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SAFE BANK

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Contents

FROM THE EDITOR

The safety of banking systems and individual banks is determined by many factors – both internal and external. Risk managers, regulators and academics are seeking tools to better diagnose risk and control it. The analyses mainly concern different risk sources, their interdependence, bank's vulnerability to them, effective risk mitigation tools, prudential regulation and effective oversight. The research areas are very broad and their outcome is impressive. Yet, the current knowledge about the risk and the conditions necessary for the safe operation of banks is still insufficient. One obvious reason for this is the changing environment in which banks operate, the second – the sophisticated nature of risk itself. Thus, there will always be a need for ongoing research into risk – its nature, measurement techniques, impact of external factors, etc. The outcome can help to improve risk management processes in banks and may lead to the adoption of better regulation and design of more efficient supervisory architecture.

This issue of "Safe Bank" consists of articles concerning many of the issues mentioned above. We begin with an article by Anna Matuszyk and Aneta Ptak-Chmielewska who present the tools for identifying potentially fraudulent loan transactions. As loan fraud is a significant credit risk factor, proper data analysis and designing an early warning system might be a crucial element of bank's credit risk management system. The next paper concerns the second kind of bank risk – liquidity risk. Although it is a very important kind of risk and history has proved it was a direct reason for the bankruptcy of many banks (and troubles for whole banking systems), regulations relating to liquidity (including establishing prudential norms and standards) arose relatively recently. Basel III finally included not only capital requirements, but also liquidity norms. Karolina Patora analyses European Union regulations (CRDIV/CRR package) concerning one of those norms – liquidity coverage requirement – and compares it with Basel rules. The author then assesses on this basis whether the EU regulation would enable a prudential objective of the liquidity coverage requirement to be reached.

The next three papers present the results of research concerning sectoral aspects of banking risk. Aneta Hryckiewicz-Gontarczyk and Joanna Wierusz-Wróbel assess

the impact of foreign banks' withdrawals on banking sector concentration. Both issues – foreign banks' activity on local markets and banking sector concentration – have an influence on financial stability, thus conclusions drawn from this research might be yet little – explored area of cooperative banks – her paper presents the analysis of the vulnerability of Polish cooperative banks to changes in macroeconomic environments within the poviats(counties) in which these banks operate. The conclusions drawn are important for designing proper further analysis and potential actions concerning those local banks. There are some important findings for the analysis of the stability of the financial system in Milda Burzała's paper. The author analyses the US financial market to check whether the crisis in the interbank market ran parallel to the crisis in the capital market.

The last paper presented in this issue – by Jerzy Pruski and Jakub Kerlin – characterizes the deposit insurance research present in papers published from 1930 till 2012. The analysis of the research fields presents how approaches to deposit insurance varied over time and therefore how the deposit insurance systems changed. As the authors point out that deposit insurers seem to be the least scientifically examined financial safety net participants, they indicate some gaps in research and suggest areas of desirable new analysis, given the new regulations and whole "post- crisis reality".

This issue of "Safe Bank" closes with Piotr Masiukiewicz's review of the book "Shadow Banking" by J.K. Solarz. As shadow banking may strongly influence the stability of the financial system, there is a need to analyze this phenomenon more closely.

I am convinced that the ideas, analysis and conclusions presented in this issue will be interesting for researchers and practitioners. At the same time I hope they will inspire subsequent authors and will trigger further discussions and studies – of both a theoretical and empirical nature. We encourage you to publish their outcome in our "Safe Bank".

Monika Marcinkowska

Problems and Opinions

Anna Matuszyk[*]
Aneta Ptak-Chmielewska[**]

PROFILE OF THE FRAUDULENT CUSTOMER

1. INTRODUCTION

Fraud may occur in any financial activity. However, banks are particularly exposed due to their role as intermediaries in the financial markets. The risk of financial crime increases concomitantly with an economic downturn, as people are more likely to commit fraud in a recession. This creates significant risk to financial institutions and has recently led to increased interest in proper fraud prevention systems. The key to such systems is to choose the most suitable fraud determinants to identify fraudulent transactions.

Modelling fraud is not the main objective in credit scoring. The main goal is to distinguish good clients from bad ones, without analyzing which of them want to extort money. Over the last decade, there has been growing interest in credit scoring because the number of credit frauds has increased, prompting researchers to look for a solutions to this problem.

According to Dorfleitner and Jahnes (2014), the increasing number of credit defaults caused by application fraud has placed more pressure on banks to maintain the profit of their credit portfolios, since fraud losses are mostly treated as operational risk and result in immediate losses. Furthermore, they are often

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unexpected and therefore not budgeted, in contrast to classical risk factors based on economic determinants.

In March 2012, the National Fraud Authority published its Annual Fraud Indicator, which estimated that fraud was costing the UK over £73 billion (https://www.gov. uk... 2013). According to CIFAS – the UK's Fraud Prevention Service – motor finance and insurance products each account for roughly 1 in 5 of all application frauds. The Finance Leasing Association (FLA), a trade association for the asset, consumer and motor finance sector in the UK, published figures for motor finance fraud. In the 12 months to September 2011, FLA members reported 840 fraud cases. The value of these cases in terms of the original loan amount was £15.3 million.

In this paper three fraud models were created using the logistic regression, decision tree and neural network approaches. The predictive power of the models was checked using the following measures: percentage of correctly classified cases, ROC curve, Gini coefficient and Average Square Error. The study was based on a real data set consisting of 65,000 personal loans with 350 events of fraud in a bank operating in Europe. The data was provided at the individual level, and the product type was auto loans.

The structure of the paper is as follows. First, we introduce the definition of the fraud event. We outline the main problems encountered when modelling application fraud. In Section 3 we present the available literature in this area. In Section 4 we explain the techniques used in the research, i.e. logistic regression (LR), decision tree (DT) and neural network (NN). In Section 5 we describe the data provided. In Section 6 we explain the details of the models built. Finally, in Section 7 we discuss the results, draw conclusions and outline the possibilities for future research.

2. FRAUD DEFINITION, CLASSIFICATION, PROBLEMS

The definition of a loan application fraud was proposed by Dorfleitner and Jahnes (2014). They distinguished first-, second- and third-party fraud. First-party fraud occurs when a fraudster applies for a loan using his own account and has no intention of repaying the sum. Second-party fraud involves an intermediary who helps to carry out the fraud. And finally, third-party fraud is when a fraudster uses another person's identifying information to perpetrate the crime.

Sandrej (2005) proposed a different classification of fraud, distinguishing internal fraud from external fraud. According to him, external fraud is when the fraudster is outside the bank, while internal fraud is when there is assistance from a bank employee. In a credit card environment there are two main types of fraud: application and behavioural (Bolton, Hand, 2001). When it comes to personal loans, it is application fraud we are dealing with.

There are various reasons why application fraud has not been well researched. One is that it is very difficult to obtain fraud data from financial institutions

because of the need to maintain confidentiality and for competitive reasons. Another reason is the lack of publicly available data. One exception is a small automobile insurance data set used by Phua et al. (2004). There is also a problem with the censorship of detailed results in publications. This is because of the risk that fraudsters could easily use the output to adapt their behaviour.

Another difficulty is related to the data sets, which are usually large, and each transaction must be examined and decisions made in real time. The transactions are often heterogeneous, differing substantially even within an individual account, and the data sets are typically very imbalanced, with only a tiny proportion of transactions belonging to the fraud class (Hand, 2007).

Generally, we can distinguish the following main problems when modelling application fraud:
1) Very limited literature
2) Difficulty in obtaining data
3) Risk of fraudsters changing their behaviour as a result of research findings
4) Fraud data sets are large but only a tiny proportion will be fraudulent transactions.

3. LITERATURE REVIEW

The literature on application fraud in personal loans is very limited. There is some research but mainly into credit card fraud and focusing on behavioural fraud.

A study carried out by Wheeler and Aitken (2000) showed the possibility of using identity information such as names and addresses from credit applications. They used a case-based reasoning approach to analyse the most difficult cases that have been misclassified by existing methods and techniques. An adaptive diagnosis algorithm combining several neighbourhood-based and probabilistic algorithms was found to have the best performance, and the results indicate that an adaptive solution can provide fraud filtering and case ordering functions to reduce the number of required final-line fraud investigations.

