

## The Contribution of the Neo-Schumpeterian Approach to the Development of the Economic Theory: Emphasis on the Meso-Economic Level\*

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**Abstract.** *This article tries to show that there are alternative approaches to the economic theory, besides the well-known economic schools, Classicism, Neoclassicism and Keynesianism. The neoclassical principles allow a formalization – widely accepted by experts – that provide effective tools for measuring the effects of the economic activity. The economic science pays a special attention to the study of the economic agents' behaviors, and to the economic results obtained by them through economic activity. Any human science uses principles and works with assumptions, and the neoclassical assumptions have generated efficient tools for quantifying the economic outcomes, and for accounting the economic growth. But these hypothesis, such as the assumption of economic agents' rationality, allow a very limited understanding of the behaviors of economic agents within the markets. The recent invention of the Nuclear Magnetic Resonance device, allowed the emergence of a new scientific paradigm, the development of neurosciences. Researchers can observe at a high level of graphic detail various types of activities that occur in the human brain, and some economists have introduced in the study of the economic theory, for example, the assumption that the consumer is driven by emotions when*

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*purchasing quantities of goods and services. So, economists may look for additional theories to explain the behavior of the economic agents. An increasingly importance is given to the theoretical contributions built on the work of the economist Joseph Alois Schumpeter, who has an original economic approach based on his own principles. It is proposed to focus the attention on a mesoeconomic vision about the industry, to understand how resources are being allocated and reallocated between companies, and to study the economic processes of evolution, which are influenced by the emergence and dissemination of the innovations. It is supposed that the price is allocating the resources in the economy, but the companies' behavior is generated by a competition and cooperation for innovation.*

**Keywords:** evolutionary economics; mesoeconomics; economic growth; neoclassical hypothesis.

**JEL Codes:** B13, B15, O3, O4.

**REL Codes:** 2B, 5B.

## Introduction

### What problem does this article study?

This article tries to show that there are alternative approaches to the established economic currents, and that the economic processes can be studied at a higher level of detail at the mesoeconomic level. Several important processes are taking place here: the allocation of resources, a process of transition from one technology to another, a process of reallocating the resources between the sectors of the economy and a process of convergence of the firms in terms of productivity and behavior. The economy studies economic phenomena and processes, and any human process involves human relationships, being there an evolution (dynamic) of the human behaviors in the society, and a change in the various structures through which the studied items may be combined. The economists are simultaneously studying the methods of producing goods and services, how the people „appreciate” them through their own system of values, and the evolution in time of these methods (individual and global). They can study these aspects through a structure, and these structures represent an organized vision of the elements from a system.

### Why is it important to study this topic?

In any human science, there are several possibilities to approach the human processes and relationships, and the notion of relationship is used to study different connections between the elements from a system. Therefore, economists can see the human society as a system. A system can be studied organized, and this organized study is effective through a structure. Any computer-worker knows how difficult the programming in a computer language was, without using the programming structures. For example, in Quick Basic, we can use the command „Go To” to resume some previously written instructions. The disadvantage of the structured computer programming was that a software that was making simple things reached to a very large size. Another disadvantage was that the software was being hard to understand by another computer-worker, and many times he was forgetting what exactly he wanted to do, even forgetting his own program. The economists recognize the importance of the principle of comparison, and statisticians know that it makes sense to compare in time and space only those data that are collected based on a structure. We can say that a structure allows the economist to have an ordered work, being easier to calculate the added value obtained by using the factors of

production and their market allocation at different moments of time. The relationships between elements can be reordered through theories. The economic theories represent a combination – with different percentages – of the quantitative formalization of the economic processes, and their qualitative understanding.

#### **How exactly does the author try to answer this question?**

The economists understand and study the economic reality, trying to explain through the collected data some behaviors or economic results. Some theories can better describe reality than others, meaning that they have an opportunity cost. When studying the quantitative relationships between elements, we can remain at a descriptive stage of the economy by presenting some alternative possibilities (with an opportunity cost), or we can look for some correlations between these elements. Any econometrician knows that some correlations occur more likely than others, and this implies the fact that the economic realities can be explained by alternative theories. It is possible that several events to happen in a certain context, but some will show a higher probability than others.

In the neoclassical theory, there is used a powerful tool of formalization of the economic theory: the concept of representative economic agent. After there is chosen, based on several principles, who could be considered the representative economic agent from an economy, we can econometrically model both the results obtained in an industry, and the economic results at the macroeconomic level. Basically, we can use some microeconomic principles to explain several macroeconomic results. These methods were and are used by the economists due to the lack of detailed data sets, comparable in structure, in time and space, between companies and households. Over time, we will have more detailed data sets, but the economists' problems of "fine" occur when trying to shape the social organization.

