

"Alexandru Ioan Cuza" University of Iași
Doctoral School of Economics and Business Administration

THESIS - Summary

Statistical modeling of the dynamics of the business cycle's phases

Advisor:
Prof. Dr. Jaba Elisabeta

Ph D Candidate:
Palașcă Silvia

Iași, 2015

"Alexandru Ioan Cuza" University of Iași

The rectorate

Sir/ Madam

Please note that on the **8th of May 2015**, at **11⁰⁰**, in room **R402**, Miss Silvia Palasca, a PhD student at the Doctoral School of Economics and Business Administration will defend the thesis entitled "**Statistical modeling of the dynamics of the business cycle's phases**" in order to obtain a doctoral degree in the fundamental domain of **Economics**, sub-domain **Cybernetics and Economic statistics**.

The committee is composed of the following members:

President:

- Prof. dr. **Mihaela Onofrei**, Faculty of Economics and Business Administration, University "Alexandru Ioan Cuza"

Scientific advisor:

- Prof. dr. **Elisabeta Jaba**, Faculty of Economics and Business Administration, University "Alexandru Ioan Cuza"

Members:

- Prof dr. **Lucian Albu**, Institute for Economic Forecasting (IPE), INCE Romanian Academy
- Prof dr. **Mihai Roman**, Faculty of Cybernetics, Statistics and Informatics, Academy of Economic Studies in Bucharest
- Prof. dr. **Pohoățã Ion**, Faculty of Economics and Business Administration, University "Alexandru Ioan Cuza"

Please enclosed the summary of the thesis and invite you to attend defense of the thesis. The thesis can be found at the Library of the Faculty of Economics and Business Administration.

Acknowledgement

First and foremost I wish to express my gratitude towards Prof. Dr. Elizabeth Jaba, my scientific advisor, for the professionalism with which she guided me on the way to achieving remarkable results, her competence and scientific guidance, as well as the real support she offered me for the entire period of the doctoral studies.

My gratitude goes out to the doctoral committee members who accepted the invitation to analyze and validate through their experience the scientific approach in the thesis.

I would like to thank the guidance committee composed of. prof.dr.Pohoață Ion,, lect. dr. Silviu Ursu and lect. dr.Iulian Stoleriu, for helpful discussions and encouragement during the thesis preparation. They constantly provided insightful materials and intellectual challenges needed throughout this training. I would also like to thank prof. Dr. Laura Asandului for the useful advice and aid.

My appreciation goes to prof. Dr. Onofrei Mihaela, prof. Dr. Cocriș Vasile and conf. Dr. Liviu Maha for their support in the research project "Performance and excellence in doctoral and postdoctoral research in the field of economics in Romania".

A special thought goes to my PhD colleague Enea Sebastian for the constant support, attention and patience showed as co-author of many of the studies conducted.

I would also like to thank Ms. Alina Coșuleanu and Mr. dr. Cucuteanu Gabriel for the attention they paid to the administrative elements of doctoral degree.

I thank all the colleagues from the University of Al. I. Cuza University of Iasi for a collegial atmosphere and mutual support.

Lastly, I would like to thank my family who supported me throughout the course of the Ph.D. I dedicate this degree to my parents.

This work was co-financed by European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number OSDRU / 159 / 1.5 / S / 134197 "performance and excellent doctoral and postdoctoral research in the field of economics in Romania".

Table of contents

Introduction	4
Part I Theoretical and methodological aspects of business cycles	6
Chapter 1 Conceptual Elements of the Business Cycle	7
1.1. The importance of the business cycle study.....	7
1.2. Definition of the business cycle.....	9
1.3. Characteristics and classification of business cycles	15
Chapter 2 Business Cycle Theories.....	18
2.1. Historical perspective of the business cycles	18
2.2. Modern perspective of the business cycles	24
Chapter 3 Econometric Methods for the Study of Business Cycles Phases.....	36
3.1. Methods for the identifying business cycle phases	36
3.2. Highlights in the literature on the analysis of turning points	62
3.3. Comparing the effectiveness of methods involved in the study of business cycles' phases	66
3.4 Econometric methods for the synchronization of business cycles	68
Part II Empirical approaches to the phases of the business cycles.....	76
Chapter 4. Business cycle indicators.....	77
4.1. Precursor, successor and coincident indicators of the business cycles.....	78
4.2. STUDY - Gold and unemployment - business cycle indicators.....	85
Chapter 5. Synchronization of the business cycles.....	95
5.1. Causes, motivations, tools and economic effects of business cycles synchronization	95
5.2. STUDY - Business cycles' synchronization through international trade in Europe 1991-2011.....	107
5.3. STUDY - Business cycles' synchronization through foreign direct investment in Europe 1992-2011	115
5.4. Estimating the effects of synchronization of business cycles in Europe, using cluster analysis	125
5.5. STUDY: Business cycles' synchronization in the G7, using Markov chains	137
5.6. Macro-cycle or macro- cycles in Europe?	146
Chapter 6. Political and Social Effects of the Business Cycle	147
6.1 STUDY - The political business cycle in Romania	148
6.2 STUDY - Social effects of the economic crisis	157
Conclusions.....	171
References	180

Introduction

Economic fluctuations were a focal point for economic science from antiquity to the present day and there is yet no single explanation for their emergence and development.

