

ECONOMIC AND FINANCIAL INSTABILITY PERIODS INDUCED THROUGH THE BANKING SYSTEM

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Abstract: This paper is an empirical study which analyzes the influence of banking system to the economic and financial environment. At the basis of this research there are two subjective definitions of economic instability periods (CII) and of financial instability periods (FII) and two composite indexes called EWI (Economic Warning Index) and FWI (Financial Warning Index) defined in a prior research. The countries included in the study are Czech Republic, Hungary and Romania. There is both a quantitative and qualitative approach. Using econometrics techniques as OLS regressions, Fixed effects and Fixed dummy effects there were identified significant banking indicators in explaining economic and financial instability periods. Then, I compose a banking index which captures the costs occurred to the banking system and I assess its performance in explaining the economic and financial instability indexes through in the sample and out of the sample techniques. This research aim to observe the influence of the banking sector evolution to the incidence of economic and financial instability periods and give us a warning regardless any negative trends in the macroeconomic or financial activity, affecting the national or the global situation. Using model simulations on historical data, the model performance was assessed upon in the sample and out of sample estimation techniques. The evaluation results suggest that banking indicators give us a warning signal of the negative trend of economic and financial environment.

Keywords: *economic instability, financial instability, leading indicators, banking system.*

JEL classification: *G01*

1. Introduction

The recent economic and financial crises have had a significant impact on the world economy. It revealed the need of continuous improvement in identifying, measuring and predicting vulnerabilities of the economy as a whole. A key lesson drawn from the past experience was that we have to take into consideration the interconnections between economic, financial and banking system.

Current crises offered a great lesson that the surveillance for crises prevention must be more rigorous and with a better incorporation of financial sector. After its onset it was highlighted the requirement to take care about cross-border spillovers, macro-financial linkages within and across countries and broader systemic risks for the global economy.³

³ Kato, T. (2010), "Early Warning Systems and Their Role in Surveillance", Deputy Managing Director, International Monetary Fund

Because it is not possible to predict the exact point in time at which the crisis sets in, the purpose of this paper is to identify possible vulnerabilities induced through banking system and to treat them in order to mitigate the costs of the economy. I defined a set of eighteen potential leading indicators from banking/financial sector, in the period 2000 - 2012. It was composed a balance panel with seven hundred and eighty observations. At the basis of my decision to choose a continuous model was the fact that it motivates policy makers in steering policy continuously. Using econometrics techniques there were identified significant banking indicators in explaining economic and financial instability periods. Then, it was composed a banking index which captures the costs occurred to the banking system. Its performance in explaining the economic and financial instability indexes it was assessed through in the sample and out of the sample techniques. The research result reveals the importance of the banking system indicators in explaining economic and financial instability periods. A better incorporation of those indicators in supervisory tools of decision factors would help in mitigating economy costs occurred in such difficulty periods.

This paper is organized as follows. Second section presents us literature review of economic, financial and banking indexes created to identify the vulnerabilities and to treat them in order to avoid large scale damages. Those researches aim to obtain a complete picture of the evolution of concerns to improve measuring, predicting and managing the vulnerabilities to the economic system. It is also highlighted the current precarious context. Third section presents the construction of the panel data, through selection of the countries, selection of potential leading indicators and of the research period. There are also presented the transformations of the variables, in order to obtain comparable results. Fourth section presents us the composition of the model, followed by econometrics techniques of estimation as OLS, Fixed effects and Fixed dummy effects applied for the panel and econometrics techniques used to assess its performance in term of in-the-sample and out-of-sample fit. Fifth section shows the results, presenting the estimations and their interpretations. Last section concludes about the utility of this model in actual environment and summarizes the main ideas. Econometric code in R language and detailed description consisting in five appendixes is available at request.