#### **What is the link between this article and the existent specialized literature?**

The symbiosis capital-labor takes place within the human organization, the economic processes are carried out here, and they have the effect of generating economic results. At least in theory, the human organization can be structured, which means that basing on the same set of rules to define an organization, so that the statistical data to be econometrically processed. We know that the economists-accountants can measure the economic results

obtained in each organization through financial or econometric tools, the economists-managers combine the organization's capital with labor, and the economists-researchers try to provide theoretical explanations as close to reality as possible, at all economic levels.

The economists-researchers can make theoretical models in a positive or a normative approach. They saw that the transformations from the economy are both qualitative and quantitative. At least in theory, the human value system can be changed, because each person can establish an objective, and according to this objective he may order some alternatives with different values, so we can structure them to some extent. Even at a society level we can order a system of values. But this system is dynamic and qualitative variations occur. Any anthropologist or historian knows that significant qualitative changes have occurred when people began to eat well, to have a shelter and to communicate better, meaning to socially interact in normal conditions. At the same time, major qualitative economic changes have occurred after the invention of the plow, the mass production and the personal computer. The Internet gives people the opportunity to play, to communicate, to socially interact, and the ability to access scientific knowledge. It represents a process of transition that occurs over time and represents an evolution. Knowledge is distributed in society through organizations, but even if we define the organization by a set of rules in order to be able to use – for example – the principle of comparison, one person can be part of several organizations simultaneously, and it may produce added value spontaneously, unpredictable. Besides the fact that it is difficult to shape the individual's behavior, it is hard to formulate a regression to quantify which event influenced more the added value, or which organization allowed to the individual to obtain a higher added value in relation to another individual. This is the reason why organizations are difficult to compare. An analytical tool proposed in the evolutionary (neo-schumpeterian) "school" of thought to measure the qualitative changes in the economy is using the concept of innovation. The concrete economic results may be innovations of products or innovations of the production process, and the highest importance is given to the technological innovations of production since it is assumed that they create the most opportunities to further develop new technologies, new products, they allow the accumulation of knowledge etc. The approach is permissible because there may be an interaction in terms of explaining some behaviors and not just the results of the new theory of endogenous growth, but also creates the economist's freedom to provide through an original econometric model, his own observation for the statistical data which are disaggregated observed.

The economists give different percentages of importance to the knowledge generated by the human capital and by the capital of production (including financial capital), and this is why more specialized studies say that now is a debate between the evolutionary economic approach and the new theory of endogenous growth.

### Content

An economist researcher's work involves the combination of ideas and theories with empirical studies – in certain circumstances – in order to obtain scientific results. Depending on the chosen target, he tries to explain how exactly the economic system works. By formulating theories, methods and techniques, he can remain in the qualitative area of explaining some economic phenomena and processes, or he can try, in certain circumstances, a quantitative approach.

According to some economists, like David Cass (Samuelson, Barnett, 2007), an economic theory can be seen as a way of organizing ideas in order to give a clear image of understanding reality. Some economists adopt a style of understanding the economic system through an empirical research-oriented approach, while others prefer to rely on a strong intuition. Certainly, this theoretical intuition is formed by understanding the various theories that describe various phenomena and private processes. Economy is a human science that uses, from a form of abstraction, at least three approaches: descriptive, based on behavior or based on results.

In terms of descriptive approach, graphical statistical data are used as methods of analysis, in order to analyze some dimensions and dependences that exist between the economic variables. Initially, there was no difference between economy as a science and philosophy, many economic problems being studied in philosophical works (Cornescu, Bucur, Crețoiu, 2008). Human society exists because of human activities, and because of this issue, the economists can cooperate with anthropologists, psychologists, neurologists etc. in order to understand different economic behaviors.

The third type of approach can be achieved by quantifying, interpreting and predicting some results obtained from the economic activity, such as various indicators of productivity.

Because of the need to understand the economic behaviors and results, and to explain the possible interdependence between these two approaches, there were various economic doctrines, movements and schools of thought.

Economic science is a combination of observable data and theories, both regarding agents' behaviors and the effects obtained from the economic activity. This is why there arise some conceptual difficulties to scientifically substantiate some tools to anticipate human behavior and economic results, because these two are interdependent, both influencing each other dynamically and mutually.

