THE QUANTITATIVE SURVEY ON MACROECONOMIC DETERMINANTS OF AGGREGATE CREDIT RISK

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Abstract

Common exposure to macroeconomic risk factors across banks (financial institutions) is a source of systemic risk that influences, among others things, the quality of bank´s loan portfolios and credit risk (Festić et al., 2011). This paper focuses on the growing literature on credit risk determinants (macroeconomic, bank-specific or institutional) that emerged especially in the last decade. The aim of the paper is to provide more general information on effects of macroeconomic credit risk drivers. The aim is fulfilled with usage of quantitative meta-analytic techniques. Concretely, general effects of macroeconomic determinants on credit risk are used in the meta-regression to identify key differences among relevant studies.

The authors focus only on those studies, which use non-performing loans (NPLs) as an indicator of credit risk, although there are several possible measurements of the aggregate credit risk such as loan loss provisions, loan loss reserves or new bad debt ratio. More specifically, authors focus on the models, which use non-performing loans ratio (NPLR), calculated as the ratio of non-performing loans to the total gross loans, as dependent variable.

The authors consider five most common macroeconomic determinants of non-performing loans ratio, which are presented in the relevant literature: economic growth, interest rate, inflation, unemployment and exchange rate. The general effects of selected macroeconomic credit risk drivers are calculated as weighted averages of parameters of respective macroeconomic determinants, which were estimated in the empirical studies. The weights of parameters, which represent precision of estimation, are calculated as an inverse of their standard errors; see for instance Knell and Stix (2005). In the case that standard errors are not provided in the papers, they are either calculated from other presented results such as standard deviations or t-statistics; or otherwise, if it is not possible to calculate them, the papers are excluded from the analysis. The preliminary results suggest that there are some significant differences among studies which could be identified when the meta-regression is employed, for instance, data specification or number of countries and observations included in the model play significant role.

Keywords: Aggregate credit risk, Non-performing loans ratio, Meta-analysis, Macroeconomic determinants

1. INTRODUCTION

Monitoring of credit risk is one of the most important parts of macroprudential analysis, which is focused on evaluation of systemic risks. Systemic risk is considered to be endogenous based on common exposures of financial institutions to macroeconomic risk factors and interactions between real economy and financial systems (Borio, 2003). The aim of the paper is to provide more general information on effects of macroeconomic risk drivers influencing aggregate credit risk and identify key differences among studies. The aim is fulfilled with usage of quantitative meta-analytic techniques. In general, meta-analysis is a quantitative method, which enables researchers to identify publication selectivity, to correct effects caused by misspecifications in methodologies or to investigate structural differences in estimated parameters (Havranek and Sedlarikova, 2014). Meta-analysis can also help to identify ambiguous results provided by empirical literature (e.g. how changes in price level or exchange rate affect aggregate credit risk).

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The determinants of aggregate credit risk, most often cited in the surveyed studies, which will be included in our analysis are real economic growth, interest rates, inflation, exchange rate and unemployment. Meta-analysis of existing studies has been suggested as a potentially more powerful way of gaining results compared to a standard literature surveys (see e.g. Lipsey and Wilsen, 2001; Cuaresma et al., 2011). Further, this approach allows for the analysis of possible factors which may influence estimated results (e.g. data definitions, time period, model specifications, countries included). Concerning methodology, authors employ weighted least square (WLS) approach to identify differences among studies.

The rest of the paper is organized as follows. Section 2 describes surveyed studies, their main characteristics and selection procedure. Section 3 provides basic statistical analysis including median effects and weighted averages. Section 4 presents preliminary results from the moderator analysis and last section concludes.

