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Systemic Financial Crises: A Cluster Analysis*

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Abstract:

This study examines the similarities between the current crisis and other systemic crises from the past. The purpose of our research is to discover whether previously used crisis management policies can constitute a referential in choosing the most effective policies for the management of the current crisis.

This study highlights important similarities between the current crisis and those that occurred in the past in Norway (1991) and Japan (1997), using a cluster analysis in order to obtain homogeneous groups of crises.. Also, through a qualitative analysis of crisis management policies, the study stresses the need to learn from past lessons.

Key Words: *Systemic Crisis, Management Policy, Cluster Analysis*

JEL Classification*: G01*

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1. Introduction

Over time, systemic crises affected most countries, being, however, events that are characterized by great diversity in terms of initial macroeconomic conditions, causes and triggers, level of development of affected countries and their openness towards the rest of the world, existing institutional framework and external conditions, etc. (Cecchetti, Kohler and Upper (2009), Laeven and Valencia (2010), Thalassinos (2006), Thalassinos et al., (2010)).

In these circumstances, achieving a robust research in the field of systemic financial crises, and particularly in the field of effective policies for the management of these crises, is extremely difficult if we consider that these are unusual events, often unpredictable, highly heterogeneous and influenced by many variables. The difficulty is even greater in quantitative research due to endogeneity, i.e. the inability to fully allocate macroeconomic results to a particular type of economic policy (for example, the fiscal one or the monetary one), as they relate to other influences, such as initial conditions, triggers, subsequent events, etc.

One of the solutions offered in the literature to overcome these difficulties is the analysis of the effectiveness of crisis management policies in classes of crises as homogeneous in terms of causes, triggers, effects, costs and future developments.

In this context, in the present study we assumed that the economic recovery policies have different effects during crises than when such events did not take place and we intend to achieve a multicriteria classification of systemic crises in homogeneous groups.

Also, in our analysis, we follow the approach present in many studies in the literature (Cecchetti, Kohler and Upper (2009), Laeven and Valencia (2008)) and analyze crises within national borders because, regardless of their magnitude, they are often managed at the national level, even if they are regional or global, like the current one.

On the concept of systemic crisis, the literature offers a multitude of approaches, but for the purposes of this study, we will work with the definition given by Laeven and Valencia (2010), who believe that a crisis is systemic if two conditions are met: "(1) - significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, bank liquidations) and (2) - significant banking policy intervention measures in response to significant losses in the banking system" (Laeven and Valencia (2010, p. 6)).

The remainder of this paper is organized as follows: the literature review and theoretical foundations on the effectiveness of crisis management policies are found in Section 2, the research methodology and data in Section 3, results and interpretation in Section 4, and finally the concluding remarks are found in Section 5.

2. The Effectiveness of Crisis Management Policies

Because the high costs of systemic crises require decisive action taken by authorities, researchers have turned increasingly more attention to the effectiveness of the policies designed to prevent and limit crises consequences. Among the most important policies, mentioned in the literature (Laeven and Valencia (2008), Jacome (2008), Richardson and Troost (2006), Detragiache and Giang Ho (2010)) are: liquidity support; assets purchase; government guarantees on deposits, deposit freeze, forbearance from capital requirements, government subsidies, debt cancellation, establishment of asset management companies, sales and recapitalizations of financial institutions assisted by the government.

Regarding the effectiveness of these policies, Laeven and Valencia (2008, p. 6-20) demonstrated, through a partial correlation analysis, that some are more efficient (the introduction of a general guarantee on all deposits), while others are costly and do not accelerate the process of economic recovery (liquidity support, government guarantees for certain financial institutions, forbearance from prudential regulations, bank closures and the establishment of asset management companies).

Unlike the conclusions of the analysis performed by Laeven and Valencia (2008), Enoch (2000) considers that policies such as bank closures mitigate moral hazard problems and may be more effective in terms of involved costs than the attempt to recover through recapitalization or asset sells.

Also, a strategy based on the liquidation of troubled banks may lead, in his view, to an improved performance of other banks in the system and to a cost-sharing between the government, on the one hand, shareholders and creditors, on the other hand, demonstrating, at the same time, the seriousness of the authorities in managing the banking system problems. On the other hand, the same author shows that bank closures, although effective in terms of cost, can be risky, the most significant consequences being bank runs, disruptions in the flow of payments and reduced lending.