2. Literature review

The interest of researchers in early warning was visible even in the 1979 years with Paul Krugman's and Bilson models for explaining currency crises. Paul Krugman in his paper "A Model of Balance of Payments" presents the situations when balance of payments problems transforms into balance of payments crises⁴. Paul Krugman believes that only an analysis of international size could give a warning regarding the amplitude of the current crises. He identifies three generations of currency crises, from which the third one tries to answer at two questions: should the economies with large currency debt avoid currency depreciation and what is the role of capital mobility. In first edition of his book "The Return of Depression Economics", Paul Krugman associated crises with bacteria that once were severe epidemics, but

⁴ Krugman, P. (1979), "A Model of Balance-of-Payments Crises", *Journal of Money, Credit and Banking* 11(3), pp. 311–325

considered defeated by the modern medicine. Surprisingly those bacteria revived in a stronger form, resistant to all antibiotics. His conclusion is that the entire economy is “a surprisingly dangerous place”.⁵

Those things happen in a context in which Ben Bernanke (2004) and Robert Lucas (2003), among other economists, declared few years ago that even the economy will occasionally suffer any recoil, the era of great depressions is already gone. The economic cycle was considered an outdated notion. The economist states that we have to learn from all economic and financial crises, because anyway those are very hard to predict. Graciela Kaminsky, Saul Lizondo and Carmen Reinhart in their paper “Leading Indicators of Currency Crises” compose an early warning system in predictive purpose for currency crises. The authors use as leading indicators a broad variety of variables: external sector, financial sector, real sector, public finances, institutional and structural variables, political variables and “contagion effects”, whose behavior is studied. They compose an index of exchange market pressure with the significant indicators. When this index is above its mean by more than three standard deviations it is considered as crises.⁶

Lucia Alessi and Carsten Detken (using signaling approach developed by Kaminsky, Lizondo and Reinhart used to predict foreign exchange and banking crises) composed early warning indicators for costly asset price boom/ bust cycles. They highlight 3 gaps identified on “leaning against the wind”. They identify high-cost boom which is a boom followed by three years of real GDP growth lower with at least 3 percentage points than the potential growth and low-cost boom. In 1989 it was a HCB, in 2000 only 60% of the first wave has been found, and they also identified a new wave in 2007. The conclusions of the paper highlights that financial variables are preferred to real variables in predicting costly asset price booms.

Rose and Spiegel analyzes the occurrence and effects of a crisis using a Multiple Indicator Multiple Cause (introduced by Goldberger 1972), focusing on national variables, but ignoring cross country “contagion” effects. They analyze a continuous variable, taking care only on the cross-country incidence, and ignoring the time-series effects, fact which failed the results because they take care on national variables. The analysis of Stephen G. Cecchetti, Marion Kohler and Christian Upper based on 40 systemic banking crises reveal that current financial crises is composed from a broad range of economic factors and they identify systemic banking crises tendency to create negative output effects.⁷

The paper’s dataset “This Time is Different: A Panoramic View of Eight Centuries of Financial Crises” includes African, Asian, European, Latin American countries, North America and Oceania, in 1800-2006 period and use variables as debts, prices, exchange rates, government finances, trade, GDP and capital flows and construct a composite index of financial instability that is multidimensional. The conclusion is that “financial crises are more a way of life affecting all” and that serial default is a widespread phenomenon across emerging markets and several advanced economies. If prior to World War II, serial banking crises in advanced economies were most common, as other emerging markets developed their financial sector,

⁵ Krugman, P. (2000), “The Return of Depression Economics”

⁶ Kaminsky, G., S. Lizondo and C. Reinhart (1998), “Leading Indicators of Currency Crises” <http://ideas.repec.org/p/pramprapa/6981.html>

⁷ Cecchetti, S.G., M. Kohler and C. Upper (2009), “Financial Crises and Economic activity”, NBER Working Paper Series

they became part to the “serial banking crises”. Also, they identified a pattern in the incidence of IMF programs. Another important fact is that private debts increase prior to a banking crisis and that banking crises precede or coincide with sovereign debt crises. Debt continues to rise after default as arrears accumulate and GDP contracts. The authors identified that short term debts become public after the crises occurs. Their analysis confirms that financial crises emanate from the financial centers with transmission through interest rate shocks, commodity prices collapses, capital flows and shocks to investor confidence. An extremely valuable conclusion is that tranquil period of 2003-2007 proves once that each lull is followed by a new wave of defaults.⁸

Another paper of Carmen M. Reinhart and Kenneth S. Rogoff is focused on banking crises and highlights that crises are more severe for the financial centers like UK, USA and France. They analyze for the first time in the literature the role of “housing prices” and find similarities of behavior of frequency and duration of banking crises between developed and middle-income countries.⁹

