Research Article

Symmetric Model of Economic Equilibrium: Circular Organization of Economic Processes

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Preface
On the basis of dialectical analysis of basic economic categories a new understanding of economic value, price formation and general equilibrium has been proposed. Market economy appears as the form of a complex, non-linear, functionally closed and causally open system of economic actions. Such systems have a number of unique properties that are well studied by second-order cybernetics. The self-organization of a market economy is carried out through the recursive processes. Recursive processes in the economic system, as well as in other complex nonlinear dynamical systems, generate "eigenvalues" ("fixed points"). These "eigenvalues" are the equilibrium prices and quantities of goods to which through the recursive processes tend the actual prices and quantities, thus providing a tendency to the general equilibrium. However, due to constant influence on the system of random external factors, the general equilibrium is never achieved. On the base of created model the hidden relationships among the gross profit, gross saving, gross investment and gross consumption in debt, as well as the relationships among the other economic parameters are revealed.

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1. Introduction

One of the main components of the current economic paradigm is the theory of general economic equilibrium. It has the same value in neoclassical theory as the labor theory of value in Marx's economic doctrine. Although economists have not yet succeeded in creating an adequate model of general equilibrium, the very idea of equilibrium is so attractive that economists will never abandon it.

Unlike the natural sciences, the theories in social sciences can change the way of systems' functioning.

"Social sciences like economics differ from the hard sciences in that beliefs affect reality: beliefs about how atoms behave don't affect how atoms actually behave, but beliefs about how the economic system functions affect how it actually functions [1].

An economic reality is formed by the collective actions of social agents. However, these actions depend on the knowledge got from the cognition of economic reality. It turns out that, on the one hand, the collective actions depend on the cognition and on the other hand cognition is determined by the collective actions. As long as neo-classics are not aware of this circular causality,

in their theory, it takes the form of a logical "vicious circle". Therefore, they can neither develop an adequate economic theory nor evolve effective policies.

The above mentioned "vicious circle" is brought about by the false methodology of neoclassical theory. According to it economists studies only the economic facts, phenomena, but cannot get at the essence of economic activity, because they do not recognize its existence and do not own the methods of its knowledge. Thus, what happens in the economic reality at the level of empirical facts, a great deal is brought about by the very theories, that depend on that facts.

However, only the processes occurring at the empirical level of market economy (that is, something that is studied by the neoclassical thought) depend on the actions of economic agents. But the essence of the market economy is not determined by these actions. Rather, economic actions themselves are caused by this essence. Therefore, it is necessary to investigate the essence of economic processes. However, such investigation is possible only by the dialectical method of research, which is radically different from the methods of neoclassical economists. In result of an investigation of the essence, the market economy

appears as an operationally closed complex nonlinear system of economic actions. Like all such complex nonlinear systems, it has a number of unique properties, which are studied by second-order cybernetics, constructivism and chaos theory. The study of these properties allows us to give answers to many questions, to create effective mathematical models and to develop adequate economic policy.

To identify the operational closeness of market economy, first must be identified the dialectical relationships between the fundamental economic categories, which cannot be detected by traditional methods of neoclassical theory. Let's try to make a dialectical analysis of basic economic categories.

2. Relationships Between Fundamental Economic Categories
2.1 Production and Consumption
To discover the essence of market economy, you must first reveal the deep inner connection, which exists between production and consumption processes in general, and between production and consumption sectors of economy - in particular. The process of production of products itself is a process of consumption of recourses, and vice versa.

"Production, then, is also immediately consumption, consumption is also immediately production. Each is immediately its opposite [2]. " ... each of them, apart from being immediately the other, and apart from mediating the other, in addition to this creates the other in completing itself, and creates itself as the other. ... Thereupon, nothing simpler for a Hegelian than to posit production and consumption as identical.

So, in reality, they are not two different processes, but the same process, seen from the different points of view. Or, in other words, they are two different but dialectically connected functions which performed in the process of converting resources into products [3].

In a market economy, where products and resources take the form of commodities, this process takes the form of transformation of some commodities into others or, if expressed in the sense of P. Sraffa, "the production of commodities by means of consumption of commodities". Because of this circumstance, the production sector and consumption sector are also inseparably linked. Although they are "in the external relation to each other" (Marx), each of these sectors by itself is a unity of production and consumption processes; i.e. both are the production of commodities through the consumption of commodities. In this sense, they are identical. But since each of them consumes what the other produces, then they are also opposite to each other.. They are identical and opposite at the same time and form a dialectical contradiction, that's what drives the economy.

"Contradiction is what moves the world in general and it is ridiculous to say that contradiction cannot be thought [4].

The subjects of the production sector are entrepreneurs as producers, and the subjects of the consumption sector are consumers, i.e. the owners of production factors (including the entrepreneurs as ordinary consumers).

