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*Summary of the doctoral thesis:*

**The General Equilibrium Theory. A Differentiated Approach in  
Terms of Existing Models and Future Evolution**

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## Summary

**Keywords:** *General Equilibrium, Keynesian, Monetarism, Turbulence, Hazard, Search Frictions, Nash Equilibrium*

Economic reality is characterized by the existence of large and numerous interdependencies between markets. One example represents the aspects that characterize the job market act as determinants of the demand for consumer goods, as employees spend their earned income on the labor market, and producers undergo hiring depending on the amount of production sold at a price that is considered fair. Also, important aspects in the economic process are the phenomena of substitution and complementarity, both at a consumer level, and at a producer scale. In this context of the pricing in all markets, there is a switch to the conceptualization and analysis of the general equilibrium. From a theoretic perspective, general equilibrium refers to a situation in which all markets in the economy (economic goods market, money market, capital market and labor market) are simultaneously in equilibrium, i.e. when prices and quantities do not change. Moreover, in the general equilibrium analysis, an important issue is the developing of the economic disequilibrium condition.

The economic equilibrium problem concerns political economy since its inception, more precisely ever since economic thinking was set up a science on its own. The Classical thinking of economic equilibrium can be found in the works of Adam Smith, David Ricardo and John Stuart Mill, just to mention its most representative exponents of classical liberalism. One of their main goals was denouncing the restrictive mercantilist ideas of free competition. For Adam Smith, the state should refrain from intervening in the economy, because when people act freely in search of their self-interest, there is an invisible hand that turns efforts into benefits. In fact, the theory of the "invisible hand", stated by Adam Smith, can be considered as a form of the concept of economic equilibrium. According to this theory, a competitive market-based economy can spontaneously secure the equilibrium between production and consumption, and supply and demand, which makes government intervention unnecessary. Also, according to the theory of the "invisible hand", the game of interests that occur on the market is enough to harmonize the economic life.

Further, the most important theories regarding the economic equilibrium and disequilibrium are those stated by Alvin Marshall, Leon Walras, and John Maynard Keynes, after which other theories emerged in order to include other phenomena in an economy.

In subsequent approaches, economists have focused particularly on three issues that arise in the context of general equilibrium systems (which are mainly based on the assumption of perfect competition): (i) whether there is a corresponding general equilibrium solution in the sense of compatible variables' values; (ii) whether this solution is unique, i.e. if there is only one value for each variable consistent with the global solution; (iii) whether the system is stable, meaning if it returns after a disturbance in the equilibrium values. Although during the 20th century, many economists, including Kenneth J. Arrow and Gerard Debreu, proposed mathematical models and approaches in order to study equilibrium and give definitive answers to these considered issues, the current global economic conjuncture, determined by the worst economic financial crisis registered after World War II, led to the resumption and reconsideration of these equilibrium and disequilibrium approaches from a broader perspective.

Within the theoretical context of the twentieth century, these developments led to the emergence of one of the most important dilemmas for economists: fiscal policy versus monetary policy. This dilemma is even more present in this timeframe, which is characterized by crises and major economic imbalances.

With regard to the economic policy, this was different, depending on the political orientation of individual governments. In this respect, periods of monetary policy, which targeted control and stability, were fiercely supported by monetarists represented mainly by the School of Chicago, but alternated with periods in which governments adopted economic policies meant to encourage employment by increasing public spending, namely policies which have their basis in Keynes's economic thinking.

For monetarists, budgetary or fiscal impulses may affect revenues, however, only short term, but instead, government spending financed by public loans or taxes will lead to the suppression of an approximately equal volume of private spending, both for consumption, and investment, so ultimately production, employment and global income will not suffer significant changes.

In the last century, the two schools of economic thought have had an open confrontation regarding the most effective market economy system and which should be adopted by the government in its policies for sustainable economic development and growth.

Despite Milton Friedman's claim that the differences between monetarists and Keynesians are only of an empirical nature, the essential debate between the two orientations is reflected in the economic model used: monetarists are Walrasian and they consider the economy exhibits only temporary imbalance, also, they believe in the positive action of Adam Smith's "invisible hand", whereas Keynesians advocate for a contrary approach.