3. Data set

I construct a balanced panel of three countries over 2000 – 2012 at annually frequency, obtained from World Bank and containing a number of seven hundred and eighty observations. I choose to perform the analysis for Czech, Hungary and Romania because according to Eurostat Database and World Bank analysis those countries registered comparable level of variables as GDP per person, unemployment rate, public debt, budget balance and other economic or financial indicators. Because the number of observations is the same for all countries, the panel is balanced. I chose to use annually percentage changes (%) data in order to avoid the limitation of available indicators with predictability power of the model. Using monthly or quarterly data the explanatory power of the model could be reduce by omitting important potential leading indicators which are not available in monthly frequency.

At the basis of this research there are two subjective definitions of economic instability periods (CII) and of financial instability periods (FII) and two composite indexes called EWI (Economic Warning Index) and FWI (Financial Warning Index) defined in a prior research. Economic Warning Index (EWI) represents a weighted cost of economic instability periods. Financial Warning Index (FWI) represents a weighted cost of financial instability periods. On the other side there was identified a set of potential leading indicators belonging to banking sector. Those eighteen indicators were selected based on their significance and on their relevance related to crises symptoms. My selection of indicators was influenced by availability of data and frequency of observations. During the research a problem in estimating the crisis monitoring indicators was the lack of timely and appropriate data, which avoid a complex analysis based on more variables and more years.

The entire list of potential leading indicators was obtained from World Bank database in the idea of having consistency of the methodology used for calculation of this

⁸ Reinhart, C.M. and K.S. Rogoff(2008), “This Time is Different: A Panoramic view of eight Centuries of Financial Crises”, NBER Working Paper

⁹ Reinhart, C.M. and K.S. Rogoff (2008), “Banking crises: An equal opportunity menace”, Working paper 14587

indicator. According to World Bank, the definitions of indicators which compound the panel are as follows¹⁰.

Bank capital to assets represents the ratio of bank capital and reserves to total assets.

Bank nonperforming loans to total gross loans represent the value of nonperforming loans divided by the total value of the loan portfolio. The loan amount recorded as nonperforming should be the gross value of the loan as recorded on the balance sheet, not just the amount that is overdue.

Claims on central government include loans to central government institutions net of deposits.

Claims on other sectors of the domestic economy include gross credit from the financial system to households, nonprofit institutions serving households, nonfinancial corporations, state and local governments, and social security funds.

Deposit interest rate is the rate paid by commercial or similar banks for demand, time, or savings deposits. The terms and conditions attached to these rates differ by country, however, limiting their comparability.

Domestic credit provided by the banking sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits).

Foreign direct investments are the net inflows of investment to acquire a lasting management interest in an enterprise operating in an economy other than that of the investor.

Interest rate spread is the interest rate charged by banks on loans to private sector customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits

Lending rate is the bank rate that usually meets the short- and medium-term financing needs of the private sector and it is normally differentiated according to creditworthiness of borrowers and objectives of financing.

Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year, without including investment companies, mutual funds, or other collective investment vehicles.

Market capitalization (also known as market value) is the share price times the number of shares outstanding.

Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition is frequently called M2. The change in the money supply is measured as the difference in end-of-year totals relative to the level of M2 in the preceding year.

Portfolio equity includes net inflows from equity securities other than those recorded as direct investment and including shares, stocks, depository receipts, and direct purchases of shares in local stock markets by foreign investors.

Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.