A study made by Dorfleitner and Jahnes (2014) was based on a data set consisting of nearly 43,000 personal loan applications from Germany. They found that the sales channel or loan amounts are significant determinants of application fraud. They used a logistic regression method, which was found to be a statistically significant approach for profiling loan application fraudsters. Furthermore, they proved the economic significance of the results by developing a fraud management framework taking into account the fraud rate, the average default cost due to fraud and the costs of fraud screening.

Harmann-Wendels et al. (2009) empirically studied the determinants of new account fraud risk within two dimensions – the probability of fraud, and the

expected and unexpected (monetary) loss-per-account due to fraud. By fraud risk, they mean the risk of a bank failing to enforce a debt because the identity of the person incurring the debt cannot be ascertained. Using a real data set of account applicants, they found that fraud risk is very sensitive to demographic and socio-economic variables such as nationality, gender, marital status, age, occupation and urbanisation. For example, foreigners are 22.25 times more likely to commit account fraud than Germans, and men are 2.5 times more risky than women.

T. Mählmann (2010) studied new account fraud, where an imposter opens lines of credit using a false identity. They analyzed the correlation between fraud and default risk. According to their findings, common socioeconomic/demographic characteristics of account holders have opposite effects on estimated default and fraud probabilities. For example, women possess a lower fraud probability but a higher default probability compared to men and foreigners, who are more likely to engage in account fraud but less likely to default than Germans.

4. METHODS

The following methods were used in creating the fraud models: logistic regression (LR), decision tree (DT) and neural network (NN). Below is a short description each of these techniques.

4.1. Logistic regression

Logistic regression models are a very popular statistical method for predicting customer insolvency. They can be used as binomial models (where one of the variables is dichotomous), or as ordered polynomial ones where the dependent variable can exist in more than two states. Logistic functions can be estimated using the weighted least squares or maximum likelihood method.

The logistic function in the binomial models takes the following form:

$$P(Y=1) = \frac{1}{1 + \exp^{-(\beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k)}},$$

where:

$P(Y=1)$ – dependent variable, in this case it defines the probability of fraud,

β_0 – constant

β_i, $i = 1, 2, \ldots, k$ – weights,

x_i, $i = 1, 2, \ldots, k$ – independent variables.

Ratio $P(Y=1)$ takes the values from the interval <0;1>, where 0 is a non-fraudulent customer, and 1 a fraudulent one. The closer to zero value the ratio gets, the lower the probability of

fraud. Logistic regression is a useful tool where the outcome is a binary variable. According to Dorfleitner and Jahnes (2014) logistic regression is a statistically significant approach for profiling loan application fraudsters.

4.2. Decision tree

A decision tree is a non-parametric statistical method. Observations are classified by assigning cases into groups. It calculates the probability of event occurrence at the group level. The decision tree model does not require the prior selection of variables. The main danger when using a decision tree model is the tendency to over-fit, which makes the final model unstable.

Figure 1. Schematic diagram of the decision tree
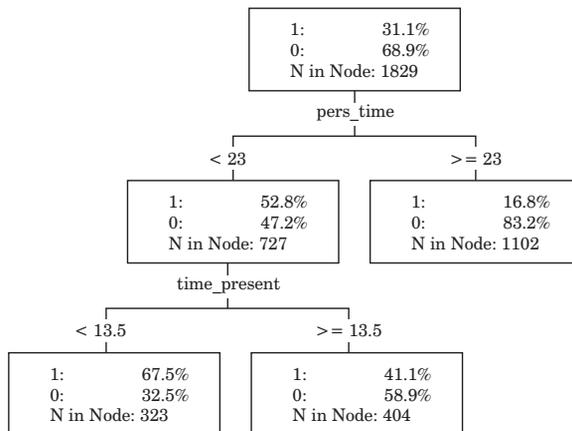
Source: own elaboration.

The decision tree contains so-called root (the main element, containing the entire data set) nodes and sub-nodes formed by splitting the data according to the rules used. A tree branch creates the node with further subsegments. The final division element is called a leaf, which is the final node and not split further. Each observation of the output file is assigned to one final leaf only. A typical decision tree model, built for a binary dependent variable, contains the following items:

❖ node definitions – the principles for assigning each observation to a final leaf
❖ probability (posteriori) for each final leaf which is the ratio of modelled occurrences of the binary variable in each end leaf
❖ assigned level of the dependent variable in the model for each final leaf.

Decision rules can be based on maximizing profits, minimizing costs or minimizing the misclassification error. In contrast to binary logistic regression,

decision trees do not contain any equations or coefficients, and are based only on the data set allocation rules. The rules generated by the model can be used for prediction without the dependent variable (the result is a binary decision).

After creating a decision tree model with the selected method, the next step is to cut the tree down to the correct size. This is done in stages. Firstly, one division is cut off, then all possible combinations of the trees are checked and the best are chosen. Then another division is cut and the best tree is checked (already shortened twice), etc. As the number of leaves grows, the tree value will initially increase but after reaching a certain point, the growth will not be visible, or a drop can even occur. This is the optimal size of a tree.

4.3. Neural network

A neural network is one of the methods used in scoring models. In our study, NN should help to specify the relationship between the borrower's characteristics and the probability of fraud. This method also allows you to determine which features are the most important in the fraud event prediction.

A single artificial neuron has multiple inputs x_n, $n = 1, 2, …, N$, and one output. Neuron inputs are selected explanatory variables. Indicators are selected based on the method chosen, e.g. the factor analysis method or principal components method. For each variable a specific weight w_n is assigned. Then the total stimulation of the neuron is calculated, which is the sum of the products of the explanatory variables and their weights. The neuron output value depends on the total stimulation of the neuron, which is achieved by using a suitable activation function $\varphi(y)$. The format of this function determines the type of neuron. For a binary variable the activation function for the output layer will be a logistic function, which narrows the estimation to the interval [0:1], making it possible to interpret in terms of the probability of the event occurrence.

The most frequently used is the Multi-layer Perceptron network (MLP network) with one hidden layer (Figure 2).

**Figure 2. Schematic diagram of the artificial neural network**
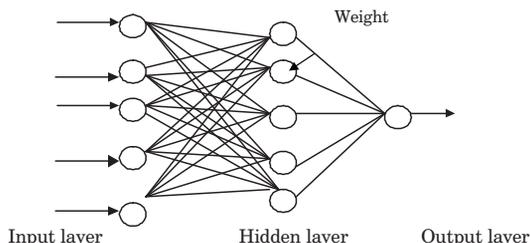
Source: own elaboration.

5. DATA DESCRIPTION

In this study we used a data set from a bank operating in Europe. This dataset covered a period of over 90 months, namely from January 2001 to October 2008. It contains more than 65 thousands cases provided at the individual level. The product type is automobile loans. Due to the small number of fraud events before 2003, all cases before 2003 were deleted. Finally, for modelling purposes, a smaller dataset was used consisting of 980 cases with 245 fraud events. The final sample contains all the fraud cases (245) and 735 randomly selected non-fraud cases, so the proportion is 1:3. This proportion is adequate to measure the first and second type of errors (King, Zeng, 2001).

The fraud definition used by the financial institution that provided the data is as follows: only cases reported to police and courts and then confirmed by the police were considered as fraud events. Figure 3 presents the original data set distribution with the percentage of fraud cases.

Figure 3. Fraudulent transactions in the original data set
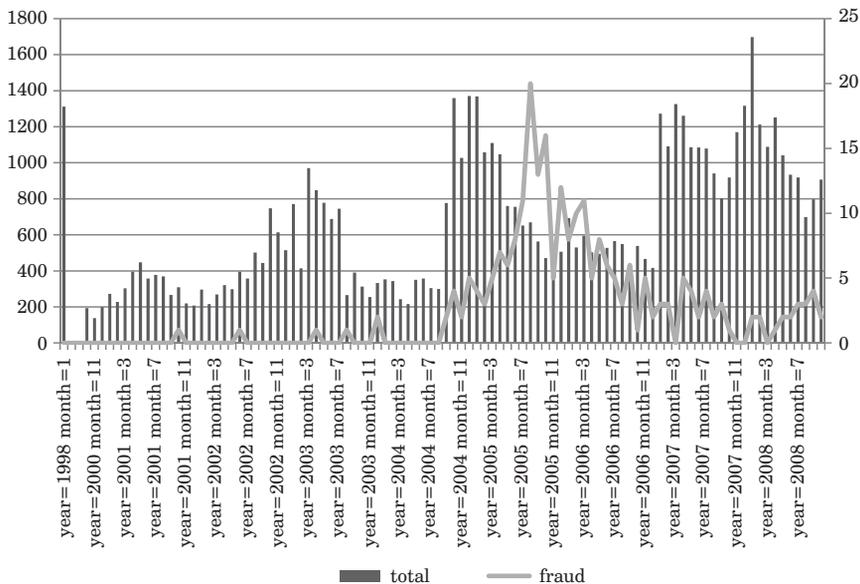
Source: own elaboration.