Monetarism emerged out of the contemporary economic difficulties. In times of profoundly felt crises, the society develops new theoretical perceptions and is looking for new values. Against such a basis, Keynesian arose, following the Great Depression of 1929-1933, and, based on the current premises, determined by the current economic and financial crisis, we can expect new models to arise for the analysis of economic equilibrium and disequilibrium.

Many economists see the crisis of 2007-2008 as an inevitable consequence of past excesses of the economy, and truly as a healing process. The current context, determined by the economic crisis, provides positive prospects for the emergence of a new approach to the general equilibrium theory, in terms of the current economic reality that will permanently and significantly change the economic thinking, as well as help achieve a synthesis of the various patterns of equilibrium on aggregate markets, which could lead to a stable general equilibrium framework for sustainable recovery, and further for the development of the global economy. In other words, the recovery of the economies out of the crisis will be achieved through a concerted action of the state and market forces; however, it must be considered the fact that the market is a system based on the principle of self-regulation, and the state should not interfere in the mechanism of its operations, but must remain a "partner" in order to ensure a coherent fiscal policy and a regulatory framework of markets, enabling agents to freely express themselves in a legitimate competitive environment, in which they can achieve their desired benefits.

The research on the general equilibrium theory, which is the subject of this thesis, will raise a number of important issues that have emerged in the last century and especially after the outbreak of the current economic crisis regarding the capacity, and the limit of the economic models in ensuring the necessary predictability for the development of various economic phenomena and the achievement of general equilibrium, both in medium, and long term. This

economic crisis has revealed the limit of the proposed models in the current economic context, and the measures, taken to reduce the negative effects of the crisis, would seem that no longer meet the theoretical suggestions of advocates for Keynes, Friedman, and other prominent economists. In this tough context, we can expect the emergence of a new vision of equilibrium, by combining the tools offered by Keynesians and liberals, but their research results should not be considered as postulates for economic policies. Therefore, major current issues will be addressed in terms of economic theory and policy, with the main objective of finding new ways to allocate resources, which could ensure sustainable economic development.

In this research, the general equilibrium will be considered through a differentiated approach from the perspective of existing models and future developments. The structure of this thesis aims to address four major research issues:

- (i) Equilibrium and Disequilibrium Issues in Economic Theory
- (ii) The Theory of General Equilibrium from Keynes's Perspective: Theoretical Analysis and Suggestions for Economic Policy
- (iii) The Monetarism Concept Regarding the Existence of Equilibrium in Economic Theory and Policy. Effects and Significance
- (iv) The General Equilibrium Theory Approach in the Context of the Current Economic Reality and Future Perspectives

Given that this thesis aims to analyze general equilibrium, is important, first of all, to define what constitutes a state of equilibrium, and what determines it. Thus, the first chapter covers conceptually the issues of equilibrium and disequilibrium, which were the subject of research for economists for the past last century and a half.

This first chapter begins by examining and defining the concept of economic equilibrium, after which the analysis will be extended to the problems of achieving general equilibrium, and then to the transition from equilibrium to disequilibrium issues, addressed in economic theory.

Equilibrium, a term used in various sciences, designates, at a market level, a situation in which consumers and sellers are satisfied with the current combination of prices and quantities that are bought or sold. Also, the equilibrium is a central concept of modern economic analysis describing situations which economists claim would always do, but which serve as a reference to study specific situations. In this framework, the main forms of equilibrium are uncooperative equilibrium (Nash equilibrium) and competitive equilibrium (Walrasian).

The mathematical formulation of the general equilibrium theory is known as the Arrow-Debreu model, named after the two economists who made this formulation: Kenneth J. Arrow and Gerard Debreu. The major contribution of Kenneth J. Arrow and Gerard Debreu for economics was in a 1954 article, which addressed the existence of general equilibrium. Strongly mathematized, this paper characterizes a general equilibrium state with a few assumptions about the rationality of consumers and businesses. Their demonstration is more elaborate than that of Walras, whose demonstration consists of only achieving an equality between the number of equations and number of unknowns necessary to ensure the existence of an general equilibrium.

This significant contribution to the development of equilibrium was acknowledged to Kenneth J. Arrow (1972) and Gerard Debreu (1983) by granting them the Nobel Prize. Also, the Nobel Prize was awarded to other economists, who have contributed to the development of the equilibrium theory: Paul Samuelson (1970), Maurice Allais (1988), John Richard Hicks (1972), John C. Harsanyi, John F. Nash, and Reinhard Selten (1994).

