. Change in the geographic distribution of production and consumption of agricultural products.
3. A greater awareness of the importance of healthiness and quality of food and protection of the environment in the inhabitants of developed countries.
4. Development of bioenergies industry that increases the demand for agricultural products, directly affecting quotations.

The most important indicators rate EU27 among the more advanced economies in the world, where only a lesser part of labour force is employed in the agricultural, sector which is thus scarcely contributing to GDP (not including correlated industries), but occupying a relevant place in international trade.

European Union is becoming an exporter of differentiated processed food and high value added products and an importer of first transformation products and agricultural commodities, thus reducing self-sufficiency rate of the most important cereals (maize, wheat, soy).

The changes introduced by the Common Agricultural Policy expose EU to international competition. In particular the abolishment of coupled support and the inclusion of single payment scheme discourage production leading to the worsening in the commercial balance of some goods, especially those which have experienced an increase in use.

Moreover the stress posed by CAP on the strategy of multi-functionality and the greater amount of resources allocated on rural development policies have induced farmers to diversify their production (De Pin, 2008).

Together with the EU, also the economies of the United States and Canada are among the most developed ones, but with different characteristics. If the area covered by the two countries spans almost the same width, only 7% of the Canadian land is cultivated, while arable land in the US amounts to 43%. Population number also differs in the two countries, with 32 millions inhabitants in Canada and 300 millions in the US. Both countries rely on a productive structure characterized by a high concentration of production with a limited number of big companies (188ha is average SAU in the United States, 295ha in Canada).

Economies of scale combined with an efficient organization are the pillars of Canadian and the United States competitiveness in international agricultural commodities. The role played by these

two countries in international markets can easily be exemplified by analyzing supply balances of some commodities (hard and soft wheat, soy, maize and rapeseed). Calculate the ratio between resources and their uses is a useful indicator to understand the situation of domestic market in a country (De Pin, 2011). The lower this indicator is, the thinner becomes safety margin (the stock necessary to cover a 2 months-consumption) in case of the shock produced by a poor harvest.

Canada and the US have traditionally been major exporters of wheat, with self-sufficiency rates over 280% in Canada and 150% in the US. But particularly poor harvests (like those of 2006-2007), increase in exports and deficit in global supply have dramatically reduced stocks to 30% in the last years.

The US are the world's largest exporter of maize but they have seen their self-sufficiency rate reduced to 130% in 2000 and to 110% in 2010 and the ratio between resources and uses has fallen to 10%, far below safety margin.

As for soy, the supremacy of the US exports is now threatened by the considerable Brazilian production. Self-sufficiency rate has barely changed (150%) but the ratio resources/uses has dropped to 11%. The most radical change has taken place in consequence of the development of biofuels, that has changed supply balance sheets of cultivations involved (maize, soy and sunflower).

Also Argentina and Brazil have gained a place among emerging economies. The percentage of their labour force employed in agriculture is respectively 9% and 14% and the part occupied by this sector in both formation of GDP and export is increasingly relevant. Both countries are characterized by a high concentration of production in the hands of big companies. Supply balance sheets of chief exports (like bovine meat, maize, soy, sugar and alcohol) highlight the role played by Argentina and Brazil in international markets for agricultural commodities.

The traditional export of bovine meat has fallen in amount. The increased consumptions in emerging economies is satisfied by the increase in local production, meanwhile consumption in western countries slows down and new barriers are posed by safety standards and traceability. But if emerging economies provide a sufficient production of meat, they deserve larger amounts of feed such as maize and soy (China above all). Thus Argentina and Brazil have gained weight in international exchanges so that Brazil is second world's leading soy exporter.

Another emerging economy is certainly India, the second country in the world for number of population (over 1.25 billion) after China. India employs 57% of its labour force in agriculture, a sector which produces 20% of GDP. Its main productions are rice, wheat, sugar, milk and bovine meat. But Indian agriculture suffers from the excessive fragmentation of its productive system (average company size is 1.3ha). As for arable crops, Indian supply balance sheets show instead a

trend of instability so that the country passes every year from the position of net importer to net exporter of cereals and sugar.

India is a net exporter of rice, with a production ranging from 70 to 100 million tons and self-sufficiency rates reaching over 150%.