From all the available variables, only those valid at the moment of application were chosen. Table 1 contains a description of the characteristics selected. As a reference category in logistic regression the one with the highest frequency was

selected. All categories with a frequency below 10% of the sample were merged with one another category having a similar fraud rate. Missing data with a frequency lower than 1% was added to the most frequent category.

Table 1. Characteristics used in the models

Characteristic	Description
Brand	SEAT VOLKSWAGEN SKODA (ref. category) OTHER
Category of contract	Annuity (ref. category) Descending/no data
Gender	Female (K) Male (M) (ref. category)
Marital status	he: single/widowed/divorced she: married/widowed she: single/divorced he: married (ref. category)
Commercial phone number given	NO YES (ref. category)
No of scoring	Ordinal: 0,1,2,3,4,5,6
Children	no data/no information no children (ref. category) at least one child
Type of object	USED NEW (ref. category)
Other securities	YES NO (ref. category)
Payment	Direct Debit / no information transfer (ref. category)
Second applicant	YES NO (ref. category)
Type of contract	other standard (ref. category)
Customer	old new (ref. category)
Income Mean £ 0.6 K Median £ 0.5 K	< £ 0.4 K (ref. category) <£ 0.4 – £ 0.7 K) £ 0.7 K +

Characteristic	Description
Financing amount Mean 39,202 PLN Median 33,487 PLN	< £ 5K <£5K–£7K) £7K + (ref. category)
Duration of loan Mean 48.6 months Median 48 months	< 24 months <24–48) months <48–60) months 60 months + (ref. category)
Purchase price Mean £ 10.9 K Median £ 9.4 K	<£7 K (ref. category) <£7 K – £11 K) £11 K+
Downpayment Mean 34 Median 30	< 10% <10–20) % <20–40) % 40%+ (ref. category)
Age	<30 years <30–40) years <40–60) years (ref. category) 60 years +
Year of contract	2003 2004 2005 2006 2007 2008

Source: own elaboration.

Our expectations for the characteristics included are based on the selected sample and refer only to car loans. We expect that customers buying expensive new cars may be susceptible to fraud and may intend not to pay the debt. We would also expect that young people are more risky in comparison to older (retired) customers, so would assume they are high risk. We would also expect that other security measures should make the transaction safer for the bank. Conversely, we would expect older people and families (or at least married customers) to be less risky. The most predictive variable could be the down payment. If the downpayment were high we would expect payments to be made on time. A fraudulent customer would be a new one without any relation to the bank. We would expect the duration of the loan to be a rather neutral variable.

We split the data set into two samples: training and validation. The respective proportions are 75%:25%. Stratified sampling was chosen in order to assure the same proportion of frauds in both samples.

6. RESULTS

In this section we present results obtained from the models built using logistic regression (LR), decision tree (DT) and neural network (NN). Measures were chosen on the basis of those mostly quoted in the literature. All calculations were made using SAS Enterprise Miner and SEMMA methodology.

6.1. Logistic regression

The stepwise selection procedure was applied and variables meeting significance level criteria ($p<0.05$) were chosen to build up the model. Table 2 presents ten final characteristics that were significant in this model.

Table 2. Type 3 effects for logistic regression model

Variable	DF	Chi-sqWald	p-value
Type of contract	1	13.7980	0.0002
Purchase price	2	16.7276	0.0002
Downpayment	3	16.8316	0.0008
Duration of loan	3	12.8616	0.0049
Marital status	3	16.5333	0.0009
Type of object (used/new)	1	15.5664	<.0001
Payment	1	20.8805	<.0001
Second applicant	1	14.8845	0.0001

Source: own elaboration.

According to the results, the significant variables can be divided into three groups:
1) Variables describing the loan type: contract type, method of payment, duration of loan, second applicant, downpayment
2) Variables describing the customer: marital status
3) Variables describing the loan object: type of object, purchase price.

The variable type of contract has two attributes – standard and other. The standard type has 82% lower risk than the other type. As for the method of payment, it can be noticed that direct debit has a lower fraud risk compared to transfer. The length of the loan was another statistically significant predictor in the model. The longer the loan duration, the higher the risk of a fraud event. The largest difference occurs between standard loans (2–4 years) and long loans (over 5

years). The risk in the 2–4 years group is almost 91% lower than in the over 5 years loans group. The next significant variable was the down payment. Loans with an own contribution lower than 10% are 14 times more risky compared to loans with an own contribution over 40%. In the case of the second applicant variable, results obtained were similar to those found by Dorfleitner and Jahnes (2014). A second applicant reduces the fraud risk by almost 86%.

Table 3. Odds ratio for logistic regression model

Variable		Odds ratio	p-value
Type of contract	other standard (ref. category)	0.180	0.0002
Purchase price	£11K + <£7 K – £11K) < £7K (ref. category)	4.500 0.899	0.0061 0.8410
Downpayment	< 10% <10–20) % <20–40) % 40% +(ref. category)	14.114 9.777 3.835	0.0004 0.0005 0.0337
Duration of loan	< 24 months <24–48) months <48–60) months 60 months + (ref. category)	<0.001 0.092 0.255	0.9209 0.0016 0.0539
Marital status	he: single/widowed/divorced she: married/widowed she: single/divorced he: married (ref. category)	5.390 1.008 1.056	0.0006 0.9891 0.9317
Type of object	USED NEW (ref. category)	5.362	<.0001
Payment	Direct debit / no information transfer (ref. category)	0.007	<.0001
Second applicant	YES NO (ref. category)	0.140	0.0001

Source: own elaboration.

Marital status turned out to be a significant variable. The highest risk is from unmarried men. In comparison with married men, the fraud risk in this group is 5.4 times higher. The authors quoted obtained similar results.

Customers buying used cars are over 5 times more risky than customers buying new cars. Dorfleitner and Jahnes (2014) used an additional variable – loan amount – but in our study, purchase price proved to be a much more important variable.

However, the effect on fraud occurrence was similar. The higher the amount, the higher the risk of fraud. Also, the more expensive the car (i.e. costing over £11K), the higher the risk. The risk was 4.5 times higher in compared to the cheaper cars (those less that £7K).

6.2. Decision tree

The significant variables in the decision tree model (assuming significance criteria based on chi-square statistics and significance level 0.2) are as follows in order of priority:
1. Marital status
2. Category of contract
3. Downpayment
4. Payment
5. Duration of loan

The significant variables in this model confirmed the accuracy of the prediction obtained in the regression model. Similar characteristics had a significant effect on the fraud occurrence.

Figure 4. Decision tree path
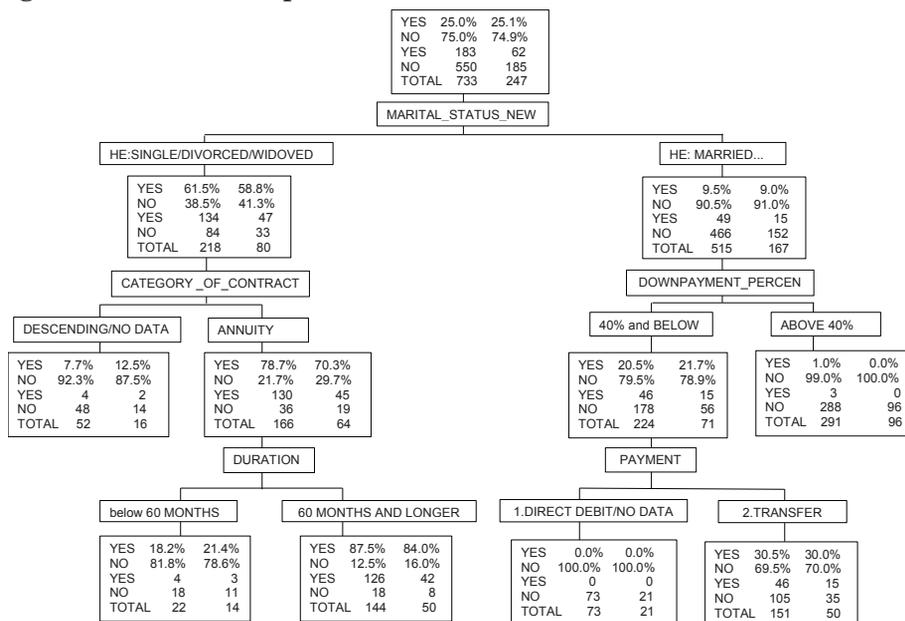
Source: own elaboration.