¹⁰ World Bank, 2013, <http://data.worldbank.org/indicator>

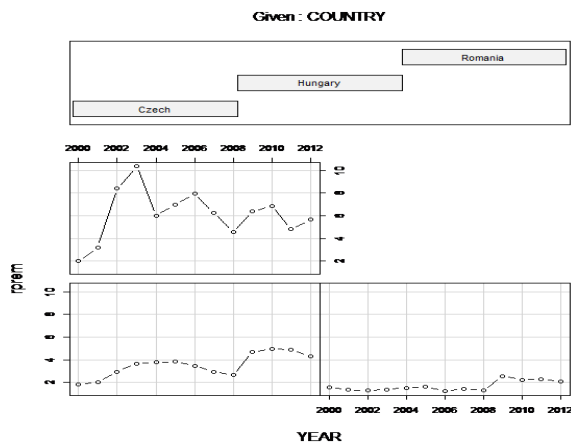
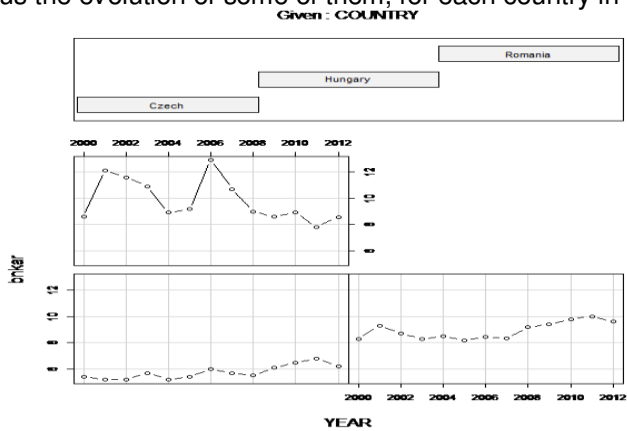
Risk premium on lending is the interest rate charged by banks on loans to private sector customers minus the "risk free" treasury bill interest rate at which short-term government securities are issued or traded in the market.

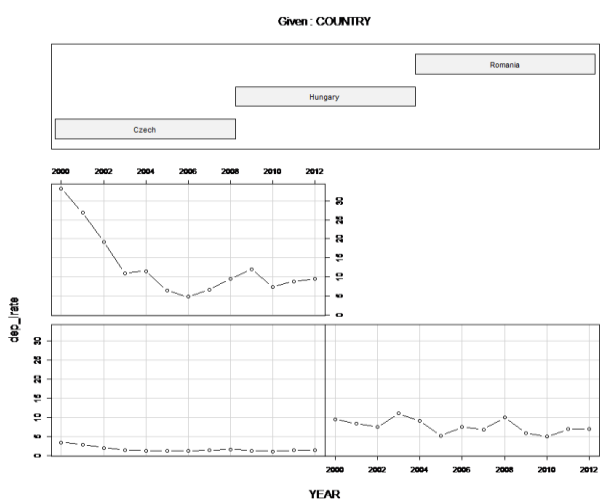
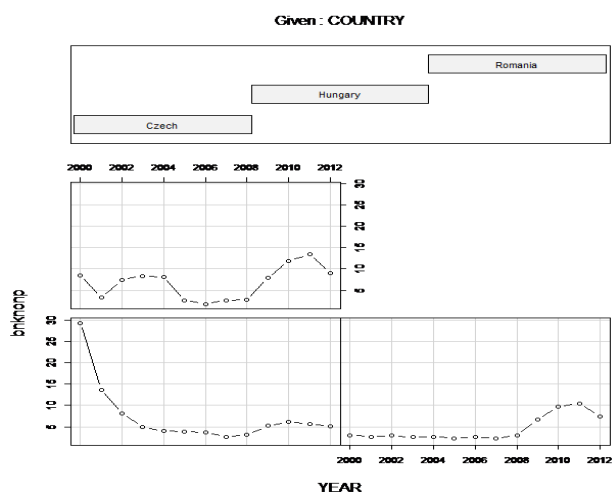
S&P Global Equity Indices measure the U.S. dollar price change in the stock markets covered by the S&P/IFCI and S&P/Frontier BMI country indices.

Stocks traded refer to the total value of shares traded during the period. This indicator complements the market capitalization ratio by showing whether market size is matched by trading.

Turnover ratio is the total value of shares traded during the period divided by the average market capitalization for the period.

The above indicators were collected for Czech, Hungary and Romania because despite the difference which appears for each country and for time to time, those countries registered a similar level of data. In the period 2000 – 2012, according to the data those variables registered evolutions (either positive or negative) from 15% to 37,705%, indicating instability periods. Using annually percentage changes assure us that the variable are standardised and there are no outliers in the dataset. To justify the choice of potential leading indicators, the following four graphs present us the evolution of some of them, for each country in the analyzed period.





