

CONSTRUCTAL THEORY AND ECONOMIC CYCLE

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Abstract

More and more economists are talking about an impending crisis, even people who have no economic concerns are waiting for it. Economists discuss the extent and depth of this future crisis and analyze the possible consequences and how we can overcome them. The past fight against the diminution of the amplitude of the economic cycles has proved its limits and the measures taken have only prepared a new cycle and a new crisis. As H. Minsky has observed, the struggle to get out of the straits of a crisis contains the germs of a new cycle. There has been much written about business cycles and there are around 12 theories trying to penetrate in this curious world of regular variations of economic indicators. All these theories have in our opinion a limited view of the economy and attack economic cycles from perspectives that are often fruitless and harmful in the long run. In the last period, a theory created by a Romanian professor who teaches in America, Professor Adrian Bejan, has easily penetrated from physics to the field of economic sciences, and the theory is called the constructal theory. It is a theory that is suitable for both a mathematical - empirical analysis and a priori deductive analysis. It is a theory that provides fertile ground for economic analysis and above all it is a theory that leads to conclusions similar to the Austrian School of Economics. In our opinion it is the theory that brings to light long-term social and economic mechanisms with a strong explanatory and predictive character at the trend level. Objections can be raised against this theory; objections that we will mention at the end of the article. In this article we want to make a brief presentation of the theory in economic vision to relate it to the past economic cycles and crises and especially to the future ones. The theory speaks of many economic flows; flow systems with multi-storey architecture; of hierarchical configurations as they occur naturally; of wealth differences that are a condition of economic existence. The whole social system, according to this theory, is a flow system that evolves over time, with a certain pattern, and evolution has the appearance of systems superposed with a certain configuration. Cycles occur when the decision makers erroneously intervene in the spontaneous architecture of the flow systems due to their misunderstanding. We consider this theory a fertile ground for future research with this vision. Surprisingly, this theory can be related to another theory coming from physics but with major implications in economics, namely the self-organizing criticality theory. But considering the economy of the article we will leave this link for the future.

Keywords: flow systems, hierarchical architecture, cycles, flows, financial system.

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Introduction

The authors of this article intend to bring the Constructal Theory built by Professor Adrian Bejan into the economic field. The first part of the paper will consist of a presentation of the mentioned theory; the second part will be the use of this theory as a means of explaining and analyzing the economy and especially the economic cycles. An attempt will also be made to bring together the Constructal Theory and the Austrian School of Economics.

The authors have tried through previous articles to unravel the mystery of economic cycles through classical economic theories. We believe that this article brings a new light to the economy and a new style in seeing things.

Constructal theory

The whole human life is movement, action. Action means flow within an organized framework. A human system in balance with the environment is a dead system with no flow. An organized system tends towards a dynamic balance with the environment, that is, flows between the system and the environment occur (eg information flows).

Every living system spontaneously forms a flow configuration and a certain flow rate. By studying the elements that make up the flow, one can predict the shape and structure of the system. The only purpose of a flow system is to ease the flow. All systems transform their morphology to facilitate flow and gain a succession of models.

To understand the flow systems we must have in mind a river basin of a river. At first the water infiltrates the soil and moves slowly and over short distances then the first streams (channels) are formed in which the speed of movement and the quantity transported is higher. The first channels merge in a certain ratio into a larger channel. And the process continues until you reach a download point. The channels on a higher gear are longer and larger than those on the lower gear, in the channels on the upper gear the water moves with greater speed and mass compared to those with a lower gear.

The architecture of the system appears because only in this way the flow is easy, it acquires rhythm and it can be improved, ie it becomes efficient and evolves. The systems necessarily evolve towards a more efficient flow configuration. The degree of perfectibility of the flow of a system increases, despite and above all due to: the resistance to flow. The emergence of the flow systems and their evolution is spontaneous.

Within this theory it is important to define the concept of system and to establish its limits on the basis of criteria. The object and matter of the flow must be analyzed; between which points the flow takes place; what is the flow surface; channel matter; the quantities carried. Movement means a relationship between two objects and the movement of one in comparison with the other.