Using the result of the decision tree model we were able to define the profile of the typical fraudulent and non-fraudulent customer.

1. *Profile of the fraudulent customer:*
   – man: single / widowed / divorced
   – type of contract: fixed instalments
   – loan duration: 60 + months.

This profile had 150/733 clients (20.4%). The probability assigned to the final leaf in the decision tree model was 86%, which gives a 3.4 times higher risk in comparison to the whole sample (assuming the proportions of frauds in the entire sample equal 25%).

2. *Profile of the non-fraudulent customer:*
   – Woman: married / widow / single / divorced, man: married
   – Downpayment: over 40%.

This profile had 291/733 clients in the training sample (39.7%). The probability assigned to the final leaf in the decision tree model was about 1%, which is almost 25 times lower than in the sample as a whole 1% / 25% = 0.04.

6.3. Neural network (NN)

The results of applying the Neural Network model are presented in Table 4. The Multi-layer Perceptron network was used with one hidden layer and 9 variables included in both the previous models – logistic regression and the decision tree.

Table 4. Results of neural network model

Neural Network Results		
Parameter	**Estimate**	**Gradient Objective Function**
1 CATEGORY_OF_CON1_Descending_noda	–1.076355	–0.000013271
2 TYPE_OF_CONTRACT1_other_H11	–3.343056	0.000043742
3 downpayment_percent1_below10__H1	–0.468720	0.000000653
4 downpayment_percent2_1020__H11	3.492458	–0.000005283
5 downpayment_percent3_2040__H11	–4.604571	0.000016697
6 duration1_24monthsandshorte_H11	–3.528740	0.000010101
7 duration2_2448months_H11	0.988200	–0.000009095
8 duration3_4860months_H11	–0.796016	–0.000016246

Neural Network Results		
Parameter	**Estimate**	**Gradient Objective Function**
9 marital_status_1_he_single_divor	–0.704855	0.000003936
10 marital_status_2_she_married_wid	–2.599170	0.000014920
11 marital_status_3_she_single_divo	0.158492	0.000019830
12 object_used_new1_USED_H11	4.292633	–0.000025460
13 payment1_directdebit_nodata_H11	–2.012679	–5.286869E–8
14 second_applicant1_YES_H11	–0.991820	–0.000029867
15 _DUP	–1.774844	–0.000105000
16 TYPE_OF_CONTRACT1_other_H12	–3.442941	–0.000098794
17 _DUP1	0.244557	–0.000087800
18 downpayment_percent2_1020__H12	1.161893	–0.000115000
19 downpayment_percent3_2040__H12	5.670118	–0.000122000
20 duration1_24monthsandshorte_H12	–1.449947	–0.000110000
21 duration2_2448months_H12	–2.625735	–0.000108000
22 duration3_4860months_H12	–0.130230	–0.000119000
23 _DUP2	2.476361	–0.000114000
24 _DUP3	2.027080	–0.000116000
25 _DUP4	–5.776023	–0.000099894
26 object_used_new1_USED_H12	0.182166	0.000186000
27 payment1_directdebit_nodata_H12	–0.985630	–0.000105000
28 second_applicant1_YES_H12	–4.227913	–0.000087338
29 _DUP5	–0.222298	0.000017854
30 TYPE_OF_CONTRACT1_other_H13	–0.924431	–0.000005365
31 _DUP6	–1.631694	0.000010206
32 downpayment_percent2_1020__H13	1.210802	–0.000003218
33 downpayment_percent3_2040__H13	–0.704159	0.000002633
34 duration1_24monthsandshorte_H13	1.536328	0.000005344
35 duration2_2448months_H13	0.171423	0.000002061
36 duration3_4860months_H13	–1.029980	0.000007026
37 _DUP7	–1.164605	–0.000001681
38 _DUP8	0.647242	0.000008471
39 _DUP9	–0.831810	–0.000012594
40 object_used_new1_USED_H13	0.956127	–0.000005430

Neural Network Results		
Parameter	**Estimate**	**Gradient Objective Function**
41 payment1_directdebit_nodata_H13	1.896231	–0.000025365
42 second_applicant1_YES_H13	0.081030	0.000007703
43 BIAS_H11	–3.921059	0.000037298
44 BIAS_H12	–8.190903	0.000140000
45 BIAS_H13	3.294980	–0.000032590
46 H11_fraudyes	7.803602	–0.000003812
47 H12_fraudyes	2.835943	0.000002616
48 H13_fraudyes	–8.518100	0.000035115
49 BIAS_fraudyes	–1.089161	0.000021293

Source: own elaboration.

6.4. Comparison of the results

All models had similar results (Table 5 and Table 6) but the neural network model was the best one.

Table 5 Comparison of the classification frequencies

Method used	Actual G/ Predicted G	Actual G/ Predicted F	Actual F/ Predicted G	Actual F/ Predicted F
Training sample				
Actual	550	–	–	183
DT	525	25	34	149
LR	526	24	22	161
NN	525	25	13	170
Validation sample				
Actual	185	–	–	62
DT	171	14	10	52
LR	176	9	2	60
NN	173	12	3	59

Legend:
Actual G – actual good customer
Actual F – actual fraudulent customer
Predicted G – predicted good customer
Predicted F – predicted fraudulent customer

Source: own elaboration.

Table 6 presents traditional performance measures, like AUROC, ASE, Gini coefficient and misclassification rate. All the models give very similar results but NN performs best. The misclassification rate for estimated models is very low, at below 10%.

Table 6. Performance measures

Method used	ROC	ASE	Gini Coefficient	Misclassification rate
Training sample				
DT	0.95	0.07	0.90	0.08
LR	0.98	0.05	0.96	0.06
NN	0.99	0.04	0.98	0.05
Validation sample				
DT	0.95	0.08	0.89	0.09
LR	0.98	0.04	0.97	0.05
NN	0.98	0.05	0.96	0.06

Source: own elaboration.

7. CONCLUSIONS

In this study, three models for detecting fraud have been presented. The models were created from real data sets from a financial institution. The model that fits the data best was built on the neural network, however, very low classification errors indicate that the model was overtrained. The logistic regression model was better than the decision tree model (significantly lower classification error for non-fraud events with a similar level of misclassification). In practical usage, the logistic regression model is more beneficial than a neural network or a decision tree model. Nevertheless, the decision tree model provides additional information about the customer profile.

A fraudulent person is most typically a single man (single/divorced/widower) requesting a loan for a five-year period or longer. A detailed screening procedure is definitely not necessary when the customer is a woman (regardless of marital status) or a married man who is applying for an auto loan and has a downpayment greater than 40%.

The conclusions from the models can be used in business practice to reduce costs and save time during creditworthiness analysis. Dorfleitner and Jahnes (2014) described the most risky transactions and tried to give the cut-off point at which it is worth checking the application manually (make a detailed screening) for

transactions that show a significantly high risk of fraud. In our model, we showed the sociodemographic profile of the potentially fraudulent customer which should be of interest during the application procedure. Detailed screening of selected customers makes it unnecessary to use external database screening (in credit bureaus), which gives significant savings. Research will continue in this area using additional data, and new statistical techniques will also be used.

Abstract

When there is an economic downturn, financial crime proliferates and people are more likely to commit fraud. One of the most common frauds is when a loan is secured without any intention of repaying it. Credit crime is a significant risk to financial institutions and has recently led to increased interest in fraud prevention systems. The most important features of such systems are the determinants (warning signals) that allow you to identify potentially fraudulent transactions.

The purpose of this paper is to identify warning signals using the following data mining techniques - logistic regression, decision trees and neural networks. Proper identification of the determinants of a fraudulent transaction can be useful in further analysis, i.e. in the segmentation process or assignment of fraud likelihood. Data obtained in this way allows profiles to be defined for fraudulent and non-fraudulent applicants. Various fraud-scoring models have been created and presented.