To organize the production process, entrepreneurs buy from owners not the production factors (Labor, Land, Capital), but only the rights to temporary use of services of production factors. Payments for them are the wage, and rent. And entrepreneurs sell to them and to each other entrepreneurial services embodied in the sold commodities and make a profit as part of their prices. Primary economic resources for entrepreneurs are just these rights to use the services of production factors, which they buy from the owners [1].

But if this is so, regardless of whether production factors themselves are reproducible or irreproducible, in all cases, the primary resources *as economic* resources and *as commodities* are *reproducible* goods. Reproduction of primary resources as commodities is reduced to reproduction of life of owners only which have the right to sell these rights to use of production factors. The owners sell the services of production factors and keep these factors as a permanent source of incomes just because they do not sell the production factors themselves. Thus, the approach of Marx to the problem of buying the right to use the labor force in the market economy should be extended to other production factors.

However, there is a difference between the reproduction of the owners of Labor power and the owners of Land and Capital. In the first case, together with the reproduction of the owner of the Labor force, the Labor force itself (as production factor) is reproduced as the ability to work. For this is the ability of the owner himself. But the reproduction of the owners of Land and Capital does not mean the physical reproduction of these factors of production. Here the property exists separately from the proprietor. Therefore, the reproduction of the owner means the reproduction of rights, but does not mean the reproduction of production factors [1].

This means that the reproduction of primary resources is reduced to consumption of final products, i.e. of consumer goods, needed for owners' life. This is the reproduction of resources not in a physical, but in an economic sense. Of course, in the physical sense, the amount of reproduced resources (services of production factors) depends not on the amount of products consumed by its owner. It depends on the amount of production factors and on the amount of their services, the "right to use" of which their owners decide to sell to the entrepreneurs. But, after all, economics is interested exactly in the economic sense of economic processes. Also, the production of final products is of interest for economics, not as a physical or technological process, but as an economic process. Namely, it is interested in the production process of final products *as commodities,* which belong to their owners, have social utility, are destined for sale, etc.

From the above, it follows that the production sector produces the final products and consumes the primary recourses, but the consumption sector, on the contrary, reproduces primary recourses and consumes the final products. Each of these sectors

consumes the commodities that are produced by the opposite sector. Broadly speaking the "resources" of one side are the "products" for the other side [1].

Just because of this contradiction, these sectors become necessary for each other, and together become the necessary parts of a single whole. This whole, dissected inside into separate branches, just dictates the proportions of social production, consumption, distribution and exchange. This whole is a market economy "producing commodities through the consumption of commodities". And the relations between the production and consumption sectors, as the opposite parts of a single whole, take the form of market exchange.

3. Surplus Approach

Exchange ratios (relative prices) in the market are set in such a way that only a part of the final products producers exchange for primary resources, needed for production of total final products. That is, the value of primary resources spent by producers in the production sector is equal to the value of only one part of final products, produced by these resources. That part of these products, which producers exchange for resources, necessary for reproduction of whole product, is a *necessary products*. The rest part of the created product is *surplus product,* sales of which make a profit as reward for entrepreneurial risk [1].

In the same way, only a part of the primary resources their owners exchange for final products needed for reproduction of entire primary resources (i.e. needed to satisfy their subsistence needs). This is the *necessary resources.* The rest part of resources is the *surplus* or *saved resources*, the sale of which generates owners' savings and which is the reward for their abstention and frugality. The more the owners' abstention is, the more resources are saved from their current consumption. As noted above, the total amount of primary resources depends only on the amount of production factors in owners' possession, but not on the volume of owners' consumption.

4. Profits and Savings

The value of the surplus product, as well as the value of the surplus (saved) resource, is surplus value. Surplus value is created both in the process of transformation of primary resources into the final products and in the transformation of final products into the primary resources. In the first case, it is done through entrepreneurship, in the second - through abstinence. Entrepreneurs sell surplus products and make the profits and the owners sell the surplus (saved) resources and make the savings.

The profits remain in the production sector, and the savings - in consumption sector. Profits and savings are the net income of economic subjects, the difference between incomes and expenditures which they received through entrepreneurship and abstinence [1]. In fact, the alternation of incomes and expenditures takes place in both production and consumption spheres. But the producers' incomes are consumers' expenditures and producers' expenditures are consumers' incomes. Accordingly, the difference between incomes and expenditures takes for them the mirror opposite forms of profit and savings.

As soon as incomes of some are expenditures for others and vice versa, the profits and savings cannot be independent variables. That is why the gross profit and gross savings are internally interconnected. Changing of exchange proportions between the final products and primary resources (i.e. their relative prices) influences the profits and savings in opposite way. Naturally, in conditions of equilibrium prices, the gross profit and gross savings should match.

