Why 1 + 1 = 2 is not valid in economic theory?

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Abstract. Economic theory attributes some characteristics to socio-economic formation without proving that socio-economic formation really has these characteristics. In addition, economic theory uses these characteristics to describe the behaviour of socio-economic formation. As an experiment should be the principal criterion of truth for every scientist, the article explains what type of system is socio-economic formation and why. Resulting from type of system, real characteristics of socio-economic system are described. Facts that were experimentally proved have been used for that purpose. These experiments were done and proved by physics and their results where described mathematically.

1 Introduction

Before starting to analyze the socio-economic formation as a system, we have to define what the system is and what types of systems exist.

The system is a set of elements with specific features that are related to each other. Information comes into the system from surroundings through input channels. The system passes information into surroundings through output channels.

The system has n input variables $x_1 \ldots x_n$ that change their values in time independently from the system. Surroundings of the system give a rise to the changes of input variables. Moreover, the system has m output variables $y_1 \ldots y_m$ that functionally depend on the values of input variables. The relationship between the values of the input and output variables is determined by the internal variables of the system $z_1 \ldots z_k$. These variables are called state variables.

Imaginary skin that surrounds and separates the system from its surroundings is called the boundary of the system. The boundary of the system has specific features that allow either to isolate the system from its surroundings or to mediate the interaction between the system and its surroundings through strictly defined rules.

Systems can be classified from different perspectives. In general, systems can be divided into two groups:

a) Hard system is a system that is associated with one specific problem.
b) Soft system is a system in which a wide range of factors plays an important role.

From the perspective of the relation to its surroundings, systems can be divided into the following groups:

a) Open system is a system that exchanges mass and energy with its surroundings. Surroundings are defined for open system, i.e. at least one input and one output is defined.
b) Closed system is a system that exchanges only energy with its surroundings. Mass is not exchanged.
c) Isolated system is a system that does not interact with its surroundings, i.e. mass and energy are exchanged only between elements of the system.

From the perspective of the behaviour of the system, systems can be divided into the following groups:

a) Deterministic system is a system whose behaviour is uniquely determined by its state and stimulus.
b) Stochastic system is a system in which stochastic (random) processes as linkages between elements of the system proceed.

From the perspective of the behaviour of the system in time, systems can be divided into the following groups:

a) Static system is a system whose immediate state depends on immediate external impulse and does not depend on its previous states.
b) Considering the behaviour of the system in time, dynamic system is a system whose immediate state depends on its previous states and external impulses and distinguishes by inertia and delayed reactions.

From the perspective of time events, systems can be divided into the following groups:

a) Continuous system is a system whose input and output variables are available at any instant of time.

b) Discrete system is a dynamic system with numeric variables, i.e. values can be collected only from defined set of values. The behaviour of discrete system is defined in discrete time that is formed by an organized sequence of discrete points on continuous time axis.

2 Definition of socio-economic formation

Socio-economic formation is a type of society that is developed on the production type basis. The basis of every formation is formed by the production type that is the unity of productive force and production relation.

Productive force is people that has some knowledge, working experience and working habits and activates productive means.

Productive means are the set of work means and work objects that are used to create material goods in the process of social production.

Work means are all material means by which people acts on work objects to change them purposefully.

Productive relation is a set of social relationships that are formed between people regardless of their will and consciousness, i.e. objectively, in the process of production, distribution, exchange and consumption of material goods.

The set of productive relations forms the economic basis of socio-economic formation that reflects social relations between people arising in production, exchange, distribution and consumption of material goods. The economic basis ultimately determines the political and legal superstructures, social structure of the society, way of life, family forms etc. Emergence and development of every socio-economic formation depend on specific and general economic laws that are closely related. Specific law is also effective on a certain stage of economic development and determines it until the transition to a new phase of economic development. General economic laws link together socio-economic formations within the single development process of the human race. The law of compliance of productive relations with the character and the level of the development of productive force is the common law of all socio-economic formations. Every socio-economic formation has its stages of development. A conflict between productive force and productive relation arises at a certain stage of development of an antagonistic socio-economic formation what calls for a change of the old way of production by a more progressive one.

3 Reflection and reflexive system

The basic meaning of reflection is ‘Something returned in response’. Resulting from the basic meaning of reflection, reflection is a reaction on an action.

Interaction between subjects must exist so that an action causes a reaction. Actions and reactions circulate through interaction between subjects in the system.

Physics exactly proved that interaction is a natural property of every system and every subject has an ability to react on impulses.

Newtonian mechanics proved and formulated laws that describe interaction between subjects in a system.