2. SURVEYED STUDIES

The authors searched various sources of information in the period from June to October 2014 (e.g. Web of Science and Scopus databases or published literature reviews) and tried to find all papers focused on aggregate credit risk, which was regressed on selected macroeconomic determinants: economic growth, interest rate, inflation, exchange rate and unemployment. Overall, authors identified 33 studies that included 92 models and almost 300 estimated parameters of the five respective determinants. To include individual study into the selection the following conditions had to be fulfilled: (i) aggregate credit risk was measured as non-performing loans ratio (or its logarithmic transformation), (ii) at least one of the selected macroeconomic credit risk drivers was included and (iii) study presented results on standard errors or other characteristics that enable authors to consider precision of the estimations. However, there was significant amount of studies that did not hold these conditions, i.e. studies on disaggregated level (e.g. Boss et al., 2009; Cifter et al., 2009; Munich and Suria, 2013) or studies using other indicators of credit risk (i.e. loan loss provisions, see Arpa et al., 2001; Kalirai a Scheicher, 2002; Hoogarth et al., 2005; Vogiazas and Nikolaidou, 2011; various specifications of default rate (see Virolainen, 2004; Bonfim, 2009; Vuillemey, 2014); indicators based on the inflow of NPLs (see Marcucci and Quagliariello, 2008; Bofondi and Ropele, 2011) or loan loss reserves (see Liu and Yang, 2010; Love and Arissc, 2014). Furthermore, there were studies focused only on bank-specific or institutional determinants of credit risk, which did not take into account selected macroeconomic risk drivers (e.g. Podpiera and Weill, 2008). Also some types of models not dealing with time series were excluded (e.g. Kauko, 2012).

As can be seen from the table 1 there is only a limited number of studies that were published prior to the global financial and economic crisis, and the literature was fast-growing after 2010. More than half of the studies focus only on one country and only five of them use larger panels. This might be due to limited data availability and problematic international comparison, for instance, because of different definitions of non-performing loans in individual countries. The surveyed studies use mostly quarterly data, followed by annual data but only 3 of them use monthly data. More than half of the papers are published in journals indexed in the Web of Science (WOS) or Scopus database. Two thirds of the papers employ dynamic specification in the models (i.e. at least one lag of explanatory variable).

Table 1: Surveyed studies and their main characteristics

	Authors	Year	Countries	Data	Freq.	Source
1	AHMAD, F., BASHIR, T.	2013	Pakistan	1991-2011	A	SC
2	ALHASSAN, A. L., KYEREBOAH-COLEMAN, A., ANDOH, CH.	2014	Ghana	2005-2010	A	SC
3	BABIHUGA, R.	2007	96 countries	1998-2004	A	WP
4	BABOUČEK, I., JANČAR, M.	2005	Czech Republic	1993M1-2004M11	M	WP
5	BUNCIC, D., MELECKY, M.	2013	54 high and middle income countries	1994-2004	A	IF
6	CASTRO, V.	2013	Greece, Ireland, Portugal, Spain, Italy	1997Q1-2011Q3	Q	IF
7	DE BOCK, R., DEMYANETS, A.	2012	25 emerging countries	1996-2010	A	WP
8	ESPINOZA, R., PRASAD, A.	2010	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE	1995-2008	A	WP
9	FESTIĆ, M., REPINA, S., KAVKLER, A.	2009	Estonia, Latvia, Lithuania, Romania, Bulgaria	1999Q1-2008Q4	Q	IF
10	FESTIĆ, M., ROMIH, D.	2008	Slovakia, Slovenia, Czech	1995M1-	M	IF