Regarding the general equilibrium analysis, an important issue that occurs is the economic disequilibrium. Theory of economic disequilibrium considers that in an economy there

are different forms of disequilibrium, with different intensity levels, in the form of economic crisis, budget deficit, unemployment, and inflation. In addition, disequilibrium theory proposes a dynamic analysis of equilibrium and considers, theoretically, that economies are always in a state of imbalance, because they evolve and are in a process that strives for an equilibrium situation. After a strong development of the disequilibrium theory during the 1960s and 1970s, it slowly stopped having the privileged attention of economists, especially after the economies' problems (stagflation, major imbalances) started to be resolved.

The conceptual approach to the problems of equilibrium and disequilibrium in economic theory has allowed the demarcation of the defining terms for using the specific instrumentation of economic theory in the researches of the subsequent chapters.

Based on the definition of the analysis terms of the concept of equilibrium, in chapter two, I achieved a comprehensive analysis of Keynes's general equilibrium theory, both theoretically and empirically.

In this approach, the main ideas of the General Theory have been summarized as follows: the theory of effective demand; stating the fundamental psychological law on income and consumption; the marginal efficiency of capital; the general theory of interest rate, representing the preference measure for liquidity; and the theory of employment.

A first interpretation of the General Theory was given by John Hicks and Alvin Hansen, who developed an economic model based on Keynesian macroeconomic theory. The general equilibrium approach, from the perspective offered by this model, provides a simple and consistent analysis of the effects of monetary and fiscal policy on aggregate demand and interest rates. The model tackles the problem of determining simulated equilibrium values of interest rate and national income as a result of the conditions in the money market and goods market for the achievement of the macroeconomic equilibrium by integrating the real and monetary sectors in the economy. The major limit of this model is that it was developed for a closed economy.

Based on Keynes's the main ideas, I realized an empirical research using the regression model to analyze the validity of the assumptions and equations underlying Keynes's model. This empirical research has been applied to five countries classified into 3 types of economies, namely the Anglo-Saxon type (U.S. and UK), Western European-type (France and Germany), and the emerging European type (Romania).

Regarding the factors affecting nominal income, they vary depending on the size of the economy. Thus, the nominal income of larger economies depends on the volume of employment, the previous income level, and previous level of employment volume. By comparison, for Romania's European emerging economy, the nominal income depends on the amount of labor employed (0,5289), tax rate (-0,2119), and consumption level (1,0879).

The situation changes radically when discussing the real income situation: for large economies, the factors makers remain similar to those for nominal income, but for Romania the determinant factors change, and this time the same factors that influence the larger economies have a similar impact on Romania's economy, namely the level of employment (1,5480), the output of the previous period (-1,5480), and the volume of employment in the previous period (0,7738).

The consumption analysis revealed that the factors' structure changed for the more developed economies in regard to Keynes's assumptions, and is also influenced to some extent by the tax level. For Romania's emerging economy, there is no influence of taxes on consumption, and its influencing factors are disposable income in the current period (0,7317), disposable income in the previous quarter (-0,7317), and consumption for the last three quarters

(0,1461; 0,2056; and -0,1265). However, it is noted that the main factor influencing consumption remains disposable income.

Further, the savings' level in Romania is influenced by current disposable income (3,1932) and previous disposable income (-1,6698), savings from the previous period (0,7697) and taxes from the previous period (-0,8039). For comparison, savings the larger economies are influenced by current and previous disposable income, savings from the previous period, current taxes and previous taxes (for the U.S. economy).

For the larger economies, investments' level is influenced by the current and previous level of nominal income, the previous employment level, and the current period and previous real wage. For the European emerging economy, in addition to the factors of influence already mentioned, also appear two other influencers: variation of tax rate (-1,4749) and variation of government's consumption ratio (-1,7149).

The results of this research showed that the economic reality has undergone structural transformation, causing changes of Keynes's model equations. These changes have led to further developments of Keynes's theory and to the evolution of the Neo-Keynesian School, otherwise analyzed in the last section of this chapter.