Among emerging economies we can also count China, the most populated country with its 1.4 billion inhabitants despite Government policies for population control. 58% of the huge labour force is employed in agriculture that constitutes the 13% of GDP.

Rice, wheat, maize and swine meat are the traditional Chinese products. Chinese high productivity agricultural system is sustained by intensive cultivation techniques and a massive use of labour force, fertilizers and water. The shortage of arable land in comparison with population number makes food supply a matter of primary importance. China is world's leading producer of rice and a net exporter of this product, with a self-sufficiency rate of about 140%. As for wheat, supply balance is more unsteady, letting the country alternate from net importer to net exporter, so that from 2001 to 2006 China has not accomplished self-sufficiency.

China is also the world's leading producer and consumer of swine meat and its growth in the zootechnical sector bears heavy implications on supply balance sheets of feed grain (maize and soy). The volume of imports of soy has decupled in the last decade (from 3.8 to 38 million tons) and self-sufficiency rate has fallen from 78% to 28%.

Reforestation program in agricultural land subject to elevated environmental risk and the allocation of land for biofuels industry have further reduced the land available for the production of food. It is not an easy task to define China's role in the global food industry. The trend of food consumption and the potential to produce it point out that the huge China's food needs will directly affect global agricultural markets, whatever be the future of the country.

## **2. On the limit of the principle of population**

Agricultural products and in particular food are necessary and irreplaceable needs. The demand for such products depends on the growth in number of population which is currently experiencing a considerable increase, and on the income.

The relationship between demand for food and population is the core topic of the treatise "*An essay on the principle of the population as it affects the future improvement of society*" (1789), by the Reverend T.R. Malthus (1766-1834). In his study he asserts that population growth requires the cultivation of lesser fertile lands, leading to a progressive shortage of means of subsistence, up to

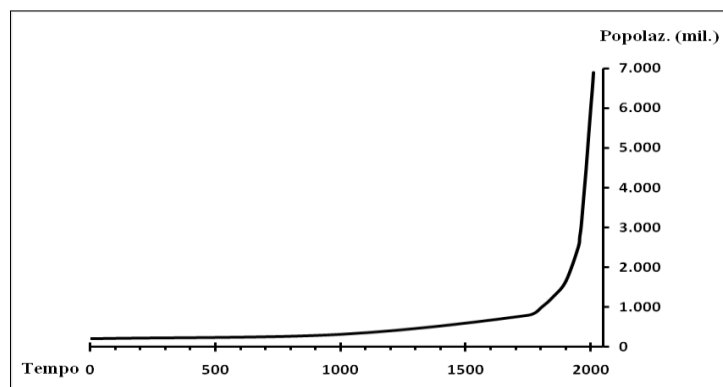
the standstill of economic development, because birthrate growth outpaces the increase in food supplies.

As the increase in number of population is subject to the availability of livelihood, natural resources, which are by nature finite, pose a limit to this growth (Meadows, 1970). So as population presents an exponential growth while products follow an arithmetic progression, there will be a point in which the increase in production will not be able to cope with the increase in population.

Present population growth, which does not encounter precedents in the past, raises questions on the degree of saturation of our planet, on agricultural production capacity and on the legitimacy and sustainability of this growth pattern.

The most densely-populated countries, namely China and India, have experienced a 20% population increase rate in the last decade, reaching 1.4 and 1.3 billion inhabitants respectively. That means, Asia hosts more than 60% of the world's population, a number which has more than trebled since World War Two.

### Global population growth



Despite the alleged superiority of human species, the theories of Malthus and C. Darwin (1809-1882) and the philosophical analysis of F. Nietzsche (1844-1900) prove that the destiny of mankind is ruled only by biological laws. The anthropocentric human subjectivism implies the annihilation of other species.

The present rate of growth in population is absolutely excessive and abnormal, occurring in an unrestrained and discriminatory way, in relation to the ecological balance of the earth. From this point of view this estrangement from nature law is dimmed with uncertainty and will lead to no positive future.

The dominant role of the human species leaves non escape to the other living being as the humans have occupied almost every ecological niche, therefore the survival of the other species depends on their relevance for man's needs.

This growth pattern proves to be highly unsustainable, because it inevitably alters the environmental balance of our planet, a fact which becomes a restraint on any kind of future development (Brundtland G. H. 1987).