Theory of reflection defines reflection as a complex flow of reflections of anything in something.

Interaction process represents a complex flow of actions and reactions. Interaction is nothing else than a reflexive process therefore every system is reflexive system.

Resulting from the above mentioned, reflection is not the property that differs systems. It is exactly opposite, reflection is characteristic of every system.

The most important criterion differing systems and determining their specific properties is relation to surroundings of systems.

The other criterion, as there are listed in the introduction, are less important.

The most specific systems are open systems because they are always out of balance. The specific kind of open system is living system because not every open system is living system but every living system is open system. More over, only the behaviour of living system can be manipulated. In addition, reflexive theory of Vladimir Lefevre is valid only in living system.

4 Socio-economic formation as a system

Socio-economic formation represents a set of elements with specific characteristics and mutual relations. Resulting from this fact, socio-economic formation is a system. As every system is reflexive system, socio-economic formation is reflexive system, too.

Information and goods are input variables that change in time and independently from the system. These changes are initiated by surroundings of the system. There is not only information or a good on the input of socio-economic formation. There is always a set of information and goods on the input if socio-economic formation. A set of information and goods are the output of socio-economic formation. Information and goods on the output of socio-economic formation functionally depend on input information and goods. There is not only information and a good on the output from socio-economic formation. There is always a set of information and goods on the output from socio-economic formation. The relationship between input and output variables is determined by state variables. The economic basis is the state variable of socio-economic formation.

In special circumstances, neither no information and goods are coming into socio-economic system nor no information and goods is leaving socio-economic formation. This is the case of socio-economic formations that are isolated from its surroundings but they are very seldom.

The surroundings of socio-economic formation are formed by political and legal superstructures that are determined by the economic basis. In fact, political and legal superstructures form a communication interface of socio-economic formation that limits the way of interaction between socio-economic formation and its surroundings.

Socio-economic formation exchanges information and goods with its surroundings. It is necessary to highlight that money has to be understood as a kind of a good because money is a good with specific characteristics. The development of socio-economic formation is the result of mutual exchange of information and goods.

As energy is a fundamental entity of nature that is transferred in the production of physical change within the system and usually regarded as the capacity for doing work, a good is an equivalent to energy in socio-economic formation. An accepted good represents an increment of another good in socio-economic formation and this increment is equal to the work done by socio-economic formation. The work is done by using an accepted good to improve characteristics of an existing good or to produce a new one.

Information is an expression for the capture of forms of an objective reality that exist in socio-economic formation and can be described in any way. These forms of reality exist independently on our consciousness. Information that either exists in a socio-economic formation or is accepted from its surroundings is contained in both, the economic basis and political and legal superstructure.

In broader sense, mass is an expression for all physical expressions of forms of objective reality, i.e. an expression of what exists independently on our conscious and can be weighed and measured. In strict physical meaning, mass is a substance from which physical objects are composed. Resulting from the comparison of the definition of information with the physical definitions of mass, information is equivalent to mass.

Resulting from the above mentioned, socio-economic formation is an open system because it accepts mass, i.e. information and absorbs energy, i.e. goods from its surroundings. As socio-economic formation is open system and every open system is out of balance, socio-economic system is out of balance, too. It is its natural feature.

If socio-economic formation is analyzed from the other perspectives that are listed in the introduction of this article, we shall find out that socio-economic system is also:

a) Soft system because wide range of factors plays an important role in socio-economic formation.

b) Deterministic system because behaviour of socio-economic formation is uniquely determined by its state and stimulus.

c) Dynamic system because immediate state of socio-economic formation depends on its previous states and external impulses and distinguishes by inertia and delayed reactions.

d) Continuous system because input and output variables of socio-economic system are available at any instant of time.

4.1 Economic theory and equilibrium

Theory of demand and supply describes how consumers preferences determine the demand for goods while company costs play important role in the demand for goods. Supply and demand curves are the basic tool to explain what determine market prices, where supply and demand curves intersect, where supply and demand are in equilibrium.

There is always a relation between the market price and the required quantity of a good. The relation between the price and the bought quantity is expressed by the demand function or the demand curve.

Supply function or supply curve shows the relation between the market price and the quantity of a good that producers are willing to produce and to sell.

Economic theory says that market equilibrium is established when supply and demand intersect because supply and demand forces set up balanced price and balanced quantity Market equilibrium is established at such price and quantity when supply and demand are equal. Balanced price and balanced quantity occurs when voluntarily offered quantity is equal to voluntarily required quantity. Equilibrium is set in the point of intersection of supply and demand curves on the competitive market. There is neither gap nor surplus at balanced price.

