International Journal of Innovation and Applied Studies
ISSN 2028-9324 Vol. 27 No. 1 Aug. 2019, pp. 171-177

http://www.ijias.issr-journals.org/

Financial stress of the banking system and economic growth in WAEMU: Do the effects of monetary policy and public debt matter ?

Kpégo Didier Anatole GBENOU

PhD in Economics. Researcher in the Directorate of Studies and Research of Central Bank of West African States (BCEAO), Senegal

ABSTRACT: This paper analyzed the effects of the monetary policy and public debt on the relationship between the financial stress of the banking system and economic growth in the WAEMU countries from 1990 to 2016. From a panel smooth transition regression estimation, the results indicate that the relationship between the GDP growth and the degree of financial stress depends on the changes in the policy rate and the level of the debt-to-GDP ratio. We find that: (i) in a high financial stress regime, a restrictive monetary policy and a high debt-to-GDP ratio have a negative effect on economic growth - (ii) a monetary expansion and a low debt-to-GDP tend to mitigate the negative effects of high financial stress on the GDP - (iii) in a regime of low financial stress in the banking sector, economic growth reacts positively, regardless of the activism of the monetary policy strategies and the level of the ratio of public debt-to-GDP.

KEYWORDS: Financial stress, monetary policy, public debt, economic growth, panel smooth transition regression, WAEMU.

JEL CLASSIFICATION: C51, E20, E52, G17, H63.

1 INTRODUCTION

The 2008 financial crisis and the 2010 public debt crisis in the European Monetary Union have put at the center of the debate on economic issues the importance of banking behavior for economic fluctuations. Thus, an economy whose banking sector is "financially fragile", is a potential source for the spread of "endogenous" macroeconomic instability. Indeed, as soon as credit institutions are unable to optimally allocate resources to investments, the dynamics of economic growth are compromised. These institutions are financially stressed and harden the terms of credit supply. When the level of financial stress is low, they provide financing for productive activities through credit to non-financial agents.

In the case of WAEMU[1] countries, credit institutions play a real "active" role in the credit market. The structure of their resources, mainly short-term, limits their ability to finance long-term investments. [1] highlighted the existence of financial stress in the banking system of WAEMU countries on the basis of credit market information asymmetries, insolvency risks, deterioration in asset quality, internal financial vulnerability and exposure of WAEMU economies to external shocks. Like [2] which focuses on the macroeconomic determinants of financial stress, this study does not specify the effects of monetary and fiscal policies on the relationship between the financial stress of the banking sector and the dynamics of real activity. However, both studies pointed out that the banking crises recorded in the Union in 1990 coincided with an inadequate monetary policy and weak fiscal discipline characterized by high debt and budget deficit ratios.

With the setbacks of the financial crisis of the last decade, the conditions of access to financial resources on the international markets, led the WAEMU countries to favor the sources of internal financing. Against this backdrop, the overall ratio of debt-to-GDP declined. From 2002 to 2014, the average level of this ratio was 36.6% compared to 105.7% a dozen years

[1] The West African Economic and Monetary Union (WAEMU) comprises eight countries: Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo.

earlier. The average of the monetary policy rate decreased from 7.8% to 4.2%. During the period 1990-1995, the financial stress index recorded is largest values between 0.40 and 0.6, corresponding to the episode of significant financial vulnerability in the banking sector [1]. These values were between -0.3 and 0.2 over the period 1996-2014. In addition, the average economic growth rate was 1.7% and 3.8% respectively over the two sub-periods. Given the key role of the banking system, it is relevant to evaluate the effects of economics policies on GDP fluctuations induced by taking in to account the vulnerability of this system. In theory, monetary activism and fiscal policy do not leave unchanged the fluctuations in economic growth induced by the behavior of credit institutions. That is the motivation behind for the present study on the WAEMU countries.

