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A PANEL DATA ANALYSIS FOR FINANCIAL STABILITY INDICATORS

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Abstract *In this study a panel data analysis was made for financial stability indicators in 7 European Union countries over 2006-2011 (Bulgaria, Czech Republic, Croatia, Poland, Slovenia, Hungary, Romania, Austria, France, Italy, Greece and England. The loam quality is explained by the coverage of non-performing loans and the index of prices in each country using a fixed-effects model. The Hausman test indicated that a fixed-effects model with Driscoll and Kraay errors is better than a random-effects one.*

Key words:
Panel data, financial indicators, financial stability, fixed-effects model, loan quality
JEL Codes:
C51, C52, G15

1. Introduction

The main challenges for the financial stability for the following term, similar to those from the level of the most of the economies of the EU member states are: the restart of crediting under sustainable conditions, on the base of continuation and even intensification of the financial de-intermediation which is manifested worldwide, as well as the proper management of the quality of the bank assets, including through the insurance of an operational balance between the costs and benefits of different management solutions of the non-performing exposures.

A financial system which has a good operation, permits to an economy to exploit its own potential of economic increase. The financial worldwide level also establishes an increase of the exposure of the system to risks, due to the possible contagion.

Among the theoretical and practical works made on international level, hereby appears that the bank system has a major significance for the stability of the financial systems.

The Romanian bank system continued to be well protected from the different unfavorable evolutions which manifested both locally and worldwide. According to the Report on the financial stability for 2013, first of all the level and the quality of the own funds have been held within the proper parameters: (i) the solvability rate was held to a proper level (14.7% in June 2013), significantly over the minimal regulated value (8%); (ii) the own funds consist in elements having good and very good quality (the rate of the level 1 funds being 13.6% in June 2013) and (iii) NBR decided to keep the prudent filters for the calculation of the own funds and of the bank prudence indexes during 2013 (therefore, de facto, the solvability indexes continue to be around 4% higher than the reported levels), following to renounce on a progressive basis to such filters during the implementation of the additional capital requirements corresponding to Basel III (between 2014-2018).

The main characteristics that a template built for the analysis of the financial stability must have are those above-mentioned according to the authors' conception: the appearance of the contagion phenomenon, the existence of the imperfections of the market, the emphasizing of the bank role, of the volume of the existing liquidities in the economy and the dissimilarity of the economic agents, the description of the macro-economical and micro-economical conditions, the possibility of use of the real data, the possibility of its practical use.

2. Literature review

A comparative condition of the financial stability indexes used by certain renowned contemporary authors for their contribution to the study of the stability of the issue, should be presented in chart no. 1[1]

Chart 1. Indexes of the financial system

Indexes	Kaminsky, Lizondo, Reinhart (1998)	Bussière, Mulder (1999)	Krkosha (2000)	Corker, Beaumont, van Elkan, Iakova (2000)	FMI (2000,2000a, 2001)	Johnston, Chai, Schumacher (2000)	Reininger, Schardax, Summer (2001)	Begg, Eichengreen, Halpern, von Hagen, Wyplosz (2002)	BCE (2002)	von Hagen, Zhou (2002)	Brüggemann, Linne (2002)	Bussière, Frantzscher (2002)	Schardax (2002)	Brouwer, de Haas, Ki viet (2002)	Gabrisch (2002)	Komulainen, Lukkarila (2003)	Gibson, Tsakalotos (2003)
Bank system				√	√	√		√	√						√	√	
Total bank assets (% din PIB)									•							•	
Weight of assets held by the state banks in the total of the bank assets				•				•									
Weight of the assets held by the foreign investors in total of the bank assets				•													
Focus level of the bank system						•											
Number of the financial institutions						•											
Correlation between the liabilities in foreign currency and the assets in foreign currency															•		
Adequacy rate of capital - solvability rate				•	•	•											
Dynamics of the credit granted by the central bank to the commercial banks					•	•											
Profitability of the bank institutions					•	•											

Source: Cerna, S., s.a. (2008), "Financial stability", Ed. Universitatii de Vest, Timisoara, pp 74-77

Among the numerous index systems proposed in the literature, the practice confirmed mainly the following[2]:

- the index system issued by IMF *(financial soundness indicators);*
- response tests of the financial system to the speculative stress factors *(stress-tests);*
- early warning systems *(early warning systems);*
- other quantitative analysis and assessment methods of the financial stability.