At the same time it is necessary to establish what forces of resistance are in the system: control point, neck, friction. The flow is always from large gradients to small ones and is unidirectional and irreversible.

Always within a system with a trained architecture, the flow is of two types: fast and slow. Slow flow is synonymous with diffusion and is carried out over short distances, and at reaching a critical mass the flow channel is formed and flow is made with speed

over long distances. The resistances encountered in diffusion, the time and the displacement speed achieved in this case are equal with those in the fast-flowing stream channels. Example: in the case of an information transmission system. First the information is infiltrated among the subjects, then a critical mass of information accumulates and the first resistances are formed, the first channels of flow appear, channels that unite and form larger channels.

The things created by man have as their purpose: a movement in space with an increasing rate in terms of speed and mass moved and a consumption of energy per unit moved in decline. The movement takes place from a point to a surface or from a surface to a point.

The flow system is self-organized so that the losses in the transported material or energy are as small as possible. The efficiency increases (energy consumption per unit of transported mass) as the material support (which moves and supports the information) is higher. Thus, a spontaneous distribution of the transported material appears, from many small to few large ones, with a certain statistical distribution. The speed increases with the transported quantity.

Each flow system is only a portion of a larger flow system. A flow system has a certain architecture, it is composed of intermediate steps; steps consisting of smaller flow systems each with its configuration. The whole evolves to increase efficiency and decrease resistance.

The social systems are identical to the other systems. They have a certain tree-like architecture, spontaneously emerging and evolving to move at an increased rate of mass, speed (over longer distances). The social system is in permanent change and search for diminished resistance. Social systems are hierarchical; hierarchy what: it goes towards harmony, facilitates flow and makes flow possible. The system as a whole changes and he counts (not the person as an isolated entity). Scientific research and technological development support the flow of materials, information from the social system, diminishing the resistance. The way flow systems evolve is unpredictable.

Engines (flow currents) evolve with brakes (resistances). The environment (context) is an engine brake. The interaction leads to a multiscale channel architecture with a vascularized and hierarchical design. The evolution is for operation with unnecessary dissipation of energy in reduction. For movement the brakes are as important as the engines.

In the economy, energy consumption is directly proportional to the result. The energy consumed creates power and force, and these move mass (information). These aspects related to the fact that the flow structure is hierarchical lead to the conclusion that the wealth is distributed unevenly. Unevenly distributed wealth is a result of natural laws. Energy must be consumed to create movement. Energy has a certain natural substrate. The substances used for energy extraction are not evenly distributed on the surface of the globe, so wealth discrepancies occur.

The solution of poverty eradication is not the destruction or aberrant modification of the flow system but the connection of isolated areas or small flow systems to large flow systems; step by step. The solution is to develop the existing flow systems in a certain area and to connect them to other systems. The worst solution is the destruction of

local systems and the creation of new ones, which have been useful in other areas with different characteristics. It must always be built on something that already exists and has proven its viability over time.

Any innovation creates a new channel through which a new flow emerges, which flows and feeds a new territory, reducing poverty and bringing wealth. Innovation can also open a channel that already existed (but was blocked) and thus flow to include new channels and new territories. Any leak is between a point and a surface or between a surface and a point.

The innovation is individual and favors the flow at a certain point or creates a flow at a certain place. At the same time, the flow from one point influences the flow of the whole system.

Inequality in the distribution of flows within a system occurs even if a perfectly symmetrical and undifferentiated physical system is built. For example, in the case of a system of perfectly equal nodes and with fixed distances between the nodes (system in the form of a grid), any flow that flows through this system differs greatly, in terms of indicators, between the flow areas. The more the source of the flow in the system is subjected to variation pressures, the more the flow in the system differs qualitatively and quantitatively by area.

If we artificially intervene and create a perfectly equal system, then the portion of the system that is closer to the source has a higher flow rate. Those on the periphery will have part of the last remnants of the flow, ie at the periphery the flow tends to zero.

Increasing the size of a system causes the periphery to move away and the center to widen its edges. In order to guarantee the equality between the nodes in terms of flow, each node must be at the same time an input and an output, ie each one is on its own without any connection with the others, just as in the beginning. This is communism.