In the theoretical literature, some authors emphasized the role of economic policy shocks on the link between GDP and the financial sector's conditions. On one hand, Keynesian analysis developed an "exogenous" concept of economic instability and has given a secondary role to financial factors in the explanation of economic fluctuations. On the other hand, this view is opposed to that of [3] who, by questioning the "real" origin of the perturbations emphasized by the real business cycle theory. He places banking behaviors as the central element of the financial instability hypothesis and macroeconomic fluctuations. These behaviors are affected by a restrictive monetary policy, the generalization of the preference for liquidity and the deterioration of the debt structure in the economy as well as the public debt. In a stable institutional environment, "a restrictive monetary policy is efficient and the interest rate increases in such a way that the demand for financing is limited by the essentially inelastic supply." However, the existence of "institutional instability" leads to the maximizing and innovative behaviors adopted by commercial banks [3]. Moreover, public debt affects the relationship between financial stress and economic growth, through its impact on risk premiums, in particular the interest rates on treasury bills ([4], [5]). When instability in the financial system is induced by a high level of public debt, this will result in a loss of confidence in the government's ability to repay its outstanding debt, a reduction in the prices of treasury bills and an increase in sovereign yields, leading to economic downturn. A combination of monetary and fiscal policy strategies that provide different instability regimes (a.k.a *f*-instabilities) in the banking sector with asymmetric effects on the real sector [6]. Thus, the economy goes through a tightening of credit conditions (high financial stress) to a regime which is not financially constrained.

At the empirical level, the analysis indicates that in a regime of high financial stress, output is generally lower than its level in a regime with low financial stress ([7], [8]). For Canadian economic, [9] add that the inflation rate as well as interest rates are higher in a regime of low financial stress, but the effects of shocks from monetary expansion and contraction are divergent. Furthermore, [10] found in the case of the United States, England, Germany and Italy that: (i) production responds positively to an increase in the debt ratio in both financial stress regimes; (ii) the difference between the multipliers obtained in these regimes is relatively low; (iii) a financial stress shock has a negative effect on output and increases the ratio of public debt-to-GDP; (iv) the large temporal variation and estimates of nonlinear impulse responses suggest that the size of budget multipliers was above their average during the 2008-2009 crisis. Neglecting the role of the state of financial markets, [11] found that the ratio of gross external debt-to-GDP above threshold of 90% tends to reduce economic growth. In addition, using a smooth transition dynamic panel regression model (PSTR), [12] show that a high levels of financial stress and the debt-to-GDP ratio constrain the dynamics of real output. Indeed, above 84% of the debt-to-GDP ratio and 2.2 of the financial stress index, economic growth has negative values. However, a high value of this debt's ratio doesn't necessarily have a negative effect on the growth if financial markets are stable. While these findings show that very high levels of financial stress and the debt-to-GDP ratio affect negatively economic growth, they don't indicate how monetary policy and the level of public debt can influence the relationship between the state of credit institutions and the growth of real output. This limit is taken into account by this study on the WAEMU.

The paper aims to analyze the sensitivity of the link between the financial stress of the banking sector and economic activity in relation to monetary policy and the level of public debt. This study adds to the literature on the nonlinearity between the financial stress of the banking sector and the real economy, and the effects of structural variables on this link within a monetary union.

The next section of the article presents the econometric of analysis followed by the results and discussion, and the final section concludes.

2 METHODOLOGY

2.1 THE ECONOMETRIC MODEL

A Panel Smooth Threshold Regression model (PSTR) is used as [12] to capture different situations in which the growth rate of real GDP is gradually switching, given the level of financial stress. Belonging to a regime depends on the transition function and the distance separating the threshold and the transition variable. It is assumed that the real GDP growth rate satisfies a two-regime PSTR defined by:

$$\mathrm{GDP_{jt}} = \nu_j + \delta_0 \mathrm{CIFS_{jt}} + \delta_1 \mathrm{CIFS_{jt}} \Phi(\mathrm{q_{it}}, \gamma, \mathrm{c}) + \theta \mathrm{X_{jt}} + \varepsilon_{jt} \ (1)$$