At the same time, Baldacci, Mulas-Granados and Gupta (2009) studied the effectiveness of fiscal policies and found that the expansionist ones, based on increases in government consumption, are more effective in reducing the duration of the crisis than those who rely on public investment or on reduced income tax. On the other hand, the same authors show that public investments have the greatest impact on economic growth, if completed after the financial crisis.

Also, one should bear in mind that policies for the effective management of a crisis depend, to a great extent, on its trigger. Thus, deposit withdrawals and bank runs can be managed by immediate liquidity support, by expanding government guarantees on deposits or by temporarily suspending depositors right to withdraw their deposits, while serious solvency problems can be managed through the administration of those institutions by supervisory authorities and through assisted mergers or liquidations (Laeven and Valencia, 2008, p. 14).

The conclusions of the above-mentioned studies are based on qualitative analysis and partial correlation analysis between management policies, on the one hand, and indicators measuring the costs systemic crisis, on the other.

A lack of accuracy of these studies refers to the difficulty in assessing the effectiveness of policies adopted by governmental, monetary and prudential authorities. Specifically, these studies fail to overcome a serious problem consisting in the fact that some of mentioned policies are endogenous to specific economic events, while others, such as those adopted by the supervisory authorities, often overlap fiscal policies or changes of normative acts, whose impact on the economy is difficult to assess.

Thus, as shown by Richardson and Troost (2006), policy endogeneity and simultaneous changes, on multiple dimensions, of the management policies, prevent the attribution of macroeconomic results to specific policies adopted. To avoid these problems, the authors proposed a "quasi-experimental econometric strategy", which involves identifying a group of banks that operate in similar economic and regulatory conditions, but were exposed to different management policies (in their study, the authors chose to analyze a group of banks in two U.S. states, and the period under review is the 1929-1930 crisis). Using this methodology, comparing the results of various management policies can lead to conclusions unaffected by the endogeneity problem. Therefore, in order to assign differences in efficiency to differences in adopted policies, scientists need homogeneous groups of elements (banks / states) to analyze and exogenous policies.

The author's conclusion is that monetary interventionism, which implies providing large-scale loans to banks that are facing difficulties, including when the related guarantees are less liquid, mitigates bank panics, reduces the bankruptcy rate for credit institutions and minimizes the costs of the crisis.

3. Research Methodology and Data

The cluster analysis we used in this study is a classification technique characterized by the fact that the inclusion of items in a given cluster (or group) is done gradually and without "a priori" knowing the number of clusters. Also, two fundamental criteria must be met:

- elements grouped in each class are as similar in terms of their specific characteristics;
- elements grouped in a class differentiate as much as those grouped in any other class.

We chose the hierarchical classification method proposed by Ward because, with this method, the principle underlying the classification of items in clusters is to minimize variance within clusters and maximize the distance between the formed clusters. This method involves an agglomerative clustering algorithm and it uses an

analysis of variance approach to evaluate the distances between clusters. It starts out with a number of clusters equal with the number of items (n clusters of size 1) and continues by grouping these small clusters into larger ones, until all the observations are included into one cluster. At each step of the algorithm, clusters or observations are combined in such a way as to minimize the sum of squares of any two clusters that can be formed at each step.

Since our analysis aims, precisely, to obtain as homogeneous groups, taking into account a multitude of variables, we believe that the described method serves its intended purpose.

This study uses the systemic crises resolution database developed by Laeven and Valencia (2008), and adds to this database a number of baseline variables regarding the initial conditions and subsequent macroeconomic developments for a number of 37 systemic crises that occurred during 1980-2003. Also, the database is supplemented with data on 23 crises that occurred since 2007, as part of the current global crisis, characterized by Laeven and Valencia (2010) them as: a) - systemic crises and b) - "borderline cases", i.e. events that meet a large number, but not all, of the characteristics that, according to the authors, define a systemic crisis.

Since the limits for the indicators that define a systemic crisis are not rigorously substantiated by the respective authors, but also because of the similarity factors are dominant comparing to those of differentiation, we chose to include *"borderline cases"* events in the analysis. The classification of crises in clusters will confirm or refute our choice.