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			Republic	2006M12		
11	FESTIĆ, M., BEKŐ, J.	2008	Hungary, Poland, Czech Republic, Slovakia, Slovenia	1995Q1-2007Q1	Q	IF
12	GERLACH, S., PENG, W., SHU, CH.	2005	Hong Kong	1995-2002	A	WP
13	GREENIDGE, K., GROSVENOR, T.	2010	Barbados	1996Q1-2008Q4	Q	REW
14	GUY, K., LOWE, S.	2011	Barbados	1996Q1-2008Q4	Q	REW
15	CHAIBI, H., FTITI, Z.	2015 *	France, Germany	2005-2011	A	SC
16	CHOY, I. W. T.	2014	Macao	2003Q1-2013Q1	Q	WP
17	JIMÉNEZ, G., SAURINA, J.	2006	Spain	1984-2002	A	IF
18	KAVKLER, A., FESTIĆ, M.	2010	Estonia, Lithuania, Latvia	1997Q1-2007Q3	Q	REW
19	LOUZIS, D. P., VOULDIS, A. T., METAXAS, V. L.	2012	Greece	2003Q1-2009Q3	Q	IF
20	MANCKA, A.	2012	Albania	2002Q1-2010Q4	Q	REW
21	MESSAI, A. S., JOUINI, F.	2013	Italy, Greece, Spain	2004-2008	A	REW
22	NJOROGE, L., KAMAU, A. W.	2010	Kenya	2000Q4-2009Q4	Q	SC
23	NKUSU, M.	2011	26 advanced countries	1998-2009	A	WP
24	NOVIKOV, I.	2012	Estonia, Latvia, Lithuania	1997Q3-2009Q4	Q	REW
25	PODPIERA, R.	2006	65 countries	1998-2002	A	IF
26	REININGER, T., JAKUBÍK, P.	2013	Bulgaria, Croatia, Czech Republic, Hungary, Romania, Poland, Russia, Slovakia, Ukraine	2004Q1-2012Q4	Q	REW
27	SALAS, V., SAURINA., J.	2002	Spain	1985-1997	A	IF
28	SHIJAKU, H., CECA, K.	2011	Albania	2005Q1-2009Q4	Q	WP
29	SHINGJERGJI, A.	2013	Albania	2005Q1-2012Q1	Q	REW
30	SHU, CH.	2002	Hong Kong	1995Q1-2002Q2	Q	WP
31	VAZQUEZ, F., TABAK, M. B., SOUTO, M.	2012	Brazil	2001Q1-2009Q1	Q	IF
32	YURDAKUL, F.	2014	Turkey	1998M1-2012M7	M	SC
33	ZEMAN, J., JURČA, P.	2008	Slovakia	1996Q4-2006Q4	Q	WP

Note: Freq. – data frequency, M – monthly, Q – quarterly, A – annual, IF – journal indexed in WOS database, SC – journal indexed in SCOPUS database, WP – working paper, REW – reviewed article not indexed in WOS or SCOPUS database.

Source: self-elaboration-

3. EFFECTS OF MACROECONOMIC DETERMINANS ON NPLR

Table 2 provides simple vote counting analysis that summarizes information obtained from the literature review. Table 2 reports number of models with statistically significant positive and negative impact of the respective variable as well as number of models with statistically insignificant effect and number of models that do not include respective variable. The mostly incorporated variable is real economic growth followed by interest rate; on the other hand, unemployment is not included in more than half of the models.

The empirical studies confirm theoretically assumed effects of some macroeconomic determinants of the non-performing loans. The empirical evidence on the effect of real economic growth on NPLR is mostly in line with theoretical assumptions when the economic growth increases ability of the debtors to pay their debts off (see for instance Jiménez and Saurina, 2006; Podpiera, 2006; Louzis, Vouldis and Metaxas, 2012; Buncic and Melecky, 2013). Also in the case of interest rates there is a prevalence of theoretically assumed effect on the NPLR which suggests that increase in interest rates cause rise of debt burden and increase in NPLR (see for instance Jiménez and Saurina, 2006; Podpiera, 2006; Festić and Bekő, 2008; Buncic and Melecky, 2013).

Nevertheless, in the case of inflation and exchange rate the effects on credit risk are not clear and there is almost the same number of models with positive as with negative estimates of respective coefficients. For instance Festić and Bekő (2008), Babihuga (2007) and Fofack (2005) argues that increase in inflation (especially unexpected inflation) can lead to rise of non-performing loans, on the other hand Shu (2002) suggests the opposite relation, i.e. the fall of non-performing loans ratio due to the erosion of the real value of debts. The effect of exchange rate on NPLR is mixed because of the two contrary effects – balance sheet

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effect and income effect, which are usually not separated in the surveyed studies.