Acceptance or denial of business cycles spawned various economic schools of thought sometimes contradictory, as oscillations are considered by the classical school, simple accidents which must be removed by stability, in contrast to the modern idea of anti-fragility, which argues that an oscillating system is alive, balanced and able to cope with external disturbances, with more robustness than a static one.

In the doctoral thesis, entitled "**Statistical modeling of the dynamics of the business cycle's phases**", we proposed a qualitative and quantitative study of the highly complex phenomenon called "business cycle".

The importance of research is revealed by recent events on the international economic scene, that triggered a deep recession, at the end of the 2000s, and the propagation thereof from USA to Europe and Asia as well as the side effects of this imbalance, that have been felt in other areas, such as social and political.

In this context, this paper has proposed four major goals.

First, the characterization of the existing theoretical framework to identify the fundamental ideas and research directions about the business cycle.

The second objective was to identify the most suitable business cycle indicators, both by validating those considered classics, such as variation in GDP, but also by introducing some innovative, such as the price of gold.

A third line of research has focused on studying the synchronization of business cycles and the channels through which this is achieved, since knowledge of the phenomenon helps the development of anti-crisis strategies.

The last objective aimed to study the repercussions of the economic crisis in other areas of interest, such as social but also political.

The methods used in this thesis are innovative, some are borrowed from the sciences and applied as a premiere to study phenomena related to the business cycle and its indicators. We recall among statistical tools used: panel data analysis for studying simultaneously spatiotemporal relations defining the business cycle of a particular group of countries; ARIMA type analysis was used to highlight structural changes in data sets analyzed, reflecting structural changes in the economy.

Data clustering methods in hard clusters and fuzzy clusters, helped define the poles of influence of international business cycles and showed that one can define a degree of membership to the macro-cycles for each country.

Finally, the method of Markov chains helped establish probabilities of occurrence of each phase of the business cycle, defining a stochastic model of oscillations.

The thesis is divided into two parts, each including three chapters, plus conclusions section.

The first part, entitled "Theoretical and methodological aspects of the business cycle" includes three chapters. The first chapter discusses the conceptual elements of the business cycle, definitions, classifications. The second is dedicated to the classic and modern theories which have appeared since the eighteenth century to the present. The third chapter is focused on discussing the methodological issues and statistical models used in the study of business cycles. This part corresponds to the first research objective, formulated above, related to the knowledge of the theoretical framework.

The second part, entitled "Empirical Approaches to the business cycles" also consisting of three chapters, focuses on meeting the other three research objectives, addressing in turn, one chapter at a time, the problem of business cycle indicators, followed by the measurement of synchronization of business cycles and concluding with the dissemination of economic crisis in social and political spheres of influence.

Part I Theoretical and methodological aspects of business cycles

Chapter 1 Conceptual Elements of the Business Cycle

1.1. The importance of the business cycle's study

- epistemologically, it represents the closest approach to the idea of an experiment in the sciences
- "vehicle of progress and instability", the business cycles have the power to generate strong convergence in industrial, commercial and financial processes.
- the interdependencies established between macroeconomic variables

1.2. Definitions of the business cycle

The "classical" definition of business cycle

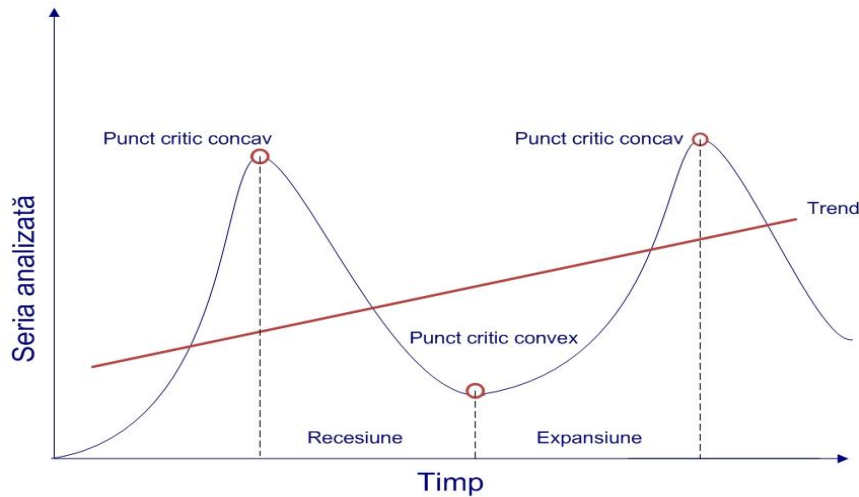
Amongst conceptual definitions we mention the one offered by Burns and Mitchell that has become representative in the twentieth century, considered now to "classical" (Burns, A.; Mitchell, C., 1946), hereinafter definition of B & M:

” Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by

similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle As a term, these fluctuations contain a period extend from 1 to 12 years, without being possible to be divided into subunits with a similar behavior.”