There is a direct relationship between the complexity of the economic system and the wealth differences within the system. The differences of wealth are natural and arise from the spontaneous configuration of the hierarchical system and from the flows that exist between the components.

There is a direct relationship between the quantity of goods produced in a country and the quantity of movement. The amount of movement can be measured by the fuel needed for travel, consumed at country level. Most innovations simply remove barriers to flow.

In short: the purpose of the systems is to access the resources needed for life. Between wealth and energy consumption the relationship is direct. The system configurations appear as a result of the uneven distribution of resources; increasing complexity is required to cover the entire surface.

Economic innovations favour flow. Money more than the exchange in nature, the same type of currency as compared to several currency models, eliminating customs barriers, using a single language, a single type of alphabet and the same units of measure.

To increase well-being and a sustainable future it is necessary to consume more energy; moving more mass / information. The resources are virtually inexhaustible, always new sources of energy are found, and the solar mass provides practically inexhaustible energy. In fact, solar energy made things move on earth and life appeared.

Each flow starts slowly, then the flow speed increases slowly, it reaches a rapid growth, and finally the growth becomes slow again. All this S-shaped flow system is repeated in all flow systems. The complexity does not result in an increasing speed until the system explosion. Complexity means rational organization according to a certain model for streamlining. A complexity without configuration would block the flow.

Change is essential within a system. Always a free-flowing system changes to streamline the flow. A system that does not change is a system condemned to death. All social innovations, including language and starting from the language reaching the machines and social organization, are realized with the purpose of a greater power of movement. The balance of a system including the social one means death, a system in harmony with the environment is dead.

Within the social system the channels of flow are formed by the collaboration between individuals. Thanks to the collaboration, freight / energy / information is transported.

Growth is just a part of evolution. Evolution first of all means structural complexity of flow, not necessarily dimensional growth. A system must be free to be able to adapt to the flow through it. Obstructing it means taking the first steps towards its destruction. Artificial changes in a complex system block it and send the flow in counter-nature directions that have low efficiency. A forced change modifies the natural flow from one part of the system and sends the current in a direction that the natural evolution avoids due to the decreases registered in efficiency. From all the studies carried out by the construction theory it follows that the constraints made on a natural system (like an economy) can only be harmful.

Free natural systems are constantly improving, that is, to distribute the forces that oppose the movement as evenly as possible over the whole. If the system encounters a higher resistance then it will try to dissipate that resistance into the system. But the resistances in a system will never be uniform, that is, evolution never ends. It strives for perfection, but it will never be achieved. It is necessary to diminish the resources inside the channels along them and at the same time to increase the resistance around the channels for an efficient flow.

Hierarchy is natural in nature and in the organization of society, but hierarchy does not mean inequality and is more predictable. The human society develops through energy consumption and also through energy consumption will solve its problems. The opinions of uniformizing energy consumption and stopping consumption are false and lead to the regression of civilization. The future is about as much energy consumption as possible, but with high efficiency devices (ie they do not waste unnecessary energy in the environment). High energy consumption is required to generate wealth, but efficient consumption (in terms of losses).

Human mechanisms interpose in the path of the fluxes of nature, intercept them and then discharge the accumulated energy elsewhere and in another way. In flow systems, the amount of flow or energy entered is equal to the quantity that comes out. These are linked to the Jevons paradox and Arthur Laffer's paradox. That is, the more energy a system uses efficiently, the more it consumes; respectively, the lower the taxes, the more quantitatively their collection increases, because the economy as a whole grows.

Unused fuel is lost wealth. The chance of development for disadvantaged areas is to be coupled to large and functional flow systems, systems that bring them wealth. Human civilization is a living tissue with knots between which are flow channels for energy flow. Human organizations collect energy and transform it into the environment in the form of movement or loss.

Any flow entails, modifies, penetrates the environment and the materials with which it comes into contact. The placement of cities on large areas and the dimensions of these cities respect a logarithmic function in distribution. Cities are centers of concentration of flow on large areas. The human flow from a certain area is directed towards cities in the sense of flowing from a surface to a point. The flow continues from small cities to larger cities.