Unlike consumption of owners of production factors, entrepreneurs' consumption is consumption in debt. From an economic point of view, the entrepreneurs invest funds from their monetary assets in their own subsistence without knowing in advance whether their consumption expenditure will be compensated by the expected profit as the results of their activity. They in debt from future profit. The entrepreneur consume in debt to himself, hoping to repay it from his future profit.

Producer, thanks to expenditures, receives incomes and the consumer - thanks to incomes carries expenditures. Producers first carry expenditures, then receive incomes. Consumers — vice versa. A producer makes economic decisions regarding expenditures depending predominantly on the incomes expected in the future, but a consumer - depending predominantly on the previously received incomes. Therefore, the profit making is associated with entrepreneurial risk and the making of savings - with abstinence.

Society as a whole, as well as each economic subject, simultaneously is producer and consumer. Therefore, in both capacities, in a sense, it is simultaneously both entrepreneur and saver. Producer is not only an entrepreneur but also a "saver", because he does not spend received income entirely on the continuation of production but saves a part of income. Just this «savings» is withdrawn profit for personal consumption. And making decision about spending, producer calculates not only profit expected from the future incomes but also - what "savings" will remain from the previous at the end of the current period.

Also, in a sense, consumers are not only savers but also "entrepreneurs". Excessive consumer expenditures means a reduction in savings needed to insure future consumption. Therefore, the running current expenditures requires taking into account the risks of shortfalls of future incomes and possibility of forced reductions in consumption standards in future. So, taking decisions regarding the current expenditures they consider not only which savings will remain from the past income at the end of the current period, but also whether there will be excess of future income above the current expenditure, i.e. whether will be "profit".

Therefore, all economic actors make each decision regarding expenditures, taking into account both received incomes and expected incomes. Consequently, the decision is taken from the position of both saver and entrepreneur. Since in general case the excess of expected income above current expenditure is their profit, but excess of already received income above the current expenditures is savings. And in the alternation of incomes

and expenditures from subject's position depends whether the difference between incomes and expenditures will be considered as profit, or - as savings. That is "entrepreneur" and "saver", "profit" and "savings" are the same reflective concepts as the concept of "producer" and "consumer".

5. Investment in Physical and Human Capital
Generally, investment means the transformation of income into capital, which brings more income. But naturally, only that part of income can be transformed into capital, which is not consumed, i.e. savings, which is withdrawn from the consumption sector, or profit, which is withdrawn from the production sector. But money itself cannot produce real capital goods (whether physical or human capital). It requires products and resources. It is possible to transform into capital goods only those goods which are not used in current consumption. Such are only surplus products in production sector and saved (surplus) resources in consumption sector (in short, *surplus goods*). Investing in physical capital just means that part of the primary resources is used not for production of current consumer goods, but for production of physical capital. And investing in human capital means that part of the final products is used not for reproduction of primary resources, but for production of human capital (entrepreneurship, training of the future labor force, knowledge, skills, health, etc.) Investments of savings and profits are only a monetary expression of real investments of saved resources in physical capital, and surplus products -. in human capital.

Investment as a function implies the transfer of surplus goods *on a credit basis* to the direct producer for production of (physical or human) capital, hoping to get benefits in the future. Accordingly, the production of capital implies the *consumption* of surplus goods *in debt*. The function of investing in the production of capital goods and the function of production of capital goods' are different functions. These functions can be performed both by different actors and by the same actor. The economic sense of this process is that the investor provides in credit his surplus goods to the producer of capital, but the producer consumes these goods in debt. So, in any case, *investment* implies *consumption in debt* and one is impossible without another.

6. Economic Values
Economic needs are only "solvent" needs. If the needs cannot be satisfied because of lack of resources, we cannot regard them as economic needs, as the real incentives of economic activity. Economic utility is the ability of limited goods to satisfy the solvent needs of people. The greater the need for a good, the greater the utility of that good. Both are the same relation of the subject to the object, seen from different points of view. So, economic utility and needs are correlated concepts. In the process of satisfying needs, these goods are consumed, i.e. they disappear as the utility. But the subject perceives disappeared utility as the cost. Consequently, the utility of limited goods is the ability of those goods to be used usefully, the ability to be transformed into costs. The more deficient the goods are, the more carefully man regards them; the more economic utility they represent before satisfaction of his needs, and the more economic costs – after the satisfaction.

The costs, as well as the utilities, are not the objects. The economic utilities and the economic costs are the specific economic attitudes of subject to objects from the position of unsatisfied and of satisfied needs. These concepts imply each other, but without each other, they lose any sense. However, because they imply each other internally, and each transforms into the other in the process of economic activity, so it is clear that there is something else behind them, that they are different forms of manifestation of some third concept, general for both of them, which integrates them into itself as the different mode of existence of a single whole. This third concept, which synthesizes them, is "economic value". Since economic values are the unity of utility and costs, the market prices in which they are manifested also reflect the unity of utility of goods and the costs of their production [5].