Figure 1- Diagram of a business cycle

Fazele ciclului economic



Source: own processing after

<http://sparkcharts.sparknotes.com/economics/macroeconomics/section4.php>

NBER definition

The practical definition of the business cycle is the one used by the National Bureau of Economic Research (NBER) in the US, which states that a certain the economy is in recession if it has experienced two or more consecutive quarters of negative GDP growth, which analogously means that, expansion is defined as two or more quarters of positive GDP growth. The simplicity of this definition brings into discussion its validity.

1.3. Characteristics and classification of business cycles

As regards the business cycles, the most used classification is the one according to duration. Schumpeter (Schumpeter & Schumpeter, 1954) notes:

Stock Cycles (Kitchin), which have a duration of about 40 months. The main reason for their appearance is the need to rebuild the stock. They also called the "minor cycle".

Fixed assets investment cycles (Juglar) with a duration of about 7-10 years, caused by major developments arising from industrial processes. These are called "major cycles" or, using Juglar's terminology of "intercrize" or rather, "inter-recession". Kitchin recognizes their existence, but claims that these are groups 2-3, rarely 4 short cycles. (Estey, 1960, p. 17).

Infrastructure investment Cycles of (Kuznets) with a duration of 15-25 years, associated with demographic processes (migratory movements) that influence the intensity of construction activity.

Long cycles (Kondratiev), which have a duration of 50 years, are due to major innovations, consisting of an alternation of business cycles with a shorter duration, such as Juglar type cycles.

Chapter 2 Business Cycle Theories

2.1. Historical perspective of the business cycles

The early business cycle analysis models which were developed in the XVIIIth and XIXth century are the kernels of modern economic theory.

The classical theory proposed by Adam Smith can be considered the starting point of more recent theories, such as that belonging to Keynes, and the real business cycle, while the first monetarist theories lead to the development ideas of the Chicago School.

Some initial theories about business cycles, such as demographic, agricultural and climatic conditions will be completely abandoned in the second half of the twentieth century. These were not justified any longer by economic realities, but remain valuable by the study instruments they propose, like structural equations and time series analysis.

2.2. Modern perspective of the business cycles

The twentieth century is a time of ideas and new theories on the business cycle. Extreme events (world wars, the Great Depression) that occurred during this period of time, provided the impetus for rethinking the causes of business cycles and ways to overcome recessions.

While Schumpeter identifies innovation as a driver of business cycles, Keynes prefers the reiteration of classical theory, by altering its assumptions, centering the discussion on aggregate demand.

An opposite view, focusing on aggregate output is given by real business cycle theory.

The Chicago School relies on a logical, econometric approach, , wishing to induce to the central banks the idea that is not wise to abuse the power they have.

Chapter 3 Econometric Methods for the Study of Business Cycles Phases

From the multitude of existing theories presented in the previous chapter, it is anticipated that the study methods and econometric models developed are numerous and diverse.

This chapter aims to make a summary of the methods currently used for the study of the business cycles, along with a comparison of their predictive power, in order to choose the most valuable, with the shortest response time.

3.1. Methods for the identifying business cycle phases

3.1.1. Dynamic equations models

3.1.1.1. Dutch econometric model

3.1.1.2. The Samuelson model (1939)

3.1.1.3. The Allais model for monetary dynamics (1955)

3.1.2. Threshold methods - The Bry & Boschan algorithm (1971)

3.1.3 Methods of trend disposal

[1]. Estimate a linear, deterministic trend, and eliminate it from the original series by simply subtraction;

[2]. Differentiate the original series to eliminate the stochastic component;

[3]. Apply complex filters, Hodrick-Prescott type, Baxter-King and Christiano-Fitzgerald

3.1.4. Stochastic methods

3.1.4.1. Auto-regressive methods - ARIMA

Box and Jenkins (1970) proposed the implementation of a methodology based on ARMA (auto-regressive moving average) stochastic processes. The equation proposed by them, for a process described by y_t series and modeled by ARMA (p, q) is:

$$y_t - \phi_1 y_{t-1} - \dots - \phi_p y_{t-p} = \varepsilon_t - \theta_1 \varepsilon_{t-1} - \dots - \theta_q \varepsilon_{t-q},$$

where (ε_t) is a series of random independent and identically distributed disturbances.

3.1.4.2. Markov chains

The study the business cycle can benefit from using Markov chains by identifying the business cycle phases with the set of possible states of a stochastic process.

This leads to a simple Markov chain with two states. The transition probabilities are the elements of the stochastic matrix:

$$\begin{pmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{pmatrix}, p_{11} + p_{12} = 1, p_{21} + p_{22} = 1.$$

The states of the system are a_1, a_2 , the transition probabilities $p_{ij} = \mathbb{P}(X_n = a_j | X_{n-i} = a_i)$, while X_n are the variables modeling the chain.

These are estimated by maximum likelihood (Perlin, 2012) starting from the equation:

$$y_t = \mu S_t + \varepsilon_t \\ \varepsilon_t \sim \mathcal{N}(0, \sigma_{S_t}^2); S_t \in \{1, 2\}$$

proving the regime change between states 1 and 2. The maximum likelihood function of this model is:

$$\ln L = \sum_{t=1}^T \ln \left(\frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{y_t - \mu_{S_t}}{2\sigma^2}\right) \right).$$

The difficulty of estimating this model is that the S_t conditions are not known, but are internal to the system, otherwise it would have been sufficient to maximize the previous expression, depending on the vector of parameters $\theta = (\mu_1, \mu_2, \sigma_1^2, \sigma_2^2)$.