Key words: personal loan fraud, fraud determinants, profile of the fraudulent customer

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Karolina Patora[*]

LIQUIDITY COVERAGE REQUIREMENT UNDER THE DELEGATED REGULATION OF THE EUROPEAN COMMISSION AND BASEL III RULES – A COMPARATIVE STUDY[1]

INTRODUCTION

A general liquidity coverage requirement has already been proposed under the Capital Requirements Regulation (CRR)[2] with a view to be further specified by the European Commission (EC). On 10 October 2014 the EC adopted the delegated act on liquidity coverage requirement (*delegated act* or *delegated Regulation*)[3], which provides detailed quantitative liquidity rules.

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[2] Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012, Official Journal of the European Union, L 176/1 (CRR).
[3] Commission Delegated Regulation (EU) No 2015/61 of 10 October 2014 to supplement Regulation (EU) 575/2013 with regard to the liquidity coverage requirement for Credit Institutions, OJL11. 17.1.2015 7232.

The delegated Regulation is based on the rules set out by the Basel Committee (*Basel rules* or *Basel III*)[4], which represent an internationally agreed framework for liquidity regulation. The Basel rules incorporate lessons learned during the recent financial crisis and can be regarded as best practices. Notwithstanding the fact that the liquidity coverage requirement (the LCR) should be consistent with the recommendations of the Basel Committee[5], the European Commission proposed numerous adjustments[6].

The reason for the changes to the approach proposed under the Basel accord was twofold. Firstly, certain adjustments were introduced in order to take account of Union specificities resulting from the fact that the scope of application of these two documents differs. In contrast to the Basel rules, the delegated act applies at the individual as well as consolidated level and it encompasses not only internationally active banks but all credit institutions operating in the European Union. Secondly, the European Commission has placed particular emphasis on promoting growth and investment in the economy.

The purpose of this paper is to identify major differences between the approaches toliquidity regulation presented under the delegated act and the Basel accord, in order to assess whether the delegated Regulation adopted by the European Commission would enable a prudential objective of the liquidity coverage requirement to be reached. The article is structured as follows. Firstly, the notion of the liquidity coverage requirement (LCR) is presented along with its scope and transitional provisions. Secondly, the differences with regard to the composition of the liquidity buffer and characteristics of the high quality liquid assets which make up the liquidity buffer are discussed. Thirdly, the liquidity inflows and outflows are compared. Finally, main conclusions are presented.

1. LIQUIDITY COVERAGE REQUIREMENT

The liquidity coverage requirement is a prudential standard, which requires credit institutions[7] to hold a sufficient cushion of high quality liquid assets to enable them to withstand a period of stress lasting for at least 30 calendar days without requiring assistance from central banks or governments. The prudential aim of the requirement is therefore to foster a short-term resilience of the credit institutions to liquidity crises.

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[4] BCBS, *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools,* Bank for International Settlements, January 2013.

[5] See paragraph 101 of the CRR.

[6] Under paragraph 101 of the Regulation No 575/2013 (CRR), the liquidity requirement should be consistent with the proposal of the Basel Committee.

[7] Investment firms are not yet included in the scope of the delegated Regulation.

The standard was initially agreed at the international level and published by the Basel Committee in the form of a list of recommendations, incorporating lessons learned from the recent financial crisis[8]. It was transposed to European law through the legislative texts known as the CRDIV/CRR package[9].

The requirement should be equal to the ratio of a credit institution's liquidity buffer to its net liquidity outflows over a 30 calendar day stress period and it should be calculated as follows[10]:

$$\frac{\text{Liquidity}}{\text{Net Liquidity outflows over a 30 calendar day stress period}} = \text{LCR }(\%) \geq 100\%$$

The LCR should be maintained at a level of at least 100%. In certain cases[11], when stress periods occur, the ratio may fall below 100%. As specified under the delegated Regulation, the requirement will come into force on October 1, 2015, and it will be fully introduced in 2018[12].

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[8] Compare with *Basel III: The Liquidity Coverage Ratio…, op. cit.*

[9] Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms (CRD IV) and Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms (CRR).

[10] See Article 4 of the delegated Regulation.

[11] Under Article 5 of the delegated Regulation, the conditions that allow for a sale of liquid assets by a credit institution, which might potentially lead to a breach of the requirement, include:
   – the run-off of a significant proportion of its retail deposits;
   – a partial or total loss of unsecured wholesale funding capacity, including wholesale deposits and other sources of contingent funding such as received committed or uncommitted liquidity or credit lines;
   – a partial or total loss of secured short-term funding;
   – additional liquidity outflows as a result of a credit rating downgrade of up to three notches;
   – increased market volatility affecting the value or quality of collateral or creating additional collateral needs;
   – unscheduled draws on liquidity and credit facilities;
   – potential obligation to buy-back debt or to honour non-contractual obligations.

[12] During a phase-in period, the ratio might be maintained below the required level: 60% of the requirement from 1 October 2015, 70% from 1 January 2016, 80% from 1 January 2017, and 100% from 1 January 2018. See Article 38 of the delegated Regulation.

2. LIQUIDITY BUFFER

The delegated act specifies a set of general[13] and operational[14] requirements that liquid assets or credit institutions have to comply with in order to qualify as part of the liquidity buffer. These eligibility criteria are generally aligned with those of Basel III, with several exceptions concerning:

a) diversification requirement,
b) requirement to test access to the market,
c) preferential treatment of the deposits and other funding in cooperative networks and institutional protection schemes (IPS),
d) restrictions with regard to issuers of liquid assets,
e) liquid asset characteristics.

Among other factors, a credit institution should have a well diversified pool of liquid assets, which could be readily accessible in times of stress. What is more, it should test access to the market through regular sales of a significant sample of

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[13] Under Article 7 of the delegated Regulation the general eligibility criteria include:
   – no legal, contractual, regulatory or other impediments to convert assets into cash within 30 calendar days (unencumbrance of assets),
   – easy access to market prices and ease of valuation,
   – requirement of being listed on recognised exchanges or being traded in active and sizeable markets as characterised by low bid-ask spreads, high trading volume, large and diverse number of market participants and a presence of a robust market infrastructure,
   – limitations as regards the type of issuer.

[14] The operational criteria, under Article 8 of the delegated Regulation, require that:
   – a credit institution should have a well diversified pool of liquid assets, which could be readily accessible in times of stress,
   – the distribution of liquid assets should be consistent with the liquidity needs by currency (liquidity buffer should contain foreign currency denominated liquid assets up to the extent which can be justified by the amount of the net liquidity outflows denominated in that currency),
   – the pool of liquid assets should be under the control (direct or indirect – through policies and procedures) of a specific liquidity management function within the credit institution (e.g. Treasury), so that that the assets can be monetised quickly or used as a source of contingent funds, including during stress periods,
   – a significant sample of the liquid assets should be monetised regularly in order to test access to the market (conducting such tests would enable the credit institutions to liquidate a portion of their liquid assets in times of stress with the minimum risk of sending a negative signal to the market participant, which could otherwise distort their reputation and lead to liquidity spirals. Liquidity spirals occur when funding and market liquidity risks interact. If investors sell assets to meet funding requirements, they create price declines, loss of confidence, and further funding pressures. See more: *Global Financial Stability Report: Containing Systemic Risks and Restoring Financial Soundness*, World Economic and Financial Surveys, International Monetary Fund, April 2008, p. 3 and M. Drehmann, K. Nikolaou, *Funding liquidity risk. Definition and measurement*, Working Paper Series, No 1024/March 2009, European Central Bank, 2009, p. 22).

liquid assets. As regards the diversification requirement[15], the scope of exemptions is relatively wider under the delegated act. In contrast to Basel III, the requirement does not apply to certain liquid assets, such as assets representing claims on or guaranteed by multinational banks and international organisations, or restricted-use committed liquidity facilities. The scope of exemptions is also wider with regard to the market access test requirement. The requirement does not apply to extremely high quality liquid assets qualifying as level 1 assets category (except for extremely high quality covered bonds), nor to the restricted-use committed liquidity facility, or to deposits and other funding in cooperative networks and institutional protection schemes (IPS)[16], as these assets are deemed sufficiently liquid.

The recognition of the deposits and other funding in cooperative networks and institutional protection schemes[17] as of liquid assets (either level 1 or level 2 liquid assets) represents another significant divergence from the Basel rules. The reason for their inclusion in the liquidity buffer, as stated by the EC[18], was that members of the network cannot take advantage of central bank liquidity facilities. Instead, the central institution or body in the network or IPS acts similarly to the central bank. Such an argument, however, does not hold true for commercial banks, which may also establish an IPS while having access to the central bank's operations. Therefore, the EC's explanation of this derogation cannot be regarded as sufficient.