4.2 Characteristics of socio-economic formation

Living system is open system. Living system accepts mass and absorbs energy from its surroundings therefore is always out of balance. The organization is the most striking feature of living system. This feature is determined by the structure of building blocks of the system. The organization of a system consists in the fact that molecules are organized into larger units (biopolymers) in conformity with specific rules; biopolymers in specific organization form cells; cells arranged in accordance with specific regularities form separate organs; separate organs form complete living organism. The structure determined by the division of subsystems in a system is called physical structure. Apart from the specific physical structure that can be seen in the living organism, a huge number of the other equivalent physical structures are possible.

We proved that socio-economic formation is open system. Socio-economic formation has organized structure therefore it is living system. In socio-economic formation, an individual is equivalent to a molecule. As every individual is living system, because his structure is organized, and accepts information from his surroundings and consumes goods, every individual is out of balance, too. Every other subsystem is formed by individuals in socio-economic formation therefore all subsystems are open and living systems.

Resulting from the above mentioned, socio-economic formation is not only open system but it is living system, too. As open and living systems are always out of balance, socio-economic formation is always out of balance, too. More over, all subsystems of socio-economic formation are also open and living system therefore these subsystems are always out of balance, too. We can consider proved that both, socio-economic formation and all its subsystems are always out of balance.

The question is on the basis of what evidence economic theory came to the conclusion that equilibrium is in the point of intersection of supply and demand curves.

4.3 Socio-economic formation and equilibrium

I try to find answer to the question whether it is possible to establish equilibrium in socio-economic formation.

We proved that socio-economic formation is always out of balance. In addition, socio-economic formation is soft, deterministic, dynamic and continuous system. Every subsystem of socio-economic formation is out of balance, soft, deterministic, dynamic and continuous system, too.

Socio-economic formation exchanges information with its surroundings that is an equivalent to mass. Every subsystem of socio-economic formation exchanges information with its surroundings, too.

From the perspective of special theory of relativity, mass and energy are the same because mass turns into energy and vice versa. This principle can be applied to information and goods because information is an equivalent to mass and a good is equivalent to energy. In fact, a good is materialized information. If a new product is introduced in socio-economic formation those technology of production is unknown, for instance, information about existing new technology is extracted from a product, i.e. socio-economic formation exchanged both, information and good with its surroundings.

Living system requires disequilibrium for its development - it is its basic feature. Socio-economic formation as living system requires disequilibrium for its development, too.

Resulting from non-equilibrium thermodynamics, socio-economic formation as open system can be unstable against fluctuations (defects) in the state that is far enough from equilibrium, i.e. qualitative change can be initiated. Vice versa, socio-economic formation is stable against fluctuations near to equilibrium.

In view of the affinity of living and non-living systems being in disequilibrium, it is important to remind principles of development that non-equilibrium thermodynamics predetermine for the systems that examines. The system spontaneously redresses stationary state (state near to equilibrium) that is defined by minimum entropy production. If quantitative changes are accumulated and the system gets into the state that is far away from equilibrium, a qualitative change is initiated by the influence of non-linearity and by an appropriate fluctuation after which stationary state is re-established. Re-established stationary state is characterized by better structure, i.e. lower entropy. Entire considered process is random and deterministic. Any small defect, i.e. fluctuation is required to get the system that is far from equilibrium into a qualitatively better state. The detection of such fluctuation has a random character. If such fluctuation is detected in a prominent situation, the change from "quantity" to "quality" happens very quickly and inevitably. Therefore such process is a dialectical unity of randomness and inevitability.

Amount of information H contained in a message (statement, etc.) is defined by the formula

$$H = \log_2 1/p = - \log_2 p \qquad (1)$$

where p is the probability of occurrence of a give phenomenon (feature, etc.). If not all phenomena (features, etc.) are equiprobable than

$$H = - \sum p_i \log_2 p_i \qquad (2)$$

and $\sum p_i = 1$.

Bit is the unit of the amount of information. One bit is the amount of information contained in a statement about a phenomenon which probability of occurrence is 1 / 2.

The relation between the amount of information required to know the system and entropy of the system is expressed by the formula

$$S = (k \ln 2) H = \text{const. } H \qquad (3)$$

Brillouin's principle of negative entropy: information can be used to decrease entropy in the system and vice versa.

If formula (3) is rewritten in the form of $\Delta S = \text{const. } \Delta H$, we can come to the conclusion that the increase of amount of information about the system results in the increase of entropy in the system and vice versa. If information is returned into the system, entropy in the system is decreased. These findings are the contents of Brillouin's principle of negative entropy.