In different moments of time, there are different market structures, due to various changes in economic behaviors and results. Thus, due to changes in people's needs and production processes by introducing new technologies and innovations, there are constantly appearing qualitative changes in the economic system, which are manifested by a permanent change in the economic system's structure. Structural changes may be quantified by a system of relationships that can be measured by a system of equations. This system of relationships is a symbiosis between theory and the data collected. In order to understand how the economic system works, it takes the economist's intuition and practical sense, valid for any other human science.

If the economic system did not have structural changes, its variations could be easily measured by delayed variables. In an attempt to better understand this system of economic relationships that are interdependent with the obtained results, the schools of thought presented different objectives and angles in order to understand how it works, and then to propose some ways to improve its functionality. Wassily Leontief appreciated Joseph A. Schumpeter's work as being oriented to better understand the ideas that underlie various schools of thought, and to find them scientific utility in different levels of abstraction of the economic theory: "Researchers have been at all times which stood on a top from where they were able to investigate all the ground around them rather than from a valley, and which not just from a superficial or a formal point of view, recognize the right of existence of various schools of thought. He had a real understanding of their ideas and an emotional affinity for all" (Leontief, 1950, pp. 103-110).

To understand the variation of the structural changes over the variation of the economic system, we can make a theoretical journey starting from the Marxist vision. He gave the economic system a dynamic vision determined by a continuous evolution due to „the technology embedded in capital". He tried to understand how the capitalist system managed to develop so much, in terms of the produced quantities of goods and services, unlike other forms of organization of the socio-economic life. According to some authors, such as Rosenberg (1974, pp. 90-108), Marx identified some "economic era"; he

introduced the hypothesis that science influences the productivity of the production factors, but also imposed a restriction according to which “it was necessary to satisfy any objective conditions”, so that science would not become an independent variable to the economic system. Marx does not explain what those “objective conditions” mean.

The marginalist economists studied the economic system by the vision of a more efficient allocation of a given stock of resources. It was introduced the concept of decreasing marginal utility and the stationary state of the economic system was inserted. John Bates Clark (Clark, 1908) was the first author who made a synthesis of the static and dynamic states, in the same piece of work, and he believes that when an economic system is stable, he is in a static state, and when it begins to fluctuate it becomes dynamic, as a “container with water when is shaken”.

At the beginning of the twentieth century, the stationary state was, in the view of economists, the long-term balance in classical and neoclassical economy, and the tool of formalization was represented by the comparison of several static equilibria, from different moments of time. This approach has allowed the introduction of production functions into the analysis, as a set of combinations of inputs and outputs. This analysis represented a quantification of changes in the variables capital and labor. In other words, there are not taken into account various structural changes of the economic system, but there are quantified the readjustments from the variables labor and capital, which include the structural changes of the economic system.

Even if at the beginning of the twentieth century it was considered that an economic growth can be achieved only through the ratio capital/labor ( $K/L$ ), in time, it began to be taken into account the technological aspects (related to the technical progress) which are proportionately or disproportionately influencing the production factors, capital and labor. Solow (1957, pp. 312-320) built a Cobb-Douglas model, in which he decomposed different sources of the output's growth per capita, in order to quantify the influence of labor and capital accumulation. Its production function was  $Y = A \times F(K, L) = F(K, L \times A)$ , where the parameter A represents the technological changes (or the stock of knowledge) which proportionately influences the production factors. Through this approach, the technical progress is not built in the production factors, so it is exogenous to the model and remained in literature known as the “Solow residue”. Solow (1957, pp. 312-320) obtained in his study that 87.5% of the output's growth is due to parameter A. Although the author associated this parameter with the technical progress, he thought it might be influenced by

other factors such as “slowdowns, accelerations or improvements in workforce’s education”, which could be responsible for the output’s growth.

This study opened the door to a new line of research that had as an objective accounting the economic growths through some assumptions based on the neoclassical spirit. The econometric approach of the productivity measurement is based only on observing the amount of output and the amount of input. Although theory shows that it is a nonlinear function that describes obtaining output, often in practice, economists are constrained by the small samples to introduce restrictions such as constant returns of scale, in order to increase the estimators’ number of degrees of freedom (OECD Manual, “Measuring Productivity, Measurement of Aggregate and Industry-level productivity, Growth”, 2001) At the same time, it is questionable how the residual variable of the production function might be interpreted.