Saving means saved movement power. When more energy is consumed in a particular place than is necessary then the surplus economy moves to another place where it is needed. If at some point energy is generated above necessities then it is necessary that this energy be stored and used later or elsewhere. This is achieved through money and capital. Money transfers energy / movement power from those who have excess to those who currently use it.

In economics the rules form flow channels and make the flow easy along the channel and at the same time the transverse losses to the external environment are minimal. The business world with its rules is only a channel system that facilitates flow.

Increasing the dimensions of a system leads to a decrease in operating losses and a reduction in resistance forces. Simultaneously with the increase in size also increases the amount of energy necessary for the operation of this system, quantity that represents a limiting factor. Thus, at the intersection of energy supply and demand, the system will be set up. Increasing the efficiency of the flow through human-built systems will reduce the size of the systems, ie their miniaturization.

Evolution has two aspects. The first is that more and more masses are being transported, and the transport bodies like cars and airplanes are getting bigger and bigger. The second aspect is that the consumption of energy unit per mass unit decreases gradually. The result: the total energy consumption increases, the mass transported increases, but the unit consumption decreases.

An efficient flow system must move an object from one point across the entire surface and not just from one point to another. The flow systems overlap one another and absolutely all have an evolution in S compared to the flow time and power. That is, the flow has a slightly increasing flow rate, will accelerate strongly, stabilize and then a low growth rate followed by disappearance. The disappearance is not preceded by a decreasing flow rate, that is, the flow is not in the form of a Gaussian curve. Human flow systems do not lead to cataclysms, they just overlap with each other for a more efficient and intense flow.

Growth is different from evolution as a concept. The growth of a system is S -shaped, and evolution means a flow system overlapping or evolving from another. The freedom of the social flow system ensures wealth, efficiency and especially longevity. Rigid, bureaucratic systems with cumbersome changes lead to poverty, and their survival is uncertain. Without freedom a system cannot change, cannot adapt to changes, in a word is condemned.

The birth of a flow system can take place in two modes with different flow directions. The first way is by the formation of the smallest channels following an indistinguishable diffuse flow. The training direction is from low to high. The second way is by starting from the mouth of the exit where a main channel is formed, and slowly the secondary channels are formed. In the main channel, an infusion of flow from the neighboring surfaces takes place initially, following these diffusion flows to form their own channels due to the agglomeration and concentration of the flow.

The channels of flow in a social system are formed by the laws of the state. The decentralization of the state does not mean uniformization or a single dimension of channel for all places, but it is the allocation of a certain type of channel that suits an area and its characteristics. In a centralized, bureaucratic, artificially developed state, the center is heavily vascularized to the detriment of undeveloped peripheral areas for which no channels of wealth flow are built. This is about the empire of the U.E.

The flow systems do not replace each other but instead overlap each other, each having its own field of action. Sustainable economic development is in fact the free evolution of human flow systems, so that they can adapt for larger flows, at greater distances and with less fuel on the transported freight unit. The evolution is gradually in small steps, and at a certain step new flow systems can appear that overlap the old ones without replacing them, but only covering a new domain. Each system deals with its own flow pattern.

Existence as a life means a system that has an impact on the environment around it. The more a system has an impact on the environment, the more it transforms it, the more viable, efficient, powerful and durable it is. Something that does not change the environment around it is something dead. By optimizing and changing a living system further changes the world around us.

The evolution of a system is in small steps to find lower resistance in the path of flow, for fluidizing the system as a whole. The system evolves as a whole and not on the pieces and not on an individual level; although system upgrades occur from the individual level, with improved nodes giving a higher flow rate.

APPLICATION OF THE CONSTRUCTAL THEORY IN ECONOMY

We will continue the article by applying T.C. in economics and we will try to distinguish the mechanisms of the economy and especially of the economic crises through the scientific lens given by this theory. To do this we will start from the simplest elements of the economy and we believe that we will reach conclusions that are much closer to the principles of the Austrian School.