For a Markov chain, the maximum likelihood function is modified, being replaced the weighted average likelihood for each state $f(y_t|S_t = j, \theta)$. The weights are the probability of occurrence of the respective state $\mathbb{P}(S_t = j)$. The maximum likelihood function becomes:

$$\ln L = \sum_{t=1}^T \ln \sum_{j=1}^2 (f(y_t|S_t = j, \theta) \mathbb{P}(S_t = j)).$$

When probabilities are not directly observable, the previous function is estimated iteratively based on probability inference, according to Hamilton (1989):

1. Choose start probability at time $t = 0$, for each frame,

$$\mathbb{P}(S_0 = j), j = 1, 2$$

These can be chosen equal, $\mathbb{P}(S_0 = j) = 0,5, j = 1, 2$ or by calling the unconditional probabilities (Chauvet & Hamilton, 2005):

$$\mathbb{P}(S_0 = 0|\psi_0) = \frac{1 - p_{11}}{2 - p_{11} - p_{22}}$$

$$\mathbb{P}(S_0 = 1|\psi_0) = \frac{1 - p_{22}}{2 - p_{11} - p_{22}}$$

2. Choose $t = 1$ and calculate the probabilities to time $t-1$:

$$\mathbb{P}(S_t = j|\psi_{t-1}) = \sum_{i=1}^2 p_{ji} \mathbb{P}(S_{t-1} = i|\psi_{t-1})$$

3. Update the probability for each state for time t . This operation is done by calculating the conditional probability:

$$\mathbb{P}(S_t = j|\psi_t) = \frac{f(y_t|S_t = j, \psi_{t-1}) \mathbb{P}(S_t = j|\psi_{t-1})}{\sum_{j=1}^2 f(y_t|S_t = j, \psi_{t-1}) \mathbb{P}(S_t = j|\psi_{t-1})}$$

4. Update $t \rightarrow t + 1$ and re-iterate 2-3, until $t=T$.

5. Compute maximum likelihood function, which estimates the parameters from the vector θ and the matrix of the states at time t , ψ_t .

$$\ln L = \sum_{t=1}^T \ln \sum_{j=1}^2 (f(y_t|S_t = j, \theta) \mathbb{P}(S_t = j|\psi_t)).$$

3.2. Highlights in the literature on the analysis of turning points

Harding and Pagan define the business cycle through four main features, described as a triangle:

- the duration of the cycle and its phases;
- the amplitude of the cycle and its phases;
- the asymmetric behavior of each phase;
- the accumulated movements in phases.

3.3. Comparing the effectiveness of methods involved in the study of business cycles' phases

3.4 Econometric methods for the synchronization of business cycles

3.4.1. Panel data analysis

Fixed effects Method

Fixed effects method treats the constant as belonging to a particular group, thus it is typical for a certain section / a temporal moment, hence it allows the use of different constants for each group (section) or per time unit analyzed.

Random effects method

Random effects method is an alternative estimate, which considers the constants belonging to each section / time as random parameters, rather than fixed.

3.4.2. Cluster analysis

The thesis employs two different clustering techniques, ie hard k-means clusters and fuzzy c-means clusters, in order to assess the most appropriate method of measuring the transmission of business cycles.

Part II Empirical approaches to the phases of the business cycles

Chapter 4. Business cycle indicators

4.1. Precursor, successor and coincident indicators of the business cycles

Table 1- Classification of the usual business cycle indicators

Indicators	Precursor	Coincident	Successor
Pro-cyclical	Investments	GDP/GNP	Inflation
Anti- cyclical	Initial unempl.rate	Commercial flows	Unemployment rate
Non-cyclical	-----		

Source: (Roubini)

4.2. STUDY - Gold and unemployment - business cycle indicators

The purpose of this study is to evaluate statistically the predictive power of several variables, in order to validate them as indicators of the business cycle and to classify them either as precursor or successor indicators. The detection of critical points in the time series, focuses exclusively on US area and the study uses Markov chains. The results show that both the gold price and unemployment can play alternatively the role of as precursor or successor indicators.

The novelty of the study lies in the idea of introducing a third dimension in the classification matrix discussed at the beginning of the chapter, namely, the business cycle phase. In this case, some indicators, which show only a weak pro-cyclical or anti-cyclical character towards the business cycle are particularly useful when studying the relationship only with a certain stage of the business cycle.

The results in this section were published under the title "Leading and lagging indicators of the economic crisis" (Palasca & Jaba, 2014).

Chapter 5. Synchronization of the business cycles

5.1. Causes, motivations, tools and economic effects of business cycles synchronization

5.1.1. Synchronization of business cycles

A special phenomenon regarding the business cycles is represented by their synchronization, an equally controversial and difficult phenomenon.

5.1.2. Determinants of business cycle synchronization

The literature has identified four main determinants of business cycle synchronization, namely:

- International Trade;

- industrial structure and specialization;
- financial channels;
- economic policies and structural determinants,

which are super-imposed on globalization, a phenomenon that can be analyzed from two perspectives, both as a driver and as a result of synchronization.