Keynes's contribution to address equilibrium at a macroeconomic level paved the way for a remarkable development of the scientific research in economics over the last century. Thus, Keynesian theory was and still is a landmark for any macroeconomic analysis. Regardless of the adopted school or ideology, all macroeconomic researchers have used the tools provided by Keynes since 1936. Keynes was criticized by some economists (noting here the strong opposition from monetarists), and supported by other economists, because in the current period, five years after the crisis of 2007, his ideas are brought back into discussion.

As stated previously, the strongest opposition to the Keynesian theory was sustained by the representatives of the monetarist school who criticized mainly the Keynesian attitude towards the role of the state in the economy. However, the deregulation policy advocated by monetarists was the main cause of the outbreak of the 2007-2008 crisis, but also the liberal deregulation led to a sharp increase in economic activity in the last 25 years.

As shown, in order to better understand the business processes and the essence of the debates between Keynesians and monetarists, it is necessary to study both the theoretical and especially the empirical monetarist theses. In this respect, in the next chapter, the monetarism vision was addressed in terms of achieving equilibrium in the economy.

Thus, in the third chapter, for the analysis of the counterattack against Keynesianism in the second half of the last century, I resorted to the presentation, interpretation and empirical research of the monetarist theses on the existence of equilibrium in theory and economic policy. This approach aimed to highlight the advantages, disadvantages, and the effectiveness of the actions promoted by the proponents of this school of economic thought.

From a theoretical perspective, the Chicago School had a major role regarding the influence of the monetarist ideas in economic theory. Also, another important aspect to be noted is the diversity of ideas within the same school of economic thought. Thus, in this chapter, equilibrium was analyzed using Friedman's monetarist theory, Karl Brunner and Allan Meltzer's point of view, and the Federal Reserve Bank of St. Louis monetarists' perspective.

All of these monetarist orientations support a common set of ideas, namely:

- (i) the long-term monetary neutrality,
- (ii) the short-term monetary non-neutrality,
- (iii) the budget deficit is an important factor for monetary phenomenon,



- (iv) the fiscal actions have a limited impact on national income, but can cause short-term changes in production and employment,
- (v) the distinction between real and nominal interest rates,
- (vi) the role of monetary aggregates in policy analysis.

The first four ideas of this set were analyzed in an empirical research, whose main purpose was to see the validity of the assumptions above. The results of this research showed that some hypotheses are confirmed, others are refuted, yet there is a relationship between variables:

- (i) empirical research disproves the hypothesis of long term monetary neutrality, but confirmed the existence of a long-term relationship between the four variables of the quantity theory of money (money supply, velocity of money, prices, and real output);
- (ii) empirical research refuted the hypothesis of short term monetary non-neutrality, as it was invalidated for the U.S. and UK, but partly confirmed for the euro area and Romania;
- (iii) empirical research confirmed the hypothesis that the budget deficit is an important phenomenon of inflation;
- (iv) empirical research contradicted the hypothesis that fiscal actions have little influence on the national income.

The empirical research also presented another important result regarding the factors attached to variables, as in some relationships there is a contradiction between the values obtained in the research and the values proposed by the economic theory. Thus, there is the possibility of certain limitations concerning the achievement of forecasting and decision-making for economic policy based on these models.

In the final section of the chapter, the monetarist approach was analyzed in terms of the Mundell-Fleming model of the general equilibrium in open economies.

The fourth chapter is devoted to the analysis of the current state of macroeconomic research and the development of a general equilibrium model for markets with turbulence and search frictions.

Since 2007, the global economy has passed through an experience that not only highlighted the flaws in the prevailing economic models, but also the negative aspects of the human society, which led to the collapse of a sense of trust. Thus, the final part of the research implied achieving a general equilibrium in the context of the current and future economic realities.

This chapter contains three sections consecrated to the research and analysis of the general equilibrium in the current economic and scientific context, determined by profound changes in the global economy. In this last chapter, I discussed in an innovative and personal perspective the general equilibrium theory in the context of the current and future economic realities. Thus, in this chapter, two researches have been conducted:

- (i) the first research took the form of a meta-analysis that aimed to understand the causes that triggered the subprime crisis of 2007 and the events that led to the global recession in the aftermath of the economic and financial collapse. This research used seven reference works, that treated the events related to the 2007-2008 crisis, both those leading to its triggering, and the effects of the collapse.
- (ii) the second research took the form of a factor analysis that aimed to determine the directions of research that characterized the aftermath of the crisis started in 2007

and the timeframe of 2008-2011. This research used secondary data which were extracted from 342 articles, which have 665 individual researches.