With $j = 1, \dots, 7$, the country, $t = 1990, \dots, 2014$, the year; ν_j the vector of fixed effects, $\mathrm{CIFS_{jt}}$, the composite index of financial stress. X_{jt} is the vector including the policy rate, the debt-to-GDP ratio and others control variables. δ_0, δ_1, and θ are parameters to be estimated. ε_{jt}, is the error term, varying in time and specific to each country. $\Phi(\mathrm{q_{it}}, \gamma, \mathrm{c})$ denotes the transition function associated to a transition variable q_{it}, and $c = (c_1, \dots, c_m)'$ a vector of dimension $(1 \times m)$ including the threshold parameters and γ a smoothing parameter supposed to be positive. The logistic transition function is continuous and integrable on [0, 1]:

$$\Phi(q_{it}, \gamma, \mathrm{c}) = \left[1 + \exp\left(-\gamma \prod_{\mathrm{p}=1}^{\mathrm{m}} (q_{it} - \mathrm{c_p})\right)\right]^{-1} \ ; \ \gamma > 0 \text{ and } \mathrm{c_1} < \cdots < \mathrm{c_m} \ (2)$$

The order of the transition function has a direct impact on the transient dynamics between extreme regimes. From an empirical perspective, it's usually sufficient to consider m = 1 or m = 2. Generally, these values allow for the necessary variations in the slopes coefficients to account for a majority of nonlinearities due to changes of regimes. However, from a theoretical standpoint, the PSTR model allows a variation in the elasticity of the economic growth rate relative to financial stress, over time and by country. Depending on whether the transition variable q_{it} is the index of financial stress $CIFS_{jt}$, the elasticity of the growth rate of the real GDP relative to the financial stress in country *j* at period t is:

$$\mathrm{e_{jt}} = \frac{\partial \mathrm{GDP_{jt}}}{\partial \mathrm{CIFS_{jt}}} = \delta_0 + \delta_1 \Phi_1(\mathrm{CIFS_{jt}}, \gamma, \mathrm{c}) + \delta_1 \frac{\partial \Phi_1(\mathrm{CIFS_{jt}}, \gamma, \mathrm{c})}{\partial \mathrm{CIFS_{jt}}} * \mathrm{CIFS_{jt}} \ (3)$$

with: $\Phi_1(\mathrm{CIFS_{jt}}, \gamma, \mathrm{c}) = \left[1 + \exp\left(-\gamma(\mathrm{CIFS_{jt}} - \mathrm{c})\right)\right]^{-1}$

and: $\frac{\partial \Phi_1(\mathrm{CIFS_{jt}}, \gamma, \mathrm{c})}{\partial \mathrm{CIFS_{jt}}} = \left[\gamma * \exp\left(-\gamma(\mathrm{CIFS_{jt}} - \mathrm{c})\right)\right]\left[1 + \exp\left(-\gamma(\mathrm{CIFS_{jt}} - \mathrm{c})\right)\right]^{-2}$

When the transition variable q_{it} is different from the index of financial stress, such as the public debt-to-GDP ratio or money market rate, the elasticity of economic growth relative to the financial stress in country *j* at period *t* is:

$$\mathrm{e_{jt}} = \frac{\partial \mathrm{GDP_{jt}}}{\partial \mathrm{CIFS_{jt}}} = \delta_0 + \delta_1 \Phi(\mathrm{q_{it}}, \gamma, \mathrm{c}) \ (4)$$

With $\begin{cases} \delta_0 \leq \mathrm{e_{jt}} \leq \delta_0 + \delta_1 \ if \ \delta_1 > 0 \\ \delta_0 + \delta_1 \leq \mathrm{e_{jt}} \leq \delta_0 \ if \ \delta_1 < 0 \end{cases}$

Parameters δ_0 and δ_1 represent in this case elasticities of the real GDP growth rate relative to the financial stress of the banking sector. A negative (positive) value implies a decrease (increase) in elasticity with the value of the threshold variable.

2.2 ESTIMATION OF THE PSTR MODEL

The estimation of the PSTR is relied on a procedure to find the slopes coefficients, the thresholds and the smoothing parameters$(\delta_0, \delta_1, \gamma, c, \theta)$. First, the individual effects ν_j are eliminated by normalizing the variables with the respective sample means, then the model is estimated by setting the initial values for the parameters of the transition function. Finally, the Non Linear Least Squares (NLLS) method is used for the estimation of the different coefficients. This method minimizes the residual sum of squares of the PSTR with respect to the slopes coefficients, the thresholds and the smoothing parameters.