5.2. STUDY - Business cycles' synchronization through international trade in Europe 1991-2011

The euro area has a clearly defined business cycle dictated by the founders and supported by the countries of the second wave of accession. With regard to the indicators used, it turned out that both GDP and annual growth rates for external trade are good measures for modeling business cycles synchronization.

The results in this section were published under the title "Statistics of the Romanian Political Business Cycle" (Palasca, 2013)

5.3. STUDY - Business cycles' synchronization through foreign direct investment in Europe 1992-2011

The purpose of this study is to explain the synchronization of business cycles, starting from the relationship between the growth rate of GDP and the inputs/ outputs of foreign direct investment (FDI). In terms of methodology, the study uses panel data analysis which has the advantage that it captures the behavior of both the cross section (country) and the effects of the period (year).

An array of fixed and random effects models are proposed and tested in order to choose the most appropriate and statistically significant.

The study concludes that there is strong statistical evidence, supporting the existence of the synchronization of business cycles in Europe. In addition, the statement of the previous study, which claims that the degree of synchronization is dependent on the time of accession to the European Union is also verified.

The results in this section were published under the title "Globalization versus Segregation - Business Cycles Synchronization in Europe." (Enea & Palasca, 2012)

5. 4. Estimating the effects of synchronization of business cycles in Europe, using cluster analysis

The clustering of countries, on economic and / or financial grounds has increased the importance of evaluating the transmission of fluctuations between countries, as evidenced by recent works (Artis M., Okubo T., 2009; Eickmeier, 2007).

The methods used for these studies cover a wide range of statistical approaches, including cluster analysis and, more specifically, fuzzy cluster analysis (Boreiko, 2003), (Tsangarides & Qureshi, 2008), which is considered to be more realistic, as a country can have a number of features in common with a certain group and other features can be more similar to those of another group.

The aim of this work is to compare the two methods of grouping, ie disjoint clusters k-means type clustering and fuzzy c-means type on their performance to assess the business cycle transmission between European countries in the last two decades.

The results in this section were published under the title

- "Measuring Globalization by Means of Business Cycles Synchronization. A Fuzzy Cluster Framework. "(Jaba, Palasca, Enea, & Roman, 2014)

- The results of this section were published under the title "Business Cycle Synchronization Channels in the European Union" (Enea & Palasca, 2013)

5.5. STUDY: Business cycles' synchronization in the G7, using Markov chains

The objective of this study is to divide the countries of the G7, in leaders and followers, in terms of the business cycle and in particular regarding the crisis. To this end, were implemented in MATLAB Markov switching models to identify critical points in the series of the quarterly seasonally adjusted GDP, for the time interval 1991-2012.

The results show a clear demarcation between leaders and followers, each country playing a different role in each phase of the business cycle. Moreover, there is a significant quadratic relation between the aforementioned probability and duration of the crisis.

The results in this section were published under the title "Leaders and Followers in the Business Cycle Game. A Case Study of the G7 "(Palasca & Jaba, 2015).

5.6. Macro-cycle or macro- cycles in Europe?

Europe's case is relevant to the problem of synchronization of business cycles, because this region is a veritable breeding ground for the elusive phenomenon, especially in its history after World War II and, more recently, in the period after 1990.

The results showed that, depending on the variable studied, the findings differ significantly.

Chapter 6. Political and Social Effects of the Business Cycle

In an ideal context, political influences economic and social dimensions only indirectly, through a positive the legal framework, conducive to development, which it creates and is intended for the proper functioning of the other two spheres.

The proposed approach aims to quantify the magnitude of these influences in two directions :

- the link between business cycle and political cycle;
- the influence of the economic crisis on health policies.

In reality, the political influence is likely to be direct by regulatory and budgetary constraints that may destabilize the chances of achieving a market equilibrium situation.

6.1 STUDY - The political business cycle in Romania

The purpose of this section is to demonstrate the intrusion of political manipulation tools before the election, followed by reverse policies after the elections, leading to the emergence of a cyclical pattern. The study focuses on the case of post-communist Romania. Statistical analysis of data provides clear evidence of political intrusion in the economy of Romania between 1995-2014.

The results in this section were published under the title "Statistics of the Romanian Political Business Cycle" (Palasca, 2013).

6.2 STUDY - Social effects of the economic crisis

This study aims to assess the impact of the current crisis on health systems in European countries, in order to highlight the link between economic environment and negative, on the social level. The results on the time axis, indicated a clear breakdown of all national healthcare systems in 2009, while the effects of cross-sectional suggested that the 23 countries could be divided into 3 groups depending on their health policy in particular with regard to health insurance.

The results in this section were published under the title "The Aftermath Of The Economic Crisis: Healthcare Systems'inequalities In Europe" (Palasca & Aeneas, 2014).

Conclusions

Regarding the implications of the studies presented in the thesis, to economic and social policies, we can mention:

1. Use the gold price in the algorithm for calculating the phase of the business cycle;
2. Extended caution regarding the exchange rate for strong currencies in the pre-election period;
3. Establishment of anti-cyclical measures in vulnerable social areas (health, pensions, education), whereas the austerity measures destabilize, sometimes irreparably, the system;
4. For small or developing countries, monitor the economic situation of the leader countries, especially regarding trade and investment relations, as these are business cycles transmission channels. As a leading country recovers quickly, the recession transmitted through one of the aforementioned channels, to a developing country can have devastating and long-lasting effects, even if they come with some lag.