On the *systemic level,* both resources and products are essentially the same limited goods, and utility and costs as different forms of manifestation of economic value, are the actor's specific attitude to these goods from the position of unsatisfied and of satisfied needs. But on the *level of separate acts* of activity, the limited goods inevitably appear before the actors in the form either of resources or products, but their values - either as utilities, or costs. So, the value of the same limited good appears before its consumer as economic utility, and before its producer - as economic costs. However, actors are consumers and producers simultaneously. This is stipulated by the logic of economic activity. And the products themselves are resources for producing other products and so on. Accordingly, utilities are destined to be transformed into the costs, and the costs are destined to create utilities.

In production and consumption sectors the subjects perceive the value of primary resources and final products in opposite way. The value of goods, which producers perceive as utility, the consumers perceive as cost, and vice versa. But society as a collective subject is producer and consumer at the same time. He treats all goods as unity of utility and as costs, that is, he perceives them as economic values. But, as noted above, in production sector, the final products are produced from primary resources, and in the consumption sector, on the contrary, primary resources are reproduced by consuming the final products. Therefore, not only the values of final products are determined by the values of primary resources, but, also the values of primary resources are determined by the values of final products.

As mentioned, in production sector, the final products are produced from primary resources, and in the consumption sector, on the contrary, primary resources are reproduced by consuming the final products. Therefore, producers and consumers perceive the cost of primary resources and final products differently. The value of goods, which the former perceive as utility, the latter perceive as cost, and vice versa. But society as a collective subject is producer and consumer at the same time. He treats all goods as unity of utility and as costs, that is, he perceives them as economic values. Because of this, not only the values of final products are determined by the values of primary resources, but,

conversely, the values of primary resources also are determined by the values of final products.

If you collect together all the above reasoning and recognize the dialectics of economic processes in the context of the integrity of a decentralized economic system, we inevitably come to the understanding that the economy is a closed, self-organized system of recursive processes. Because of the circular organization of economic processes, such systems have a number of unique properties that have been well studied in chaos theory, constructivism, and second-order cybernetics. This allows to appeal those unique studies for explaining economic processes in the format of interdisciplinary analysis [6]. That's why the interdisciplinary analysis of these processes can give us the answer to many unanswered questions in economics. The operational closeness of the market economy becomes particularly evident through mathematical modeling.

7. Symmetric Model of Economic Equilibrium
This model is a model of an ideal equilibrium state of the economy, which shows how the economic forces arise, where directed and how they interact in such a way that they provide the homeostasis of a decentralized economic system. So it is a model of the "attractor" of economic system, the state to which the system always aspires, but never reaches it because of the deviating influence of external and internal factors. Today, the very idea of economic equilibrium is increasingly being attacked by some economists and more and more attention is being paid to disequilibrium models. But the very idea of disequilibrium as

such, in any case, implies the idea of equilibrium, as the idea of a system's such potential state, only relative to which it can exist. Economic equilibrium does not exist in fact, but potentially exists always, as an attractor, without which the economic system will lose integrity and fall apart. We cannot understand how a real disequilibrium economy functions if we do not understand how the forces that constantly push it to equilibrium arise and ensure order in the organization of the economic life of society.

But to create an adequate equilibrium model, it is necessary to present the market economy as a complex, non-linear, functionally closed and causally open system of economic actions. In the case of ideal equilibrium, each action of each actor is complemented by the corresponding actions of some other actors in the same system. Together, the actions of all actors, like puzzles of a single picture, leaving no gaps, form a closed, completely balanced system of economic actions. But such an ideal state is only an "attractor" of a real economy based on the division of labor [7].

The self-organization of a market economy is carried out through the positive and negative feedbacks, through the circular organization of economic flows and recursive processes. Recursive processes in the economic system, as well as in other complex nonlinear dynamical systems, generate "eigen-values" ("fixed points"). These "eigen-values" are the equilibrium prices and quantities to which, through the recursive processes, tend the actual market prices and quantities, thus providing a tendency of the system to the general equilibrium.

Table 1: Matrix of Closed Economic System

x_i - goods produced in sector 1 (consumed in sector 4), i = 1,2, . . . , m;

p_i - equilibrium price (value) of good x_i, i = 1,2, . . . , m;

y_j - goods produced in sector 4 (consumed in the sector 1); j = 1,2, ..., n;

v_j - equilibrium price (value) of the good y_j, j = 1,2, ..., n;

a_{ij} - consumption of resource j for production of unit of product i (technological coefficients);

b_{ji} - consumption of product i for reproduction of unit of resource j;

α_i - profit rate in the production of good i;

β_i - savings rate in the production of good j;

P – gross generated profit (the value of surplus products) in the sector 1;

S - gross generated saving (the value of saved resources) in the sector 4;

D - gross consumption in debt (gross withdrawn profit);

I - gross investment (gross withdrawn saving);

S' - saving from withdrawn profit;

P' – profit from production of investment goods.