For a better specification of the PSTR model, the linearity and non-linearity tests of residual, relating to the number of transition functions to be used, are implemented. The decision rules of these tests are based on statistics from Fisher's version of Lagrange Multiplier (LM_F) and the pseudo-likelihood ratio (LRT) proposed by [13] and [14], and adapted to small samples. Indeed, the linearity test aims to verify whether the threshold effect is statistically non-zero in order to specify the link between financial stress and real GDP growth based on a switching regime model. If these statistics reject the hypothesis of linearity in favor of a PSTR, the supposed optimal transition variable will be estimated by considering all variables.

In addition, the test of nonlinearity on the residual aims to determine the number of regimes or the number of transition functions in order to capture all the heterogeneity and nonlinearity of the data. If the linearity is rejected, a null hypothesis test is implemented for the existence of a transition function in PSTR ($H_0: r = 1$) against the alternative hypothesis of having at least two transition functions ($\mathrm{H_1}: \mathrm{r} = 2$). The decision rules rely on LM_F and LRT statistics indicated above. If H_0 is rejected, the next step is to test: $H_0: r = r^* + 1$ against $H_1: r = r^* + 2$. The test procedure continues until the null hypothesis is accepted.

2.3 THE VARIABLES OF THE MODEL

The dependent variable is the real GDP (GDP) representing the measure of the economic activity in each country. The Composite Index of Financial Stress (CIFS) is computed by [1], and it reflects the fragility of the banking system. Indeed, these authors developed the CIFS of the banking system in WAEMU countries, according to the methodology used by [15] and [16]. This composite index is built as an aggregation of the normalized variables related to the financial soundness of the banking sector, the internal and external factors of the financial and macroeconomic vulnerabilities of this sector. High values of the CIFS reflect a tightening of credit supply constraints that negatively affect the real activity. Low values of the CIFS, indicates that the conditions of financing are favorable to production. It is expected that the low and high levels of financial stress will have a positive and negative impact on the growth rate, respectively.

The ratio of public debt-to-GDP (DEBT) is used to assess the effect of fiscal policy on the relationship between financial stress and the GDP [10]. In addition, the policy interest rate (RATE), notably the marginal lending rate captures the impact of monetary policy on the economic activity. This rate has a countercyclical effect on the relationship between financial stress and GDP [17].

The control variables include the ratio of private sector credit to GDP (PRIV), the ratio of gross fixed capital formation to GDP (GFCF), the trade openness (OPEN) measured by the sum of imports and exports divided by GDP and the active population (APOP) used as a proxy for human capital. It is expected that these four variables positively impact economic growth.

The data cover the period from 1990 to 2016 in all WAEMU countries except Guinea-Bissau. The variables RATE and DEBT are from the BCEAO database. The other variables were extracted from the World Development Indicators of the World Bank.

3 ECONOMETRIC RESULTS

3.1 PANEL THRESHOLD REGRESSIONS SPECIFICATION TESTS

LM_F and LRT statistics reject the null hypothesis of absence of nonlinearity effect at 5%, when the index of financial stress (CIFS), the policy rate (RATE) and the public debt ratio (DEBT) were respectively used as transition variables (Table 1). The alternative hypothesis H_1: r = 2 is rejected. In these three models, only one transition function is sufficient to explain the nonlinear effects of the financial stress on economic growth rate. Based on AIC and BIC values and the residual sum squares (SCR) (Table 2), a threshold transition function is more appropriate to account for the nonlinearity between financial stress and growth in the PSTR model. These conditions are also sufficient to represent the nonlinear relation between these two variables with regard to the policy rate and the ratio of public debt-to-GDP ratio.