We classified the systemic crises depending on a number of variables included in the following categories:

- variables on the development of the country where the crisis manifested: GDP per capita recorded the year before the crisis;
- variables on macroeconomic conditions prior to the manifestation of the crisis: the GDP growth rate; inflation; interest rates; the exchange rate against the U.S. dollar; the exchange rate based on purchasing power parity; the financial intermediation, as measured by the ratio of banking deposits to GDP; the current account deficit as percentage of GDP;
- variables related to external conditions in the year before the crisis: world GDP growth; the occurrence of other crises;
- variables on economic developments in the first two years after the onset of the crisis: the manifestation of a currency crisis in that period; the evolution of international liquidity as measured by total international reserves (excluding gold); GDP growth; inflation; the exchange rate against the U.S. dollar; the exchange rate based on purchasing power parity.

Data sources are World Economic Outlook and IMF International Financial Statistics.

Each of these variables is standardized as Z score (converted into a variable with the mean equal to 0 and the standard deviation equal to 1). By using this process, all variables will have the same unit and same weight in the model.

We did not introduced in the cluster analysis, as Cecchetti, Kohler and Upper (2009) did in a study of a smaller number of systemic crises, the response of the authorities to the crisis, i.e. the policies that have been used, because we intend to analyze these management policies within the resulted clusters.

4. Results and Interpretation

The sample we analyzed consists of 60 systemic crises that manifested in the period 1980-2008. We classified these crises using Ward's method.

The results of the cluster analysis are represented by a dendogram (chart no. 1). As the number of clusters into which crises are grouped is not initially known, this element was not specified in the model.

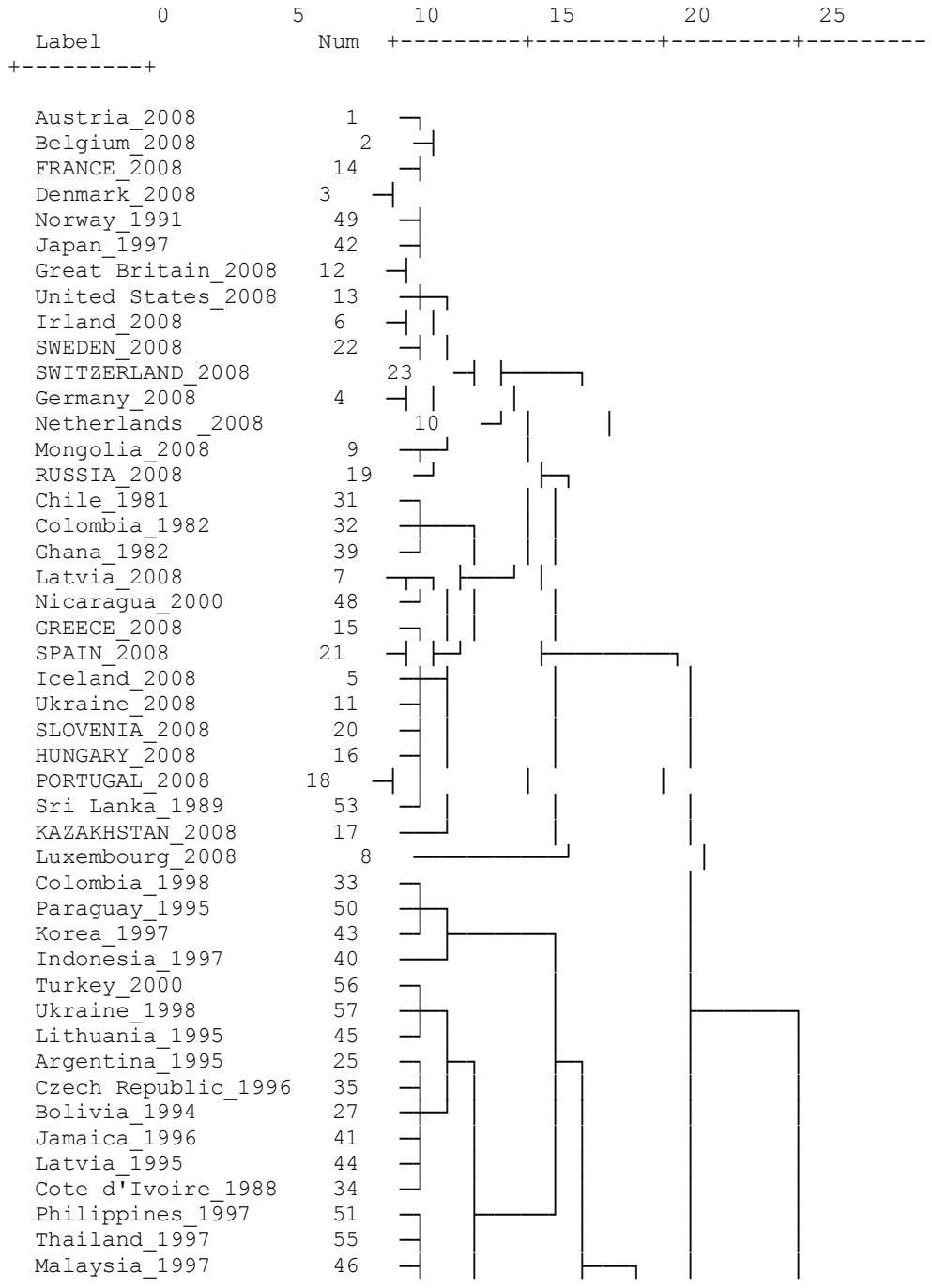
Thus, chart no. 1 shows the grouping of crisis based on their similarity and gives a measure of the magnitude of differences between clusters.