In order to be able to use these methods of measuring the results, respectively the various indicators of productivity, there were introduced some simplifying assumptions specific to the neoclassic approach:

- The economic system is studied through the concept of stationary state;
- The economic system’s approach is in terms of the general equilibrium theory and there are being used the principles of the marginal calculation, where the marginal utility is decreasing;
- The production processes can be represented by functions of production or by functions of transformation at various levels of the economy. They represent different sets of combinations of inputs and outputs. Basically, they are the optimization functions that aim to obtain the maximum of output with a set of inputs;
- The manufacturers are rational, representative firms aiming to obtain efficiency by maximizing revenues and minimizing costs;
- The markets are competitive, functioning on the assumption that the economic agents are perfectly informed;
- The price is the one that allocates the resources in a market, and every manufacturer takes this price from the market and can only make adjustments in the quantities they produce.

These conditions are important because “they guide us how to measure some parameters that would otherwise be very difficult to identify. An obvious example is the use of cost components instead of output elasticities; the first are observable, while the last are not, but theory shows that, in terms of balance, the two must be equal” (OECD Manual, “Measuring Productivity, Measurement of

Aggregate and Industry-level productivity, Growth”, 2001). But at the same time, there are some problems with the measurement of the economic performances during business cycles. During the business cycle, there are significant variations of the microeconomic aspects that have influence on the firm’s performance (scale economies, the degree of utilization of the installed capacity, the quality of the management, organizational structure, the quality of the human capital), but also of the macroeconomic issues (the price level, exchange rate, employment or various institutions). In other words, the uncertainty of the economy increases, being required a more “intuitive” interpretation of the obtained results. For example, during the recession, a lower rate of utilization of the production capacity could be accompanied by a relatively constant output, but which to be followed by an increase in the amount of inputs.

To be able to “guess” the phenomena that describes the observed data, meaning the facts, we need a theory to explain them.

Through a general vision, we can assemble some theoretical structures – reflecting pieces of that vision – and the more precisely they describe reality as they are more “realistic” made. This involves relationships of exclusion between theories, meaning that some theories are better than others because they describe better the economic reality. In other words, the positive economic science is concerned to describe the behavior of the economic agents, to measure their results and to understand some of the interactions between results and behaviors. First, the economists have to understand how the economic system works, how to measure the results, and only afterwards to propose regulatory measures to improve its functionality. Under normal conditions – excluding natural disasters, wars etc. – the limits on ways to improve the economic system are given by the uncertainty of human behavior, the scientific progresses and the new technologies. Because of these, the quantitative economy will always make a distinction between the analysis of the short-term phenomena and the analysis of the long-term phenomena. It is possible to reduce the uncertainty through a better understanding of the human behavior, and this can be done by economists working with psychologists, neurologists or anthropologists. In this regard, economists have recently started some collaborations with neurologists and founded a new science, the neuroeconomy. For example, based on recent studies from the neuroeconomy, the consumer’s theory has been extended by introducing the emotional consumer’s hypothesis.

Using the data aggregated by the National Accounts System is a method to quantify the economic results obtained in one country, but it does not allow

the understanding of the companies' behaviors, and there can be made only short-term forecasts of the economic activity, because the engine of the economic development is represented by the technological changes (with significant degrees of uncertainty). To understand in depth the adoption and harmonization of technologies within companies, it is important to process as many data series as possible at the microeconomic level. However, besides the significant expense of data collection by some of the Institutes of Statistics, these data are being processed with some delay (between 3 and 10 years), so that they might be undervalued/overvalued by managers, and this implies a measure of maintaining the confidentiality by the data provider. I have stated this things because even with the knowledge of some relevant stocks of data about companies, there are still remaining various degrees of uncertainty in economists' work.

Some economists, such as Wassily Leontief (Samuelson, Barnett, 2007), came up with the idea that it is possible, at least in theory, to align the cash flows from micro to macro level and not vice versa, as it is today. Although they are shrouded in uncertainty – regarding the new technologies, competitors' behavior and consumers' behavior – companies are trying to reduce this uncertainty by formulating strategies (maintaining their own behaviors during a certain period of time) translated into business plans. In these plans of investments are being made specific budgets, which are respected for a certain period of time, but which could be aggregated at a macro level.