Compared to the Basel accord, the delegated act proposes a more detailed definition of issuers whose assets should not be included in the liquidity buffer[19]. In general, assets issued by credit institutions should not be recognised as liquid assets, which is in line with Basel rules[20]. However, the delegated act permits private bank assets with an explicit State guarantee to be included in the liquidity buffer. The derogation is time limited and will be phased out as credit institutions may include the securities only if the guarantee was granted or committed prior to 30 June 2014[21].

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[15] The requirement for asset diversification concerns the assets among various categories as well as within the same category. Diversification criteria may include types of issuers, counterparties or geographical location of those issuers and counterparties as laid down in Article 8(1) of the delegated act.

[16] See Article 8(4) of the delegated Regulation.

[17] See Article 16 of the delegated Regulation.

[18] See paragraph 12 of the delegated Regulation.

[19] See Article 7(4) of the delegated Regulation.

[20] Securities qualifying as level 1 assets should not represent an obligation of a financial institution or any of its affiliated entities. This includes, in particular, government guaranteed securities issued during the financial crisis, which remain liabilities of the financial institution. The exception is when the bank qualifies as a public sector entity. See paragraph 50(c) tier 4 of Basel III.

[21] See paragraph 7 of the delegated Regulation.

Certain characteristics of high quality liquid assets described in the Basel rules[22], such as a proven flight to quality, low volatility, low duration, low legal risk, low inflation risk, low correlation with risky assets, central bank eligibility and the requirement to monitor the physical location of liquid assets, have not been included in the delegated Regulation. Instead, the EBA took a set of factors into account – where applicable – while examining the liquidity profile of the assets[23]. The EBA was assigned, prior to the trilogue negotiations, to examine the liquidity profile of a broad range of assets[24], including residential mortgage-backed securities (RMBS), other central bank eligible securities, or non-central bank eligible but tradable assets. It was found that certain asset classes' liquidity can be attributed to a different set of characteristics. Credit rating, time to maturity and issue size were found to be significant determinants of liquidity for sovereign and public sector debt, corporate and covered bonds and all types of asset-backed securities (ABS). This was the reason for setting additional eligibility criteria, alongside the operational criteria, to certain asset classes under the delegated act. The EBA also found that, in general, assets such as sovereign bonds, covered bonds, some other forms of public sector securities, corporate bonds, ABS, gold and equity may be put in an order of decreasing liquidity, whereas equities, gold, ABS not backed by residential mortgages, credit claims, securities issued by financial institutions, central bank securities, bank-issued government guaranteed bonds and bonds issued by promotional banks should not be perceived as liquid assets of high credit quality at all[25].

The differences identified in terms of the general and operational criteria for inclusion of assets in the stock of high quality liquid assets will probably result in an average increase of the LCR.

2.1. Composition of the liquidity buffer

Similar to Basel III[26], the liquidity buffer specified in the delegated act should comprise of level 1 assets of extremely high liquidity and credit quality, as referred to in the CRR, representing a minimum of 60% of high quality liquid assets

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[22] See paragraph 24 and 26 of Basel III.

[23] The criteria, which are listed in Article 509(4) of the CRR, included a minimum trade volume of the assets, minimum outstanding volume of the assets, transparent pricing and post-trade information, credit quality, proven record of price stability, average volume traded and average trade size, maximum bid/ask spread, remaining time to maturity and minimum turnover ratio. Based on these criteria and others used in the academic literature, the EBA considered such liquidity metrics as price impact, bid/ask spread, trading volume and turnover, zero-trading days and volatility. See *Reporton appropriate uniform definitions…*, *op. cit.*, p. 8.

[24] The EBA should also examine liquid assets specified under Article 416 of the CRR, except for cash and bonds issued or guaranteed by government, central banks or multinational organizations.

[25] *Report on appropriate uniform definitions of extremely high quality liquid assets (extremely HQLA)…*, op. cit., p. 20.

[26] See paragraph 46–48 of Basel III.

(see Graph 1). Additionally, a minimum of 30% of the liquidity buffer should be composed of level 1 assets excluding extremely high quality covered bonds. Level 2 assets of high liquidity and credit quality can be subdivided into two categories – level 2A and level 2B assets – which differ in terms of their ability to meet the prudential objective of the liquidity requirement, whereas a maximum of only 15% of the liquidity buffer may be held in level 2B assets.

Graph 1. Composition of the liquidity buffer under the delegated act

LEVEL 2 ASSETS
(a maximum of 40%
of the liquidity buffer)

of which Level 2B assets
(a maximum of 15%
of the liquidity buffer)

LEVEL 1 ASSETS
(a minimum of 60%
of the liquidity buffer)

of which extremely
high quality covered bonds
(a maximum of 30%
of the liquidity buffer)
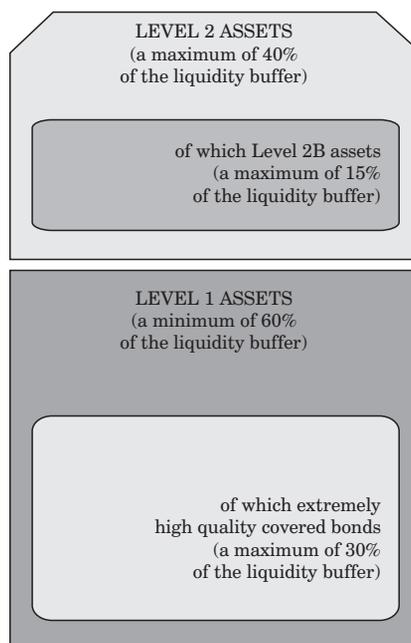
Source: own work based on Article 17 of the delegated Regulation.

For the purpose of calculating the liquidity buffer[27], the valuation of liquid assets should be based on market prices and it should take due account of appropriate reductions, known as haircuts, reflecting a possibility that the prices may decline under stressed conditions which an institution might be exposed to for 30 consecutive days[28]. The value of liquid assets should also be adjusted for the impact of secured funding, secured lending or collateral swap transactions using liquid assets where these transactions mature within 30 calendar days. What is

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[27] The formula for calculating of the liquidity buffer is laid down in Annex I to the delegated Regulation. See also Article 17 of the delegated Regulation

[28] See Article 9 of the delegated Regulation.

more, even if a liquid asset ceases to meet the applicable eligibility criteria, it is permitted to be kept in the liquidity buffer for an additional 30 day period, which is in line with Basel III[29].

As regards the composition of the liquidity buffer in general, the most notable difference lies in the more detailed description of the composition of level 1 assets due to the inclusion by the European Commission of extremely high quality covered bonds[30] in its scope along with a respective cap. Widening the range of instruments included in the liquidity buffer will inevitably lead to an average increase of the LCR. However, it may be assumed that the effect will be more noticeable in those countries in which markets for extremely high credit quality covered bonds are well developed.

2.2. Level 1 assets

Level 1 assets (L1) consist of the most liquid assets and, as such, they form a substantial part of the liquidity buffer. These assets are perceived as reliably liquid in times of stress, that is why they should be subject to a 100% cap and a 0% haircut, except for extremely high quality covered bonds, which should constitute no more than 30% of the liquidity buffer and their value should be deducted by at least 7% from the market value (see Table 1).

The recognition of covered bonds as extremely liquid assets represents the main divergence from the Basel III rules and is not compatible with the prudential approach. Even the EBA, due to data constraints, recommended inclusion of covered bonds in the L2 instead of L1 assets category in order to align with the Basel rules[31]. However, according to the EC, the nature of covered bonds allows them to be considered sufficiently liquid. The features in favour of such treatment include their secured nature, the requirement for the issuer to replace non-performing assets in the cover pool and to maintain the cover pool at a value exceeding the nominal value of the bonds, which is known as the asset coverage requirement. The Commission argued that these instruments can be considered as relatively low-risk and yield-bearing. They are also an important funding source in mortgage markets, while in some Member States the outstanding issuance of covered bonds is even greater than of the government bonds. Taking into consideration their credit quality (at least step 1 to be included in the L1 assets category), liquidity performance during the recent financial crisis and significant importance as regards

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[29] See Article 18 of the delegated Regulation and par. 43 of Basel III.

[30] Covered bonds are debt instruments issued by credit institutions and secured by a cover pool of assets which typically consist of mortgage loans or public sector debt to which investors have a preferential claim in the event of default. See paragraph 8 of the delegated Regulation.