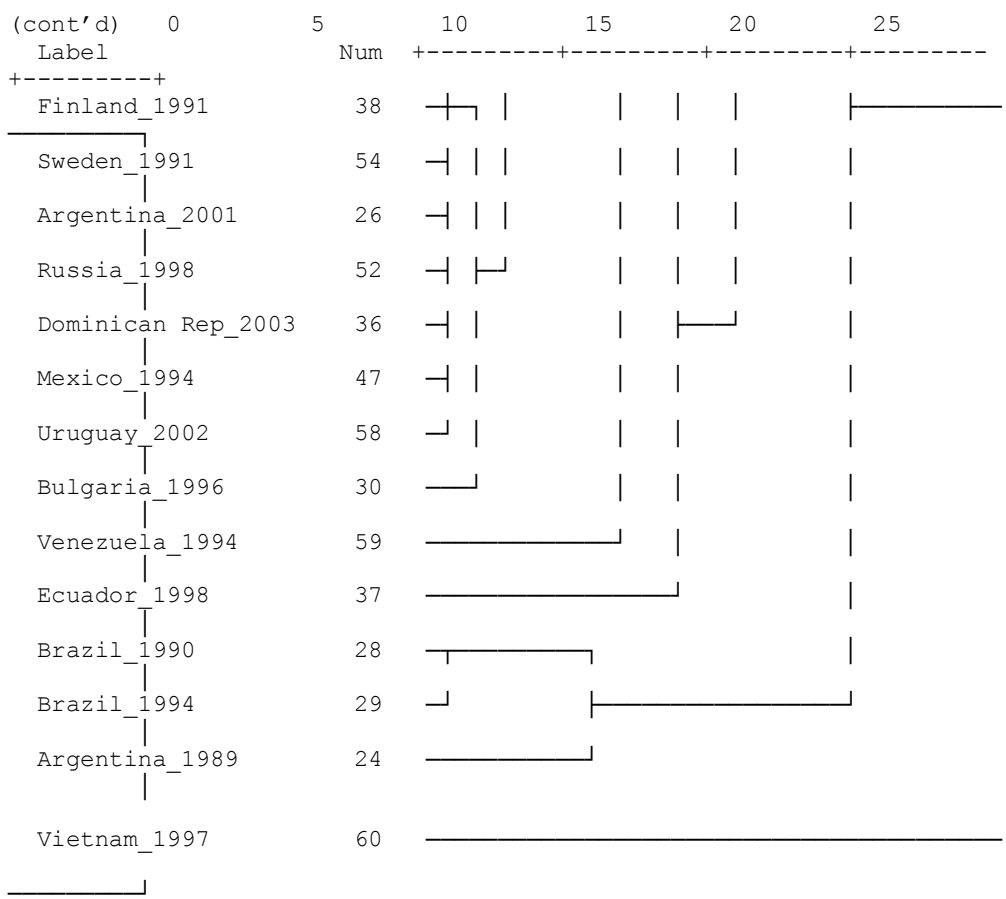
In the first stage of the algorithm, the most similar crises were grouped, the distance between them being represented on the horizontal axis of the chart. In later stages, the formed groups are structured in new larger groups, on the same principle.