Here is considered a decentralized closed economic system in which final products (m) are produced through consumption of primary resources (n) and primary resources are reproduced through consumption of final products. In order to simplify the model, the intermediate products aren't considered. The market economy is represented as a system in which "production of commodities by means [of consumption] of commodities" takes place (P. Sraffa). Division of goods into products and resources is conditional. Therefore, all goods are the products for their producers and resources - for their consumers. Below, the sector 1 is denoted as *production sector*, and the sector 2 – as *consumption sector.*

Production sector is represented by firms, and the consumption sector – by households. But each firm can produce different types of final product, and each household can reproduce the different types of primary resources. Therefore, according to the model, branches in the production sector are not made up of firms, but of *the aggregate of actions* producing homogeneous final products. They produce consumer products and physical capital. Accordingly, the branches of the consumption sector are *the aggregate of actions* reproducing the ownership of homogeneous production factors and sell the right to use them. They reproduce primary resources and human capital. Each branch produces commodities for other branches, and consumes commodities produced by other branches. Altogether, they form the market economy as an operationally closed system of economic actions.

The sector 1 produces products that are resources for the sector 4. In result of consumption of these resources, the sector 4

1) If all the agents are presented as producers, then:

$$A_i = \Sigma\ a_{ij}\ x_i\ v_j\ ;\quad i = 1,2\ ....m;\ j = 1,2....(n - 1); \qquad (1)$$

$$B_j = \Sigma\ b_{ji}\ y_j\ p_i\ ;\quad i = 1,2\ ....(m - 1);\ j = 1,2....n; \qquad (2)$$

produces products that are resources for the sector 1. Exchange of goods happens in the markets (sectors 2 and 3). All goods are produced by ones and consumed by others, some sell and others buy. All agents are both – producers and consumers, sellers and buyers. Each of them receives incomes and bears expenditures, and the difference between incomes and expenditures is used for investment in physical and human capital.

The price of the purchased good for consumers is monetary expenditures caused by the purchase of single good. Therefore, in this model, the incomes and prices paid from these incomes have opposite signs. This reflects the fact that in result of buying, the prices of goods "neutralize" incomes, at the same time the utility "neutralizes" (satisfies) the need as a result of its use. The elements of the diagonal of matrix simultaneously show production value of goods and their consumption value. As production value, it is extensive magnitude and is composed of (objective and subjective) cost elements, which are shown in the matrix' rows. But as a consumption value (utility), it is intensive magnitude and as such it is not *composed* of any elements, but itself *decomposed* on the elements of matrix' columns. Since the matrix elements simultaneously are the elements of both rows and columns, they simultaneously reflect both costs and utility. Lines show the elements of the cost of production of goods, and the columns - the distribution and consumption of the same goods in the production processes of other goods. Therefore, by horizontal summation, we get the social cost of products supplied in the market. By vertical summation, we get the amount of money that society sacrifices for their buying and that expresses the social utility of the total output of industry.

In the matrix, the resources clockwise are transformed into products, which in turn are consumed as resources for the production of other products, etc. The money incomes are transformed counterclockwise into money expenditures, which in turn are themselves the incomes and then again are transformed into expenditures, etc.

Each element of the diagonal aligns the rows and columns of the matrix. Sum of elements in each row of the sector 1 is equal to the sum of elements of corresponding columns of sector 4, and the sum of elements in each row of the sector 4 is equal to the sum of elements of corresponding columns of sector 1. That is, in a closed economic system under equilibrium conditions, is produced only what is consumed and is consumed only what is produced. This correspondence between production and consumption means that for each commodity (products and resources), demand and supply, selling and buying fully correspond to each other.

8. Description of the Model

Constants: a_{ij}, b_{ji}. Variables: x_i , y_j , p_i , v_j , α_i , β_j..