The significance of such financial stability indexes consists in that it offers a compete statement upon the financial system on the level of an economy as well as such relevant indexes related to the systemic shocks which might occur.

3. Background research

The main characteristics that a template built for the analysis of the financial stability must have are those above-mentioned according to the authors' conception: the appearance of the contagion phenomenon, the existence of the imperfections of the market, the emphasizing of the bank role, of the volume of the existing liquidities in the economy and the dissimilarity of the economic agents, the description of the macro-economical and micro-economical conditions, the possibility of use of the real data, the possibility of its practical use.

Having such requirements into view, there is observed that the mostly used templates are the following

- *Templates of the Real Business Cycle (Real Business Cycle* – RBC): which is characterized through an infinite horizon and through very strong micro-economical basics; they are the templates which take the anticipations of the economic agents into account.

- *General Equilibrum Templates (General Equilibrum*–GE): are those theoretical templates, meant to permit the reflection of the cyclical fluctuations of the

economy. They have a long tradition in the economic science, especially in the theory of the international trade, and are deemed computable general equilibrium templates) (computable general equilibrum models).

- *Dynamic Stochastic General Equilibrum Templates DSGE)*: are those templates usually used by the central banks for the provision of the inflation and the basic of the monetary policy.

- *Finite Horizon General Equilibrum FHGE* Templates: is treating the appearance of the financial fragility as a 146 equilibrum phenomenon.

- *Dynamic Aggregate Estimates Templates* – DAE: they were the mostly used templates in the macro-economy before the appearance of the theory of rational anticipations and their modernization permits the taking of the anticipations into consideration. Such templates are still used by the central banks for the basic of their monetary politics decisions.

- *Autoregressive Vecteurs – VAR –* and *structural VAR – SVAR:* are those templates created in the eighties in order to exceed the issue of the numerous restrictions that their templates include; currently, they are very spread. In the limited and most recent version (SVAR), the restrictions are imposed upon the distribution of residuals, and the followed scope is to identify the stocks and their submission mechanisms.

The panel or pool data involves remarks which possess both indexes for cross-sections, and regarding their timely evolution. The presence of the specific cross-section or temporal effects can be observed and analyzed by using techniques for fixed effects and for randomized effects. The templates including effects in one or both sizes can be mentioned, a steady effect in the size of the cross-section, a randomized effect in the size of the period or a steady effect in the size of the period. There should also be emphasized that, therefore, those with randomized effects in both sizes can be estimated only in case in which the panel is balanced, so that each cross-section should have the same effect of temporal remarks.[3]

There are several panel data templates. The main difference is that between the templates with steady effects (EF) and those with randomized effects (RE). For the templates with steady effects, the consistency of the error αi can be correlated with the xit regressing indexes, but there is still kept the hypothesis that there is no correlation between the xit and the randomized consistency of εit error. In the RE templates, there is presumed that the αi is totally randomized, a stronger hypothesis involving its non-correlation with the regressors (Baum, 2001).

In order to decide if a RE or FE template is better suited, we can perform a Hausman test. The Hausman principle can be applied to all the hypothesis testing issues in which two assessors are involved. In the concrete case of the data panel template, it is known that the FE assessor is consistent both in the RE template and in the FE template. In the FE template, it is also effective. On the other side, the RE assessor cannot be used in the FE template, being effective in the RE template by its construction (Kunst, 2009).

