A FINANCIAL SYSTEMIC STRESS INDEX FOR ROMANIA

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Abstract

Detecting and measuring financial stress and its systemic risk channels have been one of the main concerns for authorities and financial supervisors especially after the financial crisis from 2008. In this paper, we aim to build a financial stress index (FSI) for Romania using monthly data from May 2005 to December 2019. The purpose of the indicator is to provide a quick, clear and intuitive assessment of the current state of the financial system. To do so, we compose 5 different sub-indexes using 9 variables which represent five different market segments: banking sector, money market, stock market, securities market and foreign exchange market. The results suggest that the financial stress index developed successfully captures the stress episodes observed in Romania in the past.

Keywords: financial stress index, financial crisis, composite indicator of systemic stress

JEL Classification: E44, E58, G10, G20

1. Introduction

Currently, most central banks have as a fundamental objective defined in the law of organization and operation, price stability. However, against the background of the major financial and economic crisis that began in 2007, another concept came to the fore, that of financial stability, as well as the role that the central bank must play in preserving it.

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Financial stress can be defined as an interruption of the normal functioning of the financial system (ECB,2009). The importance of financial stress arises from its potential adverse effect on the real economy. Even if in some cases the high levels of financial stress are not necessarily followed by economic downturn it is still possible threat to the growth of the real economy. Because the financial stress is not an observable variable, several studies presented the need to build an index which reflects the actual state of stress in the financial system by combining different indicators of the financial market. The European Central Bank (ECB) and the Federal Reserve have created several indicators aiming to measure "the current state of instability, i.e. the current level of frictions, stresses and strains in the financial system". In addition to monitoring financial stability such an index can be used for activate or deactivate particular policy instruments (Johansson and Bonthron, 2013) and also for determine the timing of entry/exit of unconventional policy measures and strategies, such as the introduction and withdrawal of extraordinary liquidity support to the banking system (Holló, 2012)

The aim of this paper is to construct a financial stress index (FSI) for Romania based on several indicators of financial stress for the banking sector, money market, stock market, securities market and foreign exchange market. The results show that the estimated FSI captures the high stress periods observed in the past in Romania.

The remaining of this paper is organized as follows: the next section contains an overview of the relevant literature in the field of the topic researched, section 3 describes the methodology and data used, section 4 presents the results in a structured manner while the final section concludes.

2. Literature review

Regarding financial stability, there is no generally accepted definition in the literature and no synthetic indicator to measure it. A broad definition refers to the ability of the financial system to attract and place funds effectively and to withstand shocks without harming the real economy. This first definition emphasizes the importance of prudential supervision. A narrower definition emphasizes the absence of crises and the existence of a certain level of stability in asset prices, including interest rates. This approach shows that central banks' interest rate policy is very important for financial stability. In this

context, there may even be a conflict between the objective of price stability and that of financial stability.

Many studies have considered several indicators for measuring stress in financial markets. According to Louzis and Vouldis (2013) financial stress is a situation in which one or more segments of the market show the signs related to financial stress, namely increasing uncertainty and asymmetry of information. The main concern in developing financial stress indexes is that the indicators should be able to serve as an early warning indicator for slowdowns in the real economy (Islami and Kurz-Kim, 2013). The development of stress indicators for certain segments of the market and their combination into a composite index of systemic stress provides insights into the propagation channels of specific events (Louzis and Vouldis, 2012).

Financial stress indexes have been built for one country (Illing and Liu, 2006; Hakkio and Keeton, 2009; Morales and Estrada, 2010; and Holló, 2012) or for several countries (Cardarelli et al., 2011; Holló et al., 2012; and Islami and Kurz-Kim, 2013). In general, stress indicators for a single country combine more indicators into one statistic than multi-country stress indexes. This is not surprising in view of data availability. Most studies use market data, but some (Holló et al., 2012) use both mixed market and balance sheet data, while Morales and Estrada (2010) consider only balance sheet data.

Authors use different ways to combine indicators into a composite stress index. Whereas most studies take the average of standardized variables, others use principal components (Illing and Liu, 2006; and Hakkio and Keeton; 2009). More recently, Holló et al. (2012) employed portfolio theory-based combination schemes that considers the correlation structure of stress indicators in order to measure the level of systemic stress.

Financial stress indicators have been used for different purposes. Cardarelli et al. (2011) use their stress index for 17 advanced economies from 1980 to 2007 to study the relationship between financial stress and economic slowdowns. Their results suggest that periods of financial turmoil characterized by banking distress are more likely to be related with deeper and longer downturns than periods of stress principally in securities or foreign exchange market. Moreover, downturns associated with banking-related financial stress have a tendency to last at least twice as long as recessions that are not preceded by financial stress. Similarly, Cevik et al. (2013) developed a financial stress index for Bulgaria, the Czech Republic,

Hungary, Poland, and Russia to assess the relationship between financial stress and economic activity. The impulse response functions based on bivariate VARs show a significant connection between financial stress and certain measures of economic activity.