Choosing the number of clusters and hence the distances between the elements within a cluster depends on the decision of the analyst. Also, the number of clusters may remain anonymous, and, in this situation, a successive grouping of smaller classes in larger ones is made. Based on this methodology we drew chart no. 1, in which the names of the countries and the years of the crises are shown on the vertical axis.

Crises which manifested after 2007 and which were considered by Laeven and Valencia (2010) as *"borderline cases"* are capitalized, in order to check their separate grouping.

Chart no. 1 - Dendogram resulting from Ward's classification method





In **Chart no. 1** we can see that most of the crises that occurred after 2007 are grouped in the initial stage, indicating a high degree of similarity between them. However, in the same initial stage, we see that other crises, manifested in the past, are grouped with current events.

Thus, the results that we got partially confirms those obtained by Cecchetti, Kohler and Upper (2009), according to which current events are unique. These events have, indeed, according to our analysis, a high degree of dissimilarity compared to most other major systemic crisis, but there are similar events in the past that may constitute a referential for authorities in choosing the most effective management policies for the current crisis. In our opinion, the current financial crisis combines characteristics of past crisis episodes with new ones, the latter being the consequence of profound transformations that have marked the financial world in recent years.

However, current events from a number of countries (France, Greece, Hungary, Kazakhstan, Portugal, Russia, Slovenia, Spain, Sweden, Switzerland),

considered by Laeven and Valencia (2010) as *„borderline cases"* are not grouped separately depending on the variables we included in the analysis. Thus, our conclusion is that they can be analyzed together with other crises that occurred since 2007, in a similar manner.

Regarding the similarities of current events with other crises manifested in the past, we see in chart no. 1 an initial grouping (indicating a high degree of similarity) of the current crisis manifested in Austria, Belgium, France, Denmark, UK, USA, Ireland, Sweden, Switzerland, Germany and Netherlands with crises that manifested in Norway in 1991 and Japan in 1997. Since this is the most significant grouping of current events with past crisis (the degree of similarity is high and current events in many states are present in this cluster), we consider appropriate to chose the events in Japan (1997) and Norway (1991) as a referential in analyzing the efficiency of the management policies used in the current global crisis. In other words, since these past events have the greatest degree of similarity with the current events, we expect the policies and instruments that have yielded good results in the management of past events to have a high degree of efficiency in the management of the current crisis too.

These results are consistent with those obtained in the studies conducted by Borio, Vale and von Peter (2010) which examines the authorities' response to the current crisis and compares it to that given by the Nordic states' authorities, in the crisis from the early '90s. Our results are also consistent with those obtained by Takeo and Kashzap (2008) and Barbu, Dardac and Boitan (2009), who examines the programs implemented to support banks by public authorities in response to the current crisis by reference to the *"Japanese lesson"*.

Considering the obtained results, we will briefly present the main coordinates of the crisis management policies that were used in Norway (1991) and Japan (1997) and we will consider whether current crisis management policies follow the lessons of past crises.

Regarding the Japanese crisis that was triggered in 1997, the major management policies used were: the protection of depositors of bankrupt banks; government intervention in the form of nationalizations, used very late in the crisis, after the failure of major banks; recapitalization by issuing preferred stock, a measure with limited success; the establishment of asset management companies; mechanisms for resolving bank failures; Takenaka plan (which imposed a series of measures, including rigorous assessment of bank assets, a ban on unrealistic data declared by banks and plans to recapitalize banks (Barbu, Dardac and Boitan, 2009)).

Regarding crisis management policies used in Norway (1991), considered by many authors as exemplary (Borio, Vale and von Peter, 2010), they consisted, in particular, of: substantial capital injections made quickly after the announcement of bank difficulties; restructuring and recapitalizations of banks; management dismissals and restrictions on operations for banks that have experienced problems; liquidations and closures of small banks, faced significant challenges, together with

guarantees issued on all their deposits by the guarantee schemes; immediate establishment of a government insurance fund to provide liquidity to the deposit guarantee fund, after the exhausting of its resources; more restrictive accounting standards and lack of exceptions from prudential requirements for financial institutions.

Compared with the policies that were used to manage the crises in Japan and Norway, the interventions of authorities in the states affected by the current crisis are mainly represented by: the injection of liquidity with the aim to support financial institutions; insurance programs and the purchase of troubled assets; government guarantees on bank assets; increased amounts covered by deposit guarantees schemes; bank recapitalization and restructuring.