4. Model

4.1 Composition

At the basis of this research there are two subjective definitions of economic instability periods (CII) and of financial instability periods (FII) and two composite indexes called EWI (Economic Warning Index) and FWI (Financial Warning Index) defined as follows in a prior research ¹¹.

CII was composed by applying weighted schemes to monthly industrial production growth, unemployment rate growth and external trade growth. In this equation a growth of unemployment rate represents a cost for the economy, so it enters with positive sign in composition of CII. Because first difference of external trade is negative, it also represents a cost for the economy. Industrial production growth

¹¹ Rodica – Oana Ionita, 2013 - "Early Warning Indicators of economic and financial instability indexes" published at FIBA – International Finance and Banking Conference

enters in the equation with negative sign, because it adds value for the economic activity.

FII is composed by applying weighted schemes to an interbank benchmark index specific to each country and to a capital market index. For the interbank reference index I used PRIBOR for Czech Republic, BUBOR for Hungary and ROBOR for Romania. For capital market I used BUX for Czech Republic, PSE for Hungary and BET for Romania.

$$CII = \frac{(unr - ext - indp)}{FII = ABS\left(\frac{PRIBOR / BUBOR / ROBOR + BUX / PSE / BET}{2}\right)}$$

$$EWI = 0.006 * ecsi + 0.0111 * mmir + 0.0148 * cpri + 0.0049 * rtt + 0.0186 * hicp + 0.0319 * stockmc + 0.0124 * ir3m + 0.3697 * exchr_gr + confin * 0.0032 + ind_k * 0.5 + ln_fres * 0.0275$$

$$FWI = 0.02 * ecsi + 0.0234 * mmir + 0.019 * cpri + 0.0139 * rtt + 0.043 * hicp + 0.5 * stockmc + 0.0607 * ir3m + 0.0147 * exchr_gr + confin * 0.1614 + ind_k * 0.1344 + ln_fres * 0.0096$$

For those indicators it was tested in prior research the heterogeneity across countries and years and it was revealed that the countries and year of the research are comparable, registering small differences.

On the other side, there are eighteen potential leading indicators belonging to banking system. Those eighteen indicators were selected based on their significance and on their relevance related to crises symptoms.

4.2 Methodology

This article purpose is to investigate which of the banking indicators are significant in explaining periods of economic instability quantified through CII, periods of financial instability quantified through FII, economic warning index (EWI) and financial warning index (FWI).

One of the methods used for estimating the unknown parameters in the two linear regression models was OLS. Because OLS regression does not consider heterogeneity across countries and time I continue the analysis with fixed effects and fixed dummy effects. In the following analysis I considered also the heterogeneity across countries and across years. I estimated fixed dummy effects because the simplest approach to model heterogeneity is to assume that each country has its own specific intercept (dummy). Each component of the factor variable is absorbing the effects particular to each country. I also performed a Fixed effects estimation. In panel data analysis, the term fixed effects estimator (also known as the within estimator) is used to refer to an estimator for the coefficients in the regression model. If we assume fixed effects, we impose time independent effects for each entity that are possibly correlated with the regressors.

In Table 1 are available the results of the three different of estimations for the four indexes.

Table 1: Estimation results

Index/ Adjusted R ²	OLS	Fixed effects	Fixed dummy effects
CII	48.53%	38.03%	97.41%
FII	57.35%	37.53%	91.00%
EWI	89.80%	42.87%	99.97%
FWI	70.51%	42.91%	98.69%