Most economists agree that technology (knowledge) and science are still producing more and more added value in the economic system. But from a macroeconomic perspective of the quantitative economy, there may be significant delays between the investments made in technology and the economic results obtained, and working with aggregated sizes does not reflect how exactly the economic activities are distributed among various human organizations. Besides this, some empirical studies show that an important part of the economic growth is due to the process of dissemination of some technologies or to the process of imitation (OECD, „Work With Firm-Level Statistics: Some Key Applications”, 2001). In other words, continuous production functions cannot reflect in detail the effects of the technological changes that take place in companies. In a dynamic system, as the economic system is, it is difficult to methodologically separate the impact of the technological change from the impact of human capital or from other factors related to the structural organization of the company, management innovations, marketing etc. Some studies show that they can be successfully separated on

short-term, but there are significant difficulties when trying to make long-term changes because of the permanent changes in the economic structures. The economy is a dynamic system and various fluctuations, such as business cycles, may occur due to delays. In other words, while different investments in new technologies are being achieved with delay – even in the conditions of a low inflation rate and of macroeconomic stability – there are generated new business cycles, structural changes occurring in the economic system, as well as changes in the economic agents' behavior. At the same time, mathematically, the maximizing solution of a dynamic system is different from the solutions obtained in the case of maximizing several static systems. The only version in which the two solutions can be comparable is the situation where the two methods of analysis of the system are used in the same economic structure, an unlikely situation in the market economy.

In order to better understand the long-term economic system, respectively the formulation of approaches regarding companies' behavior in terms of how they adopt technologies and turn them into various processes of production, how they adjust their organizational structure, change their production capacity depending on the business cycle etc., it is necessary to process a large amount of data. Nowadays, at the current volume and rate of data collecting and processing, in the micro-econometric practice, when some dynamic studies are made using panel data collected at different time intervals, there are still arising several differences from the economy in real time, because of the slow data processing. There may also occur structural differences within the same country/region/industry/sector between the static moments of time in which the data took place, when studying the dynamics of the economic system. For an economist, a powerful tool is the principle of comparison, and here occur again differences between the various structures of the countries/regions/ industries/ sectors, even at the same moment of time.

### **The relaxation of the neoclassical assumptions**

In time, some economists understood that the use of the continuous mathematical functions are – through some parameters – a very general measurement of the economic activity, and they began to relax the neoclassical assumptions by trying to propose alternative theories. At the same time, several Institutes of Statistics, World Bank, European Bank for Reconstruction and Development, OECD etc. started to constitute some series of company-level data that have the same structure, which means that they are comparable between the studied countries. Basically, continuous mathematical functions

were a method to avoid the empirical studies, as the last ones involve higher costs, because of the costs of data collecting and managing.

Some authors argued that the assumptions of the neoclassical theory are useful for some theories of economic growth accounting, but may be insufficient to explain the economic agents' behavior. Joseph A. Schumpeter (Schumpeter, 1942) argued in several papers that the engine of the long-term development would be the innovation. Dosi (1988, pp. 1120-71) tried to show that markets do not provide a perfect information of the businesses, but on the contrary, these asymmetries of information are those that create opportunities for producers to invest in research and development, and to create new technologies. For this reason, Dosi (1988, pp. 1120-71) and Nelson (1974, pp. 886-905) argue that it might be necessary to find other tools to quantify the economic growth. In other words, in terms of the neoclassical equilibrium, there would be no incentive for innovation, the observed companies would be homogeneous and there would be no improvements in their productivity.

If the producers are rational, they always know to order the available technological alternatives and to identify the best markets in which to conduct their economic activity. But this assumption reduces the importance of the economic problems faced by economists, and the identification of options to be made by the companies. Depending on the context, on the uncertainty of the technology, on consumers and competitors' behavior, the companies must dynamically learn about the new technologies, to modify the capacity, to adjust the organizational structure etc.

Instead of the assumption of producer's rationality, expressed by "optimizing behavior" and "maximizing profits", there is being introduced the concept of "limited rationality", and the companies aim to get a satisfactory profit. It is clear that they aim to achieve a higher level of profits, but because they are confronted with uncertainty, they are forced to learn by trial-and-error (Bayesian) about technologies, about the adoption of technologies, about competitors etc. Sometimes, a company tries to imitate the competitors' technologies, but even through the very process of imitation, there is accumulating a stock of knowledge in the companies that changes the organizational structure and improves the quality of the human capital. From the interaction between the knowledge about a technology and the knowledge accumulated in human capital, there may occur some innovations that may be new to the company, new to the industry or new to the world. This knowledge can be „learned" by the human capital of other companies, some knowledge stocks may be stored in databases, technical diagrams, or they can be "mixed

learned” through the activity of research and development. This knowledge does not disappear, it accumulates both in technologies and in industries.

Through incremental innovations (consecutive, on a small scale) of the production processes and of the products, and through the activity of research and development, permanent variations occur both in the company’s organizational structure and in the quality of the human capital. The future results of the scientific research are shrouded in uncertainty, and the opportunities regarding the future potential markets are unknown as well. At the same time, there is possible to appear some breakthrough technologies that will bring consistent “mutations” in the structure of the economy. These appearances of new structures of organizing the elements from reality can be compared with the concept of “scientific paradigm” of Thomas Kuhn (1962). He showed in his work that a “scientific paradigm” is a set of rules accepted by an academic community. Following the scientific approaches, some people have doubts about these sets of rules, and new scientific paradigms appear.