These are the main coordinates of the crisis management policies, which are found in most of the analyzed states and, in our opinion, they indicate the concern of the authorities to support the banking capital. However, the rapidity with which these programs were implemented highlights that authorities are aware of the importance of fast action, learned from past crises. On this issue, Borio, Vale and von Peter (2010) show that, in the management of the current crisis, the intervention was even faster that that used in the Nordic countries in response to the crisis from the '90s. Also, the fact that, in the current crisis, liquidity support operations have a leading role highlights the awareness of the beneficial role that these interventions had in past events.

However, actions taken in response to the current crisis do not seem to make an equally important emphasis on limiting moral hazard, as government control and ownership, management dismissals or penalties on shareholders play a less important role in the management of the current crises than in previous episodes to which we refer in this study.

5. Concluding Remarks

Using systems for unsupervised recognition of forms (cluster analysis), this study examines the similarities of the current crisis with other systemic crisis that occurred in the past. The purpose of this exercise is to discover whether crisis management policies previously used can constitute a referential in choosing the most effective policies for the management of the current crisis. The results indicate important similarities between current events and crises that manifested in the past in Norway (1991) and Japan (1997).

Also, the management policies used in the current crisis shows that government and monetary authorities have learned something from the lessons of the past.

However, both researchers and practitioners are still seeking the answer to the question "How will be the end of the current crisis that seriously threatens the overall stability of the financial world and, particularly, that of the Euro area?". The answer is, indeed, extremely difficult. It's like a three-dimensional chess game in

which economic, financial and political factors are interacting. The answer to this question must be an argued one and, from this perspective, can be a starting point for future research.

References

1. Baldacci, E., S. Gupta and C. Mulas-Granados, 2009, "How Effective Is Fiscal Policy Response in Systemic Banking Crises", *IMF Working Paper, WP/09/160*
2. Barbu T., N. Dardac and I. Boitan, 2009, „The effects and cost of bank recapitalization in financial crises", paper prepared for the 10th International Conference Finance and Economic stability in the context of financial crisis, The Academy of Economic Studies, Bucharest, Romania, 11-12 december 2009
3. Borio C., B. Vale and G. von Peter, G., 2010, "Resolving the financial crisis: are we heeding the lessons from the Nordics?" *BIS Working Papers no. 311, June 2010*
4. Cecchetti, S., M. Kohler and C. Upper, 2009, „Financial Crises and Economic Activity", *National Bureau of Economic Research, working paper no. 15379*
5. Detragiache E. and Giang Ho, 2010, "Responding to banking crises:lessons fron cross-country experience", *IMF Working paper, WP/10/18*
6. Enoch, C., 2000, "Interventions in Banks During Banking Crises: The Experience of Indonesia.", *IMF Policy Discussion Paper 00/2, Washington, DC: International Monetary Fund.*
7. Jacome, L., 2008, "Central Bank Involvement in Banking Crises in Latin America", *IMF Working Paper, WP/08/135.*
8. Laeven, L. and F. Valencia, 2008, "Systemic Banking Crises: A New Database", *IMF Working Paper, WP/08/224*
9. Laeven, L. and F. Valencia, 2010, "Resolution of banking crisis The Good, The Bad, The Ugly", *IMF Working Paper, WP/10/146*
10. Richardson, G. and W. Troost, 2006, "Monetary Intervention Mitigated Banking Panics During the Great Depression: Quasi-Experimental Evidence from the Federal Reserve District Border in Mississippi, 1929 to 1933", *National Bureau of Economic Research Working Papers, no. 12591*
11. Takeo, H. and A.K. Kashzap, 2008, "Will the US bank recapitalization succeed? Eight Lessons from Japan", *National Bureau of Economic Research Working Papers, no. 14401*
12. Thalassinos, J., Kyriazidis, Th., Thalassinos, E., (2006), "The Greek Capital Market: Caught in Between Poor Corporate Governance and Market Inefficiency", *European Research Studies Journal, Vol. IX, issue (1-2), pp. 3-24.*
13. Thalassinos, E., Zampeta, V., Deceanu, L., Pintea, M., (2010), "New Dimensions of Country Risk in the Context of the Current Crisis: A Case Study for Romania and Greece", *European Research Studies, Volume XIII, Issue (3).*