Following the second research, three main research directions were identified, which explains 56% of the total researches, based on which the current state of the research was analyzed:

- (i) F1 – the first direction concerns the research approach in terms of an interaction between aggregate general models and economic and price fluctuations, however the papers of this factor cover less the general approach of macroeconomics,
- (ii) F2 – the second direction is characterized by the approach of monetary policy and money supply in the researches, but the papers of the second factor do not address the real variables (consumption, savings, production, employment, and investment)
- (iii) F3 - the third direction is characterized by the approach of currency and interest rates, but does not address the macroeconomic policies and the macroeconomic aspects of public finances.

General equilibrium models, especially the models presented throughout the preceding chapters, have direct implications for the current economic crisis. By solving the models, prescriptions for most economic recessions in the last century were obtained, which have succeeded up to the economic crisis of 2007-2008, which, due to its extent and magnitude, was an event that can not be compared to anything that has happened before, yet it contains all events into one, as Krugman stated (2009). Therefore, this time the situation should be addressed differently.

Searching for reasons for which things have not functioned properly since 2007, it is inevitable to reach toward the scientific contributors of economics. In fact, their proposed models covered individual actions of agents, argued often by economic analysis. Nobody has been able to provide a perfect solution for a logical understanding of the chaotic fluctuations in asset prices and, especially, financial assets. And yet these prices are key factors in economic decisions.

The empirical research findings from the second chapter and the third chapter, together with the results of two researched presented in the first two subsections of chapter four, represented the hypotheses for achieving an equilibrium model for markets with turbulence and search frictions (in the third section of chapter four).

Moreover, following this endeavor, I have developed a model that contains nine equations that correspond to the current and future economic realities, considering the fact that global economies are affected by the negative effects of the economic crisis and are under a direct pressure from changing economy paradigm.

The model developed throughout the fourth chapter attempts to provide an answer to the desire to understand the current and future economic realities, given that many considered this crisis a surprise appearance of a negative phenomenon, even though the signals elaborated by various economists have predicted this decline in economies.

The model which was the result of this research consists of nine equations and attempts to integrate the main aspects of the new economic state which was established after the economic crisis of 2007. The unpredictability econometric models regarding the triggering of this crisis, led me in the process of elaborating this model to introduce in the systems of equations the turbulence based on the existence of hazard.

The hazard interacts with economic vulnerability and generates risks in the economy, leading to the existence of turbulence. Vulnerability is a qualitative variable which refers to the

characteristics of the economic processes regarding the ability to forecast, to be resilient and to recover, when faced with external shocks. It is inferred that vulnerability is a variable that is in an inverse relationship with the presence of the state in economy, i.e. the level of market regulation, and, in turn, hazard is derived from the composition of risk with regulatory level.

In such circumstances, the risk and hazard are in an inverse relationship, i.e. a stricter regulation leads to a reduction in risk, whereas a reduced state presence in the economy increases the risk. However, it should be borne in mind that a stronger regulation also causes a reduction in the risk of positive contingencies and unexpected events. Therefore, an excessive regulation will reduce the capacity of markets to generate an allocation that allows a certain level of national income, as regulatory constraints will generate a disinvestment of savings at the expense of market economies with a lower regulatory level. Under these conditions, hazard occurs at the intersection of the hazard's line with the hyperbole that expresses the indirect relationship between risk and regulation (Figure 4-6). Another result is that a certain level of regulation allows for two scenarios: one that could create a favorable hazard that could lead to a more efficient allocation of resources through the market, yet there could be an associated risk for generating moral hazard effects with negative repercussions on the economy and markets, similar to the events of the 2007-2008 crisis and the period that followed after the triggering of the crisis.

After the clarification of the terms in which the concept of hazard will be used and associated to the economic variables, we turn to the concept of turbulence to give it a quantitative expression. Thus, I considered turbulence as the aggregate amount of associated hazards.

In order to obtain the equilibrium conditions in the goods and services market, money market and the financial market, the results from the previous researches served as assumptions, whereas for the labor market equilibrium, this was approached from the perspective of the equilibrium model with search frictions developed by Diamond, Mortensen and Pissarides.