Considering unemployment rate, the positive and statistically significant estimated parameters prevail but there is a relatively larger share of insignificant estimates compared to other macroeconomic variables. More detailed explanations of assumed effect of macroeconomic determinants on NPLR are provided in Melecky and Sulganova (2013).

Table 2: Vote counting

Number of models with	REG	LR	INFL	ER	UNP
Positive stat. sign. coefficient	9	44	18	20	26
Negative stat. sign. coefficient	70	10	18	19	2
Statistically insignificant coefficient	6	7	10	12	12
Variable not included	5	29	44	39	50
Total	90	90	90	90	90

Note: REG - real economic growth, LR - interest rate, INFL - inflation rate, ER - exchange rate, UNP – unemployment.

Source: author's calculations.

Table 3 summarizes statistics of the overall effects of selected determinants in the models. Firstly, minimum and maximum sizes of the effects from selected studies are presented. Furthermore, in the next two rows arithmetic averages and median effects of estimated parameters are provided. Last row of table 3 presents weighted averages. The weights of parameters, which represent precision of estimation, are calculated as an inverse of their standard errors, see for instance Knell and Stix (2005). More precise models (e.g. because of larger data sets) therefore gain higher weights. As can be seen from table 3, simple arithmetic averages vary significantly from the weighted averages; however, some of the median values are quite close to the weighted averages, for instance those reported for exchange rate or interest rate.

Table 3: Meta-statistics

Descriptive statistics	REG	IR	INFL	ER	UNP
Min	-8.88	-0.58	-2.69	-10.27	-0.20
Max	68.81	10.80	1.75	3.42	3.27
Average	0.04	0.43	0.02	-0.24	0.56
Median	-0.19	0.11	-0.11	0.01	0.28
Weighted average	-0.09	0.08	-0.04	0.01	0.22

Note: REG - real economic growth, IR - interest rate, INFL - inflation rate, ER - exchange rate, UNP – unemployment.

Source: author's calculations.

Due to the extensive size of the tables containing information about estimated coefficients and calculated weighted estimated coefficients of the individual models authors do not report them and they are available upon request.

4. META-REGRESSION ANALYSIS

This section focuses on the identification of study-specific factors which might have impact on the results obtained from the surveyed studies. The estimation method preferred in this analysis is weighted least squares. Typical meta-regression is thus given as in equation 1.

$$\hat{\beta}_{i,j} = \mu + D_j\theta + u_{i,j}\,. \tag{1}$$

Where $\hat{\beta}_{i,j}$ is the weighted coefficient estimate corresponding to variable *i* in study *j* and D_j is a matrix containing variables reflecting various characteristics of the study and $u_{i,j}$ is error term, which may have a different distribution for each of the analyzed studies, see e.g. Cuaresma (2011). The matrix D_j includes both continuous and dummy variables, which summarize information related to e.g. data definition, period included, estimation method or publication. As a control variables the authors include: variables describing data set, frequency and level of data, and number of observations of individual studies. Furthermore, control variables, which identify dynamic form of model specification and method of estimation are employed. Also

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variables describing number of countries included in a study and whether these countries are European are taken into account. The last characteristics used as control variables are those identifying whether part of the data set belongs to the crisis period and whether studies are published in a journal with impact factor. The detailed description of control variables is provided in the table 4.

Table 4: Definitions of the control variables used in meta-regressions

Control variable	Abr.	Definition
Average year	AY	Continuous variable: Average year of data set (year 2000 was used as a base) of individual model
Number of years	NY	Continuous variable: Number of years included in the data set of individual model
Number of observations	NO	Continuous variable: natural logarithm of number of observations included in an individual model
Frequency of data	FRQ	Binary dummy: 1 if frequency of data is quarterly, 0 otherwise
Level of data	BL	Binary dummy: 1 if bank-level data are used, 0 otherwise
Multiple countries	MC	Binary dummy: 1 if number of countries included in model is higher than one, 0 otherwise
European countries	EC	Binary dummy: 1 if at least one country included in model is European, 0 otherwise
Dynamic specification	DYN	Binary dummy: 1 if model specification is dynamic, 0 otherwise
Impact factor	IF	Binary dummy: 1 if study is published in a journal with impact factor from the Web of Science database
Estimation method	OLS	Binary dummy: 1 if method of estimation is OLS, 0 otherwise
Crisis included	CRIS	Binary dummy: 1 if crisis years (from 2008 to nowadays) are included in data set, 0 otherwise

Source: self-elaboration.