Table 1. Nonlinearity test with transition variables: CIFS, RATE, DEBT

	Model 1		Model 2		Model 3	
Transition variable q_{it}	CIFS		RATE		DEBT	
n	m=1		m=1		m=1	
	LM_F	LRT	LM_F	LRT	LM_F	LRT
H0 : r = 0 vs H1: r = 1	7.792 [0.005]	7.783 [0.006]	4.096 [0.041]	4.00 [0.044]	7.537 [0.023]	3.735 [0.026]
H0 : r = 1 vs H1: r = 2	0.767 [0.381]	0.735 [0.392]	5.136 [0.097]	2.509 [0.104]	0.248 [0.618]	0.237 [0.627]

Note: *m, the optimal number of transitions function, K the number of explanatory variables, q_{it} the transition variable and n the number of centering parameters. Values in brackets are p-values associated with LM_F and LRT statistics.*

Table 2. Determination of the optimal threshold number by model

	Model 1		Model 2		Model 3	
q_{it}	CIFS		RATE		DEBT	
n	m=1	m=2	m=1	m=2	m=1	m=2
n opt.	1	0	1	0	1	0
SCR	0.200	-	0.430	-	0.198	-
AIC	-6.680	-	-7.546	-	-6.668	-
BIC	-6.536	-	-8.329	-	-6.488	-
Obs.	182	182	182	182	182	182

Note : *SCR, Residual Sum Squares, AIC, Akaike Information Criterion, BIC, Bayesian Information Criterion,*

3.2 THE THRESHOLD EFFECTS OF FINANCIAL STRESS ON ECONOMIC GROWTH

Table 3 reports the estimation of the parameters for the final PSTR models with transition variables including the index of financial stress, the policy interest rate and the ratio of debt-to-GDP. Given the small values of gamma (γ), the structure of the PSTR is appropriate to model the nonlinearity between financial stress of the banking sector and growth rate, when the transition is induced by the policy interest rate and the ratio of public debt-to-GDP. The results show positive and negative signs for parameters δ_0 and δ_1 respectively, implying the existence of a nonlinear relationship between financial stress and the real output growth. Indeed, this relation is positive up to a certain threshold of the transition variables, after which it becomes negative. The optimal threshold for the index of financial stress is 0.253. Under conditional nonlinearity, the optimal policy interest rate threshold is 1.501 (in logarithm) or 4.5% in level. That of the ratio of public debt-to-GDP is 4.422 (in logarithm) or 83.3% in level. It should be noted that on different groups of countries in their sample, [12] obtained different thresholds varying between 0.4 and 3.1 for the index of financial stress and the ratio between 42% and 84% for the debt-to-GDP.

When the financial stress index induces the transition, the coefficient δ_0 is positive ($\delta_0 = 1.215$), while δ_1 is negative ($\delta_1 = -1.390$). This implies that growth rotates from a low stress financial regime to a higher regime. This finding confirms that of [18] who found that an episode of low financial stress is consistent with high growth and increased financial stress leads to a contraction of real activity.

Table 3. Final results of the PSTR model

	Model 1	Model 2	Model 3
Transition variables	**CIFS**	**RATE**	**DEBT**
(m*, r*)	(1.1)	(1.1)	(1.1)
Parameter δ_0	1.215*** (0.053)	0.196** (0.056)	0.795*** (0.020)
Parameter δ_1	-1.390*** (0.044)	-0.708** (0.217)	-1.565*** (0.023)
Centering Parameter c_i.	0.253*** (0,048)	1.501*** (0.247)	4.422*** (0.515)
Gamma (γ)	17.586*** (3.260)	4.038*** (0.804)	2.763*** (0.436)
Coefficients of control variables			
PRIV	0.186*** (0.019)	0.492** (0.205)	0.481** (0.201)
RATE	-0.048** (0.009)	-0.066** (0.024)	-0.011 (0.016)
DEBT	0.201** (0.100)	0.015*** (0.002)	0.458*** (0.034)
GFCF	0.042** (0.020)	0.034** (0.013)	0.040* (0.022)
OPEN		-0.013 (0.031)	-0.021 (0.018)
APOP		0.041** (0.021)	0.550*** (0.012)
Obs.	182	182	182
R^2	0.521	0.574	0.522
DW	2.259	2.278	2.219
Fisher	8.931***	9.025***	6.642***

Note: For each model, m the optimal number of transitions function is determined sequentially. For the *i th* transition function, *i = 1,…, r*, the n centering parameters c_i and the value of the corresponding slope γ_i are shown in the Table. The standard errors in parentheses are corrected for the heteroscedasticity biases using the White method. ***, ** and *, denote significant statistics at 1%, 5% and 10% respectively.