Dosi (1982, pp.147-162) focuses on the interaction between the economic factors and these sets of rules (economic institutions) to try to make a comparison between the scientific paradigm and the technological one. The fact is that as more and more importance is given to scientific research, the degree of interdependence between the scientific sphere and the technological one increases. Naturally, many technological components – seen as elements – can be reconstructed in several ways with other technological components, and their combination and/or discovery of new components is possible either through scientific research, either through several experiences accumulated in the human capital. Dosi (1982, pp.147-162) defined a “technological paradigm” as a “pattern of solutions” of a “selection of technological problems”, in which the solutions are being found relying on several principles derived from known sciences or from practical past experiences. In his view, technology can be regarded as a “set of units of knowledge”, of experiences resulted from successes, failures, methods, procedures, “best practices”, in which science is not just a neutral element, but it is, to some extent, endogenous to the market.

So, when a new technological paradigm appears, there are being created the opportunities for generating a new set of technologies, including the possibility of knowledge accumulation, both in the technological paradigm and within each technology separately. A new technological paradigm is, for example, using alternative fuel for cars. New technologies for cars have emerged, such as various engines that run on multiple fuels. To make these engines, several companies – both in the auto industry and other industries –

have invested in research and development in order to create new technologies, but also to adapt the existing technologies to the new fuels, or to substitute different components of the existing technologies. So, there appeared some qualitative changes in those industries, as well as in the organizational structure of each company.

Although useful in the economic models that use different neoclassical assumptions – including the representative company – in the real economy it is possible to observe that the companies are significantly heterogeneous. In a normative formulation, we can “guess” that as the amount of scientific research and the dissemination of technological knowledge through the Internet will increase, the percentage of the qualitative transformations in relation to the quantitative transformations will increase as well, in all economic levels. These “mutations” occur at the microeconomic level (company’s organizational structure), at the mesoeconomic level (sectors and industries), and at the macroeconomic level (economic policies and state institutions). In a positive approach, we know that the technologies are not adopted immediately in the company, because there are some gaps on the stock of knowledge needed to use them. Technologies’ adoption represents a process of their integration, of a permanent “adaptation” of the organizational structure, including a critical stock of knowledge so that the company to be able to survive the competition.

The economic science is a human science, and there are used some common concepts, like the process. Economic phenomena and processes are dynamic, qualitative variations taking place both within the company and within the industry to which it belongs. Any process of economic transition has two key elements: reallocation and reorganization (Blanchard, 1997). The emergence of technological paradigms may generate a process of economic transition at a macroeconomic level, at a mesoeconomic level (industries) and at a microeconomic level (company). Positively speaking, new technologies incorporate a larger stock of knowledge, and new production processes and new products will lead to obtaining a higher added value, *ceteris paribus*.

So, we can summarize two distinct economic processes, when we study an industry’s adoption of technologies. One of the processes is linked to the gradual adjustment of the new technologies within the companies, and they learn through small steps various knowledge about these technologies, and sometimes adapt them in a personalized manner from which result innovations. The second process is related to the emergence of some new technological paradigms which represent a completely new reorganization of the scientific elements, and which show both various technological solutions to some new

economic and technical issues, and the reorganization of some experiences – meaning the knowledge resulted from past experiences.

These two economic processes that arise in the economy due to innovation or technological paradigms, require companies to take part in an ongoing process of transition. We will try to present, briefly, the idea of this process in Blanchard (1997) approach spirit. He described the process of transition as characterized by two distinct processes: reallocation and reorganization. Reallocation involves transfers of resources between the sectors of the economy, because companies will focus on those industries where the added value is higher. We could describe this process as a behavior of the companies that are refocusing their resources (capital, labor) to an industry that would allow them to innovate as much as possible and to get a higher added value (results). The reorganization of the companies could mean – in the context of the emergence of new technological paradigms – different adjustments, quantitative and qualitative changes in the company, from the need to be more competitive. (Mitra, Muravyev, Schaffer, 2008) show that any process of transition is given at the same time an importance that is relative to the process of reallocation and reorganization. At the level of industry (mesoeconomic), in a certain vision of the literature it is sustained as a hypothesis the inability of the old industry to adapt to the potential market, that could be generated in our case by the new technological paradigm.