In principle, equation 1 could be estimated using classical OLS method but such an estimation method does not take into account precision of the individual estimates. Potential alternative is to employ WLS estimation method by taking into account precision of each parameter estimate which is measured by the inverse of their standard errors (consistently with Knell and Stix, 2005). The dummy variable was used in the meta-regressions (except of the one for inflation) to avoid identification problem due to the existence of extreme outliers. Estimation results suggest that there are significant differences among studies as can be seen from table 5.

Table 5: Meta-regressions results

	REG		IR		INFL		ER		UNP	
	E.C.	S.E.	E.C.	S.E.	E.C.	S.E.	E.C.	S.E.	E.C.	S.E.
AY	0.03	0.15	-0.03	0.34	1.31**	0.55	0.76	0.48	0.37	0.27
BL	1.45	0.92	0.46	1.66	-16.27***	3.85	-2.48	3.10	3.30**	1.20
CRIS	0.33	1.47	-4.39*	2.47	-1.74	4.04	-4.28	3.18	-2.37**	1.10
DYN	-1.13	0.74	2.37	1.70	6.49**	2.94	2.37	2.28	0.63	0.53
EC	0.66	0.69	2.82*	1.65	-10.67***	3.45	-2.67	2.16	3.75***	1.22
FRQ	-0.60	0.84	5.18***	1.88	-8.97***	2.38	4.74***	1.52	-0.69	0.75
IF	-1.94**	0.81	1.30	1.68	-11.33***	4.17	5.77	4.00	-0.56	0.73
MC	1.68***	0.56	1.02	1.20	13.63***	4.24	-2.23	3.42	0.56	0.77
NO	-0.94**	0.42	2.56**	1.18	3.47***	1.18	1.01	1.00	0.41	0.35
NY	-0.10	0.12	-0.10	0.19	-0.61**	0.25	0.14	0.20	0.43**	0.17
OLS	1.36**	0.69	0.98	1.61	-0.96	1.97	-2.44	1.70	0.82	1.03
DUMMY	-16.76***	1.08	22.8***	3.82	NI	NI	-26.32***	2.55	40.70***	1.04

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Constant	1.96	2.54	-10.85	7.01	-6.14	6.78	-5.63	6.05	-9.16*	4.65
Observations	79		54		36		39		28	
R^2	0.61		0.68		0.70		0.86		0.99	

Note: *, **, *** denotes statistical significance at 10%, 5% and 1% level, respectively. NI denotes that dummy was not included. E.C. denotes estimated coefficient and S.E. is its standard error. REG - real economic growth, IR - interest rate, INFL - inflation rate, ER - exchange rate, UNP – unemployment.

Source: author's calculations.

Consider real economic growth first. The estimated coefficients among the models differ depending on if the study is published in the journal with WOS impact factor, if the dataset includes more than one country, if the estimation method is OLS or not and results also depends on sample size. Consider interest rate next. The differences among estimated coefficients in this case could be explained by data characteristics as frequency of the data and inclusion of crisis years into the regressions and are also significantly affected by number of countries and number of observation which enter into the models. Most of the control variables are statistically significant at least at 5% significance level in the inflation´s meta-regression; only inclusion of crisis years and OLS specification does not significantly affect differences among the studies. In the case of exchange rate, the only significant determinant of differences among studies is data frequency when estimated coefficients are significantly higher if the model uses quarterly data. Finally, the estimated coefficients for the effect of unemployment on NPLR varies among the models due to characteristics of the data (bank-level or others), inclusion of the crisis years into the model, number of years and number of countries in the model. All dummy variables in the regressions are statistically significant at 1% significance level.