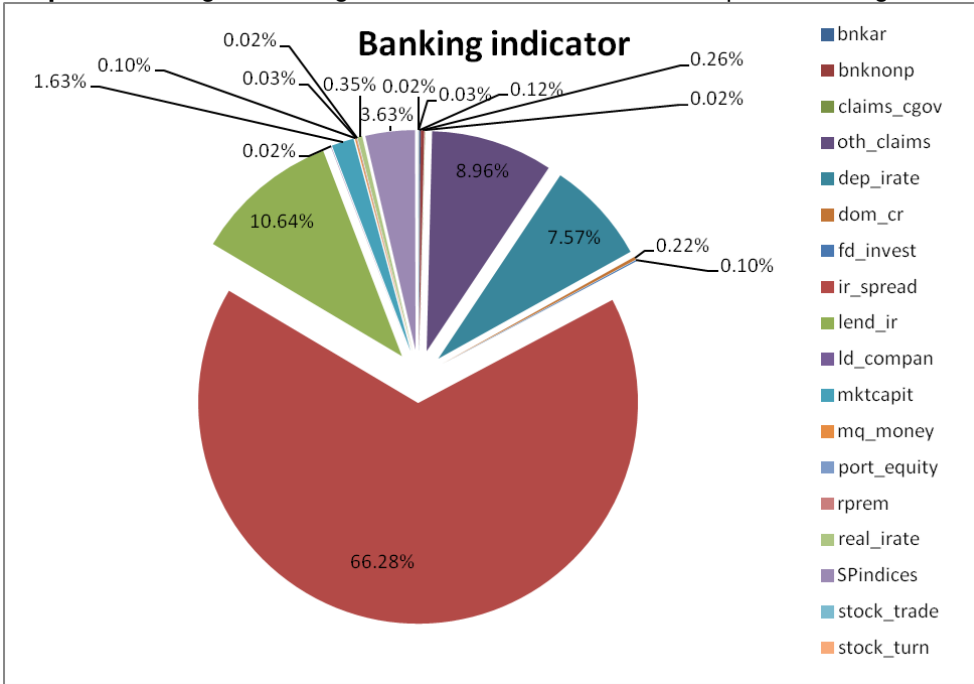
Comparing the results it is visible that fixed effects estimation has the lower explanatory power of the indexes, it explain the economic and financial warning index only in proportion of 42.87%, respective 42.91%. OLS estimation increase the explanatory power of the model explaining the economic instability period in proportion of 48.53%, financial instability period in proportion of 57.35%, economic warning index in proportion of 89.80% and financial warning index in proportion of 70.51%.

By including a dummy in the model, fixed dummy effects estimation fits better the model. According to the estimation, banking indicators explain over 90% of the economic and financial instability periods and indexes.

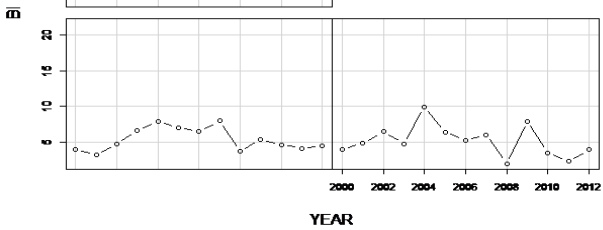
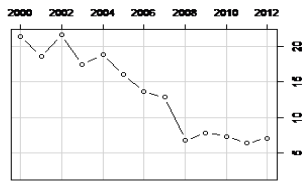
In order to identify vulnerabilities of the economic and financial environment, I composed a banking index that is multidimensional with significant variables estimated using Fixed Dummy Effects. This index represents the cost of the banking system. Higher values of the index indicate higher costs suffered by the banking system and also a cost for the whole economic environment. The significant variables were weighted according to their p-value significance. As smaller was the p-value, as important was that variable in explaining the Early Warning Index, illustrated in Graph 5. In Graph 6 it is presented the evolution of the Banking Index (BI). According to the Graph 6 its is visible that the index behave better for Romania, than for the other countries included in the study. I made this affirmation because the index captures Romania's ascending cost of banking starting with 2008 and up to the middle of 2009 and the new cost occurred starting with 2011 and up to the present.