Let us consider the existence of one man. It is a potential hub of a future network, not yet materialized. In order to survive, man arranges and changes the environment around him; environment with which a mass and energy exchange takes place. He strives and extracts the necessities of life, in a self-sufficient existence. There are no exchanges with other people. It is a diffused movement of materials and energy.

We consider the emergence of the second person who is in the same situation as the first and is also a future potential node of a network. But the two nodes are not identical in terms of abilities. Nature has not created uniformity. Thus, between the two

nodes material exchanges occur. These are easy exchanges to supplement the existing ones. The movement of materials is still widespread.

The surface we consider for simplification is uniform. Thus, knots will appear on the entire surface approximately at equal distances. Each one needs an approximately equal surface to survive (plus minus depending on abilities). Exchanges occur between nearby nodes, but the flow is limited to neighborhoods. The flow channels are materials: goods, roads of property; and that is why they are limited in volume. The abilities of the nodes are different so that different products appear.

In order to be able to move a cargo from one point of the system to any other point with efficiency, two things are needed: easy change and safe travel. Thus, it appears as a necessity of accelerating flows: money and roads. The money must also be insured the roads so that some nodes become the nodes of money and roads insurance.

Thus the first flow system with vascularized configuration is created. Over this primitive system consisting of nodes representing individuals, another system will overlap (from clusters of individual nodes). These clusters can themselves be thought of as nodes depending on the reference system. Permanent human settlements appear, where the speed of the circuit is much higher due to the approach. Superimposed systems are formed in which, depending on the scale chosen for the study, the node acquires different dimensions and composition.

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The first type of flow is diffused (between the environment and the human or between two individuals) then it is concentrated and the first channels appear that merge into larger channels. Institutions, banks (both of different degrees) can be considered channels. Like trees in a forest, they must cover the entire surface (necessities), that is, from many small to large ones with a certain rate of progress. An efficient system is one in which you can move an object or a sum of money through the whole system, if necessary and especially between any two points of the system.

Different abilities of people create different wealth even under identical natural conditions so that spontaneously wealth is distributed differently among people. But any change at the node level can change the flow as a whole. The role of the entrepreneurs is the innovation that can change the flow direction and the characteristics of the flow. But innovation can only occur spontaneously and locally, it cannot be finely anticipated and programmed. Any attempt to regulate innovation is ridiculous.

Banking system

The essence of the economic flow system consists of two flow channels: money and goods; these flow channels are bidirectional. Ideally, there should be equivalence between these channels. Unfortunately it is not, and the brake from one of the channels

has been removed, this brake represents gold as currency. So now that one of the channels goes without a brake, the flow of money is much faster than the flow of the commodity channel. Equivalence is established at times by crises.

The economic system has evolved so that it has improved its internal flow of money and goods. And the rule: the flow takes place from high concentrations to small ones, it anticipates a flow of capital from the areas where it is abundant to the areas where it is lacking. The condition is: there should be no barriers to the flow, and the surrounding areas should be allowed to connect to the system where the concentration of capital is high. The connection, without obstructionist interventions, is made freely.

The socialist systems only raised barriers over barriers to the normal flow of money and goods.

Through the flow of the economic system, two entities move in relation to each other and compared to each other. Money means information on one side and on the other side goods and services. The forces that oppose the flow of goods are greater than those that oppose the flow of money. That is why the flow of money can take different speeds from the flow of goods it represents. The only viable brakes in the circulation of money can be represented by banks, but they have shown that they can only accelerate the movement.

The speed and time of money flow between individuals is equal to the speed and time of the large channels formed by banks. And the banking system without interventions on it, would have a mathematical distribution between sizes and dimensions. Forced interventions on the banking system have made very few very large, few large, no middle and no small. This distribution is abnormal. Thus, there is no longer a ratio between the diffuse economy and the channel economy, and the system is completely destabilized. The central bank banking system created a totally wrong distribution of banks (size and number).