[31] *Report on appropriate uniform definitions of extremely high quality liquid assets (extremely HQLA)..., op. cit.*, p. 26.

Table 1. Level 1 assets under the delegated act (the DA)

Item	Haircut[a]	Cap[b]
Coins and banknotes	0%	100%
Qualifying exposures to central banks	0%	100%
Qualifying securities from central or regional governments, local authorities or public sector entities	0%	100%
Qualifying securities from the central government or the central bank of a third country which is not assigned a credit quality step 1 credit assessment by a nominated ECAI[c]	0%	100%
Qualifying assets issued by credit institutions	0%	100%
Qualifying exposures in the form of extremely high quality covered bonds[d]	min. 7%	30%
Qualifying securities from multilateral development banks and international organisations	0%	100%
Qualifying deposits and other funding held in the central institution or body by members of a cooperative network or IPS	0%[e]	100%
Qualifying collective investment undertakings (CIUs)	0%, 5%, 12%[f]	EUR 500 million[g]

[a] Haircuts are a reduction in the market value of a liquid asset expressed as a percentage of the market value. They provide an additional level of conservatism which protects against potential losses in the value of liquid assets when sold in stressed conditions. See: *Liquidity Coverage Requirement Delegated Act: Frequently Asked Questions*, Memo, European Commission, Brussels, 10 October 2014.

[b] A cap is the maximum amount of assets of a given level that a credit institution is allowed to hold expressed as a percentage of the total liquidity buffer. They are designed to reduce concentration risk, that is the risk of the liquidity buffer being composed of an excessive amount of assets of lower liquidity. See: *Liquidity Coverage Requirement Delegated Act: Frequently Asked Questions*, op. cit.

[c] ECAI or *external credit assessment institution* means a credit rating agency that is registered or certified in accordance with Regulation (EC) No 1060/2009 of the European Parliament and of the Council of 16 September 2009 on credit rating agencies or a central bank issuing credit ratings which are exempt from the application of Regulation (EC) No 1060/2009.

[d] The qualifying L1 covered bonds should, among other factors, be assigned to a credit quality of at least ECAI 1 (or a 10% risk weight), meet the transparency requirement, have an issue size of at least EUR 500 million and an asset coverage requirement of at least 2%. See Article 11.1(c) of the delegated Regulation.

[e] Where the central institution is obliged to hold or invest the deposits in liquid assets of a specified level or category, the deposits shall be treated as liquid assets of that same level or category. See Article 16(1)(a) of the delegated Regulation.

[f] The haircut depends on the type of underlying liquid assets: 0% for coins and banknotes and exposures to central banks, 5% for level 1 assets other than extremely high quality covered bonds, 12% for extremely high quality covered bonds. See Article 15(2) of the delegated Regulation.

[g] The limit of euro 500 million applies to each credit institution on an individual basis. See Article 15(1) of the delegated Regulation.

Source: own work based on Article 10, 15 and 16 of the delegated Regulation.

funding markets in the European Union, the EC assumed that certain covered bonds should be treated as extremely liquid assets of level 1 category, on condition that they are well diversified and subject to a relevant cap and haircut in order to minimise the risk of excessive concentration[32].

Notwithstanding the rationale behind the inclusion of certain covered bonds in level 1 assets, it ought to be noted that this category of assets is expected to be of unlimited availability in times of stress. Therefore, neither application of the 30% cap and the 7% haircut, nor creation of additional eligibility criteria[33] can justify such a derogation from prudential rules. The same remark applies to collective investment undertakings, which can be included in the liquidity buffer up to the amount of euro 500 million, and to sight deposits held in the central institution of a cooperative network or IPS, as their inclusion is not compatible with Basel III.

Another concern refers to the preferential treatment of sovereigns of the European Union Member States (MS), regardless of their actual credit quality and liquidity. By way of comparison, the Basel approach requires that sovereigns are 0% risk-weighted and meet additional conditions – they should be traded on large, deep and active repo or cash markets characterised by a low level of concentration, and have a proven record as a reliable source of liquidity on the repo or sale markets, even during stressed market conditions[34]. The EC explained that discrimination among various Member States would lead to a build-up of contagion risk, hence the proposed adjustment. The EBA supported this finding, claiming that the inclusion of sovereign bonds of all Member States in L1 assets would prevent fragmentation of the internal market and the bank-sovereign nexus[35]. However, if such an approach prevails, then important implications with regard to the extremely high quality covered bonds will certainly emerge for the MS assigned a credit quality lower than step 1, such as Poland. This is due to the fact that the credit quality of covered bonds is strictly related to the credit rating of the country in which they are issued. Therefore, it can be assumed that only a limited number of countries will benefit from their inclusion in the liquidity buffer. In order to decrease the risk of such discrimination, the EC allowed for the inclusion of credit quality step 2 covered bonds in L2A assets. What is more, the Commission is expected to report by 31 December 2015[36] on alternative tools to credit ratings with to the aim of removing all references to credit ratings in Union

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[32] See paragraph 8 of the delegated Regulation.

[33] Additional eligibility criteria under Article 10 (f) of the delegated Regulation include, among others, credit quality (ECAI 1), transparency requirement, issue size of at least 500 million euro, coverage requirement.

[34] See paragraph 50(c) of the Basel III.

[35] *Report on appropriate uniform definitions of extremely high quality liquid assets (extremely HQLA)..., op. cit.*, p. 26.

[36] See paragraph 9 of the delegated Regulation.

law by 1 January 2020 and, accordingly, to replace the criteria for classifying assets by their credit risk.

Finally, the EC allowed for the inclusion of assets issued by promotional banks in the liquidity buffer, whereas the EBA recommended that such assets cannot be regarded as sufficiently liquid. These assets were not taken into consideration under Basel III, therefore a positive impact on the LCR should be expected.

It can be observed that the EC's approach to L1 assets, which are of the utmost importance in times of stress, is less strict than that proposed by the Basel Committee. The adjustments proposed by the EC are aimed at increasing the average level of liquidity coverage ratio.

As regards the expected impact on LCR of covered bonds[37], it might be positive or insignificant, or it may vary across countries, as extremely high quality covered bonds were already included in level 2 assets under Basel III.

2.3. Level 2 assets

Level 2 assets (L2) represent a part of the liquidity buffer which cannot be monetised within a 30 day period under stressed conditions with the same ease as L1 assets. The L2 assets can be subdivided into L2A and L2B assets, corresponding to a relatively higher and lower liquidity and credit quality, respectively. The L2 assets are assigned a 40% cap and a minimum haircut of 15% for L2A or 25–50% for L2B assets. The composition of L2A and L2B assets is presented in Table 2.

Table 2. Level 2A and 2B assets under the delegated act (the DA)

Item	Haircut	Cap
Level 2A assets		
Qualifying securities from regional governments, local authorities or public sector entities assigned a 20% risk factor	min. 15%	40%
Qualifying securities from the central bank, central or regional governments, local authorities or public sector entities of a third country, which can be assigned a 20% risk factor	min. 15%	40%
Qualifying exposures in the form of high quality covered bonds[a]	min. 15%	40%
Qualifying exposures in the form of covered bonds issued by credit institutions in third countries	min. 15%	40%
Qualifying corporate debt securities[b]	min. 15%	40%

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[37] See paragraph 52(b) of the Basel III.

Item	Haircut	Cap
Level 2B assets		
Qualifying exposures in the form of ABS, where the underlying exposures are:		
– residential mortgage loans	25%	15%
– fully guaranteed residential loans	25%	15%
– commercial loans, leases and credit facilities to small and medium-sized enterprises	35%	15%
– auto loans and leases	25%	15%
– personal, family or household loans and credit facilities to individuals for consumer purposes	35%	15%
Qualifying corporate debt securities[c]	50%	15%
Qualifying shares	50%	15%
Qualifying central bank restricted-use committed liquidity facilities	n/a	15%
Qualifying exposures in the form of high quality covered bonds[d]	30%	15%
Level 2A or 2B assets		
Qualifying deposits and other funding held in the central institution or body by members of a cooperative network or IPS	other[e]	40%/15%
Qualifying collective investment undertakings (CIUs)	20–45%[f]	EUR 500 million

[a] The qualifying L2A covered bonds should, among other factors, be assigned a credit quality of at least ECAI 2 (or a 20% risk weight), meet the transparency requirement, have an issue size of at least EUR 250 million and an asset coverage requirement of at least 7% (or 2% under certain conditions). See Article 11.1(c) of the delegated Regulation.