Baxa et al. (2013) study whether and how the monetary policy of some central banks responded to periods of financial stress over the last three decades. Using the financial stress index built by Cardarelli et al. (2011), the authors discovered that central banks change their policy stances in the face of financial stress, but the size of such responses varies considerably over time.

Some papers try to identify leading indicators of financial stress. For example, Misina and Tkacz (2009) found that within a linear framework, the increase of domestic credit is the best forecaster of the stress indicator for Canada at all horizons, whereas asset prices tend to be better forecasters of stress when they allow for nonlinearities. Slingenberg and de Haan (2011) extend the study of Misina and Tkacz (2009) expanding the analysis to 13 OECD countries.

3. Data and methodology

The main advantage of FSI is that it is a dynamic analysis of the level of financial stability. This method has been proposed and developed in many studies and became more popular when it was used by the IMF in 2008 or by the ECB in 2010. Such an index can be constructed in different ways. Most of the existing stress indices are based on high frequency market data, but they differ depending on the selected variables (bank capitalization, credit ratings, increase in loan volume, interest rate margin or volatility of different asset classes), coverage and aggregation method. An important advantage of continuous stress indexes (or instability indexes) is that they can identify periods of small-scale stress, events that were not identified in previous episodes of the crisis and were neglected in studies based on binary variables.

The composite indicator that we constructed in this paper covers the five most important sectors of an economy's financial system: banking sector, money market, stock market, securities market and foreign exchange market. Each of these segments constitutes a sub-index of the composite indicator. The systemic nature of stress is captured by the correlations between stress components. The

systemic risk is higher when the correlation between the stress indicators increases.

The use of a composite index has a number of benefits (Baxa et al., 2011). First of all, the evolution of financial instability caused by various factors is approximated. Second, the inclusion of additional variables in the stress index does not decisively affect the overall evolution. Third, the composition of the index allows the decomposition of the authorities' reaction to different subcomponents of the index.

In this paper, we select the financial variables which constitutes the composite index based on those used in various research papers on this topic such as Cardarelli et. all (2011), Holló et al. (2012), Louzis and Vouldis (2012), Islami and Kurz-Kim (2013), Babecký et al. (2013), Zigraiova and Jakubik (2015), Cambón and Estévez (2016). In the following will be presented the indicators related to each financial segment considered.

Banking sector

The indicator of stress in the banking sector which is included in our FSI is the beta (β) of the banking sector, calculated as follows:

$$\beta = \frac{COV(R_{TLV}, R_{BET})}{VAR(R_{BET})} \quad (1)$$

where, R_{TLV} is the monthly return of Transylvania Bank shares, and R_{BET} is the monthly return of stock market index BET. The covariance between was estimated through a multivariate GARCH model.

Money market

A component of the FSI that shows the stress in the money market is the monthly volatility of the 3-month interbank interest rate ROBOR, derived from a GARCH (1,1) model. Another indicator representative for the money market is the slope of the yield curve, in this paper being calculated as the difference between deposit rate and lending rate. According to Cardarelli et all (2011) “banks generate income by intermediating short-term liabilities (deposits) into longer-term assets (loans). Therefore, when there is a negative term spread – that is a negative sloping yield curve – bank profitability is seriously jeopardized.” The last measure for the money market included in our stress index is the spread between 3-month ROBOR and the key interest rate.

Stock market

A lot of financial stress indexes include stock price volatility assuming that large fluctuations in stock prices show financial imbalances in the equity market (Hakkio and Keeton, 2009; Cardarelli et al., 2011). Our paper considers too price volatility. Therefore, following Cardarelli et al. (2011), time-varying volatility of the monthly return for the BET market index has been derived from a GARCH (1,1) specification. Further, to assess financial stress on the capital market, we take the monthly return of the BET index into account. The return was multiplied by -1 so that a sharp decrease of stock prices to be registered as an increase in the index.

Securities market

Regarding the securities sector, we considered two components of stress: inverse yield curve, calculated as difference between the short-term interest rate the long-term interest rate and the monthly return of value of transactions in government securities in the interbank secondary market.

Foreign exchange market

In our index is also included the volatility of monthly changes in the real effective exchange rate (REER). Like BET price volatility, this indicator is derived using a GARCH (1,1) specification for the monthly return of the real effective exchange rate. A significant volatility of the REER shows that the economy suffers major corrections through the exchange rate, that can affect the stability of the financial system.

To build the aggregate index, the first step was to standardize the values of the individual indexes. Later we used the arithmetic average of these variables and so we obtain the composite index.

The data used are monthly time series and cover the period May 2005 - December 2019.

The GARCH (1,1) model used in this paper is the following:

$$\sigma_t{}^2 = \omega_0 + \alpha_1 \varepsilon_{t-1}{}^2 + \beta_1 \sigma_{t-1}{}^2 \quad (2)$$

where σ_t represents the conditional volatility, ω_0 is the long term average value, α_1 reveals the influence of random deviations in the previous period on σ_t, β_1 measures the persistence of shocks on volatility, whereas $\varepsilon_t \sim N(0, \sigma_t)$.

Preliminary data analysis

In order to estimate the GARCH models we conduct a preliminary data analysis. Table 1 presents the descriptive statistics of the data.