Limitations of the discussed studies usually come from the size of the sample, a restriction on the availability of data or relevance.

The study was mostly focused on the latest economic crisis, as the scope of the thesis did not include a historical vision. However, in order to validate the proposed methods, they could be applied to historical data sets.

This thesis' contribution to the literature, resides in the fact that it presented the study of business cycles, in statistical terms, using a stochastic modern vision, without attempting to explain past economic crises, but only using the data provided by these as a basis to build new models.

Based on the theory of "black swans", which argues that rare but potentially devastating events, such as major economic crises cannot be predicted but must be anticipated, in this thesis the author has tried, wherever possible, to introduce idea volatility and randomness in the models built.

We believe that although these deterministic models lose the elegance of simplicity, they gain robustness anti-fragility (Taleb, 2012).

References

- [1]. Abberger K., Nierhaus W. (2010). Markov Switching and the Ifo Business Climate: Ifo Business Traffic Lights. *CESifo working Papers*.
- [2]. Aimar, T., Bismans, f., & Diebolt, C. (2012). Business cycles: A synthesis. *AFC Working Papers* (11).
- [3]. Alesina, A., Roubini, N., & Cohen, G. (1999). *Political Cycles and the Macroeconomy*. Cambridge: MIT Press.
- [4]. Anas, J., Bilio, M., Ferrara, L., & Mazzi, G. (2008). A system for dating and detecting turning points in the euro area. *The Manchester School*, 76 (5), 549-577.
- [5]. Andresson, E., Bock, D., & Freisen, M. (2006). Some statistical aspects of methods for detection of turning points in business cycles. *Journal of Applied Statistics*, 33, 257-278.
- [6]. Artis M., Okubo T. (2009). Globalisation and Business Cycle Transmission. *The North American Journal of Economics and Finance*, 20 (1), 91-99.
- [7]. Artis, M. (2003). Is there a European business cycle? *Working Paper No. 1053. CESifo*.
- [8]. Artis, M. J., & Zhang, W. (2002). Membership of EMU: a fuzzy clustering analysis of alternative criteria. *Journal of economic integration*, 17 (1), 54-79.
- [9]. Baltagi, B. H. (1995). *Econometric Analysis of Panel Data*. New York: Wiley.
- [10]. Baxter, M., & Kouparitsas, M. A. (2005). Determinants of business cycle comovement: a robust analysis. *Journal of Monetary Economics*, 32 (1), 113-157.
- [11]. Beckman, J., & Czudaj, R. (2013). Gold as an inflation hedge in a time-varying coefficient framework. *North American Journal of Economics and Finance*, 24, 208-222.
- [12]. Bezdek, J. (1981). *Pattern Recognition with Fuzzy Objective Function Algorithms*. New York: Plenum.
- [13]. Bhagwati, J. (2004). *In Defence of Globalization*. New York: Oxford University Press.

- [14]. Boldin, M. (1994). Dating Turning Points in the Business Cycle. *The Journal of Business* , 67 (1), 97-131.
- [15]. Box, G., & Jenkins, G. (1970). *Time Series Analysis, Forecasting and Control*. San Francisco: Holden Day.
- [16]. Bruno, G., & Otranto, E. (2004). *Dating the Business Cycle: A Comparison of Procedures*. Roma: Istituto di Studi e Analisi Economica.
- [17]. Bry, G., & Boschan, C. (1971). *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs*. UMI.
- [18]. Burns, A. ; Mitchell, C. (1946). *Measuring Business Cycles*. New York: NBER.
- [19]. Camacho, M., Perez-Quiros, G., & Saiz, L. (2006). Are European Business Cycles close enough to be just one? *Journal of Economic Dynamics and Control* , 30 (9-10), 1687-1706.
- [20]. Canova, F. (1998). Detrending and business cycle facts. *Journal of Monetary Economics* , 41, 475-512.
- [21]. Canova, F., Ciccarelli, M., & Ortega, E. (2007). Similarities and convergence in G-7 cycles. *Journal of Monetary Economics* , 54 (3), 850-878.
- [22]. Chauvet, M., & Hamilton, J. (2005). *Dating Business Cycle Turning Points*. NBER.
- [23]. Chauvet, M., & Piger, J. (2002). *Identifying Business Cycle Turning Points in Real Time*. Atlanta: FRB of Atlanta.
- [24]. Darvas, Z., & Szapary, G. (2004). Business Cycle Synchronization In The Enlarged Eu: Comovements In The New And Old Members. *MNB WORKING PAPER* .
- [25]. De Mello, L. (1997). Foreign direct investment in developing countries and growth: A selective survey. *The Journal of Development Studies* , 1-34.
- [26]. Diebold, F., & Rudebusch, G. (1996). Measuring Business Cycles: A Modern Perspective. *Review of Economics and Statistics* , 78, 67-77.
- [27]. Enea, S., & Palașcă, S. (2012). Globalization versus Segregation - Business Cycles Synchronization in Europe. *CES Working Papers* , 4, 668-692.
- [28]. Enea, S.-F., & Palașcă, S. (2013). Business Cycle Synchronization Channels In The European Union. *EURINT Proceedings* (pg. 564-575). Iași: Centre for European Studies, Alexandru Ioan Cuza University.
- [29]. Fidrmuc, J., & Korhonen, I. (2010). The impact of the global financial crisis on business cycles in Asian emerging economies. *Journal of Asian Economics* , 21 (1), 293-303.
- [30]. Fidrmuc, J., Ikeda, T., & Iwatsubo, K. (2012). International transmission of business cycles: Evidence from dynamic correlations. *Economics Letters* , 114 (3), 252-255.
- [31]. Frankel, J., & Rose, A. (1998). The Endogeneity of the optimum currency area criteria. *The Economic Journal* , 108, 1009-1025.
- [32]. Frees, E. W. (2004). *Longitudinal and panel data: analysis and applications in the social sciences*. Cambridge University Press.
- [33]. Frenkel, M., Funke, K., & Stadtmann, G. (2004). . (), A panel analysis of bilateral FDI flows to emerging economies, , 28(3), . *Economic Systems* , 28 (3), 281-300.
- [34]. Gottret, P., & Schieber, G. (2006). *Health financing revisited: a practitioner's guide*. Washington, DC: The World Bank.
- [35]. Granger, C. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica* , 37 (3), 424-438.