The effect of the policy rate on the link between financial stress and economic growth shows a positive coefficient for δ_0 ($\delta_0 = 0.196$) and negative for δ_1 ($\delta_1 = -0.708$). The rise in the money market rate above 4.5% (tightening of refinancing conditions) leads to a decline in the sensitivity of growth to the health of the banking sector. Thus, the policy rate plays a countercyclical role in the relationship between banking instability and real output growth [19].

An increase in the ratio of the debt-to-GDP negatively affects the sensitivity of the growth to the vulnerability of the banking system. Indeed, the effects of public debt on the relationship between financial stress and economic growth show positive and negative signs respectively for the coefficients δ_0 and δ_1. This sensitivity of GDP growth to the degree of financial stress in the banking sector deteriorates when the public debt ratio exceeds 83.3%. For values below this threshold, the elasticity of the GDP growth rate relative to a low level of financial stress in the banking sector is positive. This threshold is 90% in [11], and 84% in of [12] for a panel of countries.

A comparative analysis is made with regard to some countries of the panel, especially Greece and Spain, to evaluate the loss or gain in economic growth in the context of the WAEMU countries. Considering a level of the financial stress index equal to the one observed in Greece (0.96) by [12], an increase of 0.77 percentage points from the threshold in this study (0.253) associated to an average of 0.445 percentage points of the policy rate between period 1990 and 1995, entails a loss of 0.33 percentage point of the economic growth rate in WAEMU countries, [2] while a decline in the key rate in the same proportion results in a loss of 0.02 percentage point. Moreover, when the financial stress index decreased by 1.247 to reach the threshold of Spain (-1.50), changes in the money market rate in the same proportions as previously lead to a gain of economic growth rates of 0.71 and 0.05 percentage points. These results suggest that a policy rate has a countercyclical effect on the link between the degree of financial stress of the banking system and the dynamics of real output. Furthermore, the extent of restrictive monetary policy is higher than that of an expansion policy, irrespective of the pattern of financial stress. This result is similar to those of [9].

If the level of the WAEMU's public debt ratio reaches the level of Greece, in particular 91.53%, an increase of 0.094 percentage points from the 83.3% threshold in our study, with a higher of the financial stress index by 0.77 points, will result in a loss of 0.544 percentage point of a GDP growth. [3] On the other hand, when the level of vulnerability of the banking system drops from 1.247 to the threshold of Spain, an increase of 0.094 in the debt ratio will result in an increase of 1.154 percentage point in the growth of the real GDP. The magnitude of a "lax" debt policy is higher than that of "rigor" regardless of the financial stress regime. This implies that an unsustainable and imprudent debt policy would increase the vulnerability of the banking system and create conditions that are not conducive to the financing of the economy by banks. These results are consistent with those of [10].

With the exception of trade openness, the other control variables used have positive coefficients according to economic theory.

4 CONCLUSION

This paper analyzed the effects of monetary policy and debt on the link between financial stress of banking system and economic growth in WAEMU countries. The results obtained from a smooth transition panel models (PSTR) indicate that the economy can swing between a regime of low or high financial stress in the banking system, due to the policy rate levels and the ratio of public debt-to-GDP.

These results show that: in a high financial stress regime, a restrictive monetary policy and an increase of the public debt ratio have a negative effect on economic growth, if the money interest rate levels and the debt-to-GDP ratio are respectively higher than 4.5% and 83.3%. While below these thresholds and under a low financial stress regime, a prudent debt policy and accommodative monetary policy stimulate the dynamics of real output. A monetary expansion and a low of the debt-to-GDP ratio tend to mitigate the negative effects of high financial stress on the dynamics of real output. In a regime of low financial stress in the banking sector, economic growth reacts positively, regardless of the activism of the monetary policy strategies and the level of the ratio of public debt-to-GDP. As such, a better coordination between monetary and fiscal policies can limit the vulnerability of the banking system, which is conducive to a decline in economic growth.