To maintain the global productivity of the economic system – in terms of disappearance of the old industry – it is said that it is necessary to develop a new industry. From this point of view, the process of transition is the ability of old companies to start working in the new industries. In this vision, the ability of reorganizing the existing companies is very important, involving some measures to adapt to the new industries. According to an alternative vision of the transition process, we may consider the companies' convergence from the old industry to the new industry as the structural adjustments of the factors of production within the companies.

### **An approach to understanding the vision of the neo-Schumpeterian contribution**

The neoclassical current had a significant contribution to the economic theory by developing theories that can measure the effects of the economic activity, such as economic growth accounting. The economists could be grouped into three main categories: Economists-Accountants, Economists-Managers and Economists-Researchers. The last group of economists had

favorable results in developing theories of quantifying the economic results, but has always been limited in understanding the behavior of the economic agents because of the lack of available data, due to the inexistence of devices that measure the indicators of human behavior.

In the past, the economists resorted to some scientific/nonscientific studies about the human nature to explain, mostly descriptive – and not on the basis of some cause-effect correlations, validated by the theory of probabilities and by the probabilistic calculation – many theoretical discussions being about possibilities. With the invention of the Nuclear Magnetic Resonance device, researchers can observe in a precise manner several types of activities taking place in different parts of the brain and which reflects a certain degree of mental activity. Basically, this device opened the way to a new scientific paradigm, that of the neuroscientists. In economics, scientific applications could consist in a better understanding of the human behaviors. Therefore, the neoclassical assumptions can be gradually relaxed, following the neoclassical economic theory to gradually fill with behavioral theories that describe the observable reality as well as possible.

Economists can inspire from physics (capital gravity, labor gravity, rotation of the capital etc.) or from biology (selection of companies, growth rate, learning ability etc.) when certain economic theories are formulated. The Neo-Schumpeterian current borrows some concepts from biology, from the Evolutionary Theory, elaborated by Charles Darwin (Ruse, 2009, pp. 10-19).

A starting point in understanding this theory could be the fact that the economic agents are shrouded in uncertainty. The results of the evolutionary process cannot be ex-ante known, because we cannot estimate the amount of output that will be obtained with a certain amount of input. Because of this, the economic agents are forced to constantly experience in order to find out more about different technologies or the environment in which they are. The companies' permanent experiencing represents a continuous learning process, a process of selection of the companies from the market taking place, meaning the companies that managed to “adjust” to the companies that have left the market. These were some examples, but in this current we will find terms like “survival rate”, “growth rate”, the ability to “learn” about technologies etc.

This current is concerned about the qualitative changes in the economy in all its levels, about the way of dissemination of the innovations. The formulation of modern macroeconomic theories has been possible thanks to the concept of “representative economic agent”. There have always appeared disputes between the economists, to what extent the real economy is influenced

by the monetary economy, discussions about business cycles, and even appeared concepts of “monetary economists”.

Through its principles, this current attempts to show that it is important to study the economy at a mesoeconomic level, because here occur the qualitative and structural changes within the industries (Dopfer, 2004, pp. 263-279). In industry, the added value is created and the workforce is being employed. As time goes on, the companies accumulate a bigger stock of knowledge about technologies, looking at the same time to exploit them by a higher profit. In a quantitative economic growth, the companies that gathered a growing stock of traditional factors of production, were benefiting from economies of scale, were having long-term lower total average costs of production and the price was being a sufficiently representative indicator for the allocation of resources in the economy.

With the development of electronic technologies, the invention of the personal computer and the Internet, the rate of qualitative changes in the economic system has significantly increased. Knowledge can be accumulated in an increasing rate, the companies can access them more and more in order to obtain product and process innovations that can be considered new for themselves, for the industry or for the world. A positive principle of the neo-Schumpeterian current is that the competition by innovation replaces the competition by price, and it becomes the main mechanism for coordinating the behavior of the economic agents; a basic normative principle innovations include social innovation, technological innovation, organizational and institutional (Hanusch, Pyka, 2007, pp. 275-289). In the deterministic approach of the economic system it is supposed – at least in theory – that the companies can own all the information from one market, but in practice it is observed that there is a permanent dynamic adjustment of the economic agents’ behaviors, in certain circumstances are even influenced by the information regarding an ex-ante estimated output (Taşnadi, Doltu, 2001). In an uncertain approach of the economic system, it is assumed that the deterministic approach could create some rigidities (organizational, institutional, technological) which constrain the appearance and diffusion of innovations within the economic system. For example, it is deterministically estimated a potential output, and depending on it, there is formed an economic policy of adjusting the recessionist/inflationary delay, but the economic policy affects people’s social behavior in some industries, and thus, the emergence of social innovations is inhibited.