The main result of this thesis consisted in obtaining a general equilibrium model of markets that includes the current turbulences affecting the economies, as well as the search frictions that determine the disequilibrium situation in the labor market.

The course of events after the crisis of 2007-2008 led to the cessation of funding of the private sector and the development of a liquidity crisis, which together have led to the evolution of the sovereign debt crisis. Therefore, this situation has caused and still causes the need for a mix between the tax policy and the monetary policy to stimulate economic activity and to resume funding. However, the debate on financing through money creation or through government spending refers, first of all, to the comparative advantages of tax policy and monetary policy for the real economic activity.

Finally, the economic policy measures are analyzed in the context of the general equilibrium model of markets with turbulence and search frictions. In this analysis, interaction between fiscal actions (having as tools to use the growth rate of real government consumption and tax rates) and monetary actions (having as tools to use the money multiplier, monetary policy rate and the the minimum required reserve rate) is studied.

Thus, the question of using the fiscal policy or the monetary policy to stimulate financing with the highest possible positive effect on the economy, refers to the adoption of a set of optimal strategies, which must take into account the risks of adverse effects, namely a stronger imbalance of the economies and markets. Under these conditions, the set of optimal strategies is

achieved by using Nash's solution, i.e. the set of strategies  $S(S_M, S_F)$  that maximizes the product  $[U_M(S_M) - U_M(0)] \times [U_F(S_F) - U_F(0)]$  for solving the negotiation problem in terms of stimulating the economic activity.

The economic decline caused by the crisis of 2007 and which continued throughout 2008 and 2009, represented the most severe contraction registered since the Great Depression. World governments have taken swift and radical measures to stop the slippage of economic activities. Although in a first phase the measures have had an impact, and the economy began to revive, its vulnerable points and risks caused the triggering of a crisis regarding the sovereign debt.

Thus, the recovery may take different forms, depending on the relative degree of force and sustainability of the process: a 'V' recovery is fast and vigorous; a 'U' recovery is slow, whereas a 'W' recovery goes through a temporary remission and then the economic activity returns minus values. Regarding the measures of the two economies that were hit hard by the crisis, the United States and the European Union, these aimed at implementing intervention programs to stop the decline and restore the growth.

The United States of America, through the Federal Reserve, has used over the last 5 years the Quantitative Easing policy to finance the economy. Thus, two programs of Quantitative easing (QE1 and QE2) were started and finished, and the third program (QE3) is currently ongoing.

However, regardless of how the situation looks like in United States, the short and medium term prospects of the European Union appear to be just as negative. First, the EU's potential growth is lower than that of the United States. Second, the countries in this region are facing serious difficulties to counteract the crisis's effects with fiscal policy because, even before 2007, they had been registering and continue to record budget deficits, accompanied by high volumes of public debt in relation to the gross domestic product. Third, the European countries face difficulties in terms of a low rate of increasing productivity. In addition, the debt of important countries in the Eurozone (Greece, Portugal, Italy, and Spain) has increased, and their competitiveness has decreased.

Therefore, another situation where Nash's solution can be applied for optimal equilibrium refers to the current state of the European Union, under the full sovereign debt crisis. The crisis has led to the exposure of the European economies and has created an urgent need to improve the coordination of the fiscal policy. To successfully respond to the crisis, European leaders decided to create two instruments, namely the European Financial Stability Facility and the European Stability Mechanism, aimed at funding the European economies that exhibited problems. Thus, given the € 700 billion lending capacity of these two instruments, the situation of maximizing the utility of the financing programs can be analyzed with Nash's solution.

The rapid and permanent transformation of the global economy induces the interference of a broad spectrum of turbulences, based on both endogenous, and exogenous associated risks. The emphasizing competition between consumers, between businesses and between global economies in accordance with the continuous diversification of needs are leading to a continuous innovation of the tools and techniques used in economic policies in order to achieve sustainable economic growth. Therefore, the proposed model is intended to be a useful macroeconomic analysis tool for the adoption of policies that meet the purpose stated above. However, taking into account the trends of financial globalization, it is necessary that the general equilibrium model of markets with turbulence and search frictions to be further developed in order to become a tool with a high utility.

The research which represents the subject of this thesis fits into the current trend of scientific research to include and consider the existence of turbulence and search frictions as factors, namely as normal aspects of the new economic stage.

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