CONCLUSION

This paper focus on the growing literature on credit risk determinants that emerged especially in the last decade. The aim of the paper is to provide more general information on effects of macroeconomic credit risk drivers with the help of meta-analytic techniques. The authors analyzed only those studies, which use non-performing loans as an indicator of credit risk. The authors investigated the effects of the five most common macroeconomic determinants of non-performing loans ratio presented in the relevant literature: economic growth, interest rate, inflation, unemployment and exchange rate. Overall, authors identified 33 studies that include 92 models and roughly 300 estimates of the five respective determinants. The general effects of selected macroeconomic credit risk drivers are calculated as weighted averages of individual effect, which take into account precision of estimates and were found to be significantly different from the arithmetic averages.

The preliminary results of meta-regressions suggest that there are some significant differences among studies; for instance, data specification, number of countries and observations included in the model play significant role. The largest number of significant determinants among the studies were found in the case of inflation´s meta-regression (9 of 11 control variables). On the other hand, there is only one significant determinant of differences in estimated effects among studies in the case of exchange rate´s meta-regression, which is data frequency. Further, authors plan to extend the number of studies in the analysis if possible and use alternative techniques of estimation in meta-regression analysis to confirm robustness of the results.

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REFERENCE LIST

Ahmad, F., and Bashir, T. (2013). Explanatory Power of Macroeconomic Variables as Determinants of Non-Performing Loans: Evidence from Pakistan. *World Applied Sciences Journal*, 22 (2).

Alhassan, A. L., Kyereboah-Coleman, A., and Andoch, CH. (2014). Asset quality in a crisis period: An empirical examination of Ghanaian banks. *Review of Development Finance*, 4 (1).

ISBN: 978-605-64453-2-3

Arpa, M., Giulini, I., Ittner, A., and Pauer, F. (2001). The influence of macroeconomic developments on Austrian banks: implications for banking supervisit. [BIS Working Paper No. 1]. Basel: Bank for International Settlements.

Babihuga, R. (2007). Macroeconomic and financial soundness indicators: an empirical investigation [Working Paper 07/115]. Washington: International Monetary Fund.

Babouček, I., and Jančar, M. (2005). A VAR analysis of the effects of macroeconomic shocks to the quality of the aggregate loan portfolio of the Czech banking sector [Working Paper Series 1]. Praha: Česká národní banka.

Bofondi, M., and Ropele, T. (2011). Macroeconomic determinants of bad loans: evidence from Italian banks. [Occasional Papers No. 89] Rome: Banca D´Italia.

Bonfim, D. (2009). Credit risk drivers: evaluating the contribution of firm level information and of macroeconomic Dynamics. *Journal of Finance and Banking,* 33 (2).

Borio, K. (2003). Towards a macroprudential framework for financial supervision and regulation? [BIS Working Paper No. 128]. Basel: Bank for International Settlements.

Boss, M., Fenz, G., Pann, J., Puhr, C., Schneider, M., and Ubl, E. 2009. Modeling Credit Risk through the Austrian Business Cycle: An Update of the OeNB Model. In Oesterreichische Nationalbank (ed.). Financial Stability Report 17. Vienna: Oesterreichische Nationalbank.

Buncic, D., and Melecky, M. (2013). Macroprudential stress testing of credit risk: a practical approach for policy makers. *Journal of Financial Stability,* 9 (3).

Castro, V. (2013). Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. *Economic Modelling,* 31 (C).

Cifter, A., Yilmazer, S., and Cifter, E. (2009). Analysis of sectoral credit default cycle dependency with wavelet networks: Evidence from Turkey. *Economic Modelling*, 26 (6).

Cuaresma, C. J., Fidrmuc, J., and Hake, M. (2011). Determinants of Foreign Currency Loans in CESEE Countries: A Meta-Analysis. *Focus on European Economic Integration Q4/11*.

de Bock, R., and Demyanets, A. (2012). Bank Asset Quality in Emerging Markets: Determinants and Spillovers [Working Paper No. 12/71]. Washington: International Monetary Fund.