$p_i = (1+ \alpha_i) \Sigma\ a_{ij}\ v_j; \quad i = 1,2 ....m; \quad j = 1,2....(n - 1); \quad (3)$

$v_j = (1+ \beta_j)\Sigma\ b_{ji}\ p_i; \quad i = 1,2 ....(m - 1); \quad j = 1,2....n; \quad (4)$

$y_j = \Sigma\ a_{ij}\ x_i; \quad j = 1,2 ....(n - 1); \quad i = 1,2 ....m; \quad (5)$

$x_i = \Sigma\ b_{ji}\ y_j; \quad i = 1,2 ....(m - 1); \quad i = 1,2 ....m; \quad (6)$

$\beta_0 = \dfrac{\Sigma_j\ \beta_j B_j}{\Sigma_j\ B_j}\ ; \quad j = 1,2....n; \quad (8)$

$x_i \geq x_{min}; \quad i = 1,2 ....m; y_j \leq y_{max}\ ; \quad j = 1,2....n. \quad (9)$

2) If all the agents are presented as consumers, then:

$A_i = x_i\ p_i\ ; i = 1,2 ....m; \quad (10)$

$B_j = y_j v_j\ ; \quad j = 1,2....n; \quad (11)$

$p_i = \Sigma\ a_{ij} v_j\ /(1-\alpha_i); \quad i = 1,2 ....m; j = 1,2....(n - 1); \quad (12)$

$v_j = \Sigma\ b_{ji}\ p_i\ /(1- \beta_j); \quad i = 1,2 ....(m - 1); j = 1,2....n; \quad (13)$

$y_j = \Sigma\ a_{ij}\ x_i; \quad j = 1,2 ....(n - 1); i = 1,2 ....m; \quad (14)$

$x_i = \Sigma b_{ji} y_j; i = 1,2 ....(m - 1); \quad i = 1,2 ....m; \quad (15)$

$\alpha_0 = \dfrac{\Sigma_i\ \alpha_i x_i p_i}{\Sigma_i\ x_i p_i}\ ; i = 1,2 .... m; \quad (16)$

$\beta_0 = \dfrac{\Sigma_j\ \beta_j y_j v_j}{\Sigma_j\ y_j v_j}\ ; \quad j = 1,2 .... n; \quad (17)$

$x_i \geq x_{min}; \quad i = 1,2 ....m; y_j \leq y_{max}\ ; \quad j = 1,2....n; \quad (18)$

As we see, according to these formulas in both cases, the equilibrium price and the equilibrium quantity of goods are formed based on recursive processes, and the equilibrium condition is equality: $P = D = I = S$, and hence equality of average rate of profit α_0 and the average rate of savings β_0. Under competitive conditions, α_0 and β_0 strive for equality and thereby cause a tendency toward equality $P = D = I = S$ and thus to equilibrium of the entire system.

Formulas 3-6 and 12-15 are got by summing the elements of the rows and columns of the matrix. The sum of production spending and profits composes the product price and the sum of consumer spending and savings composes the price of resource. Quantity of goods sold in the market is equal to the total quantity of consumed and invested goods. At that, the minimal level of products' output is determined by the minimally acceptable level of society's consumption. The maximum level of reproduction and realization of resources is determined by the total amount of production factors in society.

Technological coefficients are the coefficients of transformation of primary resources into final products, and consumer coefficients – of final products into the primary resources. Prices are coefficients of exchange of money for goods and, accordingly, are transformation coefficients of incomes into expenditures and expenditures - into incomes [8].

Changes in the technological and consumption coefficients are caused by off-systemic factors such as development of technologies, science and education, changes in consumption preferences, in propensities to save and propensities to entrepreneurial risk, etc. But the prices and quantities of goods, the rates of profit, savings and interest are changed because of intra-system processes. Self-regulation of these prices, quantities and rates is caused by operational closedness of the economic system and by recursive processes occurring in it. It provides a general tendency of the system to the equilibrium. But environment causally effects on the processes of production and consumption. Changes in technological and consumption coefficients, caused by the impact of environment, determine the permanent deviation of the system from equilibrium. That is, the economic system is operationally closed but causally open, which causes many of its specific properties. All the above mentioned parameters are interrelated. Accordingly, production, consumption, exchange and distribution are also organically interconnected within a system.

Under the conditions of equilibrium, the gross profit is equal to gross consumption in debt ($P = D$), and gross savings - to gross investment ($S = I$). Under equilibrium conditions, the leakage from producers' incomes as withdrawn profits P, must be compensated by the inflow of funds as credits for productive investments I. But leakage of funds from consumers' incomes

as savings S must be compensated by inflows of funds for the financing of consumption in debt D. That is, in the market of resources, the condition of maintenance of demand at the appropriate level is the equality P = I, but on the market of products such condition is the equality S = D. Otherwise, the balance between supply and demand (at current prices) is disrupted in both the resource and product markets. But what is leaked from the sector 4 as savings S under equilibrium conditions must be equal to that, which through the money market inflows into the sector 1 as productive investments I. And what is as withdrawn profits P outflows from the sector 1, should be equal to that which as consumption in debt (consumer investment) D inflows into the sector 4. This is reflected in the model, according to which production investments (investments in physical capital) I and gross savings S correspond to the same element of diagonal of the sector 2. Therefore, under equilibrium conditions I = S. Similarly, the consumer investment (investment in human capital, or consumption in debt) D and gross profit P correspond to the same element of diagonal of the sector 3. Therefore, P = D.