[2] Value gets from the previous elasticty formula (4) (0.197 – 0.708*[1+exp(-4.308*(2.21-1.501)]$^{-1}$)* 0.77 = -0.33.
[3] Value gets from the previous elasticty formula (4) (0.795-1.565*[1+exp(-2.763*(4.517 - 4.422)]$^{-1}$)*0.77 = -0.544

REFERENCES

[1] Gbenou, K. D. A. and Amoussouga Gero F. (2017), Mesure et prévision du stress financier du système bancaire des pays de l'UEMOA. *Finance et Finance Internationale*, N°7 janvier 2017, http://revues.imist.ma/journal=FFI.

[2] Doucouré, F. B. and Sene, B. (2014), Les déterminants macroéconomiques de l'indice de stress bancaire dans les pays de l'UEMOA. *Revue Économique et Monétaire de la BCEAO,* N°16, Décembre.

[3] Minsky, H.P. (1957), Central banking and money market changes. *Quarterly Journal of Economics*, Mai, p. 171-187.

[4] Stein, J. L., 2012. Stochastic Optimal Control and the US Financial Crisis. *Springer Publishing House*, New York.

[5] Brunnermeier, M. K. and Sannikov, Y. (2014), A macroeconomic model with a financial sector. *American Economic Review*, Vol. 104, issue 2, pages 379-421.

[6] Hughes Hallett, A., Libich, J. and Stehlík, P. (2011), Macroprudential Policies and Financial Stability. *The Economic Record,* Vol. 87, N°. 277, June, 2011, 318–334.

[7] Cardarelli, R., Elekdag, S. and Lall, S. (2011), Financial stress and economic contractions. *Journal of Financial Stability* 7: 78-97.

[8] Van Roye, B. (2011), Financial Stress and economic activity in Germany and the Euro Area. *Kiel* Working Paper N°1743, November.

[9] Li, F. and St-Amant, P. (2010), Financial Stress, Monetary Policy, and Economic Activity. Working paper of Bank of Canada, 2010 – 12.

[10] Afonso, A., Baxa, J. and Slavík, M. (2017), Fiscal developments and financial stress: a threshold VAR analysis. *Empirical Economics,* pp. 1-29, January. https://doi.org/10.1007/s00181-016-1210-5.

[11] Reinhart, C. M. and Rogoff, K. S. (2010), Growth in a time of debt. *American Economic Review:* Papers & Proceedings, May, 573–578.

[12] Proano, R.C., Schoder, C. and Semmler, W. (2014), Financial Stress, Sovereign Debt and Economic Activity in Industrialized Countries: Evidence from Dynamic Threshold Regressions. *Journal of International Money and Finance* 45, 17-37.

[13] Gonzàlez, A., Teräsvirta, T. and van Dijk, D. (2005), Panel Smooth Transition Regression model. *SSE/EFI Working Paper Series in Economics and Finance 604*, Stockholm School of Economics.

[14] Colletaz, G. and Hurlin, C. (2008), Threshold effects in the public capital productivity: An international panel smooth transition approach. *https://halshs.archives-ouvertes.fr/halshs-00724208*.

[15] Balakrishnan, R., Danninger, S., Elekdag, S. and Tytell, I. (2009), The Transmission of Financial Stress from Advanced to Emerging Economies, *IMF* Working Paper, n°09/133.

[16] Popovska, J. (2014), Modelling Financial Stability: the Case of the Banking Sector in Macedonia, *Journal of Applied Economics and Business*, Vol.2, Issue 1 – March, 2014, PP. 68-91.

[17] Baxa, J., Horváth, R. and Vašícek, B. (2011), Monetary Policy Rules and Financial Stress: Does Financial Instability Matter for Monetary Policy? *Departement d'Economia Aplicada*, Edifici *B,* Campus de Bellaterra, 08193 Bellaterra.

[18] Davig, T., and Hakkio, C. (2010), What is the effect of financial stress on economic activity. *Federal Reserve Bank of Kansas City Economic Review,* Second Quarter, 35-62.

[19] Gerali, A., Neri, S., Sessa, L. and Signoretti, F.M. (2010), Credit and Banking in a DSGE Model of the Euro Area. *Journal of Money, Credit and Banking,* 42(6), 108–141.