Espinoza, R., and Prasad, A. (2010). Nonperforming Loans in the GCC Banking System and their Macroeconomic Effects [Working Paper No. 10/224]. Washington: International Monetary Fund.

Festić, M., Kavkler, A., and Repina, S. (2011). The macroeconomic sources of systemic risk in the banking sectors of five new EU member states. *Journal of Finance & Banking,* 35 (2).

Festić, M., Repina, S., and Kavkler, A. (2009). The overheating of five EU new member states and cyclicality of systemic risk in the banking sector. *Journal of Business Economics and Management,* 10 (3).

Festić, M., and Romih, D. (2008). Cyclicality of the banking sector performance and macro environment in the Czech Republic, Slovakia and Slovenia. *Prague Economic Papers*, 2008 (2).

Festić, M., and Bekő, J. (2008). The banking sector and macroeconomic performance in Central European economies. *Czech Journal of Economics and Finance,* 58 (3-4).

Fofack (2005). Nonperforming loans in Sub – saharan Africa: casual analysis and macroeconomic implications [Policy Research Working Paper 3769]. Washington: World Bank.

Gerlach, S., Peng, W., and Shu, Ch. (2005). Macroeconomic conditions and banking performance in Hong Kong SAR: a panel data study. In Bank for International Settlements (ed.). *Investigating the relationship between the financial and real economy*. Basel: Bank for International Settlements.

Greenidge, K., and Grosvenor, T. (2010). Forecasting non-performing loans in Barbados. *Business, Finance & Economics in Emerging Economies***,** 5 (1).

Guy, K., and Lowe, S. (2011). Non-performing Loans and Bank Stability in Barbados. *Economic Review,* 37 (1).

Havranek and Sedlarikova, (2014). A Meta-Analysis of the Income Elasticity of Money Demand. *Politická ekonomie*, 2014 (3).

ISBN: 978-605-64453-2-3

Hoggarth, G., Logan, A., and Zicchino, L. (2005). Macro stress tests of UK banks. [BIS Paper No. 22]. Basel: Bank for International Settlements.

Chaibi, H., and Ftiti, Z. (2015). Credit risk determinants: Evidence from a cross-country study. *Research in International Business and Finance*, 33 (January 2015).

Choy, I. W. T. (2014). The Effect of Macroeconomic Shocks on Financial Stability in Macao. In Chan, S. S. (ed.). Macao Monetary Research Bulletin No. 30. Calçada do Gaio: Monetary Authority of Macao.

Jiménez, G., and Saurina, J. (2006). Credit Cycles, Credit Risk, and Prudential Regulation. *International Journal of Central Banking*, 2 (2).

Kalirai, H., and Scheicher, M. (2002). Macroeconomic Stress Testing: Preliminary Evidence for Austria. In Oesterreichische Nationalbank (ed.). Financial Stability Report 3. Vienna: Oesterreichische Nationalbank.

Kauko, K. (2012). External deficits and non – performing loans in the recent financial crisis. *Economics Letters*, 115 (2).

Kavkler, A., and Festić, M. (2010). The banking sector in the Baltics. *Banks and Bank Systems*, 5 (3).

Knell, M., and Stix, H. (2005). The Income Elasticity of Money Demand: A Meta Analysis of Empirical Results. *Journal of Economic Surveys,* 19(3).

Lipsey, M. W., and Wilsen, D. B. (2001). Practical Meta Analysis. *Applied Social Research Methods Series*, 49.

Liu, Y., and Yang, W. (2010). What Caused the Soaring Non-Performing Loans in Taiwan from the Late 1990s to the Beginning of 2000s? Evidence from Panel Data of Domestic Banks. *International Journal of Information and Management Sciences, 21 (6).*

Louzis, D. P., Vouldis, A. T., and Metaxas, V. L. (2012). Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of Finance and Banking*, 36 (4).

Love, I., and Arissc, R. T. (2014). Macro-financial linkages in Egypt: A panel analysis of economic shocks and loan portfolio quality. *Journal of International Financial Markets, Institutions & Money,* 28 (C).