The equilibrium condition is the equality P = S = I = D. Thus, there must be the equality $\alpha 0 = \beta 0 = r0$, where $\alpha 0$, $\beta 0$ and $r0$, respectively, represent the average rate of profit, saving and interest. However, it should be noted that in contrast to all other commodity and money flows, transformation of P into D, and transformation of S into I occur based not on an equivalent exchange of goods, but on credit relations, in which the interest rate $r0$ performs the balancing function.

Violation of equilibrium conditions in a system violates the equality between the sum of the elements of rows and corresponding columns. This leads to a bifurcation of the elements of diagonal. Discrepancies appear between production and consumption, supply and demand, cost and utility, production and consumption values. Deficient and surplus goods appear. In the markets of various goods will appear the unsold goods or idle money. Some get additional profit at the expense of losses of others or lost profits. This creates incentives to restore equilibrium in the markets. At the same time, the imbalance between any one pair of row and column, inevitably gives rise to an imbalance between other pairs of rows and columns. General economic equilibrium will not be achieved until reaching equality P = S = I = D, which means that $\alpha 0 = \beta 0 = r0$.

It is also noteworthy that the macro-economic parameters in the model are formed directly based on microeconomic processes. There is no break between the micro and macro processes.

9. Economy as a Cybernetic System

The "Symmetric model" is based on a dialectical analysis of the fundamental economic categories. This analysis has revealed such hidden relationships between economic phenomena and processes that are not visible at the empirical level. From the "symmetric model" reflecting these relationships, it is clear that economic processes form a closed system, and the functions performed by these processes are interdependent and have a circular organization.

From a purely scientific point of view it is essential that the model of an economic system and conclusions, drawn from the analysis of this model, correspond to the provisions and principles of second-order cybernetics. H. Foerster, the founder of second-order cybernetics, writes in his book «Understanding»:

"It seems that cybernetics is many different things to many different people. ... However, all of those perspectives arise from one central theme; that of circularity [9].

The formulas of "Symmetric model" show that the intra-system processes in the economy have the recursive nature. The equilibrium prices and equilibrium quantities in this model represent a mathematical group and are set by recursive operations. In this regard, very interesting is H. von Foerster's idea. In the above book, he cites the following equations:

$x' = D(x,u);$ $u' = S(u,x);$ $x_t+1 = D(x_t,u);$ $u_t+1 = S(u_t,x),$
 and then writes:

"Those of you who are occupied with chaos theory and with recursive functions will recognize at once that these are the fundamental equations of recursive function theory. Those are the conceptual mechanisms with which chaos research is conducted; it is always the same equations over and over again. And they give rise to completely astonishing, unforeseen operational properties. Viewed historically, even early on one noticed a convergence to some stable values. An example: if you recursively take the square root of any random initial value (most calculators have a square root button), then you will very soon arrive at the stable value 1.0000. . . . No wonder, for the root of 1 is 1. The mathematicians at the turn of the century called these values the "Eigen values" of the corresponding functions.

In the "Symmetric model" such "Eigen values" are the equilibrium prices and the equilibrium quantities of goods to which the actual prices and quantities tend. Mathematicians call the "eigen values" also "fixed points", which are used in the Arrow-Debreu model, game theory, etc.

„Through this recursive closure and only through this recursive closure do stabilities arise that could never be discovered through input/output analysis. What is fascinating is that while one can observe these stabilities it is in principle impossible to find out what generates these stabilities. One cannot analytically determine how this system operates, although we see that it does operate in a way that permits us to make predictions.

From the analysis of "Symmetric model" it may be concluded that the system tends to equilibrium in accordance with its internal nature. However, it is impossible to know exactly in which way this equilibrium has been achieved, which specific processes lead to it in a particular case, since the same state of equilibrium can be achieved in an infinite number of ways.

As we can see, the mechanism of self-regulation of the market economy is based on a recursive process in an operationally closed system. Revealing this has become possible only after

the market economy has been presented as an operationally closed system of economic processes. But to present it in this form has become possible only in the result of a dialectical analysis of economic phenomena. This fact once again confirms the importance of the dialectic method for understanding how a decentralized economy operates [10-13].