Table 1

Descriptive Statistics

	R_BET	R_TLV	R_REER	R_IST	R_Robor3M
Average	0.00416	0.01036	0.00006	-0.00593	-0.00638
MIN	-0.39577	-0.38728	-0.05409	-0.42439	-0.40385
MAX	0.25297	0.33103	0.04213	0.62706	0.55174
Standard deviation	0.07816	0.10045	0.01295	0.12023	0.11036
Skewness	-1.20635	-0.74997	-0.12999	1.16772	0.70529
Kurtosis	5.46042	2.38406	2.03130	7.01572	4.50950

Source: NBR, BSE, Eurostat, own calculations

In order to test the stationarity of the data used the ADF statistic test. The results are shown in Table 2. The variables are stationary.

Table 2

ADF test

	R_BET	R_TLV	R_REER	R_IST	R_Robor3M
Value	-4.87170	-4.70100	-5.86630	-5.15340	-4.89720
Probability	0.01000	0.01000	0.01000	0.01000	0.10000

Source: NBR, BSE, Eurostat, own calculations

In Table 3 are presented the results of the autocorrelation Box-Ljung test. The data series are autocorrelated.

Table 3

Box-Ljung test

	R_BET	R_TLV	R_REER	R_IST	R_Robor3M
Value	38,928	33,286	8,203	27,629	30,895
Probability	0,028	0,012	0,016	0,024	0,015

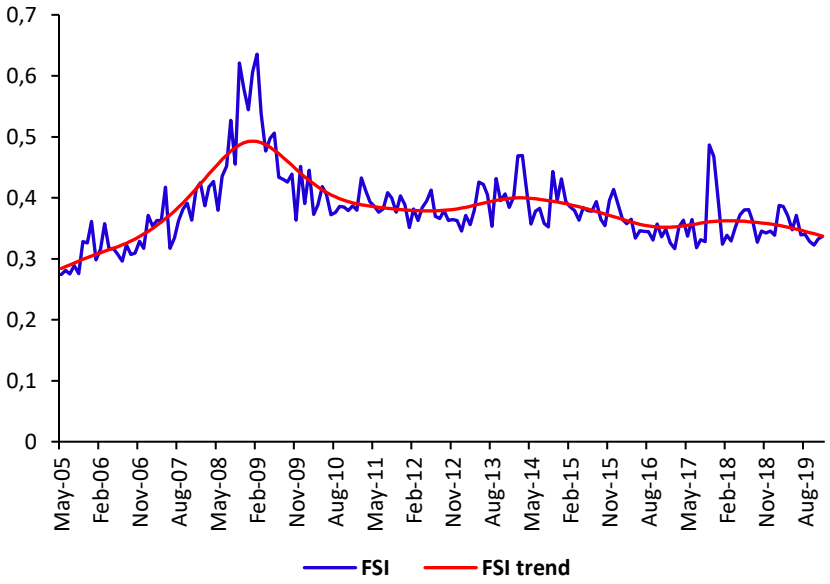
Source: NBR, BSE, Eurostat, own calculations

4. Results

In Figure 1 we presented the evolution of the FSI during May 2005 - December 2019.

Figure 1

Financial Stress Index



Source: Own estimations

In this paper we defined the high stress periods by periods when the FSI exceeds its mean by more than one standard deviation. Therefore, as can be seen from the chart, with the help of the index we were able to identify a period of financial instability in Romania, namely January 2008 – June 2009. The maximum value of the FSI index was 0.73 and was recorded in October 2008.

This period of financial stress corresponds to the financial crisis caused by the abundant liquidity created by the world's major central banks (FED, BOJ) and the desire of oil and gas exporting countries to limit the appreciation of the currency. The consequences of abundant liquidity were very low interest rates and their low volatility. Securitization, the tendency to underestimate the risk and the highly complex derivative financial instruments contributed to the worsening

of the world economic situation. The effects of this crisis also extended to Romania and were amplified by the internal vulnerabilities caused by previous fiscal indiscipline.

During 2011-2019, the composite index decreased signaling the improvement of the financial stability. We have not identified any significant stressful period. The FSI slight and sharp increase is not persistent, its level is not so high like previously and rapidly jumps back to the lower values.

We can conclude that the index captures the high stress episodes seen in the past.

5. Conclusion

This paper develops a financial market stress index (FSI) for Romania adopting monthly data between May 2005 - December 2019. The purpose of the indicator is to provide a quick, clear and intuitive assessment of the current state of the financial system. To do so, we compose 5 different sub-indexes using 9 variables that will represent five different market sectors: banking sector, money market, stock market, securities market, and foreign exchange market.

In order to construct our aggregate index, first we put the 5 individual indicators on the same scale. Further we used the average of the standardized variables to obtain the composite index. The results show that the estimated FSI captures the high stress episodes seen in the past in Romania.

Regarding future researches on developing financial stress index, they may include in the analysis other more advanced methods of aggregating individual indexes such as portfolio theory or moving average. Also, it can be analysed the connection between FSI and economic activity through different econometric methods. The sample of surveyed countries can be enlarged to identify mutual financial stressful periods.

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