Graph 5: Banking index weights

Graph 6: Banking Index

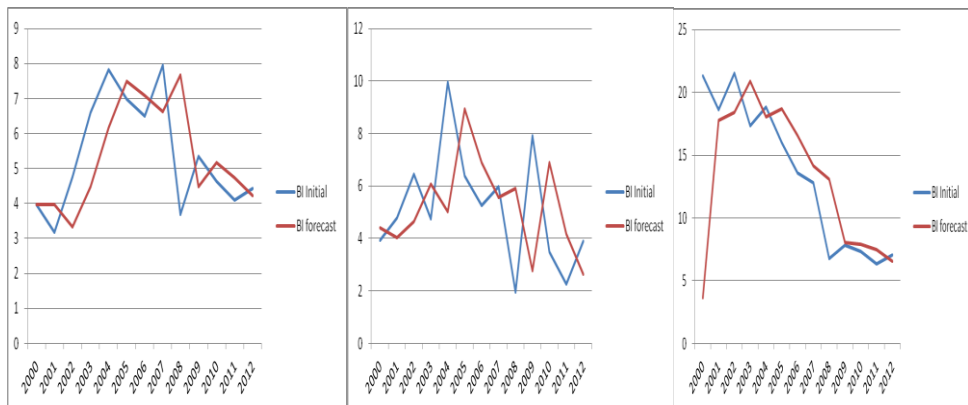


Given : COUNTRY



4.3 Performance

As follows I used econometric techniques to assess in the sample and out of sample performance of the model. Based on in the sample estimation, Graph 7 – 9 captures the comparison between the observed and the forecast values registered by the Banking Index. It is visible the comparability of the two series (from left to right: Czech, Hungary, Romania) with small differences which may appear from calculation of collected data.



5. Results

At the basis of this research there are two subjective definitions of economic instability periods (CII) and of financial instability periods (FII) and two composite indexes called EWI (Economic Warning Index) and FWI (Financial Warning Index) defined in a prior research. Because it is not possible to predict the exact point in time at which the crisis sets in, the purpose of this paper is to identify possible vulnerabilities induced through banking system and to treat them in order to mitigate the costs of the economy. I defined a set of eighteen potential leading indicators from banking/financial sector, in the period 2000 - 2012. The countries included in the study are Czech Republic, Hungary and Romania.

Using econometrics techniques as OLS regressions, Fixed effects and Fixed dummy effects there were identified significant banking indicators in explaining economic and financial instability periods. Comparing the results of the estimations, fixed effects estimation has the lower explanatory power of the indexes, it explain the economic and financial warning index only in proportion of 42.87%, respective 42.91%. OLS estimation increase the explanatory power of the model explaining the economic instability period in proportion of 48.53%, financial instability period in proportion of 57.35%, economic warning index in proportion of 89.80% and financial warning index in proportion of 70.51%. Fixed dummy effects estimation fits better the model, explaining over 90% of the economic and financial instability periods and indexes

According to the analysis, there are some significant variables which are very important in explaining the occurrence of an economic and financial instability periods, giving important signals to policy makers in order to limit potential damages

which can appear. In the future, a special attention should be granted to permanently monitoring potential leading indicators, reacting to the signals received and include those indicators in the policy measures undertaken, in order to cover all the areas of the economy and to protect against potential risks.

I, then composed a banking index which captures the costs occurred to the banking system and I assess its performance in explaining the economic and financial instability indexes through in the sample and out of the sample techniques. Using model simulations on historical data, the model performance was assessed upon in the sample and out of sample estimation techniques, suggesting that the observed and forecasted values follow the same trend, with small differences. The evaluation results suggest that banking indicators give us a warning signal of the negative trend of economic and financial environment.

6. Conclusions

In this research I composed a banking index which captures the costs suffered by the banking system, based on a panel including Czech, Hungary and Romania over the period 2000 – 2012 at annually frequency. I use eighteen potential leading indicators representing country specific variables. Using econometric techniques I identified which of those indicators are significant in explaining the instability periods of economic and financial environment. Then I assess the model performance in terms of in the sample and out of sample forecast. At the basis of my decision to choose a continuous model was the fact that it motivates policy makers in steering policy continuously and the fact that there is no need to decide between yes/ no value of crisis.

Summarizing, banking indicators have a higher explanatory power in explaining the evolution of economic and financial instability periods, explaining more than 90% from the indexes which capture the cost incurred at the economic and financial environment. After observing the influence of the banking sector to the incidence of economic and financial instability periods, I composed a banking index which captures the cost suffered by the banking system. As higher is the level of this indicator, as higher there are the costs registered.

Concluding, I state that this index fits well Romania's behavior then for the other countries included in the study, fact which is perfectly right because the countries have terms and conditions attached which differ by country, however, limiting their comparability.

A limitation of the model consist in data availability an also in the fact that it is hard to find a model which fits to all the countries included in the panel, because even if those countries are comparable, they have different regulations which affect their behavior in the current context.

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