There is a need to carry out mankind back within its natural boundaries, granting the right to existence to all other animal species and thus securing the continuation of life on Earth (Prigogine, 1979).

However, humanity appears to have taken the opposite path, this brings up serious ethic, anthropologic and metaphysic implications, as we need to prove how and why the human species differ from any other animal species.

It is also hard to understand the reason why we choose to live in an increasingly overcrowded world that results in a deterioration of the environment, where the primary target for people will be the competition for food and natural resources.

<b>World Population (billions)</b>				
	<b>1800</b>	<b>1900</b>	<b>2000</b>	<b>2050</b>
<b>World</b>	978	1.650	6.000	12.000
<b>Africa</b>	107	133	770	2.450
<b>Asia</b>	635	947	3.650	6.800
<b>Europe</b>	203	408	730	850
<b>South America</b>	24	74	510	1.200
<b>North America</b>	7	82	310	600
<b>Oceania</b>	2	6	30	100

As asserted by Darwin, the biological value of species, which identifies its existential value, is inversely proportional to its relative numerousness. This implies that as number of heads decreases, marginal existence value increases up to the limit of infinity; whereas with the growth in number of individuals this indicator drops till the assumption of a negative value if it jeopardizes natural balance. In this case there appear readjustment factors.

The present demographic growth implies a negative marginal existence value and an unsustainable imbalance for biological system.

The biological system has three limits: it is closed, finished, temporary. This furthermore implies that absolute and relative numerosity in all species (dependent variable) is direct function of environmental limit (independent variable), which is insurmountable (the Earth).

Out of biological balance there cannot be life.

From the point of view of natural law, the limit of growth for the human species in lack of antagonists is posed by the availability of natural resources. The competition for consumption involves the creation of emarginated classes who do not have access to adequate resources, while marginal costs increase with the drop off of employable productive inputs.

A sufficient supply of food to cope with a greater demand finds new frontiers in biotechnologies and innovative products obtained from the cloning of animals and plants, that means patenting life. The ongoing contraction of biodiversity goes along with the specialization of species in accordance with their productivity.

The demand for food consists in the whole of products used by the population to supply its nutritional needs. The increase in demand for food depends on the growth in number of population and in per capita consumption.

In developed countries increase in both population and per capita consumption is relatively moderate. On the other hand birthrate growth is considerably high in developing countries, causing an increase also in the demand for food. But in this latter case per capita consumption still remains low so that food demand is expected to grow much more than population.

Demand trend results from variations in income and price, which means that as income rises, the percentage of income allocated on food purchases rises slower as compared to rise in income (Engel's law).

In growing societies consumption as considered in final calories raises alongside the raising of income and tends to a limit, while consumption in initial calories keeps on increasing due to the exchange of vegetable calories with animal calories.

As income rises, the structure of consumption is reshaped. Expenditure on food will be higher in proportion to the amount of products consumed, because the average price of a single calorie has increased.

The most relevant changes are: vegetable calories with animal calories, agricultural calories with agro-industrial calories (modified calories), simple products with elaborate products.

The leading food model in high income countries is the high-energy one, that involves a large amount of animal calories and the use of highly processed products, with considerable losses along the agro-industrial chain.

In a society where the basic needs of each person are fully satisfied we find an increasing demand for agricultural products for animal husbandry (maize, soy and surrogates) which becomes the main outlet for production. In high income countries agricultural products are nowadays cultivated also for the production of energy.



The situation is different in low income countries where demand is mainly directed to vegetable products that constitute the basis of nutrition. The attempt at pursuing a model of development similar to those of developed countries though, brings about an increase in the consumption of animal proteins. China has therefore become the largest producer of poultry and swine, products that have a highly increasing domestic demand. This in turn boosts the global demand for feed and agricultural products for animal husbandry.

As for the price, the demand for agricultural products is relatively inelastic as there is no proportion in the variation of demand and price. In particular, direct price elasticity appears to be basically rigid in the short run. In the presence of an inelastic demand, agricultural markets are therefore marked by volatile prices, that means the variation in price is greater than the variation in quantity. But in the long run, direct price elasticity rises because in presence of high prices the consumer turns to surrogate products (Deaton, 1980).