- [36]. Hamilton, J. (1989). A new approach to the economic analysis of non-stationary time-series and the business cycle. *Econometrica* , 57 (1), 357-384.
- [37]. Hammoudeh, S., Sari, R., & Ewin, B. (2009). Relationship among strategic commodities and financial variables: a new look. *Contemporary Economic Policy* , 251-264.
- [38]. Haralambie, G. (2011). Criza globală și teoria ciclicității. *Economie teoretică și aplicată* , 11, 67-77.
- [39]. Harding, D., & Pagan, A. (2002). Dissecting a Cycle: a methodological investigation. *Journal of Monetary Economy* , 29, 365-381.
- [40]. Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica* , 46 (6), 1251-1271.
- [41]. Hayashi, F. (2000). *Econometrics*. Princeton University Press.
- [42]. Hibbs, D. (1986). Political Parties and Macroeconomic Policies and Outcomes in the United States. *The American Economic Review* , 76 (2), 66-70.
- [43]. Hodrick, R., & Prescott, E. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking* , 29 (1), 1-16.
- [44]. Hsiao, C. (1986). *Analysis of Panel Data*. Cambridge: Cambridge University Press.
- [45]. Ignat, I., Pohoăț, I., Clipa, N., & Luțac, G. (1998). *Economie politică*. București: Editura Economică.
- [46]. Im, K., Pesaran, H., & Shin, Y. (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics* , 115, 53-74.
- [47]. Jaba, E. (2002). *Statistică* (ed. 3). București: Editura Economică.
- [48]. Jaba, E., & Grama, A. (2004). *Analiza Statistica Cu Spss Sub Windows* . Iași: Polirom.
- [49]. Jaba, E., Balan, C., Roman, M., Viorică, D., & Roman, M. (2008). Employment rate prognosis on the basis of the development environment trend displayed by years-clusters. *Economic Computations and Economic Cybernetics Studies and Research* (3-4), 123-137.
- [50]. Jaba, E., Palașcă, S., Enea, S., & Roman, M. (2014). Measuring Globalization by means of Business Cycles Synchronization. A Fuzzy Cluster Framework. *Economic Computation and Economic Cybernetics Studies and Research* , 39-56.
- [51]. Jula, D., & Jula, N.-M. (2009). Regional Economic Voting in Romania. *Journal for Economic Forecasting* , 6 (1), 5-15.
- [52]. Kalecki, M. (1943). Political aspects of full employment. *The Political Quarterly* , 14 (4), 322-330.
- [53]. Keynes, J. (1939). Professor Tinbergen's Method. *Economic Journal* , 49, 558-568.
- [54]. Keynes, J. (1936). *The General Theory of Employment, Interest and Money*. London: Macmillan.
- [55]. Knoop, T. A. (2009). *Recessions and Depressions: Understanding Business Cycles*. Santa Barbara: ABC-CLIO.
- [56]. Kose, A., Otrok, C., & Prasad, E. (2008). Global business cycles: convergence or decoupling? *10th Bundesbank Spring Conference - Central Banks and Globalisation*.
- [57]. Krolzig, H.-M. (2003). Constructing Turning Point Chronologies with. *Colloquium on Modern Tools for Business Cycle Analysis*. Luxembourg.
- [58]. Kydland, F., Kehoe, P., & Backus, D. (1992). International Real Business Cycle. *Journal of Political Economy* , 745-775.
- [59]. L. von Mises. (2006). *The Causes of the Economic Crises*. Alabama: Ludwig von Mises Institute.
- [60]. Lawrence, C. (2003). *Why is gold different from other assets? An empirical investigation*. London, UK: The World Gold Council.