A synthesis of some normative principles of the neo-Schumpeterian contribution is considered:

“Qualitative change affects all levels of the economy, and so we must consider not only structural changes but also the removal of constraints under the status quo and allow for development under new circumstances.

Qualitative changes do not appear continuously in time but correspond to the idea of punctuated equilibria encompassing periods of smooth and regular development as well as periods of radical change.

Finally, these processes show strong non-linearities and positive feedback effects which are responsible for pattern formation and other forms of spontaneous structuring i.e. they are not completely erratic, even if the innovative success by its very nature is characterized by strong uncertainty” (Hanusch, Pyka, 2007, pp. 275-289).

Although the neoclassical current had a great contribution in accounting the economic growth, it can explain in a small amount the behavior of economic agents and how the economic growth was generated. Zvi Griliches said in 1997 that "We can take productivity growth calculation and allocate it in great detail to the various missed components, reducing thereby the role of the «unallocated» residual. But this, while very instructive and valuable, only shifts the problem to a new set of questions: Why was there all this investment in human capital? Will it continue? Where did the improvements in capital equipment come from? [...] Real explanations will come from understanding the sources of scientific and technological advances and from identifying the incentives and circumstances that brought them about and that facilitated their implementation and diffusion. Explanation must come from comprehending the historical detail” (OECD Manual, “Measuring Productivity, Measurement of Aggregate and Industry-level productivity, Growth”, 2001).

## Conclusions

The mathematical functions that summarize the macroeconomic results give an opportunity to the economists to make an “opinion” about the general condition of the macroeconomic balance, but they need a good theoretical knowledge to understand various causalities between events. The economists can be structured in economists-accountants, economists-managers and economists-researchers. By the neo-Schumpeterian contribution, it is proposed to guide the researchers’ attention to a mesoeconomic vision, meaning to focus their attention on the behavior of the economic agents and on the allocation of resources within the industry. For a better understanding of the dynamics of companies and resources, there cannot be successfully used the concept of

„representative economic agent”, because the real economic processes are heterogeneous, constantly appearing product and process innovations that can be subjectively considered by the economists-managers new to the company, new to the industry or new to the world. It is assumed that the most „fruitful” innovations are the technological ones, because they allow both the formulation of new technological processes, the emergence of new products, and new knowledge that can be accumulated to a technology, an industry or to the world. The invention of the technology of accumulating the “Internet” knowledge allows a dynamic access of the economic agents to the stock of knowledge about all existing technologies, thus creating endless possibilities to generate innovations. The economists-researchers have long intuited that changes in the economy are both quantitative and qualitative, and the neo-schumpeterian “current” proposed as a tool of quantifying the economic effects, the concept of innovation. By its tools of formalization, the neoclassical theory generated a strong theory of measuring the economic effects, but because of the restrictive assumptions (which allowed the formalization) it is difficult to shape the behaviors of the economic agents. The invention of the Nuclear Magnetic Resonance device allows the relaxation of the neoclassical assumptions regarding the rationality of economic agents’ behaviors, leaving space for the formulation of alternative theories of quantifying their heterogeneous behavior. The neo-Schumpeterians propose the guidance of attention to the industry (at a mesoeconomic level), in which the companies are not homogeneous (representative), but acquire a heterogeneous nature through the product and process innovations. These innovations are, to some extent, subjectively regarded as innovations by the economists-managers, and this involves a stochastic process of econometric modeling for the economists-researchers.

### Future research

Future research may be directed to the formulation of alternative theories generated by the relaxation of the neoclassical assumptions. The economists intuited that the neoclassical models represent a powerful tool of the economic system’s formalization, and the differential equations allowed to a certain extent to quantify the variations of the economic effects. There have always been some limits in understanding the qualitative structural variations of the human organizations which modify the estimates of the parameters from the equations of economic regression. Currently, through some parameters, we understand “by ear” how does the economic system vary when the economic results are

aggregated and there are used continuous mathematical functions. To have a closer vision to the reality, and to understand their heterogeneous behavior, we can try to shape a stochastic process at the mesoeconomic level. There are several angles to look at an economic process, and this implies the fact that some theories can explain better than others, some aspects seen in different contexts. No matter how precisely a set of rules would be defined by a statistician for defining an organization, one person can be part of several organizations simultaneously, and this implies that any regression is limited by the knowledge that can be considered as embedded either in capital or labor.

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