The mostly used assessors for the FE template is the WITHIN assessor. Such removes the steady effects by differences of averages. Because the WITHIN assessors grants a consistent assessment of the FE template, usually it is called the FE assessor. Also, it is consistent also in case of the RE templates, but other assessors are the most effective.[4]

The advantages of the panel data analysis[5]:

1. May include the individual particularities, in this way, the distortion induced through the data aggregation can be low or removed.
2. Brings information bonus by catching the individual variability
3. Reduces the multi-co-linearity phenomenon of the variables
4. Increases the number of the freedom levels and, implicitly, the power of tests, therefore the trust level in the obtained outcomes.
5. The increase of the effectiveness and consistency of the econometric assessments
6. Permits the construction and testing of certain behavioral templates more complex than the templates based on the analysis of the time serials or cross-section structures.
7. Permits a better analysis of the dynamics of the structural adjustments.

4. Methodology of research

The data are represented by the coverage of non-performing loans in some European Union countries, quality of loan portofolios in some European Union countries and the index of prices for these countries. The period is 2006-2011 and the data refer to twelve countries from European Union: Bulgaria, Czech Republic, Croatia, Poland, Slovenia, Hungary, Romania, Austria, France, Italy, Greece and England. The sources of data are represented by: EUROSTAT and IMF (International Monetary Fund- Financial Soundness Indicators).

The start regression is the following one:

$$loan\_quality_{it} = c + b \cdot coverage_{it} + d \cdot ip_{it} + a_i + \varepsilon_{it}$$

$loan\_quality_{it}$ – quality of loan portofolios in country i and year t

$coverage_{it}$- coverage of non-performing loans in country i and year t-1

ip_{it} – index of prices in country i and year t

a_i – individual effects

ε_{it}- the error

According to Baltagi (2008), first of all, we have to decide if we use a usual regression or a panel analysis. The OLS estimator is biased and inconsistent, the individual effects being present.

The application of Hausman test was made in order to decide if the model with fixed effects is better than the one with random effects or else. The probability associated to Hasman statistic is less than 0.05, the fixed effects model being better. However, we have to take into account the economic reasons for this type of model. The mechanical application of a test does not solve immediately the problem.

Table 1. Hausman test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.6848	1	0.5476

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
COVERAGE	0.4476	0.6477	0.03656	0.5476
IP	2.3334	0.4667	0.03757	0.4623

Table 2. Cross-section random effects test equation (Dependent Variable: QUALITY)

Variable	Coefficient	Prob.
COVERAGE	0.4476	0.000
IP	2.3334	0.0030
constant	6.3456	0.0624

Source: authors' computations

The standard model used for the errors starts from two important assumptions: the errors are homoscedastic and non-auto-correlated. The results of the applied tests put into evidence auto-correlated and heteroscedastic errors. Therefore, some robust estimators are necessary.

Table 3. Results of the homoscedasticity and auto-correlation tests

Tests:	Autocorrelation	Heteroscedasticity
Fixed effects model	F(1,11)= 4.8443 F computed= 25.58	Chi2(12)=21.026 Chi2 computed= 43.74
Random effects model	F(1,11)= 4.8443 F computed= 27.67	Chi2(12)= 21.026 Chi2 computed= 57.39

Stat program proved to be efficient in computing the regression with standard errors proposed by Driscoll and Kraay (2007), using the command xtscc. It is estimated the fixed effects model with Driscoll and Kraay errors that are heteroscedastic, auto-correlated up to a certain degree and possibly correlated with other groups. The robust estimations are presented in the following table:

Table 4. Estimations for fixed and random effects models corresponding to 2006-2011

MODEL	Fixed effects model	Random effects model
Constant	44.56 (23.577)*	53.39 (24.572)**
$\hat{b}$	0.0428 (0.0065)*	-0.0327 (3.674)**
$\hat{d}$	2.573 (0.036)*	2.648 (5.365)**
SIC (Schwarz information criterion)	476.577	687.935

In brackets Driscoll-Kraay errors were written, the level of significance being 1% (*) and 10% (**)

For the fixed effects model the coefficient is significant compared to the other model, that with random effects. Moreover, the SIC criterion has a lower value for fixed effects model.

5. Conclusions

A panel data approach was applied in this study to explain the evolution of loan quality in several European Union countries. The results indicated that a fixed-effects model would explain better the loan quality.

However, this research might be extended by proposing a separate model for each country. But the disadvantage is that the data set is too small. Actually, the main benefit of panel data analysis is that it could be applied for shorter time horizons.

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