The equilibrium is understood as a state toward which the system only tends from any actual state because of an imminent logic of intra-system processes, but never reaches it because of destabilizing factors of the environment. These factors can be: natural conditions, social processes, new technologies, changes in consumer preferences, etc., the influence of which in the model is reflected in the changes of technological and consumption coefficients. Therefore, it is unnecessary to know the initial conditions in the past or what will be in the future technologies, preferences, environmental conditions and other unforeseen circumstances that cannot be known in advance. Thus, the "completeness", which is necessary for identifying the "fixed points" (equilibrium prices and quantities) initially is already meant by "Symmetric model", because of the operational closeness it already implies in itself all possible sets of equilibrium prices and quantities at the given restrictions.

"First of all, the idea of closed circular causality has the pleasant characteristic that the cause for an effect in the present can be found in the past if one cuts the circle at one spot, and that the cause lies in the future if one does the cutting at the diametrically opposed spot. Closed circular causality, thus, bridges the gap between effective and final cause, between motive and purpose. Secondly, by closing the causal chain one also appears to have gained the advantage of having gotten rid of a degree of uncertainty: no longer does one have to concern oneself with the starting conditions—as they are automatically supplied by the end conditions. ...".

As for circularity, according to recursive models in general this fact is not a flaw, but a significant advantage of "Symmetric model". Regarding a circularly organized processes, Foerster writes:

What also causes complication is that now the suspicion will be raised that the whole matter of circular causality might be mere logical mischief. We already know this from the theory of logical inference—the infamous vicious cycle: cause becomes effect and effect becomes cause. It is my intent not only to liberate the "circulus vitiosus" from its bad reputation, but to raise it to the honorable position of a "circulus creativus", a creative cycle.

Therefore, although the "symmetric model of" is a static model, but as noted the dynamics implicitly imply in it, because, as was noted, recursive processes lead the system to an equilibrium (as to its "attractor") from any initial state. But because of the permanent impact of random external factors, the technological and consumption coefficients are constantly changing. So the general equilibrium is never achieved. This unceasing movement toward equilibrium, which cannot be reached, just is that "dynamics", which is implicitly assumed in this static model. **9. Conclusions**

1. The market economy is a complex, nonlinear, operationally closed and causally open system of economic actions. Each subject consumes something that others produce and produces what others consume. Therefore, the satisfaction of one's own needs is mediated by the satisfaction of others' needs. Thanks to this, all subjects are attached to each other by their action, forming a single whole, a system in which all that is produced is consumed and all that is consumed - is produced. In such conditions, each economic action generates another action. That is, there arise recursive processes, owing to which the economic system becomes closed self-reproducible system generating its own elements.

From the birth of the concept of N. Wiener, W. Ross Ashby, H. von Fowerster (1940s-1950s) the central idea of cybernetics was the idea of circular causality. Here, the cause and effect are merged into one. A cause generates an action, which itself is the cause of another action. Action generates the action. This is an activity that has become the cause of itself, or self-generation activities. Systems, in which such circular processes are carried out, are called self-referential systems, which are studied by second-order cybernetics and constructivism. Such systems are autonomous, operationally closed and have unique properties.

2. In result of this approach, we find that the self-organization of a market economy is carried out thanks to a recursive processes (commodities are produced by commodities, prices are formed on the basis of prices, actions generate actions, satisfied needs create new unsatisfied needs, etc.). Recursive processes in the economic system as well as in other complex nonlinear dynamical systems generate the "eigenvalues" ("fixed points" - in the terminology of mathematics). The equilibrium prices and quantities are just such "eigenvalues" to which the actual market prices and quantities strive, providing a system striving toward the general equilibrium.

3. The "Symmetric model" of general economic equilibrium is the model of the attractor - a relatively stable, latent structure of that state of the economic system, towards which the decentralized economy always strives by virtue of the immanent logic of intra-system processes (but never reaches it due to the permanent impact of random external factors – changes in natural and social environment). Mathematical models of nonlinear complex systems show that such systems "hide" a certain form of organization of intra-processes that are caused solely by their own non-linear properties. That is, structure-attractors can be interpreted as teleological structures, which determine the main trends in the system's evolution. But they do not exist in a physical space and time. Their detection is possible only by means of scientific analysis.

4. The dialectical analysis of the essence of economic phenomena and a model developed on its basis reveal the hidden relationships between economic parameters, which cannot be detected by other methods of research. Although neoclassical theory fixes the relationship between gross saving and gross investment, nevertheless, it is not aware of the interdependence between gross saving and gross profits, also between gross investment and gross

consumption in debt as well. Consequently it ignores the links between the all aforementioned macro-parameters (i.e. saving, profits, investment and consumption in debt), which exist within a closed economic system. But without all this it is impossible to understand – what is general equilibrium? Why does deviation from it occur? How does a disequilibrium economy function? Why do monopolization, financialization and extreme inequality occur? Why does extreme inequality inevitably leads economy into a systemic crisis? Therefore, without understanding of these processes it is not possible to create an adequate mathematical model of a decentralized economic system and develop an effective economic policy.

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