- [61]. Levin, E. J., Montagnoli, A., & Wright, R. E. (2006). *Short-run and Long-run Determinants of the Price of Gold*. London, UK: World Gold Council.
- [62]. Levitt, T. (1983, May). The Globalization of Markets. *Harvard Business Review* .
- [63]. Lutz, A. (2002). *Business cycle theory*. Oxford: Oxford Press.
- [64]. Marley, J., & Piger, J. (2010). The Asymmetric Business Cycle. *The reviews of Economics and Statistics* .
- [65]. Mihoc, G., Urseanu, V., & Ursianu, E. (1982). *Modele de analiză statistică*. București: Editura Științifică și Enciclopedică.
- [66]. NBER. (2013). *The NBER's Business Cycle Dating Committee*. NBER.
- [67]. Neftci, S. (1982). Optimal Prediction of Cyclical Downturns. *Journal of Economic Dynamics and Control* , 4, 225-241.
- [68]. Nordhaus, W. (1975). The Political Business Cycle. *The Review of Economic Studies* , 42, 169-190.
- [69]. Palașcă, S. (2013). Hard of Fuzzy Clusters in Assessing Business Cycle Transmission? *Proceedings of the IE 2013* (pg. 546-550). București: Bucharest University of Economic Studies Press.
- [70]. Palașcă, S. (2011). Interpretări statistice ale ciclului economic. *Olimpiada Națională a Studenților Economiști* (pg. 139-153). Cluj-Napoca: Risoprint.
- [71]. Palasca, S. (2013). *Statistics of the Romanian Political Business Cycle*. Grin Verlag .
- [72]. Palașcă, S., & Enea, S. F. (2012). Globalization versus Segregation-Business Cycles Synchronization in Europe. *CES Working Papers* , 668-692.
- [73]. Palașcă, S., & Enea, S. (2014). The Aftermath Of The Economic Crisis: Healthcare Systems' inequalities In Europe. *CES Working Papers* (3), 75-91.
- [74]. Palasca, S., & Jaba, E. (2015). Leaders and Followers in the Business Cycle Game. A Case Study of the G7. *Procedia Economics and Finance* , 20, 478-484.
- [75]. Palasca, S., & Jaba, E. (2014). Leading and Lagging Indicators Of the Economic Crisis. *Romanian Statistical Review* , 62 (3), 31-47.
- [76]. Pelaez, R. (2005). Dating Business Cycle Turning Points. *Journal of Economics and Finance* , 29 (1), 127-137.
- [77]. Perlin, M. (2012). MS_Regress-The MATLAB Package for Markov Regime Switching Models. Available at SSRN 1714016 .
- [78]. Quandl.com. (2013). *Gold Price: London Fixings P.M.* Open Financial Data Project.
- [79]. Rogoff, K., Kose, M. A., Prasad, E., & Wei, S. J. (2003). *Effects of financial globalization on developing countries: some empirical evidence*. International Monetary Fund.
- [80]. Roman, M., Jaba, E., & Roman, M. (2009). Economic Development and Political Cycles in Romania. *7th WSEAS International Conference on Environment, Ecosystems and Development*, (pg. 190-195). Puerto de la Cruz, Spain.
- [81]. Schumpeter, J. A., & Schumpeter, E. B. (1954). *History of Economic Analysis*. Routledge.
- [82]. Smith, A. (1962). *Avutia natiunilor. Cercetare asupra naturii si cauzelor ei*. București: Editura Academiei.
- [83]. Stock, J., & Watson, M. (2010). Indicators for dating Business Cycles. Cross-History Selection and Comparisons. *American Economic Review* , 100 (2), 16-19.
- [84]. Stuckler, D., & Basu, S. (2009). The International Monetary Fund's effects on global health: before and after the 2008 financial crisis. *International Journal of Health Services* , 39 (4), 771-781.
- [85]. Taleb, N. N. (2012). *Antifragile: Things that gain from disorder*. London: Penguin.

- [86]. Tatom, J. A. (1978). Does the stage of the business cycle affect the inflation rate? *Federal Reserve Bank of St. Louis Review* .
- [87]. Țigănaș, C. (2004-2005). Ciclul Economic. Un Scurt Popas Doctrinar. *Analele Științifice ale Universității Al. I. Cuza Seria Economică* , L-LI, 98-106.
- [88]. Tigănescu, E., & Roman, M. (2001). *Macroeconomie*. București: Editura ASE.
- [89]. Tsangarides, C. G., & Qureshi, M. S. (2008). Monetary union membership in West Africa: A cluster analysis. *World Development* , 36 (7), 1261-1279.
- [90]. Tudorel, Ș. (2006). *Introducere în dreptul comunitar*. București: Editura C.H.Beck.
- [91]. Tuftes, E. (1978). *Political Control of the economy*. Princeton : Princeton University Press.
- [92]. Voinea, L. (2007). *Corporațiile transnaționale și capitalismul global*. Iași.: Polirom.
- [93]. Wang, K.-M., & Lee, Y.-M. (2011). The yen for gold. *Resources Policy* , 36 (1), 39-48.
- [94]. Williamson, J. G. (2002). *Winners and losers over two centuries of globalization* . National Bureau of Economic Research.
- [95]. World Bank. (2013). World Bank database. Preluat de pe <http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG>