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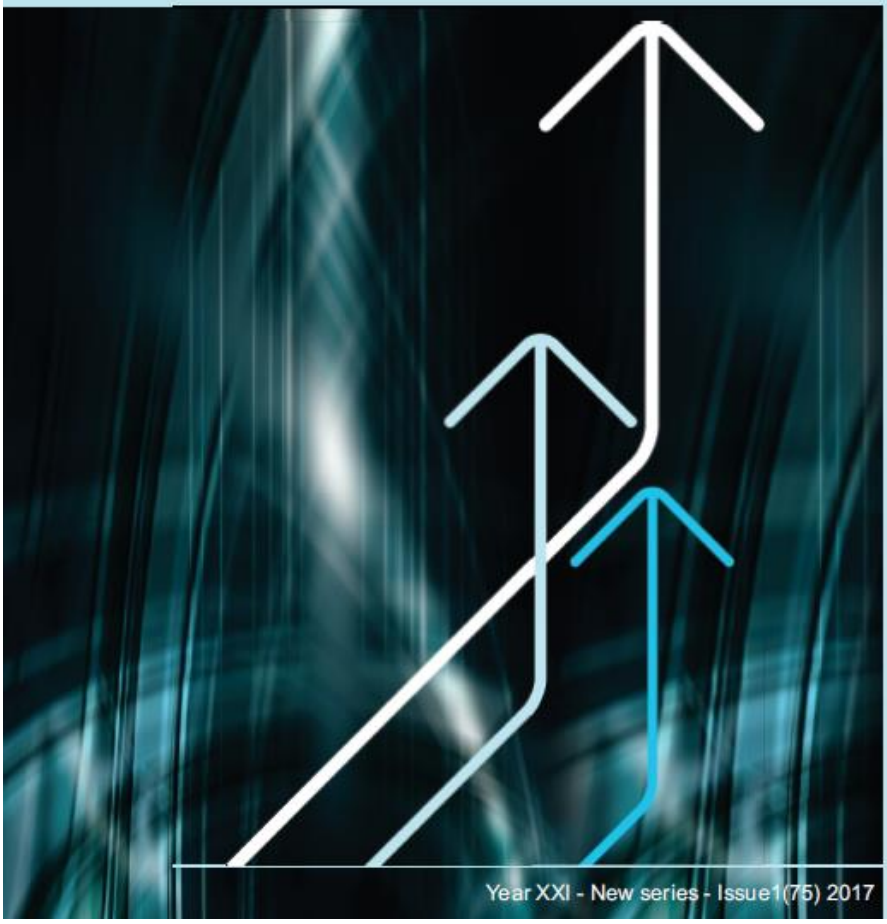

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"VICTOR SLĂVESCU" CENTRE FOR FINANCIAL
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FINANCIAL STUDIES

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CONTENTS

IS MINSKY'S INSTABILITY HYPOTHESIS ACCEPTABLE FOR THE RELATION BETWEEN BORROWING RATE AND PROFITABILITY?[1]

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Abstract

As in the financial crisis of 2008, overindebtedness of the economic units leads to an instability. In the Financial Instability Hypothesis, Hyman Minsky, who supports this opinion, points out that borrowing in capitalist systems causes instability. In this study, the validity of Minsky's hypothesis was examined in a micro-based way with reference to the relation between the profitability and borrowing rates of the firms. Therefore, it was aimed to research the relations between the debt structure and the profitability of the firms considering the sectors within the context of Istanbul Stock Exchange (BIST) Market manufacturing industry. In the study, the variables such as return on assets, return on equity, net profit margin, leverage ratio, short term debt ratio, current ratio, average collection period, inventory cycle time, economic instability and financial instability were examined. And also, the annual data over the period of 1994-2010 for the 15 firms which are in metal manufacturing industry in BIST were used. In the study, the relation between economic instability and financial instability was examined by the Westerlund cointegration test while the existence of causal relation was examined by the Holtz-Eakin Panel causality test. As a result, it was concluded that any long term relation and any relation of causality do not exist between the relevant variables.

Keywords: Instability, Westerlund Cointegration, Panel Causality Analysis, Profits and Debts for Firms.

JEL Classification: C33, G10, L6

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[1] *This article is the revised and extended version of the paper presented in World Finance Conference in Singapore, on December 12-14, 2014.*

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1. Introduction

The acts of economic agents have an undeniable effect on economic systems. Particularly, the decisions of economic agents about investment and saving dominate over markets and matters to realize the projected policies. The trends of saving and investment of economic units depend on conditions of financial markets. For example, when savings and investments in an environment which promotes a positive situation observed overall economy, many volatilities occur in financial markets, or uncertainties can cause an economic instability in economy.

Minsky (1985) tried to explain the concept of financial instability, which he defined as the extreme volatility in capital and asset prices, through "The Financial Instability Hypothesis" by emphasizing that economic stability leads to financial instability, and financial instability leads to economic instability, as well.

Minsky's Financial Instability Hypothesis explains cyclical fluctuation in economies with the concept of financial vulnerability. According to this hypothesis, investments and impaired relations between financial structures of investments during cyclical fluctuations explain the financial vulnerability. Investors tend to invest by borrowing with the effects of positive expectations in advanced economies having deepening financial markets. Therefore, investments rise and economy expands. This, also, causes increase in debts in private sector. In addition, the increase in inefficient debts causes impairment of finance market rising financial instability. Thus, an instable structure in economy arises. According to Minsky, there is a relation between borrowing and financial structures of firms.

In this study it was aimed to analyze the relation between the economic and financial instability suggested by Minsky. The 15 firms in the metal manufacturing industry between the years of 1994- 2010 were examined. This study has three objectives. The first one is to research whether there is a long-term relation between economic instability and financial instability. And the second one is to examine a possible relation of causality between economic instability and financial instability. As for the third one, it is to research the causal relation between the profitability and borrowing rates of the firms.

2. Theoretical Framework and Literature Review

In his financial instability hypothesis, Hyman Minsky, a post-Keynesian economist, researched the case in which the relation between the profitability and the debt affects economy. Minsky developed his hypothesis by using the General Theory of Keynes, by augmenting the Debt-Deflation Theory of Fisher under the influence of Marx's views on the dual price level analysis and of Kalecky's views on the increasing risk principle with budget deflation approach by integrating the Levy's views on profit.

"Minsky's Financial Instability Hypothesis is an alternative to the neo-classical synthesis, i.e., today's standard economic theory. It is designed to explain instability as a result of the normal functioning of a capitalist economy." (Minsky, 1982, p.92).

Minsky's Financial Instability Hypothesis is an endogenous theory. According to Minsky, the capitalist system has a naturally instable structure and a tendency to produce an instable situation even if there are no interventions to economy (Minsky, 1986, p. 325).

The most important financial powers of a capitalist economy are collected by financing investments and positions, and in such a type of economy, investment decisions, investment financing, investment activation are related to profits together with the commitments given for outstanding debts. Accordingly, the performance of a capitalist economy depends on the up-to-date success of the borrowers in terms of paying the commitments, and the abilities of today's credit indebtedness to pay it back (Minsky,1980, p. 212).

According to Minsky, financial instability can be explained by the existence of financial intermediaries, fluctuations in the price of financial existences and profit opportunities created by financial price fluctuations. Therefore, unproductive debts of the economic agents having more profit motivation and activist policies of monetary administration cause financial system to be more fragile. In addition, there is a relation between the finance of the investment and the price of the capital goods. According to Minsky, investors who use profit opportunities tend to invest by debts even if they do not have a capital. A typical firm uses its own capital or gets into debt in order to finance its investment. In case of borrowing for investment, both creditors and debtors have risks. The risk of the debtor is not to pay it back, and the risk of the creditor is not to be able to get the credit

from the debtor. In Minsky's investment theory, the existence of these risks affects the demand and supply of the investment negatively. However, the optimistic climate created by profit opportunities in economy decreases the possible effects of the current risk and motivates the investors to make more investment by getting into debt (Ergül, 2005, p. 137).

In the literature, there are quite a few studies on financial instability on the basis of Minsky's hypothesis. In one of those studies, for instance, Barrell, Davis and Pomerantz (2006) examined the effects of banking and monetary crises on the consumption in the OECD Countries for the period of 1970-2002. In the study, the reaction of the consumption on financial instability was examined with the Panel Data Analysis. Total consumption, real net financial wealth, and real personal disposable income variables were used in the model. As a result, it was found that consumption had a negative effect on financial instability, and it had a positive effect on real net financial wealth and on real personal disposable income. Therefore, it was concluded that consumption played an important role in relieving the effects of the financial crises. Moreover, the effect of crises was higher in case of high and rising leverage situation.

Matsumoto (2007) stated that the Indonesian economy had the same process after 1990. The economic growth of Indonesia depending on the increase of foreign debt sustaining with sources of offshore banking worsened financial positions of the companies and the financial system gradually became instable before the Southeast Asia Crisis. Oosterloo, Haan and Jong-A-Pin (2007) examined the factors which affected the financial instability in 154 countries for the 1996-2005 period with the Panel Probit Method. For this purpose, GDP per capita, systematic banking crises and the EU membership variables were used in the study. It was found out that the income per capita, systematic banking crises and the EU membership increased the financial stability. Xafa (2007) conducted another study and examined the global imbalances and financial stability. It was found in the study that there were two viewpoints about the global imbalances. According to the traditional viewpoint, the imbalances are considered as a threat to the global economic and financial stability. And according to the new paradigm viewpoint, in order to be protected from the sharp increases in interest rates in the USA, imbalances are considered as a natural result of the economic and financial globalization. In terms of political applications, the traditional

viewpoint focuses on the sudden resolution of the imbalances which include the sell-out of the dollar-denominated assets, and the monetary and financial policy decisions must be converted into reverse as soon as possible. On the contrary, the new paradigm suggests that the imbalances occur via the normal functioning of the markets. In the study, the idea of that the imbalances were not possible to be resolved was discussed, and some arguments were developed in order to support the viewpoint of the new paradigm.

Graeve, Kick and Koetter (2008) conducted a study to examine the relation between the monetary policy and financial stability level in Germany for the period of 1995-2004 by using micro and macro approaches. The financial instability was measured as distress at bank level in the study. Thus, the data on the German economy and banking system were used in the study. The Hazard Rate Model was used to measure the financial stability at bank level; and the VAR model was used for the macro model. The CAMEL System variables were used at banking level. Also, the variables such as economic growth, inflation rate, and the interest rate were used for the macro model. As a result of the study, it was determined that the unexpected tight monetary policy increased the bank distress probability, and that the effect of the monetary policy on financial stability was bigger when the bank capitalization was lower.

Klompa and Haan (2009) examined the relation between the independency of the central banks and the financial instability in developed and developing countries for the period of 1980-2005 by using the Dynamic Data Analysis Method. Firstly, the variables which demonstrated the banking system were used in the study. Then, the variables which affected the financial instability were included. The financial instability indicators were subjected to Factor Analysis to form the financial instability variable. The rate of the bank liabilities to the assets, the rate of the bank reserves to assets, the rate of the capital to assets, domestic loans, the rate of the loans given to private sector to the GDP, the change in the real interest rate, the change in the bank discount interest rates, the change in the share price index, the change in the public security incomes, the rate of the M2 to GDP and the rate of the central bank assets to GDP were used as the financial instability indicators in the study. The variables like economic growth, currency, financial market liberalization, terms of trade, economic independence, political independence, and the price stability were also included in the model. As a result of the study, it

was found that there was a negative relation between the independency of the central bank and financial instability. It was determined that this negative relation stemmed from political independence rather than economic independence. In addition, it was also seen that the increase in the GDP decreased the financial instability; and the currency, financial market liberation and political instability variables increased the financial instability.

Noren (2009) conducted a study and examined the financial stability dynamics in the Euro region. In order to obtain full capacity in the study, it was stated that the long-term balance between the required growth and the financial stability formed the focal point of the economic policies belonging to the countries in the Euro Region. In his study, Noren suggested that the reforms that were performed to ensure flexibility in labor market were significant and necessary; however, they were not sufficient alone. In addition, it was also understood that short-term indicators which would create flexibility in economic policy had to be supported in order to balance the demand in the stable balance growth policy as well as to make the reforms in the labor market applicable. It was also determined that all of the factors mentioned above were essential to ensure the financial stability.

Silipo (2011) examined Minsky's Financial Instability Hypothesis from different viewpoints in a theoretical manner. The issues dealt with in the study are as follow: Economic units are more inclined to take risks during economic growth and economic recession. Banks are more eager to finance those who take loans. Over-indebtedness and financial innovations during the bursting period make the system become more fragile and leave it open to reverse effects. As a result, it was seen that these effects led to a debt crisis.

Keen (2013) conducted a study in 1995 and dealt with Minsky's Financial Instability Hypothesis Model and expanded it to produce a strict macroeconomic model which could produce monetary and real acts emerged by the big recession. This model reflected the extreme points rather than real economic situations because some real viewpoints were not included like the capital commodity price levels formed far from the ordinary commercial goods, the effect of the governmental expenditures ignored and the interest rates changed with the inflation rates.

Greenwood-Nimmo and Tarassow (2013) conducted a study and evaluated Minsky's Financial Instability Hypothesis in a macro-econometric manner, and tried to develop a small macroeconomic model that cared for the clear properties of the Minsky economy. Thus, they examined the real GDP, Tobin's ***q*** ratio, investments, federal fund rates, potential production amount, Consumer Price Index (CPI), real debt management costs, corporate domestic funds, and real gross corporate investments. After the Johansen cointegration, the VAR analysis and error correction model (VECM) analysis applications, it was concluded that there was a long-term relation between the variables. In addition, it was also determined that there was a significant relation between the cash inputs of the companies and their debt payment liabilities.

Mulligan (2013) tested Minsky's Financial Instability Hypothesis with various industrial groups registered in North America Industrial Classification System. The data of 8707 companies for the period of 2002-2009 were used in the study. Each of the companies was classified as hedge according to the *covering the interest ratio*, speculative and Ponzi finance units. The classification was made as follows: If the *covering the interest ratio* is equal to or bigger than 4, it is hedge finance unit. If it is between 4 and 0, it is speculative finance unit. And if it is less than 0, it is Ponzi finance unit. The validity of Minsky's hypothesis was handled in the context of hypothesis tests. As a result of the study, it was seen that Minsky's Hypothesis was valid for every sector except for the public and service sectors. Moreover, it was concluded that the interest rates were related to the market value and ratio of the speculative companies in various sectors. Therefore Minsky's Financial Instability Hypothesis was also related to the Austria Conjuncture Circuits Model.

Yagoubi and Mekki (2013) defined a dynamic model which handled the financial stability concept according to Minsky's Instability Hypothesis. The model used in the study was formed by being inspired by the stock-flow approach. Three sectors, which were the credit market, the goods and services market and the financial markets, were examined in the model. The study was based on the economic models that reflected the micro structural analysis. In addition, the financial dimension was also included in the macro dynamic models. As a result of the study, it was found that the balance sheet values of the financial institutions were affected by the short-term fluctuations. Also, the book value of the assets and liabilities was related to the ability of the

companies to pay their debts and financial stability. Besides, the interest rates had a considerable effect on the system instability.

Caverzasi (2014) tried to explain the mortgage crisis with the Minsky Financial Instability Hypothesis and Jan Toporowski's Capital Market Inflation Theory. Thus, the data on commercial and industrial debts and housing credits of the commercial banks were examined in the study. It was determined that the asset price inflation caused that the credits were available for the people who increased their debts and savings. It was also found that the capital asset inflation caused that the companies became less dependent on bank loans and increased their savings. This led banks to shift their commercial activities from companies to ordinary household people, and, therefore, led to the increase in their debts.

Korkmaz and Yamak (2015) conducted another study and examined the relation between economic instability and financial instability for the periods of 1987-2007 and 2008-2012 in Turkey by using the credit/income rate as the financial fragility index and by using the standard deviation of the real GNP for a 6-quarter period as the economic instability index under the VAR Approach. As a result of the study it was concluded that the financial fragility was the reason for the economic stability only for the period of 1998-2012 in the economy of Turkey.

Charles (2015) conducted a study and examined the validity of Minsky's Financial Instability Hypothesis through the simulation method. He emphasized the basic role of the shareholders on not distributing profit rates to the managers. The results pointed out that the instability hypothesis was generally valid. The decrease in the profit rates, that were not distributed, supported the results of Minsky, who emphasized the disrupting role of the shareholders in distributing the profits. Also, the periodical property of the debt rates depended on the fact that tells us that the net profits have to grow more slowly than the investments. It was also concluded that less interest rates or higher investment inclination encouraged the financial fragility.

Pirie and Chan (2016) examined the consistency of the investment decisions of institutional investors by using Minsky's Financial Instability Hypothesis. Thus, they performed face-to-face interviews with 25 investors in Hong Kong. As a result of the analysis, they found that the investors acted in consistency with Minsky's Financial Instability Hypothesis, which suggested that the markets were in a dilemma between stability and instability. Sanabria and

Garcia (2016) examined the validity of the Financial Instability Hypothesis in the economy of Spain for the period of 1994-2008. As a result of the study, it was concluded that the relation between the debts and economy bubbles strengthened the use of foreign finance, and decreased the leverage ratio in a slow pace. It was also found that there were fragile and speculative movements in the Spanish economy in the relevant period. Rozmainsky (2016) examined the changes in the monetary circulation in Russian economy for the period of 1991-1998 through the Post Keynesian Theory. In this study, the monetary changes were evaluated with the changes of the bank deposits with cash money, bartering and the unpaid debts. This relevant process is called as "monetary corruption". As a result of the study, it was found that the monetary corruption created additional obstacles in financial investments, and this, in return, led to cost-push inflation.

Minsky and many other studies in the literature discuss the theory in terms of macroeconomics. Thus, this study is attributed to a micro basis, which makes it distinct in the literature. In other words, the study discusses the Financial Instability Hypothesis on a micro basis with reference to the relation between the profitability and borrowing rates of firms. In this respect, it is considered to be distinctive.

3. Data and methodology

The data consist of 17 annual observations and 15 firms for the Metal Manufacturing Industry Companies in BIST between 1994 and 2010. The time dimension of the dataset handled in the study covers the years between 1994 and 2010. There are two significant reasons for choosing this period of time. The first one is that it includes the 1994 and 2008 global crises, which Turkey underwent. The second reason is that the aim of the study is to deal with the period until 2010 by considering that the effects of the global crises have continued until today. For this reason, this time period includes the two crises and the effects of the 2008 crisis. So-called firms are involved in pioneer firms of the manufacturing industry. Also, they were chosen as samples due to both being involved in ISO500 and BIST100 and being the firms of which data set can be obtained. The stock codes of the firms are shown in Table 1.

Table 1

Stock Codes

ALCAR	ARCLK	BFREN	BSHEV
DITAS	EGEEN	EMNIS	PARSN
FROTO	MUTLU	OTKAR	FMIZP
PRKAB	TOASO	TUDDF	

The firms' ratios of the debt and profitability variables are used. The manufacturing industry sector is one of the sectors which make great investments. The finance of the investments is supplied through debts rather than the core resources of the companies. In addition, it is considered that the debt inclination in the manufacturing industry sector affects the ongoing state of economy. This sector is the leading factor of a country. Thus, the profit and debt ratios of these companies were used in the study. The stability in sales revenues of a firm refers to its economic stability. Therefore, in the study, the standard deviation of the net sales revenues is considered as economic instability. Similarly, the solvency of a firm can indicate the stability of financial structures. The solvency of a firm depends on its sales revenue. Consequently, the deviation of the debts to sales revenue ratio is used as financial instability indicator due to showing financial instability of a firm. As it is already known, standard deviations are the indicators of a risk and show how much the results are far from the balance. In other words, a standard deviation may be defined as the indicator of the instability in economy. For this reason, the standard deviations of the relevant variables were used in the study.

It can be thought that just these variables are not enough to explain is not enough to explain that the financial structure of a firm. Therefore, the variable referred in Table 2 is also incorporated in the analysis. In the study, causality between profitability and borrowing was examined owing to the fact that it is suggested in Minsky's Financial Instability Hypothesis that there is a relation of causality between cash flow and cash outflow. Thus, the profitability as well as the borrowing rates related to firms was taken into consideration in the study. All the details regarding the variables are shown in Table 2.

Table 2

Variables

Variables	Description
ROA	Return On Assets = Net Profit / Total Asset
ROE	Return On Equity= Net Profit / Shareholder Equity
NPM	Net Profit Margin= Net Profit / Net Sales
LR	Leverage Ratio= Total Debt / Total Asset
STD	Short Term Debt Ratio= Short Term Debt / Total Debt
CR	Current Ratio= Current Asset / Short Term Debt
ACP	Average Collection Period= (365*Average Accounts Receivable) / Net Sales
ICT	Inventory Cycle Time=(365*Average Inventory) / Cost of Sales
EI[1]	Economic Instability = (Net Sales Profit) $_{\text{standard deviation}}$
FI[1]	Financial Instability=(Sales-Debt Ratio[2]) $_{\text{standard deviation}}$

Notes: 1) EI and FI variables have been composed by the recorder with reference to the theory; 2) Debt Ratio=(Long term liabilities-Short term liabilities)$_t$-(Long term liabilities- Short term liabilities)$_{t-1}$

Sources: Akgüç, 2011: 450-459; Karaca, 2014:193-208.; Botchkarev and Andru, 2011:246.

Panel data or longitudinal data typically refers to the data containing time series observations regarding a number of individuals. Therefore, observations in panel data involve at least two dimensions: a cross-sectional dimension indicated by subscript i and a time series dimension indicated by subscript (Hsiao, 2003:1). This study is used with the unbalanced panel data because some annual values are missing.

When it is analyzed through the time series or panel data, it is very significant for the variables to be stable. That is because, if the variables are instable, a spurious regression will be determined. Unit root tests are usually investigated as stable. The panel unit root tests are divided into two: first-generation tests and second-generation tests. The first-generation tests assume that there is a correlation between units. When the correlation is weak for this test, the first-generation unit root tests are used to examine it. The Pesaran CIPS test is the second-generation unit root test, and also the Pesaran CD test is used to examine cross sectional dependence. The Pesaran CD test is calculated in the following way: (Pesaran, 2004, p.5).

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{p}_{ij}\right) \quad (1)$$

Fisher ADF panel unit root test developed by Maddala and Wu is a first generation unit root test. Fisher ADF panel unit root test in the data set is not required to have a balanced panel. Also, this test may have individual gaps.

"All these procedures depend on different ways of combining the observed significance levels (p-values) from the different tests. If the test statistics are continuous, the significance levels π_i $(i = 1,2,\dots,N)$ are independent uniform (0,1) variables, and -2log$_e\pi_i$ has a χ^2 distribution with two degrees of freedom. Fisher ADF unit root test is calculated in the following way." (Maddala and Wu, 1999, p.636).

$$\lambda = -2\sum_{i=1}^{N} log(\pi_i) \quad (2)$$

π_i is the probability value of unit root test's for i cross-section in here.

After the levels/differences in which the series are fixed are determined, the relations between the relevant variables are examined.

There are two kinds of relationships between the variables: Long term and short term. The existence of a long term relationship is examined with the cointegration test while the existence of a short term relation is examined by the analysis of causality. One of the panel cointegration tests is Westerlund (2007) Panel Cointegration Test. Westerlund Panel Cointegration Test is used for the units in the case of the unequal length series. And also, this test examines the existence of long term relation for an unbalanced panel. The cointegration test is calculated in the following way:

$$\alpha_i(L)\Delta y_{it} = \delta_{1i} + \delta_{2i}t + \alpha_i(y_{it-1} - \beta_i' x_{it-1}) + \gamma_i(L)'^{v_{it}} + e_{it} \quad (3)$$

"In all three cases, note that the error correction model in (3) can only be stable if the variables it comprises are all stationary. Thus, as $y_{it-1} - \beta_i' x_{it-1}$ must be stationary, the vector β_i defines a long-run equilibrium relationship between x_{it} and y_{it}, provided of course that the errors v_{it} and e_{it} are also stationary. Any deviation

from this equilibrium relationship lead to a correction by a proportion $-2<\alpha_i \leq 0$, which is henceforth referred to as the error correction parameter. If $\alpha_i < 0$, then there is error correction, which implies that y_{it} and x_{it} are co-integrated, whereas if $\alpha_i = 0$, then the error correction will be absent and there is no co-integration. This suggests that the null hypothesis of no co-integration for cross-sectional unit it can be implemented as a test of $H_0: \alpha_i = 0$ versus $H_1: \alpha_i < 0$. In what follows, we shall propose four new panel statistics that are based on this idea."(Westerlund, 2007, p.711-712).

The causality analysis which is edited by Holtz-Eakin, Newey and Rosen (1988) are estimated by Two-Stage OLS. The Holtz-Eakin functioning of causality test is shown as follows;

"A model which is analogous to equation (4), but allows for individual effects and non-stationaries across time is f_i is an unobserved individual effect and the coefficients $\alpha_{0t}, \alpha_{1t}, \ldots, \alpha_{mt}, \delta_{1t}, \ldots, \delta_{mt}, \psi_t$ are the coefficients of the linear projection of y_{it} on a constant, past values of y_{it} and x_{it} and the individual effect f_i." (Holtz-Eakin, Newey and Rosen, 1988, p.1373).

$$y_{it} = \alpha_{0t} + \sum_{j=1}^{m} \alpha_{jt} y_{it-j} + \sum_{j=1}^{m} \delta_{jt} x_{it-j} + \psi_t f_i + u_{it} \text{ (i=1,...,N ; t=1,...,T)} \quad (4)$$

The model's difference should be taken to remove the fixed effects' indicator. In this case, differentiated final model is expressed in the following format:

$$y_{it} - y_{it-1} = \sum_{j=1}^{m} \alpha_j (y_{it-j} - y_{it-j-1}) + \sum_{j=1}^{m} \delta_j (x_{it-j} - x_{it-j-1}) + (u_{it} - u_{it-1}) \quad (5)$$

The Holtz-Eakin causality test examines whether the (5) equality contained in δ_j's is equal to zero as a group. And also, the null hypothesis is examined whether x causes y.

4. Results

In this study, it is aimed to display the long and short term relations between the economic and financial instability variables as well as the relation of causality between the profitability and borrowing rates, which have been determined. In order to obtain reliable data during the study, it is required to determine the level/differences at which the variables are stable. Firstly, for this aim, it is necessary to research whether there is a cross-section dependence.

Accordingly, in the study, the existence of a cross-section dependence was researched by means of the Pesaran (CD) Test. According to the results of the Pesaran (CD) Test, it was understood that there wasn't a cross-section dependence. Then, the series were examined with Fisher ADF test for stationary. The series are analyzed for the level value, and the results are shown in Table 3.

Table 3

Fisher ADF Unit Root Test For I(0)

	None		*Individual Intercept*		*Individual Intercept and Trend*	
Variables	**Statistics**	**Prob.**	**Statistics**	**Prob.**	**Statistics**	**Prob.**
ROA	-6.0365	0.0000***	-3.9309	0.0000***	-3.3667	0.0002***
ROE	-7.1875	0.0000***	-5.2522	0.0000***	-5.0760	0.0000***
NPM	-9.8421	0.0000***	-7.9818	0.0000***	-7.0147	0.0000***
CR	0.3407	0.6333	-0.4584	0.3233	0.2898	0.6140
LR	-0.3243	0.3728	-0.8102	0.2089	-1.5105	0.0651*
STD	0.5916	0.7230	-4.0107	0.0000***	-2.3995	0.0082***
ACP	-3.5439	0.0002***	-3.8957	0.0000***	-3.8183	0.0001***
ICT	-0.1939	0.4231	-5.1281	0.0000***	-5.0372	0.0000***
EK	-1.3217	0.0931*	-1.0850	0.1390	-1.6415	0.0503*
FI	-2.5223	0.0058***	-0.7060	0.2401	-0.8695	0.1923

Notes: Lag length is determined according to the Akaike information criterion. Maximum lags are determined 2. *, ** And ***, respectively, 0.10, 0.05 and 0.01 indicates the level of statistical significance.

With reference to Table 3, it can be said that return on assets (ROA), return on equity (ROE), net profit margin (NPM) and average collection period (ACP) are stationary at their level values. When the graphs of the economic and financial instability variables were looked into, it was seen that the results of the unit root test with the constant term were to be taken into consideration. Also, it was observed that another similar case was true for the leverage ratio (LR) and for the inventory cycle time (ICT). Within this context, it was concluded that ICT and STD were stationary at their level values. But it cannot be said that EI and FI were stable at their level values.

The variables, which are stationary, are analyzed by taking the first difference. The results are shown in Table 4.

Table 4

Fisher ADF Unit Root Test For I(1)

	None		*Individual Intercept*		*Individual Intercept and Trend*	
Variables	**Statistics**	**Prob.**	**Statistics**	**Prob.**	**Statistics**	**Prob.**
CR	-10.1172	0.0000***	-6.4057	0.0000***	-6.8214	0.0000***
LR	-10.4695	0.0000***	-6.9713	0.0000***	-4.7334	0.0000***
EK	-9.83772	0.0000***	-5.94747	0.0000***	-4.14018	0.0000***
FI	-9.28983	0.0000***	-5.70349	0.0000***	-4.79065	0.0000**

Notes: Lag length is determined according to the Akaike information criterion. Maximum lags are determined 2. *, ** And ***, respectively, 0.10, 0.05 and 0.01 indicates the level of statistical significance.

As is understood from Table 4, the current ratio (CR), leverage ratio (LR), economic instability (EI) and the financial instability (FI) are stationary at their first differences.

There are three objectives in the study. The first of them is to determine whether there is a long-term relationship between economic instability and financial instability. For this purpose, the relation is analyzed through the Westerlund Panel Cointegration method. The results are given in Table 5.

Table 5

Westerlund Panel Cointegration Analysis

	Statistics	**Z**	**Prob.**
Gt	-3.575	-7.761	0.0000***
Ga	14.017	15.164	0.906
Pt	-6.125	0.409	0.341
Pa	-5.625	-1.072	0.142

Notes: The null hypothesis is no cointegration (Westerlund (2007), p.710). Lag length is determined according to the Akaike information criterion. Maximum lags are determined 2 and leads are for 0-3. *, ** and ***, respectively, 0.10, 0.05 and 0.01 indicates the level of statistical significance.

The values of statistics, the values of probability and the values of Z be viewed in Table 5 for Gt, Ga, Pt and Pa. According to the statistical values of Ga, Pt, Pa, the null hypothesis, in which there is no cointegration, is accepted. Therefore, the existence of a long-term relation between the economic instability and the financial instability is not mentioned.

The second objective of the study is to demonstrate the causal relation which is between the economic instability and the financial instability. Within this context, the relation between the

variables is examined with the Holtz-Eakin Causality analysis. The findings are shown in Table 6.

Table 6

Holtz-Eakin Causality Analysis for Economic Instability and Financial Instability

Null Hypothesis	F Statistic	Prob.	Decision
FI doesn't Granger-cause EK.	0.7852	0.3766	Accepted
EK doesn't Granger-cause FI.	0.0001	0.9914	Accepted
Notes: Lag length is determined according to the Akaike information criterion. Maximum lags are determined 2. *, ** and ***, respectively, 0.10, 0.05 and 0.01 indicates the level of statistical significance.			

It can be viewed in Table 6 that there is not any causal relation from the economic instability to the financial instability and from the financial instability to the economic instability. In other words, it is not possible to mention bidirectional causality between the economic instability and the financial instability.

The last objective of the study was to examine the existence of any causal relation between the loan rate of the firms act with the motive of obtaining more profit in case of the emergence of the economic stability and the profitability ratio in capitalist systems. Within this context, whether there is a causal relation between the profitability rates and the loan rates was analyzed through the Holtz-Eakin causality analysis. The results are shown in Table 7.

Table 7

Holtz-Eakin Causality Analysis

Null Hypothesis	F Statistic	Prob.	Decision
CR does not Granger-cause ROA.	7.7860	0.0057***	Rejected
ROA does not Granger-cause CR.	2.7922	0.0962*	Rejected
LR does not Granger-cause ROA.	1.5543	0.2138	Accepted
ROA does not Granger-cause LR.	0.5876	0.4442	Accepted
STD does not Granger-cause ROA.	0.5170	0.4729	Accepted
ROA does not Granger-cause STD.	4.8870	0.0282**	Rejected
NPM does not Granger-cause ROA.	5.9616	0.0155**	Rejected
ROA does not Granger-cause NPM.	5.8971	0.0160**	Rejected
ROE does not Granger-cause ROA.	11.5432	0.0008***	Rejected
ROA does not Granger-cause ROE.	6.2938	0.0129**	Rejected

Null Hypothesis	F Statistic	Prob.	Decision
ACP does not Granger-cause ROA.	2.4063	0.1223	Accepted
ROA does not Granger-cause ACP.	0.0541	0.8162	Accepted
ICT does not Granger-cause ROA.	0.2233	0.6370	Accepted
ROA does not Granger-cause ICT.	0.0451	0.8320	Accepted
LR does not Granger-cause CR.	2.6696	0.1038	Accepted
CR does not Granger-cause LR.	0.0503	0.8227	Accepted
STD does not Granger-cause CR.	0.0001	0.9732	Accepted
CR does not Granger-cause STD.	0.8602	0.3547	Accepted
NPM does not Granger-cause CR.	0.0008	0.9925	Accepted
CR does not Granger-cause NPM.	0.1510	0.6979	Accepted
ROE does not Granger-cause CR.	0.1284	0.7204	Accepted
CR does not Granger-cause ROE.	0.5583	0.4558	Accepted
ACP does not Granger-cause CR.	15.7767	0.0001***	Rejected
CR does not Granger-cause ACP.	37.5598	0.0000***	Rejected
ICT does not Granger-cause CR.	0.1132	0.7368	Accepted
CR does not Granger-cause ICT.	0.0819	0.7750	Accepted
STD does not Granger-cause LR.	11.0293	0.0010***	Rejected
LR does not Granger-cause STD.	5.1960	0.0237**	Rejected
NPM does not Granger-cause LR.	0.0027	0.9579	Accepted
LR does not Granger-cause NPM.	7.6385	0.0062***	Rejected
ROE does not Granger-cause LR.	7.7476	0.0059***	Rejected
LR does not Granger-cause ROE.	2.1119	0.1477	Accepted
ACP does not Granger-cause LR.	0.5905	0.4431	Accepted
LR does not Granger-cause ACP.	0.1884	0.6647	Accepted
ICT does not Granger-cause LR.	1.4426	0.2310	Accepted
LR does not Granger-cause ICT.	1.2166	0.2712	Accepted
NPM does not Granger-cause STD.	1.5750	0.2109	Accepted
STD does not Granger-cause NPM.	2.4778	0.1170	Accepted
ROE does not Granger-cause STD.	2.3767	0.1247	Accepted
STD does not Granger-cause ROE.	5.8741	0.0162**	Rejected
ACP does not Granger-cause STD.	0.2331	0.6297	Accepted
STD does not Granger-cause ACP.	0.0035	0.9526	Accepted
ICT does not Granger-cause STD.	0.1424	0.7062	Accepted
STD does not Granger-cause ICT.	0.2858	0.5934	Accepted
ROE does not Granger-cause NPM.	16.3482	0.0001***	Rejected
NPM does not Granger-cause ROE.	0.2220	0.6380	Accepted
ACP does not Granger-cause NPM.	0.0352	0.8513	Accepted

Null Hypothesis	F Statistic	Prob.	Decision
NPM does not Granger-cause ACP.	0.1167	0.7330	Accepted
ICT does not Granger-cause NPM.	0.0832	0.7733	Accepted
NPM does not Granger-cause ICT.	3.1583	0.0769*	Rejected
ACP does not Granger-cause ROE.	0.2480	0.6189	Accepted
ROE does not Granger-cause ACP.	0.2752	0.6004	Accepted
ICT does not Granger-cause ROE.	0.7066	0.4016	Accepted
ROE does not Granger-cause ICT.	0.1671	0.6831	Accepted
ICT does not Granger-cause ACP.	0.0052	0.9424	Accepted
ACP does not Granger-cause ICT.	0.1629	0.6812	Accepted

Notes: Lag length is determined according to the Akaike information criterion. Maximum lags are determined 2. *, ** and ***, respectively, 0.10, 0.05 and 0.01 indicates the level of statistical significance.

According to Table 7, it can be said that there is bidirectional causality between the current ratio and the return on assets. Similarly, it was determined that there was bidirectional causality between the return on assets and the net profit margin as in the relation between the return on equity and return on assets. In addition, in Table 7, it can be seen that there is bidirectional causality between the average collection period and the return on assets. It was, also, concluded in the study that there were three one-way causality Firstly, it was observed that there was causality from the return on assets to the short term debt ratio. Secondly, it was determined that there was causality from the return on equity to the net profit margin. Lastly, it was seen that there was a one-way causality from the net profit margin to the inventory cycle time. Another considerable finding from the study is that there is not any relation of causality between all the other variables.

5. Conclusions

Minsky's Financial Instability Hypothesis is discussed on the basis of firms in the study. And, any short-term and long-term relations have not been observed between the economic instability and the financial instability. In the manufacturing industry field, there are 147 firms traded in BIST. As to this study, 15 firms traded in BIST have taken into consideration. Minsky's Financial Instability Hypothesis has been examined in terms of these 15 companies, and no relations have been determined between the economic instability and the financial instability both for the short-term and long-term

relations. Within this context, it may well be suggested that the Economic Stability-Financial Instability-Economic Instability Cycle of Minsky was not supplied for metal manufacturing industry for the period of 1994-2010.

In the study, due to the low number of the chosen firms within the manufacturing industry, it cannot be said that the findings reached would reflect the whole. In this regard, it is thought that if the findings are tested by spreading to a more extensive sample, different results will be obtained.

In terms of causal relations between borrowing and profitability, bidirectional causality were determined among ROE and ROA, CR and ROA, ACP and CR, STD and LR, ROE and LR. Also it was obtained that NPM was the reason of ICT; and ROE was the reason of NPM. No other causality was observed between other variables.

In this study, the validity of Minsky's Financial Instability Hypothesis is examined for the manufacturing industry sector. It is thought to be enlightening for the policymakers in organizing financial markets. Moreover, the results of the study also provide information on the relation between the profitability and borrowing of the real sector. For future studies researching the validity of Minsky's Financial Instability Hypothesis, it is considered that the sample is not to be limited with only manufacturing sector. Thus, the validity of the hypothesis can be examined more inclusively, and also, the results obtained can be generalized. Accordingly, for future studies, it is recommended to check the validity of Minsky's Financial Instability Hypothesis in the other sectors except for the manufacturing industry.

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RELATIVE PRICE VARIABILITY AND INFLATION IN TURKEY: RESULTS FROM KALMAN FILTER ESTIMATION

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Abstract

This study re-examines the relationship between inflation rate and relative price variability in Turkey for the period of February 2005-November 2015, by relaxing the assumptions of linearity and stability. The linearity assumption between the two variables is relaxed by estimating quadratic regression equation. The assumption of stability is removed by utilizing the Kalman filter approach. The Kalman filter estimates of the regression coefficients are found to satisfy the U-shaped relationship between inflation and relative price variability. Time variation on the regression coefficients and the U-shaped curve is significant. The annualized inflation rate which minimizes relative price variability varies from 4.26% to 4.93%.

Keywords: Time Varying Coefficient, Optimal Inflation, U-Shape, Kalman Filter, Relative Price Variability

JEL Classification: E30, E31, C22

1. Introduction

In the inflation literature, the hypothesis that a rise in inflation increases relative price variability (hereafter RPV), called variability hypothesis is recently attracting considerable interest. The positive relationship between the two variables has been theoretically produced by two main models: menu costs and imperfect information. The menu cost model developed by Ball and Mankiw (1994) predicts

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that the expected inflation affects RPV because of firms' sluggish price adjustment process. The imperfect information model introduced by Lucas (1973) argues that the unexpected inflation creates RPV because of suppliers' misperception about relative and general price changes.

Following the pioneering study of Parks (1978), large number of works has empirically investigated the hypothesis for different economies and periods. The most of empirical studies, including Parks (1978), Lach and Tsiddon (1992), Domberger (1987), Fischer (1981), Hercowits (1981) and Cukierman (1979) found a positive and linear relationship between inflation and RPV. The linearity assumption made by these studies has been strongly criticized by Hartmann (1991), Dabus(2000), Caglayan and Filiztekin (2003) and, Becker and Nautz (2009), arguing that the relationship between the two variables could be quadratic or piecewise linear. The findings of Fielding and Mizen (2008) and Choi and Kim (2010) supported the U-shaped relationship between inflation and RPV around non-zero inflation. In recent empirical literature, there is a strong consensus on the U-shaped or V-shaped relationship between the two variables. Another debate on the functional form refers to the instability of the U-shaped relationship. Many studies which use either linear or nonlinear form assume that the relationship between the two variables is time invariant. However, recent studies by Choi (2010), Caglayan and Filiztekin (2003) and Dabus (2000) demonstrate that the relationship between two variables depends on the regimes of inflation or monetary policy.

In the literature, there has been a limited number of studies which have attempted to test empirically the variability hypothesis for the case of Turkey. Among them, the studies by Caglayan and Filiztekin (2003) and Baglan et al. (2015) use nonlinear function form while the early works by Yamak (1997) and Yamak and Sivri (1999) and Yamak and Tanriover (2006) assume the linear relationship between inflation and RPV. In all these contributions, however, stability issue has not parametrically investigated together with nonlinearity.

The main purpose of this study is to re-examine the variability hypothesis for the case of Turkey by relaxing the assumptions of linearity and stability about the functional form. The linearity assumption between inflation and RVP is relaxed by estimating quadratic regression equation. The assumption of stability is removed

by applying the Kalman filter technique to the constructed quadratic regression equation.

2. Data and methodology

The data used in this study are consumer price index for 12 major commodity groups which are two-digit. The data are monthly and cover the period of February 2005-November 2015. All data come from the Turkish Statistical Institute. Before starting the analysis, all data were seasonally adjusted by using the Census X12 method. Aggregate and sub-aggregate inflation series are then defined as the monthly log difference of respective seasonally adjusted series. Finally, the RPV variable is constructed by using the weighted and seasonally adjusted aggregate and sub-aggregate inflation series as follows:

$$RPV_t = \sqrt{\sum_{i=1}^{12} w_i(\pi_{it}-\pi_t)^2}$$

Where: $\pi_{it} = lnP_{i,t} - lnP_{i,t-1}$, $\pi_t = lnP_t - lnP_{t-1}$, lnP_t is the logarithm of the consumer price index level at time t, $lnP_{i,t}$ is the logarithm of the price index level of commodity group *i* at time *t* and w_i is the weight of commodity group *i* in the consumer price index. Main expenditure groups and their weights are given in Table 1. The seasonally adjusted aggregate inflation and RPV time series are shown in Figure 1.

Table 1

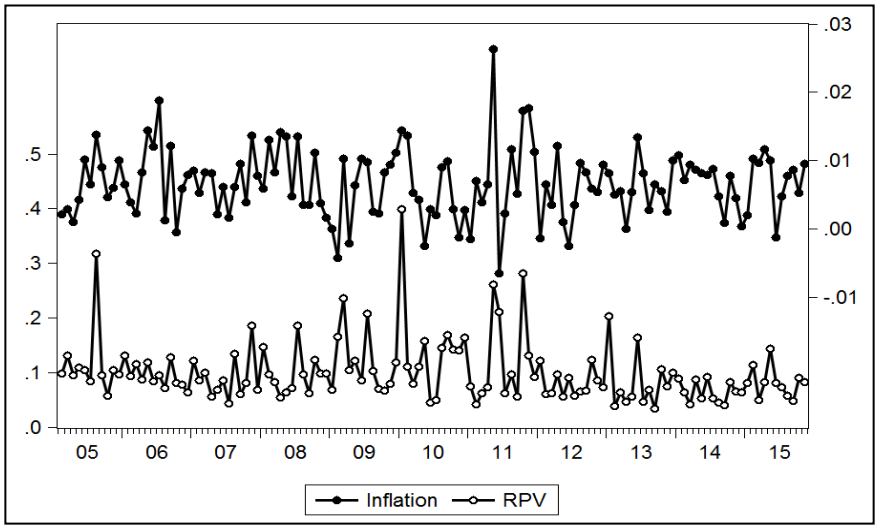
Main expenditure groups and weights

Food and Non-Alcoholic Beverages	0.2863
Alcoholic Beverages and Tobacco	0.0500
Clothing and Footwear	0.0807
Housing, Water, Electricity and Gas	0.1660
Furnishings and Household Equipment	0.0742
Health	0.0254
Transport	0.1259
Communications	0.0430
Recreation and Culture	0.0281

Education	0.0224
Hotels, Cafes and Restaurants	0.0564
Miscellaneous Goods and Services	0.0416

Figure 1

Inflation and RPV



To investigate the U-shaped effect of inflation on RVP, as first step the following quadratic regression is estimated by the ordinary least squares (hereafter OLS) assuming that coefficients of regression are time invariant.

$$RPV_t=\beta_0+\beta_1\pi_t+\beta_2\pi_t^2+\varepsilon_t \quad (1)$$

If β_1 and β_2 in the estimated regression are found to be negative and positive respectively, it is then said that there is a U-shaped relationship between inflation and RPV. The inflation rate which minimizes RPV equals to $-\beta_1/2\beta_2$.

In the second step, the assumption of time invariant coefficient is relaxed by applying the Kalman Filter technique to the following equation.

$$RPV_t=\beta_{0,t}+\beta_{1,t}\pi_t+\beta_{2,t}\pi_t^2+\varepsilon_t \qquad \varepsilon_t \sim nid(0,v) \quad (2)$$

In the Kalman filter estimation technique, the first necessary step is to construct the state space form, which consists of

measurement and transition equations (Kalman, 1960). Measurement equation represents observation equation 2, while the transition equations 3-5 describe the process of unobserved time varying coefficients.

$$\beta_{0,t}=\tau_0\beta_{0,t-1}+\mu_{0,t} \quad (3)$$

$$\beta_{1,t}=\tau_1\beta_{1,t-1}+\mu_{1,t} \quad (4)$$

$$\beta_{2,t}=\tau_2\beta_{2,t-1}+\mu_{2,t} \qquad \mu_t \sim nid(0,q) \quad (5)$$

where β_{0t}, β_{1t} and β_{2t} are the unobserved time varying coefficients of the measurement equation; τ_0, τ_1 and τ_2 are unknown coefficients of the transition equations; v is the unknown variance term of the errors in the measurement equation, and q is the unknown variance of the residuals in the transition equations. In general, β_{0t}, β_{1t} and β_{2t} are not observable. However, it is generally assumed that they are known to be generated by a first-order Markov process.

3. Empirical results

As first step, equation 1 is estimated by the OLS, assuming that the relationship between inflation and RPV is time invariant. Table 2 reports the coefficient estimates and their statistics errors of quadratic regression. As seen in this table, all coefficients including intercept term are statistically significant at least at the 5% level and have also expected signs. The coefficient of determination is found to be 0.254. By looking at this value, it can be argued that the model does not fit the data well. However, the purpose of OLS estimation is only to provide the initial values for the unknown parameters and matrix in the Kalman filter estimation. Therefore, at this point the low value of R-squared does not matter. Since the coefficient of π^2 is statistically different from zero, the relationship between the two variables is quadratic. This means that the relationship between RPV and inflation is U-shaped curve. This nonlinear relationship between inflation and RPV is displayed in Figure 2. According to the OLS estimates shown in Table 2, RPV is minimized as 0.084 when monthly inflation rate is 0.004. Finally, the fact that the intercept of the quadratic regression is found to be positive and statistically significant implies that RPV is greater than zero (0.091) event though inflation rate is zero. Therefore, the curve of the relationship intersects the positive RPV axes.

Table 2

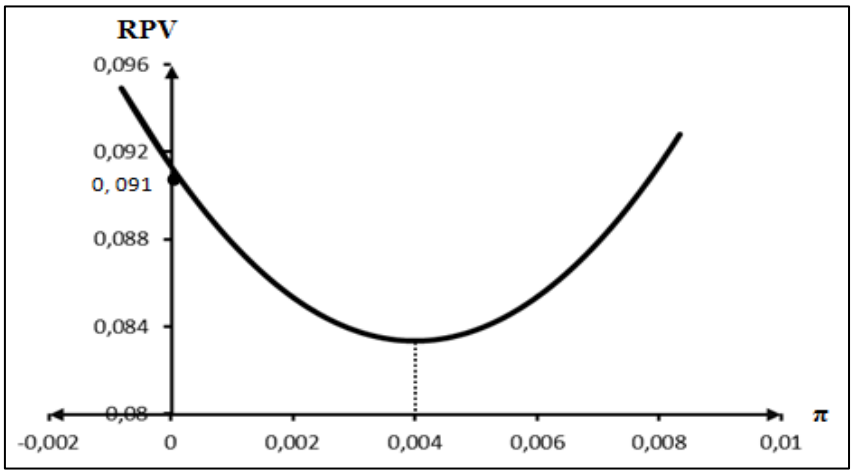
OLS estimation results

Variables	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
Intercept	0.091	0.008	11.846	0.000
π	-4.011	1.724	-2.327	0.021
π^2	501.973	99.099	5.065	0.000
R-squared	0.254			
F-statistic	21.599			
Prob(F-statistic)	0.000			

Note: The Breusch-Godfrey serial correlation LM test indicates that the residuals are not serially correlated. LM_1: 0.15 [0.70], LM_4: 1.68[0.79], LM_8: 3.65[0.89], LM_{12}: 8.81 [0.72].

Figure 2

U-shaped relationship between inflation and RPV



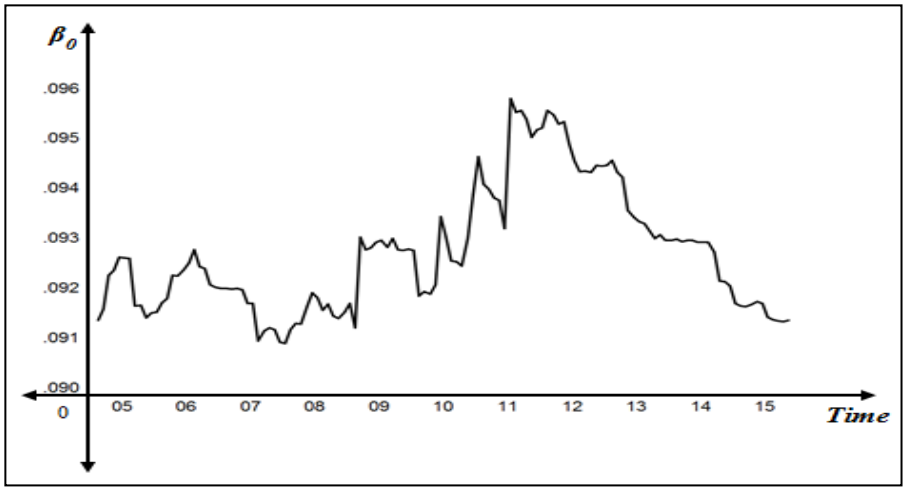
The main purpose of this study is to estimate the quadratic relationship between RVP and inflation, applying the Kalman filter technique to equation 2. Therefore, as second step of this study, this equation is estimated by Kalman filter approach. Before running the Kalman filter, in order to get time varying parameters, β_{0t}, β_{1t} and β_{2t}, the initial values of the unknown parameters of the state space model

and their variance-covariance matrix are estimated by using OLS at the expense of whole observations. By using the initial values, the Kalman filter is run under the routine of optimization in order to get estimates of the rest of the unknown parameters.

Once given the optimum and initial values of the unknown parameters and their variance-covariance matrix, the Kalman filter is again run from February 2005 - November 2015 to obtain the unconditional time varying parameter estimates. Figures 3-5 display the estimates of three time varying parameters β_{0t}, β_{1t} and β_{2t}. The estimates of all three coefficients are found to satisfy the U-shaped relationship between inflation and RPV. In all cases, the estimate of β_0 is positive. As seen in Figure 3, time variation on the intercept is significant. The estimated intercepts range from a minimum of 0.091 to a maximum 0.096 (Figure 3). Time variation in β_1 and β_2 is more significant than β_0.

Figure 3

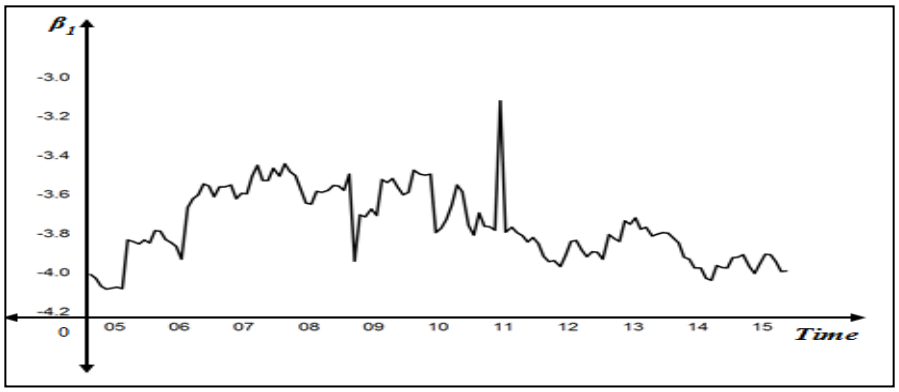
Time varying parameter estimates of the coefficient β_0



The estimates of β_1 range from a minimum of -4.086 to a maximum of -3.123 (Figure 4).

Figure 4

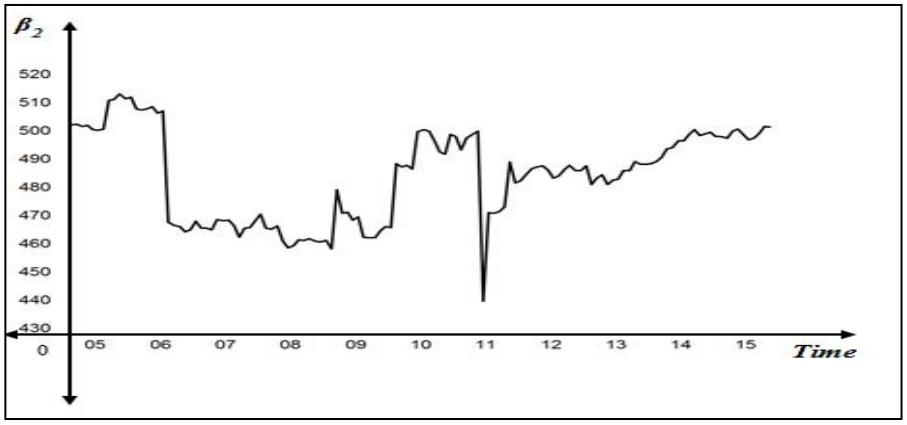
Time varying parameter estimates of the coefficient β_1



Similarly, the coefficient estimates of squared inflation variable range from 439 to 512 (Figure 5).

Figure 5

Time varying parameter estimates of the coefficient β_2

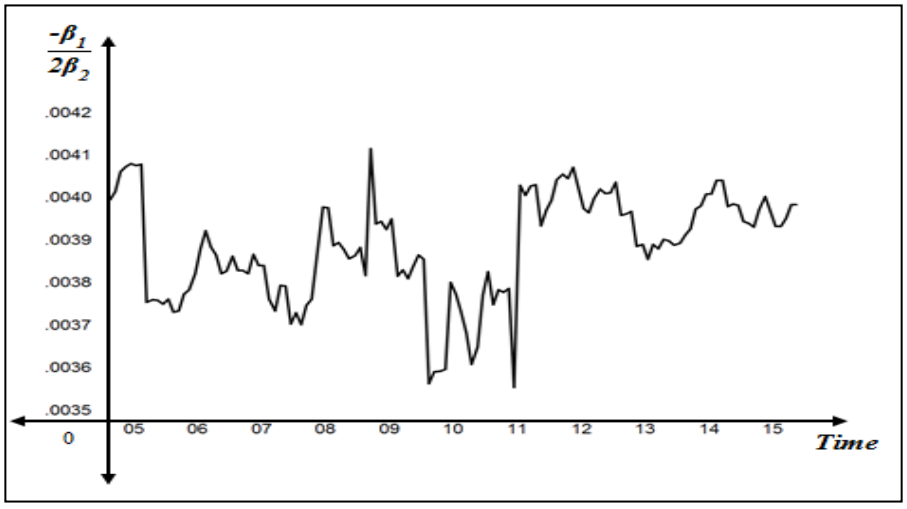


Finally, the time varying optimal inflation rates which minimize RPV are computed by using the time varying parameter estimates. Figure 6 gives the time variation on the optimal inflation rate. Optimal inflation rates range from 0.0035 to 0.0041. More specifically, when the time pattern of the optimal inflation rate is examined, three distinct

sub-periods could be easily identified. Thus, the whole period could be split into three sub-periods for illustrative purpose. The first sub-period is the period of February 2005- January 2010. The computed means of optimal inflation rate is about 0.00386 per month. In the second sub-period which covers the period of February 2010 – June 2011, optimal inflation rate drops to a level of 0.00369 per month. Finally, for the sub-period of July 2011-November 2015, it increases to a level of 0.00397 per month.

Figure 6

The optimal inflation rate ($\frac{-\beta_1}{2\beta_2}$)

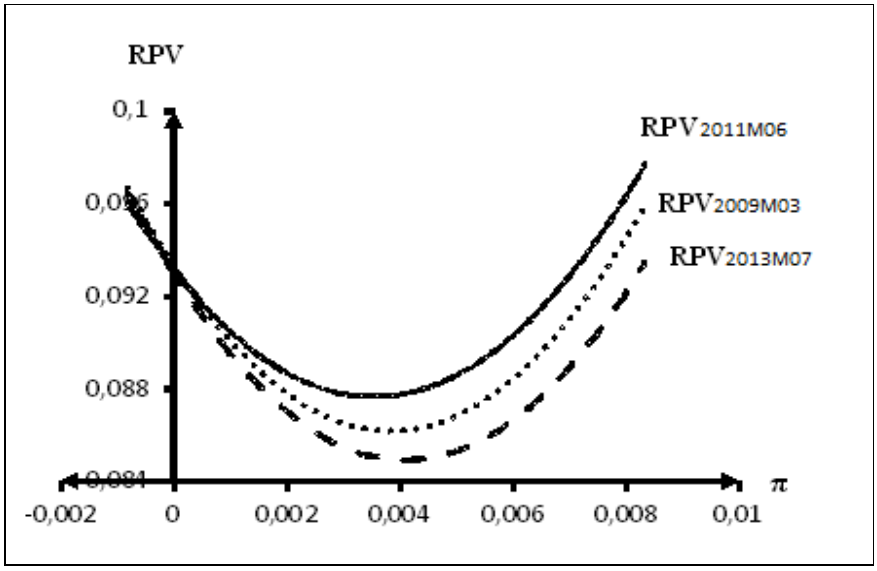


In order to demonstrate how the U-shaped curve shifts over time, first three time points in the whole period were selected and then the related three curves were separately shown in Figure 7. Among three curves, the closest one to origin and horizontal axis is the relationship curve of March 2009. According to this curve, optimal inflation rate for RPV is about 0.0041 per month. However, for June 2011, the same curve shifts up and left markedly by expressing that optimal inflation rate decreases to a level of 0.0035 per month. At the same time, the curve of June 2011 is the farthest from origin and the horizontal axes. From June 2011 to July 2013, the same curve shifts down and is located between the curves of 2009 and 2011. Inflation rate which minimizes RPV rises to a level of 0.0038. Meanwhile, it is

found that the annualized inflation rate which minimizes RPV varies from 4.26% to 4.93% for the entire period.

Figure 7

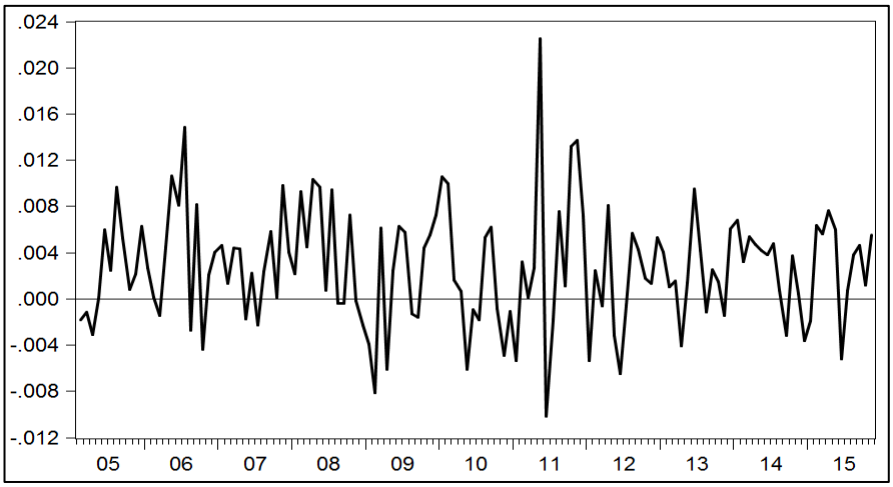
Time variation in the U-shaped curve



If the actual inflation rate is above the minimum level of the U-shaped curve, the monetary authority has power to lower RPV by reducing actual inflation rate. In this case, contractionary monetary policy conducted by authority will not only reduce RPV but also prevent the welfare cost of the allocative efficiency of the prices disrupted by relative price variability. On the other hand, if the inflation rate is below the minimum level of the curve, monetary authority will probably use expansionary policy which creates some increases in the inflation rate increase without causing any welfare cost. According to the results of the Kalman filter estimation in this study, the monetary policy used in Turkey for the period of 2005-2015 is mostly not effective in keeping optimal inflation rate for RPV. As shown in Figure 8, for most cases, the gap between actual and optimal inflation rates is positive. In 92 of the total 130 cases, monetary policy is expected to be more contractionary to reduce actual inflation and RPV.

Figure 8

The gap between actual and optimal inflation rates



4. Conclusion

The main objective of this study is to empirically investigate the effects of the aggregate inflation rate on RPV by allowing the relationship being time varying. The parameter estimation of the quadratic regression is performed by using the Kalman filter estimation approach. This technique is chosen as the major analytical tool in this study because of the many advantages it has over all other procedures such as moving OLS regressions, splitting whole period into two or three sub-periods, and stochastically varying estimation technique in terms of the optimal estimates. The Kalman filter can do all that OLS can do and more.

There are three main findings of this study. The first finding is related to the functional form of the relationship between RPV and inflation. According to results of both OLS and Kalman filter, the relationship between the two variables is quadratic. This result implies that there are two different inflation rates for any level of RPV, but only one for the minimum level of RPV. The second finding related to the stability of the relationship suggests that the U-shaped curve between RPV and inflation is time variant. Significant time variation is found in the parameter estimates of the quadratic regression. This means that welfare cost of inflation in Turkey for the period of 2005-

2105 is not constant on the monthly basis. As the last of the finding, the U-shaped curve has a turning minimum point at a positive inflation rate. This finding is consistent with the results of Fielding and Mizen (2008), Choi and Kim (2010) and, Becker and Nautz (2010).

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TRACKING FINANCIAL BUBBLES ON ROMANIA STOCK MARKET

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Abstract

The Log-Periodic Power Law (LPPL) is a consistent model capable of detecting explosives financial bubbles, which reflect the positive and nonlinear investors feedbacks. The regime imposed by the model is faster than an exponentially growth rate, combined with logarithmic oscillations. Applying the LPPL model on the top 25 most liquid companies traded on Bucharest Stock Exchange that are part of BET-XT Index basket on daily data between 26/01/1997 – 10/02/2017, we managed to find a total number of 54 financial bubbles regimes.

Keywords: financial bubble, financial modeling, log-periodic power law, stock market.

JEL Classification: C20, C49, C10

1. Introduction

This paper examines the existence of multiple bubbles regimes on top 25 blue chip stocks traded on Bucharest Stock Exchange between 1997 to 2017 period using a model called Log-Periodic Power Law (LPPL), that was independently proposed by Sornette, Johansen and Bouchaud (J. Phys. I. France 6 pp. 167-175, 1996). In this paper we use principles described in Sornette (2000 and 2004) and Pele (2012). The LPPL model propose an exponential nonlinear price trend with log-periodic movements around it that culminate ultimately with a possible price collapse.

Financial bubble is defined as a situation where the price growth rate of a financial asset is not related to the fundamental value, being mostly driven by investors future expectations. Since

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financial bubbles are very difficult to observe in real time, they are analyzed after the fact when assets prices collapse suddenly, returning to their core values.

According to Sornette (2003), the specific manner in which the prices of financial assets are collapsing is not very important, a collapse in prices occurring when the market enters into a unstable growth rate phase and any disturbance no matter how small can trigger this instability. The collapse is caused primarily due to the unstable position of the market, while the moment of shock (the trigger) is secondary in importance. So, the reason of collapsing is endogenous and the trigger is exogenous to the market.

Due to the extraordinary effect of financial crises over the world economy, the possibility of detecting financial bubbles before they burst have become a topic of interest for all market participants. Long-term investors that have a high level of risk aversion would definitely want to be protected against this type of extreme events, while short-term investors may try to profit from them. Even the Central Banks would benefit from the ability to anticipate financial bubbles regimes early on, by taking the adequate measures in order to prevent them or diminish their negative effects.

2. The log-periodic power law model (LPPL)

Sornette, Johansen and Bouchaud have developed a universal model capable of identifying bubbles using concepts used in physics. In his attempt to identify financial bubbles, the financial market is defined as a complex system where the assets prices collapse is seen as critical events. The behaviour of such a complex system is represented by the aggregation of its individual participants behaviour. On financial market the investors are the main participants, who are organized in a hierarchical structure (of different sizes).

When investors begin to replicate their decisions from each other, the psychological effect become so evident due to the fact that the interactions between them follows nonlinear patterns, the financial market reaching a point where the scale collective behaviour is developing into a speculative financial bubble regime. As time passes, the system becomes unstable due to the price growth caused by the effect of behavioural imitation among investors, so when the critical point is reached, the financial bubble burst is inevitable.

The price almost always presents two features before the collapse, namely:

- The price is growing faster than exponential
- The oscillations around the main trend have accelerated frequency

The LPPL is a consistent model capable of detecting explosives financial bubbles, which reflect the positive and nonlinear investors feedbacks. The regime imposed by the model is faster than an exponentially growth rate, combined with logarithmic oscillations.

The LPPL model is built as a function of time given by:

$$\ln p(t) = A + B(t_c - t)^{\beta}\{1 + Ccos[\omega \ln(t_c - t)^{\beta}] + \emptyset\}$$

Where:

P(t) is the price at t moment,

t_c is the critical moment (the most probable moment of price collapse),

$A, B, C, \beta, \omega, \emptyset$ are the model parameters.

In order to validate this model, there are some empirically observed restrictions on the values of the parameters, namely:

A > 0 - usually this is the price at critical time.

B < 0

C≠0, |C|<1 - this parameter controls the oscillations amplitude around the exponential tendency.

0<β<1 - this parameter controls the magnitude growth rate of the main tendency.

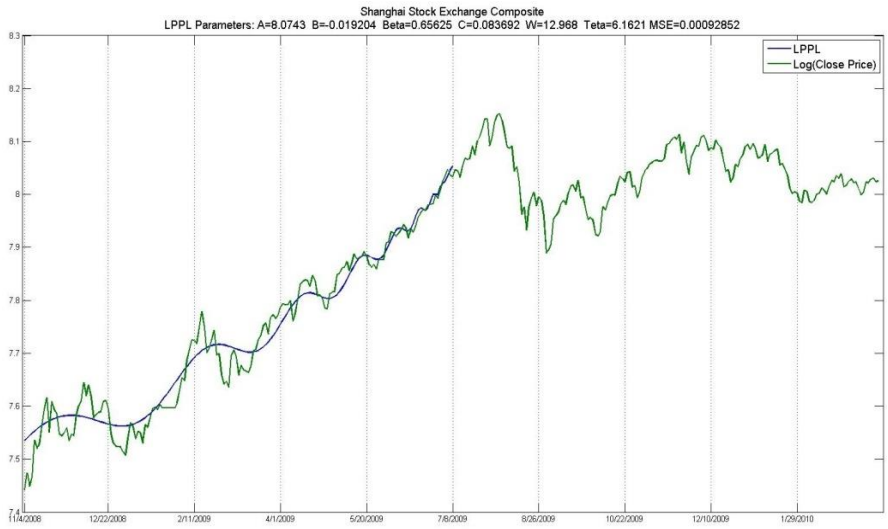
ω∈(0,∞) - this parameter controls the oscillations.

∅∈[0,4π] – represent a phase parameter.

Bastiaensen, Cauwels, Sornette, Woodard and Zhou published "The Chinese Equity Bubble: Ready to Burst" on 10 July 2009 in which they managed to detect a financial bubble regime formed on the Chinese index Shanghai Stock Exchange Composite between November 4th 2008 - July 8, 2009 (Figure 1).

Figure 1

LPPL fitted to Shanghai Stock Exchange Composite between November 4th 2008 - July 8 2009 on daily data



Data Source: Bloomberg

3. Calibration methods for the LPPL model

As explained in Fantazzini and Geraskin (2011), there are several methods for estimating the LPPL model parameters.

The 2-step Nonlinear Optimization (Johansen et al., 2000) that involves two operations: the use of default parameters (using a neighborhood search procedure called Taboo) and then Levenberg-Marquardt algorithm to minimize the sum of squared errors.

Genetic Algorithms (Jacobsson, 2009) that implies the usage of computer simulations in order to replicate the natural selection in biological systems, using four phases: a selection mechanism, a breeding mechanism, a mutation mechanism, and a culling mechanism.

The 2-step/3-step ML Approach (as detailed in Fantazzini 2010) which consist in reversing the analyzed time series and calibrate the LPPL for the case of an anti-bubble regime and using the estimated parameters as starting values for estimating all the LPPL parameters, by using again the reversed times series.

Applying the 2-step Nonlinear Optimization, the LPPL model can be written as follows:

$$y_t = A + Bf_t + Cg_t$$

Where:

$$y_t = \ln p(t),\ \ f_t = (t_c - t)^{\beta}\ \ and\ g_t = (t_c - t)^{\beta}\cos[\omega \ln(t_c - t)^{\beta} + \emptyset]$$

The A,B,C parameters can be estimated from the following system:

$$\begin{pmatrix} \sum_{t=1}^{T} y_t \\ \sum_{t=1}^{T} y_t f_t \\ \sum_{t=1}^{T} y_t g_t \end{pmatrix} = \begin{pmatrix} T & \sum_{t=1}^{T} f_t & \sum_{t=1}^{T} g_t \\ \sum_{t=1}^{T} f_t & \sum_{t=1}^{T} f_t^2 & \sum_{t=1}^{T} f_t g_t \\ \sum_{t=1}^{T} g_t & \sum_{t=1}^{T} f_t\, g_t & \sum_{t=1}^{T} g_t^2 \end{pmatrix} \begin{pmatrix} A \\ B \\ C \end{pmatrix}$$

$$\text{If } b = \begin{pmatrix} A \\ B \\ C \end{pmatrix},\ X = \begin{pmatrix} 1 & f_1 & g_1 \\ \cdots & \cdots & \cdots \\ 1 & f_T & g_T \end{pmatrix}, y = \begin{pmatrix} y_1 \\ . \\ . \\ . \\ y_T \end{pmatrix}$$

Then: $\widehat{b} = (X'X)^{-1}X'y$

Next starting from the A,BC parameters, we use Taboo procedure using the empirically observed restrictions and the Levenberg-Marquardt algorithm minimizing RMSE (in order to find the critical time t_c).

4. Data and methodology

The data used for our analysis consists of daily returns for the most liquid 25 companies traded on Bucharest Stock Exchange, that are part of BET-XT Index basket. We are applying the LPPL model on data between 26.01.1997 – 10.02.2017 (if we have historical data). More information about the companies and the available historical data can be found in the table below:

Table 1

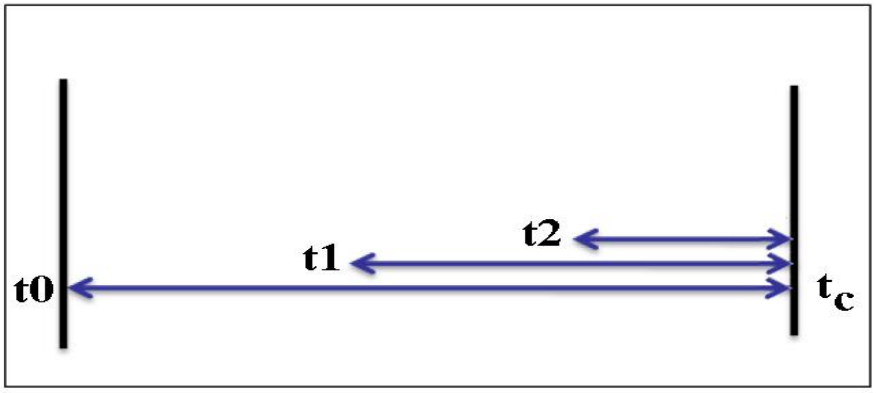
Companies from bet-xt index

Company Name	Bloomberg Symbol	Historical Data Interval
BANCA TRANSILVANIA S.A.	TLV RO Equity	26/11/1997 – 02/10/2017
FONDUL PROPRIETATEA	FP RO Equity	26/01/2011 – 02/10/2017
OMV PETROM S.A.	SNP RO Equity	04/09/2001 – 02/10/2017
S.N.G.N. ROMGAZ S.A.	SNG RO Equity	12/11/2013 – 02/10/2017
BRD – GROUPE SOCIETE GENERALE S.A.	BRD RO Equity	16/01/2001 – 02/10/2017
SOCIETATEA ENERGETICA ELECTRICA S.A.	EL RO Equity	04/07/2014 – 02/10/2017
S.N.T.G.N. TRANSGAZ S.A.	TGN RO Equity	24/01/2008 – 02/10/2017
C.N.T.E.E. TRANSELECTRICA	TEL RO Equity	29/08/2006 – 02/10/2017
SIF OLTENIA S.A.	SIF5 RO Equity	19/11/1999 – 02/10/2017
SIF BANAT CRISANA S.A.	SIF1 RO Equity	19/11/1999 – 02/10/2017
SIF MOLDOVA S.A.	SIF2 RO Equity	19/11/1999 – 02/10/2017
SIF TRANSILVANIA S.A.	SIF3 RO Equity	19/11/1999 – 02/10/2017
SIF MUNTENIA S.A.	SIF4 RO Equity	19/11/1999 – 02/10/2017
S.N. NUCLEARELECTRICA S.A.	SNN RO Equity	04/11/2013 – 02/10/2017
CONPET SA Ploiești	COTE RO Equity	31/01/2005 – 02/10/2017
BURSA DE VALORI BUCUREȘTI SA	BVB RO Equity	09/06/2010 – 02/10/2017
ANTIBIOTICE S.A.	ATB RO Equity	26/11/1997 – 02/10/2017
ALBALACT SA	ALBZ RO Equity	08/12/2004 – 02/10/2017
ELECTROMAGNETICA SA BUCUREȘTI	ELMA RO Equity	02/04/1999 – 02/10/2017
IMPACT DEVELOPER & CONTRACTOR S.A.	BCC RO Equity	11/06/2004 – 02/10/2017
BANCA COMERCIALA CARPATICA S.A.	IMP RO Equity	19/12/1997 – 02/10/2017
IAR SA Brașov	IARV RO Equity	22/04/1999 – 02/10/2017
SSIF BRK FINANCIAL GROUP SA	BRK RO Equity	14/03/2005 – 02/10/2017
ROMCAB SA TG. MUREȘ	MCAB RO Equity	09/10/2006 – 02/10/2017
ROMCARBON SA BUZĂU	ROCE RO Equity	05/04/1999 – 02/10/2017

Data Source: Bloomberg

Figure 2

LPPL calibration procedure



We are going to calibrate the LPPL model iterating through all the available data using a flexible windows period (Figure 2) and store all the cases were the LPPL parameters follows the empirically observed restrictions.

5. Results

Fitting the LPPL model on all the available data, we managed to identify a total number of 54 explosives financial bubbles regimes, described in the tables bellow for every company composing the BET-XT Index.

Table 2

All bubbles regimes detected applying the LPPL model to BANCA TRANSILVANIA S.A. (TLV RO Equity)

BANCA TRANSILVANIA S.A. (TLV RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
13/1/ 2005	16/01/ 2006	0.262438543	-0.073262762	0.4609375	0.079768682	8.952	6.162109375
07/01/ 2009	30/11/ 2009	-0.343306633	-0.010268613	0.8828125	0.121026919	19.096	6.142578125
20/01/ 2016	21/03/ 2016	7.390133061	-6.572482283	0.0078125	0.002252715	3.936	6.25

Applying the LPPL model to **BANCA TRANSILVANIA S.A. (TLV RO Equity)** on daily data between 26/11/1997 - 02/10/2017, we managed to identify a total number of 3 financial bubbles regimes (Table 2).

Table 3

All bubbles regimes detected applying the LPPL model to FONDUL PROPRIETATEA (FP RO Equity)

FONDUL PROPRIETATEA (FP RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
17/06/ 2014	30/09/ 2014	0.017747327	-0.058797124	0.296875	0.080318206	9.984	6.26953125

Applying the LPPL model to **FONDUL PROPRIETATEA (FP RO Equity)** on daily data between 26/01/2011 - 02/10/2017, we managed to identify only one financial bubble regime (Table 3).

Table 4

All bubbles regimes detected applying the LPPL model to OMV PETROM S.A. (SNP RO Equity)

OMV PETROM S.A. (SNP RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
25/05/ 2010	04/08/ 2011	-0.7070194	-0.083490747	0.328125	0.084938558	6.936	6.435546875

Applying the LPPL model to **OMV PETROM S.A. (SNP RO Equity)** on daily data between 04/09/2001 - 02/10/2017, we managed to identify only one financial bubble regime (Table 4).

Table 5

All bubbles regimes detected applying the LPPL model to S.N.G.N. ROMGAZ S.A. (SNG RO Equity)

S.N.G.N. ROMGAZ S.A. (SNG RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
20/05/ 2016	25/01/ 2017	7.127500021	-3.832056672	0.0078125	0.004998405	13.112	6.19140625

Applying the LPPL model to **S.N.G.N. ROMGAZ S.A. (SNG RO Equity)** on daily data between 12/11/2013 - 02/10/2017, we managed to identify only one financial bubble regime (Table 5).

Table 6

All bubbles regimes detected applying the LPPL model to BRD - GROUPE SOCIETE GENERALE S.A. (BRD RO Equity)

BRD - GROUPE SOCIETE GENERALE S.A. (BRD RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
15/04/ 2005	27/02/ 2006	2.948197237	-0.0071967	0.8984375	0.150921628	6	6.42578125
25/03/ 2009	26/08/ 2009	2.770714232	-0.166294681	0.359375	0.033433173	17.912	6.240234375
14/03/ 2014	30/06/ 2014	2.306509664	-0.053862111	0.3125	0.091282209	7	6.2109375
25/08/ 2015	24/11/ 2015	2.680355932	-0.120226957	0.2421875	0.066622587	12.032	6.416015625
26/05/ 2016	09/08/ 2016	2.519815855	-0.047681372	0.4453125	0.092792633	3.832	6.376953125

Applying the LPPL model to **BRD - GROUPE SOCIETE GENERALE S.A. (BRD RO Equity)** on daily data between 16/01/2001 - 02/10/2017, we managed to identify a total number of 5 financial bubbles regimes (Table 6).

Table 7

All bubbles regimes detected applying the LPPL model to SOCIETATEA ENERGETICA ELECTRICA S.A. (EL RO Equity)

SOCIETATEA ENERGETICA ELECTRICA S.A. (EL RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
17/04/ 2015	28/08/ 2015	2.562053686	-0.002084511	0.875	0.222210553	6.064	6.357421875

Applying the LPPL model to **SOCIETATEA ENERGETICA ELECTRICA S.A. (EL RO Equity)** on daily data between 04/07/2014 - 02/10/2017, we managed to identify only one financial bubble regime (Table 7).

Table 8

All bubbles regimes detected applying the LPPL model to S.N.T.G.N. TRANSGAZ S.A. (TGN RO Equity)

S.N.T.G.N. TRANSGAZ S.A. (TGN RO Equity)							
Start Date	**Critical Time**	***LPPL Parameters***					
		A	***B***	***β***	***C***	***ω***	***Ø***
03/03/ 2009	14/04/ 2010	5.900313827	-0.241306793	0.2578125	0.059047887	10.024	6.455078125
10/06/ 2011	21/02/ 2012	5.694214007	-0.124244658	0.234375	0.06729812	8.04	6.201171875

Applying the LPPL model to **S.N.T.G.N. TRANSGAZ S.A. (TGN RO Equity)** on daily data between 24/01/2008 - 02/10/2017, we managed to identify a total number of 2 financial bubbles regimes (Table 8).

Table 9

All bubbles regimes detected applying the LPPL model to C.N.T.E.E. TRANSELECTRICA (TEL RO Equity)

C.N.T.E.E. TRANSELECTRICA (TEL RO Equity)							
Start Date	**Critical Time**	***LPPL Parameters***					
		A	***B***	***β***	***C***	***ω***	***Ø***
30/08/ 2006	19/02 /2007	3.752589729	-0.018435371	0.671875	0.160175424	7.968	6.54296875
21/04/ 2009	08/10/ 2009	7.793650912	-5.134459262	0.0078125	0.003900378	4.128	6.25
15/12/ 2014	20/02/ 2015	8.530426463	-5.036427907	0.0078125	0.002574291	7.96	6.279296875

Applying the LPPL model to **C.N.T.E.E. TRANSELECTRICA (TEL RO Equity)** on daily data between 29/08/2006 - 02/10/2017, we managed to identify a total number of 3 financial bubbles regimes (Table 9).

Table 10
All bubbles regimes detected applying the LPPL model to SIF OLTENIA S.A. (SIF5 RO Equity)

SIF OLTENIA S.A. (SIF5 RO Equity)							
Start Date	**Critical Time**	***LPPL Parameters***					
		A	***B***	***β***	***C***	***ω***	***Ø***
10/07 /2003	06/09/ 2004	0.600134839	-0.9120526	0.1484375	0.025739445	4.992	6.50390625
01/12/ 2005	16/01/ 2006	1.475954601	-0.218929218	0.328125	0.091084163	5.088	6.46484375
05/10/ 2007	24/07/ 2007	1.704400292	-0.083789468	0.4375	0.06715313	9.104	6.171875
10/12/ 2009	04/02/ 2010	0.626409217	-0.007308415	0.90625	0.123845144	15.024	6.357421875
15/12/ 2011	21/02/ 2012	0.480254949	-0.067537654	0.4921875	0.081518914	8.936	6.416015625

Applying the LPPL model to **SIF OLTENIA S.A. (SIF5 RO Equity)** on daily data between 19/11/1999 - 02/10/2017, we managed to identify a total number of 5 financial bubbles regimes (Table 10).

Table 11
All bubbles regimes detected applying the LPPL model to SIF BANAT CRISANA S.A. (SIF1 RO Equity)

SIF BANAT CRISANA S.A. (SIF1 RO Equity)							
Start Date	**Critical Time**	***LPPL Parameters***					
		A	***B***	***β***	***C***	***ω***	***Ø***
21/01/ 2005	01/04/ 2006	1.44730778	-0.375482253	0.2265625	0.071323965	17.128	6.240234375
19/03/ 2007	24/07/ 2007	1.601151354	-0.077752117	0.4453125	0.078764304	3.952	6.044921875
31/03/ 2009	04/02/ 2010	0.495011847	-0.011208489	0.765625	0.09077931	18.016	6.23046875
08/09/ 2012	14/03/ 2013	0.41687293	-0.057751937	0.34375	0.094405037	6.032	6.1328125

Applying the LPPL model to **SIF BANAT CRISANA S.A. (SIF1 RO Equity)** on daily data between 19/11/1999 - 02/10/2017, we managed to identify a total number of 4 financial bubbles regimes (Table 11).

Table 12
All bubbles regimes detected applying the LPPL model to SIF MOLDOVA S.A. (SIF2 RO Equity)

SIF MOLDOVA S.A. (SIF2 RO Equity)							
Start Date	**Critical Time**	***LPPL Parameters***					
		A	***B***	***β***	***C***	***ω***	***Ø***
12/05/ 2003	06/11/ 2004	19.52325315	-20.59973737	0.0078125	0.003294161	5	6.162109375
11/11/ 2004	18/02/ 2005	0.27319719	-0.495935458	0.265625	0.04376212	10.112	6.220703125
29/03/ 2005	01/10/ 2006	0.302960037	-0.034258267	0.65625	0.089575553	8.96	6.435546875
07/06/ 2006	11/06/ 2006	0.682992316	-0.123767049	0.4140625	0.02187078	15.992	6.220703125
28/04/ 2009	21/09/ 2009	-0.144686405	-0.308271034	0.2421875	0.104309023	3.192	6.259765625
10/06/ 2011	02/06/ 2012	-0.292071536	-0.024851794	0.765625	0.101610988	11.84	6.259765625

Applying the LPPL model to **SIF MOLDOVA S.A. (SIF2 RO Equity)** on daily data between 19/11/1999 - 02/10/2017, we managed to identify a total number of 6 financial bubbles regimes (Table 12).

Table 13
All bubbles regimes detected applying the LPPL model to SIF TRANSILVANIA S.A. (SIF3 RO Equity)

SIF TRANSILVANIA S.A. (SIF3 RO Equity)							
Start Date	**Critical Time**	***LPPL Parameters***					
		A	***B***	***β***	***C***	***ω***	***Ø***
07/08/ 2005	01/04/ 2006	-0.584304995	-0.01334564	0.7265625	0.166863362	17.096	6.357421875
11/02/ 2011	03/01/ 2012	-1.021004615	-0.01763345	0.6875	0.229310859	16.968	6.376953125

Applying the LPPL model to **SIF TRANSILVANIA S.A. (SIF3 RO Equity)** on daily data between 19/11/1999 - 02/10/2017, we managed to identify a total number of 2 financial bubbles regimes (Table 13).

Table 14
All bubbles regimes detected applying the LPPL model to SIF MUNTENIA S.A. (SIF4 RO Equity)

SIF MUNTENIA S.A. (SIF4 RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
27/01/ 2005	01/09/ 2006	0.856676687	-0.139077824	0.3828125	0.109493197	5.104	6.34765625
04/08/ 2009	15/09/ 2009	6.966331626	-7.221226209	0.0078125	0.005007898	3.168	6.279296875
19/10/ 2011	13/02/ 2012	1.259485773	-1.472455596	0.0625	0.022745679	10	6.34765625
08/05/ 2013	23/01/ 2014	0.227710875	-0.203099989	0.2421875	0.083700933	3.144	6.328125

Applying the LPPL model to **SIF MUNTENIA S.A. (SIF4 RO Equity)** on daily data between 19/11/1999 - 02/10/2017, we managed to identify a total number of 4 financial bubbles regimes (Table 14).

Table 15
All bubbles regimes detected applying the LPPL model to S.N. NUCLEARELECTRICA S.A. (SNN RO Equity)

S.N. NUCLEARELECTRICA S.A. (SNN RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
None							

Applying the LPPL model to **S.N. NUCLEARELECTRICA S.A. (SNN RO Equity)** on daily data between 04/11/2013 - 02/10/2017, we didn't manage to identify any financial bubble regime (Table 15).

Table 16
All bubbles regimes detected applying the LPPL model to CONPET SA Ploiești (COTE RO Equity)

CONPET SA Ploieşti (COTE RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
29/11/	02/09/	5.058822277	-0.452642199	0.1171875	0.019785305	3.952	6.572265625

2016	2017						

Applying the LPPL model to **CONPET SA Ploiești (COTE RO Equity)** on daily data between 31/01/2005 - 02/10/2017, we managed to identify only one financial bubble regime (Table 16).

Table 17

All bubbles regimes detected applying the LPPL model to BURSA DE VALORI BUCUREȘTI SA (BVB RO Equity)

BURSA DE VALORI BUCUREŞTI SA (BVB RO Equity)							
Start Date	**Critical Time**	***LPPL Parameters***					
		A	***B***	***β***	***C***	***ω***	***Ø***
05/09/ 2013	23/12/ 2013	3.38793929	-0.00365008	0.9765625	0.130234616	7.912	6.3671875
16/06/ 2014	28/01/ 2015	14.12468381	-10.36079977	0.0078125	0.001118327	12.088	6.025390625

Applying the LPPL model to **BURSA DE VALORI BUCUREȘTI SA (BVB RO Equity)** on daily data between 09/06/2010 - 02/10/2017, we managed to identify a total number of 2 financial bubbles regimes (Table 17).

Table 18

All bubbles regimes detected applying the LPPL model to ANTIBIOTICE S.A. (ATB RO Equity)

ANTIBIOTICE S.A. (ATB RO Equity)							
Start Date	**Critical Time**	***LPPL Parameters***					
		A	***B***	***β***	***C***	***ω***	***Ø***
03/04/ 2004	19/01/ 2005	-0.355360487	-0.375123385	0.25	0.027322504	10.024	6.46484375
26/07/ 2010	13/01/ 2011	-0.769734953	-0.01857575	0.546875	0.142844897	7.016	6.26953125

Applying the LPPL model to **ANTIBIOTICE S.A. (ATB RO Equity)** on daily data between 26/11/1997 - 02/10/2017, we managed to identify a total number of 2 financial bubbles regimes (Table 18).

Table 19

All bubbles regimes detected applying the LPPL model to ALBALACT SA (ALBZ RO Equity)

ALBALACT SA (ALBZ RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
19/91/ 2007	18/07/ 2007	19.07755311	-19.16270764	0.0078125	0.005043993	5.936	6.40625

Applying the LPPL model to **ALBALACT SA (ALBZ RO Equity)** on daily data between 08/12/2004 - 02/10/2017, we managed to identify only one financial bubble regime (Table 19).

Table 20

All bubbles regimes detected applying the LPPL model to ELECTROMAGNETICA SA BUCUREȘTI (ELMA RO Equity)

ELECTROMAGNETICA SA BUCUREŞTI (ELMA RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
15/09/ 2009	04/06/ 2010	16.62543809	-16.88401549	0.0078125	0.002493568	6.048	6.064453125
25/05/ 2010	10/05/ 2010	13.66584166	-13.91759846	0.0078125	0.00203511	7.888	6.220703125

Applying the LPPL model to **ELECTROMAGNETICA SA BUCUREȘTI (ELMA RO Equity)** on daily data between 02/04/1999 - 02/10/2017, we managed to identify a total number of 2 financial bubbles regimes (Table 20).

Table 21

All bubbles regimes detected applying the LPPL model to IMPACT DEVELOPER & CONTRACTOR S.A. (BCC RO Equity)

IMPACT DEVELOPER & CONTRACTOR S.A. (BCC RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
19/04/ 2005	26/09/ 2005	4.592414691	-5.560348048	0.0078125	0.00809976	6.152	6.38671875

Applying the LPPL model to **IMPACT DEVELOPER & CONTRACTOR S.A. (BCC RO Equity)** on daily data between

11/06/2004 - 02/10/2017, we managed to identify only one financial bubble regime (Table 21).

Table 22

All bubbles regimes detected applying the LPPL model to BANCA COMERCIALA CARPATICA S.A. (IMP RO Equity)

BANCA COMERCIALA CARPATICA S.A. (IMP RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
03/08/2002	24/01/2003	0.468040815	-0.101681098	0.4375	0.222023751	4.112	6.279296875
09/08/2004	02/02/2005	1.083995612	-0.094563603	0.4375	0.046214867	13.064	6.416015625
16/09/2009	02/10/2010	-0.011176464	-0.118592812	0.375	0.108573489	5.064	5.927734375
09/09/2014	28/01/2015	6.658321726	-6.186880331	0.0078125	0.004721775	6.096	6.318359375

Applying the LPPL model to **BANCA COMERCIALA CARPATICA S.A. (IMP RO Equity)** on daily data between 19/12/1997 - 02/10/2017, we managed to identify a total number of 4 financial bubbles regimes (Table 22).

Table 23

All bubbles regimes detected applying the LPPL model to IAR SA Brașov (IARV RO Equity)

IAR SA Braşov (IARV RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
20/04/2006	26/10/2006	2.262519003	-0.087662471	0.5703125	0.112433033	3.024	6.298828125

Applying the LPPL model to **IAR SA Brașov (IARV RO Equity)** on daily data between 22/04/1999 - 02/10/2017, we managed to identify only one financial bubble regime (Table 23).

Table 24

All bubbles regimes detected applying the LPPL model to SSIF BRK FINANCIAL GROUP SA (BRK RO Equity)

SSIF BRK FINANCIAL GROUP SA (BRK RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
25/06/ 2009	04/01/ 2010	14.8653299	-15.97213532	0.0078125	0.004449697	5.936	6.376953125

Applying the LPPL model to **SSIF BRK FINANCIAL GROUP SA (BRK RO Equity)** on daily data between 14/03/2005 - 02/10/2017, we managed to identify only one financial bubble regime (Table 24).

Table 25

All bubbles regimes detected applying the LPPL model to ROMCAB SA TG. MUREȘ (MCAB RO Equity)

ROMCAB SA TG. MUREŞ (MCAB RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
None							

Applying the LPPL model to **ROMCAB SA TG. MUREȘ (MCAB RO Equity)** on daily data between 09/10/2006 - 02/10/2017, we didn't manage to identify any financial bubble regime (Table 25).

Table 26

All bubbles regimes detected applying the LPPL model to ROMCARBON SA BUZĂU (ROCE RO Equity)

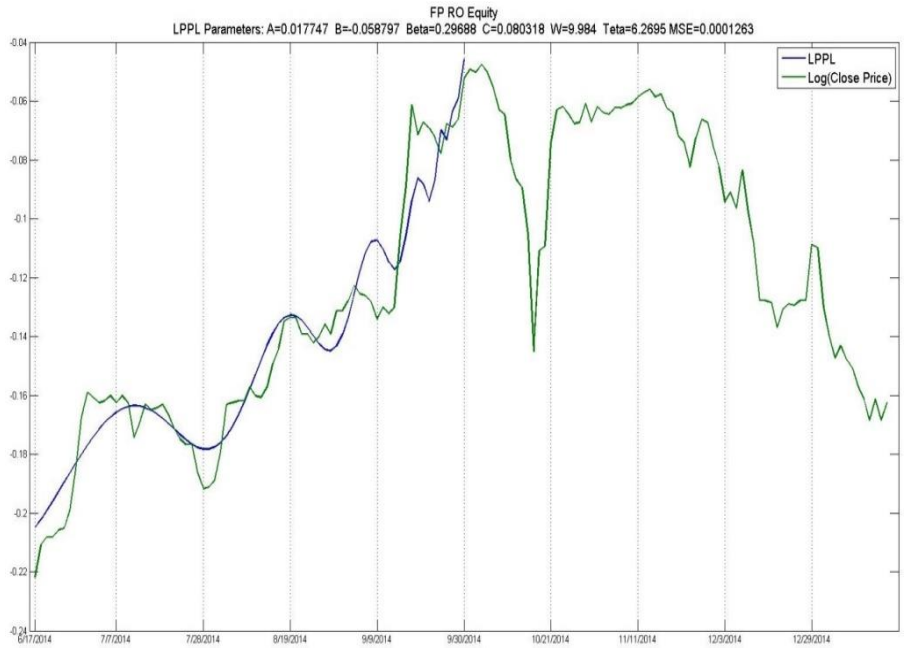
ROMCARBON SA BUZĂU (ROCE RO Equity)							
Start Date	Critical Time	*LPPL Parameters*					
		A	*B*	*β*	*C*	*ω*	*Ø*
15/12/ 2006	15/05/ 2007	3.584813992	-2.148807189	0.15625	0.03765896	4.16	6.572265625

Applying the LPPL model to **ROMCARBON SA BUZĂU (ROCE RO Equity)** on daily data between 05/04/1999 - 02/10/2017, we managed to identify only one financial bubble regime (Table 26).

Some representative LPPL calibrations can be found in the figures below:

Figure 3

LPPL fitted to FONDUL PROPRIETATEA (FP RO Equity) between June 17 2014 – September 30 2014 on daily data

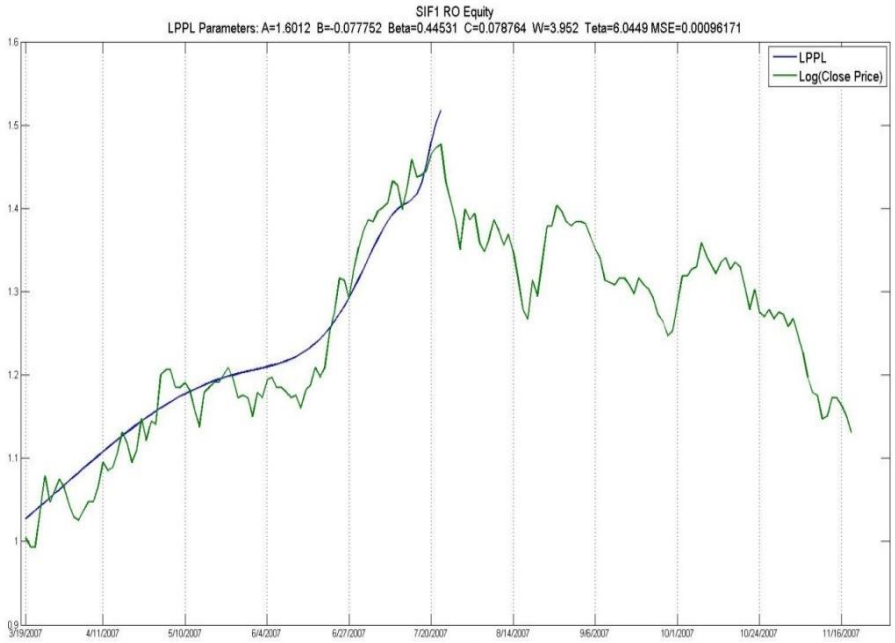


Data Source: Bloomberg

In the figure above (Figure 3) is exemplified the LPPL calibration to FONDUL PROPRIETATEA (FP RO Equity) between June 17 2014 – September 30 2014 on daily data with the following LPPL Parameters [$A = 0.018,\ B = 0.059,\ C = 0.08,\ \beta = 0.3,\ \omega = 10,\ \emptyset = 6.3$].

Figure 4

LPPL fitted to SIF BANAT CRISANA S.A. (SIF1 RO Equity) between March 19 2007 – July 24 2007 on daily data

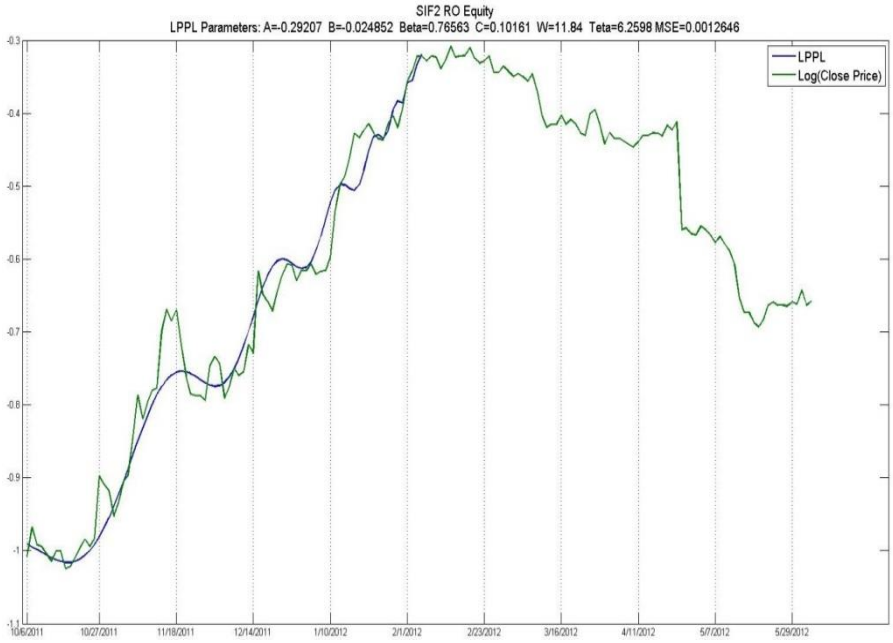


Data Source: Bloomberg

In the figure above (Figure 4) is exemplified the LPPL calibration to SIF BANAT CRISANA S.A. (SIF1 RO Equity) between March 19 2007 – July 24 2007 on daily data with the following LPPL Parameters [A=1.6, B=-0.08, C=0.08, β=0.45, ω=4, ∅=6].

Figure 5

LPPL fitted to SIF MOLDOVA S.A. (SIF2 RO Equity) between October 6 2011 – February 6 2012 on daily data

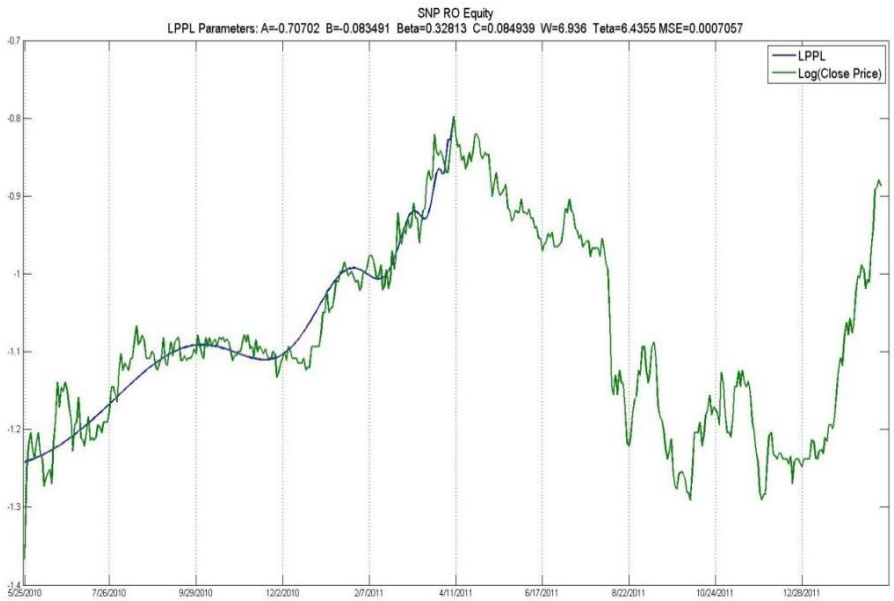


Data Source: Bloomberg

In the figure above (Figure 5) is exemplified the LPPL calibration to SIF MOLDOVA S.A. (SIF2 RO Equity) between October 6 2011 – February 6 2012 on daily data with the following LPPL Parameters [A=-0.3, B=-0.025, C=0.1, β=0.8, ω=12, ∅=6.3].

Figure 6

LPPL fitted to OMV PETROM S.A. (SNP RO Equity) between May 25 2010 – April 8 2011 on daily data



Data Source: Bloomberg

In the figure above (Figure 6) is exemplified the LPPL calibration to OMV PETROM S.A. (SNP RO Equity) between May 25 2010 – April 8 2011 on daily data with the following LPPL Parameters [A=-0.7, B=-0.08, C=0.08, β=0.33, ω=7, ∅=6.4].

6. Conclusions

We managed to find a total number of 54 LPPL model calibrations that follows the empirically observed restrictions, applied on top 25 blue chip stocks traded on Bucharest Stock Exchange between 1997-2017, using daily Bloomberg data.

In the recent global financial crisis (2007-2008) that was triggered by the collapse of the investment bank Lehman Brothers on September 15 2008, the LPPL model identified financial speculative bubbles simultaneously on 8 companies composing the BET-XT Index (C.N.T.E.E. TRANSELECTRICA, SIF OLTENIA S.A., SIF BANAT CRISANA S.A., SIF MOLDOVA S.A., SIF MUNTENIA S.A., ALBALACT SA, IAR SA Brașov, ROMCARBON SA BUZĂU).

Also, in the Greek government-debt crisis (2010-2011) that was a byproduct of the global financial crisis, the LPPL model identified speculative bubbles simultaneously on 13 companies (BANCA TRANSILVANIA S.A., OMV PETROM S.A., BRD - GROUPE SOCIETE GENERALE S.A., S.N.T.G.N. TRANSGAZ S.A., C.N.T.E.E. TRANSELECTRICA, SIF OLTENIA S.A., SIF BANAT CRISANA S.A., SIF MOLDOVA S.A., SIF MUNTENIA S.A., ANTIBIOTICE S.A., ELECTROMAGNETICA SA BUCUREȘTI, BANCA COMERCIALA CARPATICA S.A., SSIF BRK FINANCIAL GROUP SA).

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THE UNEMPLOYMENT RATE – AN ELUSIVE INDICATOR

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Abstract

This article presents the evaluation of one of the most important indicators in Romania, namely the unemployment rate. It aims to comparatively analyze the employment rate situation, the jobs availability for both Romania and other EU countries and the interest of young people in finding a job. The analysis shows a comparison between Romania and other EU countries, signaling a series of inconsistencies between the employment and the unemployment rates.

Keywords: quality life, economic development, job vacancy rate.

JEL Classification: E24

1. Introduction

The unemployment rate is a relevant indicator in assessing the quality of life, namely the level of economic development. But, like any indicator, the unemployment rate can also be a trap for some cases, depending on the method in which it is measured. The development level, the culture and the education level are some of the factors that may influence both the reality in terms of unemployment and the statistics which, depending on the context, can be misleading. One of the most frequent used definition given to the unemployed person is: the person that searches for a paid job, and who does not have such a job currently (Dobrotă, 1997).

Some authors approached the issue from a modern perspective and identified the "steady or natural unemployment", which was considered beneficial to the balanced functioning of the economy, meaning that it motivates the busy to work better not to

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lose their job, thus increasing productivity. (Ilie, Simona apud Pop, Luana, 2002).

The aim of this paper is to draw attention on one of the most important economic indicators, namely the unemployment rate, which looked at in isolation, may be wrong for Romania. The investigation method involves analysis of Eurostat data on unemployment, watching the situation in Romania and other EU countries and comparing them.

2. Employment rate vs unemployment rate

If we take the year 2015 as a reference, we see that Romania had an unemployment rate of 6.8%, lower than the average in the European Union and much lower than other countries with a higher standard of living than Romania's: the unemployment rate was of 6.9% in the Netherlands, 10.4% in France and 9.4% in Ireland. Even against Germany, which recorded the lowest unemployment rate in Europe (4.6%), while also being the economic engine within Europe, Romania's situation was an optimistic one, especially if we take into account the decreasing trend of the unemployment rate in the recent years.

On the other hand, if we analyze the employment rate, we see that Romania recorded an index of 66%, about 4% lower than the EU average (70.1%). Also, if we compare the situation of other countries to that of Romania's, we see that their employment rate is significantly greater than Romania's: France (69.5%), Portugal (69.1%), Sweden (80.5%), Lithuania (73.3%), Ireland (68.7%), Bulgaria (67.1%). However, the anomaly occurs when we compare Romania's unemployment rate to that of the countries listed above. Although they have an unquestionably higher employment rate than that of Romania, the unemployment rate recorded in each of the countries is still much higher than in our country.

Table 1

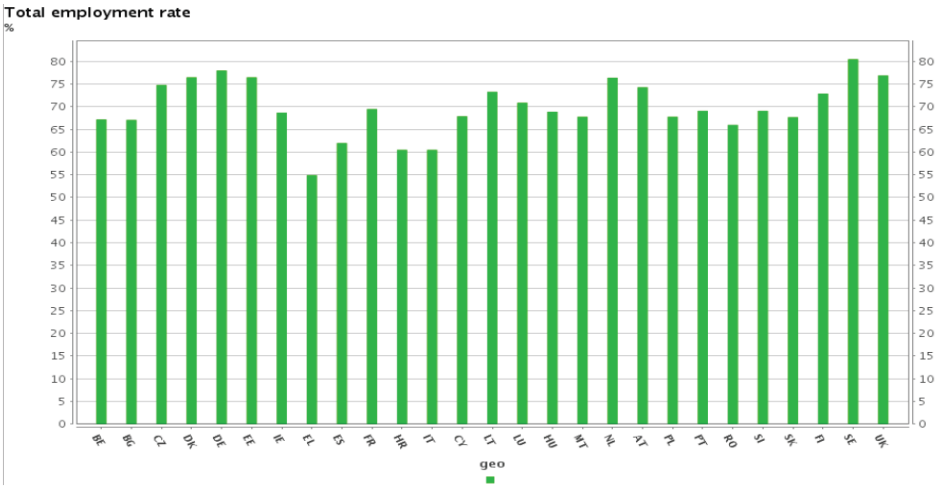
Employment VS Unemployment rate

Country	**Employment Rate %**	**Unemployment Rate %**
Romania	66	6.8
Portugal	69.1	12,6
Lituania	73.3	9.1

Irland	68.7	9.4
Bulgaria	67.1	9.2

Figure 1

Total employment rate



Source: Eurostat

In this respect, we should first mention the calculation methodology that determines the unemployment rate.

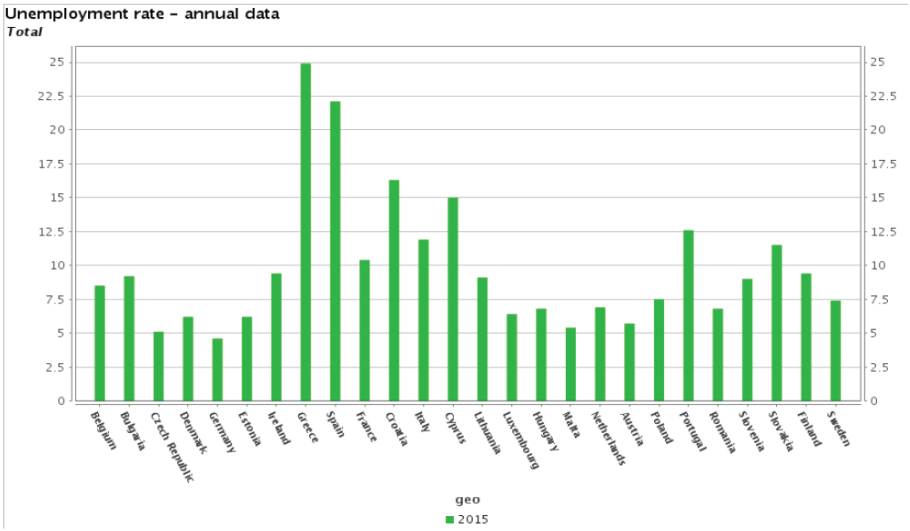
The unemployment rate is calculated as the ratio of the active labor force to the unemployed people. The unemployed are people aged 15 – 74 years old who do not have a job at the time the study is conducted, who are available to start work within the following two weeks and who were constantly seeking employment during the past weeks.

If we analyze Romania's situation, we notice that most of the unemployed people are not taken into account in these statistics. The first reason is that those who are registered as unemployed but no longer receive the unemployment compensation are expunged from the database after six months if they don't come back to the employment agency to renew their status. Also, the lack of jobs on the market discourages most Romanians from seeking a job, which makes them neither employed nor unemployed. "Emigration is not determined only by the level of the income but also by the distrust in institutions and policy makers". (Marga 2011)

Another reason concerns the population settled in other countries that has job and which is registered as employed, thus discharging the lack of available jobs in Romania.

Figure 2

Unemployment rate



Source: Eurostat

3. Job vacancy rate

The job vacancy rate measures the percentage of vacant posts and is calculated using the following formula: number of job vacancies / (number of occupied posts + number of job vacancies) * 100.

In this respect, Romania no longer has a very good position, as it can be found by 0.5% below the EU average, with a total of 53,780 job vacancies.

Germany occupies a leading position, with a rate of 2.6% and a total of 1,027,151 jobs, followed by the UK with a rate of 2.5% and a total of 752,000 job vacancies. The countries with rates lower than Romania's are: Bulgaria (0.8%), Ireland (0.9%), Greece (0.2%), Spain (0.6%), Croatia (0.7%), Lithuania (1.00%), Poland and Portugal, both with an index of 0.6%.

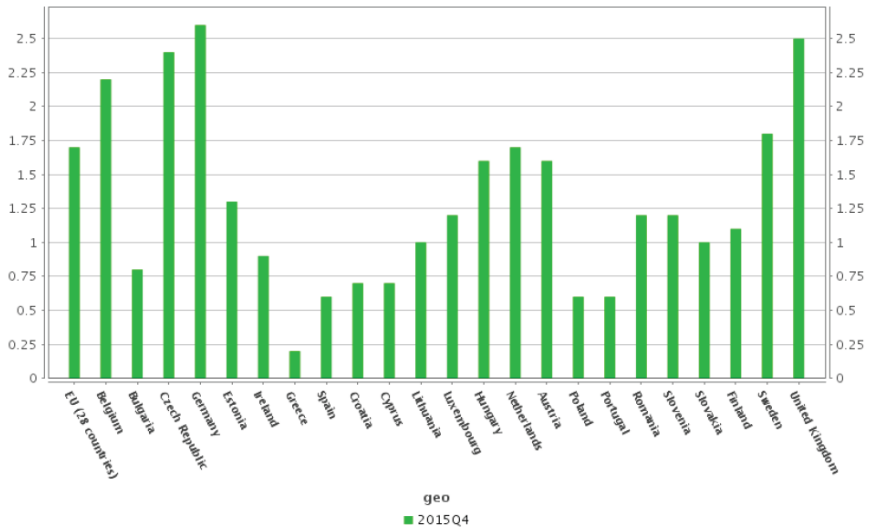
It is worth mentioning that not all job vacancies can find their candidate on the labor market, as many communities are not yet

ready for the new economic realities and schools do not prepare their students for the gradually diversified labor market. As Şfichi Cristina mentioned in her article *Unemployment in Romania during the crisis (2011)*: "Romanian economy will know the phenomenon of structural unemployment - people who want to work, but have minimum qualification required for available jobs."

One such example can be found in Romania, in Alba County, where the unemployment rate exceeds by far the national average, while the investors complain they cannot find enough labor force to conduct their business. A wiring factory (Sumitomo) opened its gates based on the workforce available in the area. Although the company has offered 1,500 jobs only 900 of them were occupied, most of them with people from the surrounding areas. The investors mainly complain about the lack of training on technical areas but also about the magnitude of a generalized phenomenon in Romania, namely the convenience of living with the help of the unemployment compensation. "The more of a mismatch in skills there is between available jobs and jobseekers, the longer it will take for displaced workers to find new jobs." (Gordon 1990). As a consequence the unemployment rate will be even higher.

Figure 3

Job vacancy rate



Source: Eurostat

4. NEET Indicator

A somewhat more realistic statistic is that related to the unemployment rate among young people between 15 – 24 years old, where Romania occupies a leading position in the European Union, with an index of 18.1 in the year 2015. In this respect, there are only three countries with higher percentages than Romania: Bulgaria (19.3%), Italy (21.4%) and Croatia (18.5%). Very large discrepancies are recorded between Romania and the Netherlands (4.7%), Germany (6.2%), Denmark (6.2%), Sweden (6.7%), Czech Republic (7.5%) and Austria (7.5%). One of the reasons has to do with the culture and perception of the young people towards finding a job. Thus, young people are accustomed to depend financially on their parents while studying, which makes it more difficult for them to detach from the advantages of a person who does not depend on a strict schedule. Another aspect refers to the fact that young people look for a job that matches their training, so that suitable jobs are harder to find.

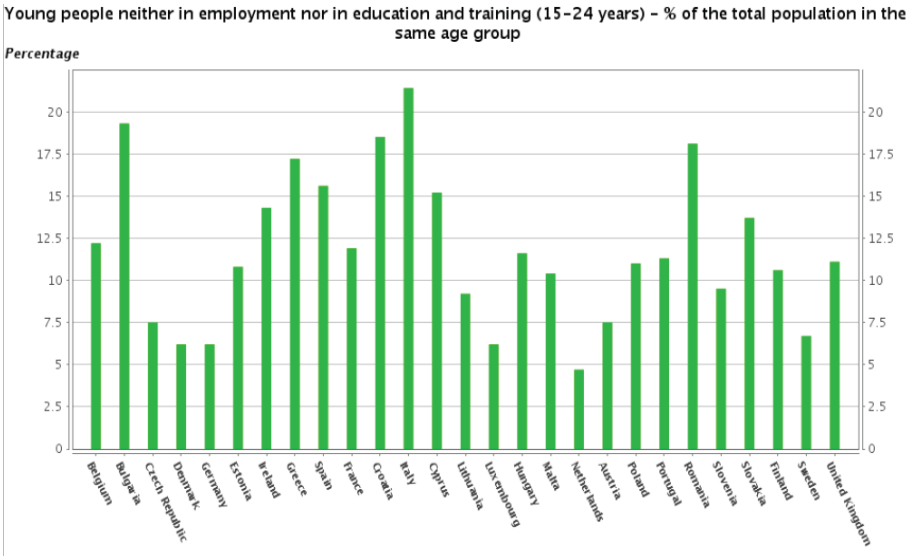
Juan Somavia, the General Director of International Labour Office concluded that: "Creating jobs for youth is not enough. Across the planet, youth are not only finding it difficult if not impossible to find jobs, but also they cannot find decent jobs. We are facing not only an economic challenge, but a security threat of monumental proportions." (International Labour Office 2010)

On the opposite side, young people from countries in Western Europe and not only, are encouraged to work during their study period, which makes them stick to the workforce or want to find a new job immediately after graduation.

The NEET indicator (young people neither in employment nor in education and training) offers important information about the group of young people aged 15 – 24 who are unemployed at the time of the survey or who have not received any kind of training for the past four weeks.

Figure 4

NEET indicator



Source: Eurostat

5. Conclusion

In conclusion, we can say that one of the most important economic indicators, designed to reflect the economic development and the quality of life in a country, does not seem to be very significant for Romania. The problem of unemployment must be addressed primarily through the number of job vacancies and the possibility of their occupancy, so the corroboration of the job vacancies with the preparation level of the active population. Another suggestion refers to the method by which the unemployment rate is calculated, which should be improved and updated to be specific to each country. Thus culture, mentality and trust in certain institutions may influence the correct evaluation of certain indicators.

The most representative example is the comparison between Romania and other EU member states starting from the two criteria (the employment and the unemployment rates). Thus, if the employment rate is an easily measured indicator, as there are several ways to verify the number of the employed people, in terms of unemployment rate the system is facing numerous difficulties.

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