The banking system per its set up, no longer consists of intermediate flow systems each with its architecture, which could provide its flexibility. The various levels of flow have disappeared. Flow steps with adaptive designs have been replaced by rigid monolithic systems. They have a reduced ability to change their own architecture. Good hierarchies are those that are left free to form their own configuration and ensure stability. In the current banking system, the hierarchies are modified abnormally (by the imposition of the central bank and its rules) and the stability can no longer be ensured. These hierarchies appear spontaneously and cannot be anticipated. In order to anticipate the evolution of the banking system, the artificially imposed rules destroyed the system.

At the same time with the engines of the banking system, the brakes also had to evolve. But they were not only not allowed to evolve but were also removed by giving up the gold standard. Thus, the banking system has become more fragile over time.

The central bank banking system modified the previous system with spontaneously hierarchical vascularized architecture and modified it according to limited interests. The accelerations inside the channels by the uncontrolled extension of the credits and the falsification of the economic signals led only to the total separation of the financial channel from the one of the goods. There must be equivalence between these two channels, but somewhere this has been lost and must be permanently redone. As I said from the whole

mechanism, the brake represented by the connection with the gold was removed.

I will briefly describe the evolution of the banking system detached from gold, which is part of an evolution of type S according to T.C.

Consider a reference system in which the ordinate is the GDP, and the abscissa the years. The renunciation of gold created a new system of flow superimposed on the initial ones and with its own artificial architecture dictated by the rules of the central banks. Starting with 1914 (when we consider that the giving up of gold begins) a slow (but rising) growth of global production similar to the first part of S. We consider 1944 (the Bretton Woods agreement) a turning year and the ascent begins (at an accelerated rate) of world GDP similar to the upward (middle) portion of S. The growth rate in this phase is rapid. Starting with 1990 we believe that we are on the last part of the S with ascension (more and more decreasing as a rhythm), and 2020 with a miniscule rate of development.

As T.C. there are no hits from a wall but only takeovers of the evolution by a new flow system with a new architecture in which the flow is improved. This new flow system should have started its evolution around 2000 (a possible existence would be that of cryptocurrencies) and intersect (in its evolution) the curve of the current banking system around 2020. But we believe that this synchronization has not product and the last part of the current system curve will be a sharp drop.

Unfortunately, we see an evolution towards a brakes-less system, more uncontrollable. From an objective link of gold, there followed a system dependent on the character and knowledge of a group of people (central bank management) and now a system, in principle, without links (the cryptocurrency system); system that will have its own configuration and hierarchy.

Crises in essence are a bottleneck in the flow of banks. Blockage that comes from overloading the old system's drainage channels and damaging them. The stream will look for another route, new systems will be activated or little used parts of the old system will be activated.

During crises, the problem cannot be identified in the flow channels or the object of the flow, therefore the harmony will occur spontaneously and should not be intervened. Changes in flow occur at the individual level it is not possible to know which node will create a new flow path.

If the economy as a whole were left free then an economic stage (a system with an S-shaped evolution) would end slowly with a slow or stagnant growth. Its final curve would intersect with the upward portion of the curve that represents the new development stage. Manipulations and economic corruption make the end of the curve a sudden drop that stops when the new upward curve of the new flow system intersects.

Austrian school and construction theory

Both theories see as the essential element the basic components, in the case of the economy: the individual. Between individuals exchanges occur, ie flows will spontaneously lead to harmony, that is to say, the construction of social structures with a certain configuration and hierarchy. Any intervention on the system is harmful. The capital will inevitably move from areas with high concentration to those with low concentration. Differences of wealth are inevitable even in perfectly symmetrical built

systems. All obstacles in the way of circulation must be removed in order for systems to be able to be coupled and an attempt to standardize wealth.

An aspect that A.S drew attention to a long time ago is resumed by C.T.. Austrians speak of gold coin and bank deposits with 100% coverage; C.T. speaks of the need for brakes for a system so that it can evolve at higher flow rates. Within the current system: breaking the gold link, the sudden expansion of credit and the multiplication of money can only accelerate a system far beyond its possibilities and to separate it from reality.

It seems that the outlook is even worse: more brake-free systems are anticipated; systems totally devoid of contact with reality; more exposed to crises and unstable.

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