Brillouins's principle can be applied on socio-economic formation, too. In the case of socio-economic formation, information has ambiguous meaning; the first one is information itself, the second one is a good. I would like to remind that money is a good with specific characteristics.

I would like to analyze changes of entropy in socio-economic formation when information is exchanged. Information is an intellectual possession of individuals. If information is only taken from socio-economic formation and no information is returned to socio-economic formation, entropy of socio-economic formation will increase until a quality change is initiated in socio-economic formation. If information is also returned to socio-economic formation, socio-economic formation makes a progress, improves its management, etc. Resulting from the above mentioned, information returned to socio-economic formation is the trigger of decreasing entropy in socio-economic formation. It is necessary to highlight that only true information can cause the decrease of entropy in socio-economic formation. False information is always the cause of increasing entropy in socio-economic formation. If mostly false information is returned to socio-economic formation, entropy will continuously increase in socio-economic formation until the critical level when the change of socio-economic formation is initiated. Entropy in modified socio-economic formation is decreased to minimum. If mostly false information is returned to modified socio-economic formation, the above explained scenario will repeat until the moment when only true information is returned to modified socio-economic formation.

Increasing entropy in socio-economic formation is the cause of economic depressions. It was told that money is a special kind of a good that has specific characteristics. Money is the only good that can be exchanged for any other good. In market economy, money is taken from socio-economic formation and minimum amount of money is given back to guarantee the profit of subsystems and individuals. As the amount of money that is returned to

socio-economic formation is not enough to consume goods that have been produced yet, to produce new ones, to invest into education, science, health service etc., it results in the increase of entropy to maximum that initiates a qualitative change in socio-economic formation. The qualitative change decreases entropy to minimum in socio-economic formation. Each qualitative change provokes changes in economic basis, political and legal superstructures. If these changes cannot keep entropy at minimum in socio-economic system, the above explained scenario will repeat. If changes made in economic basis, political and legal superstructures can keep entropy at minimum in socio-economic formation, socio-economic formation will expand and the above explained scenario will never repeat.

Socio-economic formation is always an out of balance system therefore equilibrium can never be reached. Socio-economic formation is living system therefore it can expand only in stationary state, i.e. in the state that is near to equilibrium. Stationary state can be reached by fundamental changes in economic basis, political and legal superstructures that will not be focused on striving for profit but on profitability. Effective regulatory measures must be adopted, too.

5 Conclusions

Every system is reflexive system therefore socio-economic formation is reflexive system, too. In addition, socio-economic formation is open, living, soft, deterministic, dynamic and continuous system. Every subsystem of socio-economic formation is open, living, soft, deterministic, dynamic and continuous system, too.

Socio-economic formation as well as its subsystems are living systems therefore they are always out of balance. It is impossible to reach equilibrium that is situated at the point of intersection between supply and demand curves in socio-economic formation and its subsystems.

Socio-economic formation as living system requires disequilibrium for its development. It is stable against fluctuations in stationary state, i.e. near to equilibrium. Socio-economic formation can be unstable against fluctuations in the state that is far enough from stationary, i.e. qualitative change can be initiated. Stationary state is defined by minimum entropy production.

Information can be used to control entropy in socio-economic formation. True information decreases entropy in socio-economic formation. False information increases entropy in socio-economic formation. If no information or false information is returned into socio-economic formation, entropy increases. If true information is returned into socio-economic formation, entropy decreases. Returned true information into socio-economic formation helps to make progress, to improve management, etc. Returned false information provokes the increase of entropy to maximum what is the cause of economic depressions and crashes of socio-economic formations.

To keep entropy at minimum

a) Only true information has to be returned into socio-economic formation

b) A certain deficit of all kinds of goods has to be in socio-economic formation in every time

Economic theory attached to socio-economic formation characteristics that it does not have. As it is impossible to establish equilibrium in living systems, the theory of demand and supply is wrong. This is the reason why formula 1 + 1 = 2 will never be valid in economic theory.

Stationary state can be only established by fundamental changes in the economic basis, political and legal superstructures and by adopting effective regulatory measures.

Literature

1. Samuelson, P.A., Nordhaus, W.D.: *Ekonómia I*. Medzinárodná účastinná spoločnosť BRADLO, Bratislava, 1992.
2. Krempaský, J.: *Fyzika*. Alfa SNTL, Bratislava, 1987.
3. Kolektív autorov: *Politicko-ekonomický slovník*, Nakladateľstvo Pravda, Bratislava, 1974.
4. Marx, K: *Kapitál*, Státní nakladatelství politické literatury, Praha, 1953

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