Mancka, A. (2012). The Impact of National Currency Instability and the World Financial Crisis in the Credit Risk. The Case of Albania. *Journal of Knowledge Management, Economics and Information Technology,* 2 (1).

Marcucci, J., and Quagliariello, M. (2008). Is bank portfolio riskiness procyclical? Evidence from Italy using a vector autoregression. *Journal of International Financial Markets, Institutions & Money,* 18 (1).

Melecky, A. and Sulganova, M. (2013). Macroeconomic determinants of non-performing loans: an application to the Czech Republic. In Jedlička, P. (ed). Peer-reviewed Conference Proceedings of the International Conference Hradec Economic days 2013: Economic Development and Management of Regions. Hradec Králové: University of Hradec Králové.

Messai, A. S., and Jouini, F. (2013). Micro and Macro Determinants of Non-performing Loans. *International Journal of Economics and Financial Issues*, 3 (4).

Munich, A., and Suria, B. A. (2013). Stress-testing the Indonesian economic sectors by shocks on its macroeconomic variables (an analysis of firm-wide probability of default). *The Indonesian Journal of Business Administration*, 2 (2).

Njoroge, L., and Kamau, A. W. (2010). Macroeconomic developments and banks´ behavior in Kenya: a panel data analysis. *Savings and development,* 34 (2).

Nkusu, M. (2011). Nonperforming Loans and Macrofinancial Vulnerabilities in Advanced Economies [Working Paper No. 11/161]. Washington: International Monetary Fund.

Novikov, I. (2012). The Empirical Estimation of the Influence of Credit Risk Determinants in Baltic States' Banking Sector. *Journal of Modern Accounting and Auditing,* 8 (1).

Podpiera, J., and Weill, L. (2008). Bad luck or bad management? Emerging banking market experience. *Journal of Financial Stability*, 4 (2).

ISBN: 978-605-64453-2-3

Podpiera, R. (2006). Does compliance with Basel Core Principles bring any measurable benefits? *IMF Staff Papers*, 53 (2).

Reininger, T., and Jakubík, P. (2013). Determinants of Nonperforming Loans in Central, Eastern and Southeastern Europe. *Focus on the European Economic Integration Q3/2013.*

Salas, V., and Saurina, J. (2002). Credit Risk in Two Institutional Regimes: Spanish Commercial and Savings Banks. *Journal of Financial Services Research,* 22 (3).

Shijaku, H., and Ceca, K. (2011). A model for the credit risk in Albania using banks´ panel data. [Working Paper 06 (29)]. Tirana: Bank of Albania.

Shingjergji, A. (2013). The Impact of Macroeconomic Variables on the Non-Performing Loans in the Albanian Banking System during 2005 – 2012. *Academic Journal of Interdisciplinary Studies,* 9 (2).

Shu, Ch. (2002). The impact of macroeconomic environment on the asset quality on Hong Kong´s banking sector [Working Paper]. Hong Kong: Hong Kong Monetary Authority.

Vazquez, F., Tabak, M. B., and Souto, M. (2012). A macro stress test model of credit risk for the Brazilian banking sector. *Journal of Financial Stability*, 8 (2).

Virolainen, K. (2004). Macro stress testing with a macroeconomic credit risk model for Finland. [Bank of Finland Discussion Papers 18/2004]. Helsinki: Bank of Finland.

Vogiazas, S., and Nikolaidou, E. (2011). Investigating the Determinants of Nonperforming Loans in the Romanian Banking System: An Empirical Study with Reference to the Greek Crisis. *Economics Research International*, 2011.

Vuillemey, G. (2014). Solvency vs. liquidity. A decomposition of European banks' credit risk over the business cycle. *International Economics,* 137 (May 2014).

Yurdakul, F. (2014). Macroeconomic Modelling of Credit Risk for Banks. *Procedia - Social and Behavioral Sciences,* 109 (0).

Zeman, J., and Jurča, P. (2008). Macro stress testing of the Slovak banking sector [Working Paper No. 1/2008]. Bratislava: Národná Banka Slovenska.

ISBN: 978-605-64453-2-3