Cross elasticity of demand that measures the percentage responsiveness of the demand for a good to a percentage change in the price of another good, distinguishing them as substitutes and complements, gains higher values because consumers change their habits in consumption when prices change. As it comes to food, for example, as bovine meat prices grow, the consumer will turn to other typologies of meat, such as hen and swine, ultimately resorting to vegetable products as substitutes. In animal husbandry sector, the increase in the price of soy leads to its replacement with other agricultural products like maize, sunflower, manioc and others.

We can therefore state that global demand for agricultural products is highly increasing both because of population growth and the demand from new sectors like the energetic one, and also because of the widespread growth in incomes. Moreover this demand is characterized by rigidity as it is irrepressible.

Demand directly affects prices that, as for any other kind of products, depend on endogenous and exogenous variables. The former consist in production supply area, cultivation techniques, use of GMOs, while exogenous variables include what is not related to cultivation, like market trends, substitute products, price of energy, exchange rates, speculation on agricultural commodities.

After a years-long decline prices of agricultural products show now a positive trend in growth supported by different reasons; one of those being shortage of stock, whose variation becomes a significant variable in the change of prices.

But a decisive factor is also the correlation with the quotations of energy sources as the exchange bond that has developed between the two markets encourages the growth of quotations. The rise in price of energy has repercussions on cereals market, proteaginous crops and therefore on agriculture as a whole. A consequence is the intensification of activity by financial operators in the agricultural

market that leads to price volatility. Active financial speculation in this field witnesses the renewed interest in agricultural commodities, thus affecting price formation.

Other factors have influence on quotation trends, such as the energetic policies adopted in developed countries that involve an increase in the exploitation of bioenergies, which will cause a rise in prices. The consumption of ethanol affects the prices of raw material. Energetic demand enlarges the competition for the cultivation of agricultural land, to the detriment of lesser profitable cultivations. Wheat cultivated for bread and other food products is thus substituted by maize to supply energetic industry. This rise in the demand for raw materials for biofuels has repercussions also on the prices of other agricultural products like cereals and oleaginous seeds, as it increases their relative shortage.

The effects of the increase in prices do not affect only the agricultural sector but hold a political and social relevance throughout the world. The so called “Land Grabbing”, namely the buying of large pieces of land in developing countries (mainly in Africa) by domestic and transnational companies, aims at profiting from high prices. A representative case is that of the South Korean Daewoo which had obtained a region of Madagascar as big as Belgium, that is half of all arable land in the country, to cultivate maize notwithstanding the danger of the ecological impact on such a unique environment and the violation of rights of people living and working in these areas (Liberti, 2011).

The rise in cereals prices in rich countries results in a mounting discontent among the masses of poor countries (Burkina Faso, Somalia, Russia, Peru, Pakistan, Mozambique, Egypt, Kenya, Bangladesh) where living conditions are rapidly getting harder. These negative consequences raise numerous doubts about the social effects caused by market trends that jeopardize the achievement of food sustainability in large groups of an increasing population. Lacking adequate and necessary demographic policies focused on the best peculiarities of human species other than its pure animal nature, the situation that arises is one of destabilization of the poorest geographic areas where masses of youth regard flight into rich countries as their only chance of survival. Countries of immigration thus become a land of conquest for poor migrants and this circumstances often evolve in new forms of violence.

Even if some reasons for the increase in quotations could be short-termed, such as adverse climatic conditions, drought, fires broken out in Russia and Ukraine, the importance of long-term evolutionary variables suggests that Governments realize a plan of control of supply. In such a background, a wrong evaluation that expects a poor harvest can engender alarmism and have repercussions on financial markets of all related sectors.

Growth in food demand and technologic innovation seem to be the chief variables in prices trends and bear unforeseen consequences.

Developing countries record high consumption growth rates and the modification of their diet to include more animal proteins, simulating high energy consumption models, causes the increase in demand for production of feed. Every country faces the problem by boosting production but the increasing demand could finally clash with the limits of supply as the rise in relative shortage is followed by an adjustment of prices, a chain that leads to economic unsustainability.

Another consequence is the increase in prices of farmland, a limited resource which is gradually running short, to the detriment of all species which inhabit the planet.

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