[b] The qualifying L2A corporate bonds should be assigned a credit quality of at least ECAI 1, with an issue size of at least EUR 250 million, and a maximum time to maturity of 10 years. See Article 11.1(e) of the delegated Regulation.

[c] The qualifying L2B corporate bonds should be assigned a credit quality of at least ECAI 3, with an issue size of at least EUR 250 million, and a maximum time to maturity of 10 years. See Article 12.1(b) of the delegated Regulation.

[d] The qualifying L2B covered bonds should, among other factors, be assigned a 35% or lower risk weight, meet the requirement of transparency, have an issue size of at least EUR 250 million and an asset coverage requirement of at least 10%. See Article 12.1(e) of the delegated Regulation.

[e] Where the central institution is obliged to hold or invest deposits in liquid assets of a specified level or category, the deposits shall be treated as liquid assets of that same level or category. See Article 16(1)(a) of the delegated Regulation.

[f] The haircut depends on the type of underlying liquid assets: 20% for level 2A assets, 30% for level 2B securitisations backed by residential loans or auto loans, 35% for level 2B covered bonds, 40% for level 2B securitisations backed by commercial loans and loans and credit facilities to individuals, 45% for level 2B corporate debt securities. See Article 15(2) of the delegated Regulation.

Source: own work based on Articles 11, 12, 13, 15 and 16 of the delegated Regulation.

The delegated act introduces a significant innovation with regard to the L2B assets. Unlike the Basel rules[38], it enables ABS other than those backed by residential loans to be included in the liquidity buffer. This is also in contrast to the EBA's findings[39]. The European Commission stated that deviation from the recommendations of the BCBS and the EBA can be justified for several reasons[40]. Firstly, it will encourage diversification within the liquidity buffer and weaken the bank-sovereign nexus due to a low correlation between ABS backed by certain assets and government bonds. Secondly, it will convey a positive impression to investors and facilitate economic growth by financing the real economy. Thirdly, the Commission ascertained that some ABS, in particular those backed by loans and leases for the financing of motor vehicles, reflected price volatility and average spreads comparable to RMBS during the financial crisis. In addition, ABS backed by consumer credit exhibited a sufficient degree of liquidity. The abovementioned findings of the EC, however, were not supported by any empirical evidence. The Commission requires qualifying ABS to fulfil the criteria corresponding to simple, transparent and standardised securitisations, but still it seems that the primary intention of the EC in extending the range of eligible securitised assets was to support credit for small and medium enterprises and consumers, whereas the prudential aim of the Regulation was relegated to a secondary status. This adjustment, bearing in mind the higher haircuts and the 15% cap, will possibly lead to a higher level of LCR in those Member States in which securitisation markets are well developed. In this regard, a limited impact can be foreseen for the Polish banks.

Another derogation from the internationally agreed rules relates to the restricted-use committed liquidity facilities provided by central banks, which were only envisaged as a potential option for alternative treatment in Basel III[41]. Furthermore, the delegated act, in contrast to the Basel rules, allows for the treatment of deposits and other funding in cooperative networks and institutional protection schemes (IPS) maintained with the central institution in response to special needs of the credit institutions belonging to such networks and schemes[42] as liquid assets. Credit institutions will be also allowed to include shares or units in collective investment undertakings (CIUs) in the liquidity buffer[43], in contrast to Basel III.

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[38] Under par. 54(a) of Basel II only residential mortgage backed securities can be included in the stock of liquid assets.

[39] See *Report on appropriate uniform definitions of extremely high quality liquid assets (extremely HQLA)..., op. cit.*, p. 24.

[40] See paragraph 10 of the delegated Regulation.

[41] The delegated act specifies alternative liquidity approaches with reference to the currencies with constraints on the availability of liquid assets under Article 19 of the delegated Regulation.

[42] Specific criteria for such treatment are described under Article 16 of the delegated Regulation.

[43] See Article 15 of the delegated Regulation.

3. LIQUIDITY FLOWS

The denominator of the liquidity coverage ratio is net liquidity outflows, which should be calculated as the difference between liquidity outflows and liquidity inflows over a 30 day stress period, with the assumption of a combined idiosyncratic and market-wide stress scenario[44]. A general rule is that the sum of expected inflows should not exceed 75% of the sum of expected outflows, with certain exceptions, which will be discussed further.

3.1. Liquidity outflows

The credit institutions are supposed to calculate expected liquidity outflows by multiplying the outstanding balances of liabilities and off-balance sheet exposures by the weights corresponding to their run-off (or draw down) rates. These weights have been explicitly defined under the delegated act, taking into account the results of an empirical analysis conducted by the EBA[45]. Table 3 presents the summary of those outflow categories of deposits, which deviate from the Basel accord, along with applicable run-off rates.

The approach proposed under the delegated act towards stable retail deposits is very similar to Basel III. A significant divergence refers to the category of less stable deposits subject to higher outflow rates. Fixed rates of 10–20% are proposed under the delegated act, whereas Basel III allowed for a 10% rate, which could be set at a higher level by competent authorities. What is more, this approach differs from the one currently in force. The CRR, under Article 421(3), delegates EBA to determine the conditions for identifying retail deposits subject to higher outflows. The EBA issued guidelines[46] in which it did not propose any specific rates, but recommended that the institutions develop internal models to assess appropriate outflow rates, while taking into account the conditions specified in the guidelines as well as certain additional factors. It seems that the approach proposed by the EBA enables the liquidity risk profile of an institution to be encapsulated better. This remark refers to the issue of setting fixed rates of outflows or inflows in general, while not allowing for an individual assessment of a particular bank. It supposedly promotes comparability across different institutions and jurisdictions, but it does not take account of the risk profile assigned to each institution.

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[44] See Article 20 of the delegated Regulation.

[45] *Report on impact assessment for liquidity measures under Article 509(1) of the CRR*, European Banking Authority, 20 December 2013.

[46] *Guidelines on retail deposits subject to different outflows for purposes of liquidity reporting under Regulation (EU) No 575/2013, on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (Capital Requirements Regulation – CRR)*, EBA/GL/2013/01, European Banking Authority, 06.12.2013.

Table 3. Outflow rates for selected deposits

Item	Run-off rate under the DA	Run-off rate under Basel III
Other retail deposits subject to higher outflow rates (Article 25 of the DA and par. 79–81	10–15%[a] 15–20%[b]	10% or more[c]
Cancelled deposits with a residual maturity of less than 30 calendar days and where pay-out has been agreed to another credit institution (Art. 25(4) of the DA)	100%	–
Operational deposits from credit institutions placed at the central institution that are considered liquid assets for the depositing credit institution (Art. 27(3) of the DA and par. of Basel III)	100%	–

[a] According to Article 25.3(a) of the delegated Regulation a rate of 10–15% applies where the total deposit balance, including all the client's deposit accounts at that credit institution or group, exceeds EUR 500 000 or the deposit meets at least two additional criteria:

– the deposit is an internet only account, or

– the deposit offers an interest rate that significantly exceeds the average rate for similar retail products or is derived from the return on a market index or set of indices or is derived from any market variable other than a floating interest rate, or

– the deposit was originally placed as fixed-term with an expiry date within the 30 calendar day period or the deposit presents a fixed notice period shorter than 30 calendar days, or

– the depositor is resident in a third country or the deposit is denominated in a currency other than the euro or the domestic currency of a Member State.

[b] According to Article 25.3(b) of the delegated Regulation a rate of 15–20% apply where the total deposit balance, including all the client's deposit accounts at that credit institution or group, exceeds EUR 500 000 and the deposit fulfils at least one additional criterion specified above, or the deposit fulfils or three or more criteria specified above. Additionally, according to Article 25.3(b) of the delegated Regulation a rate of 15–20% applies where the assessment of the retail deposits has not been carried out or is incomplete. What is more, competent authorities may apply a higher outflow rate on a case by case basis where justified by the specific circumstances of the credit institution. Under Article 25(5), a higher percentage outflow rate should be applied to retail deposits taken in third countries if such a percentage is provided for by the national law establishing liquidity requirements in that third country.

[c] Under par. 79–81 of Basel III supervisory authorities should set appropriate outflow rates of from 10% up to 100%.

Source: own work.

As regards operational deposits, the delegated act is broadly in line with Basel III. The only difference refers to sight deposits placed with the central institution. According to the delegated act, these deposits should be assigned a 100% run-off rate by the central institution if they are treated as liquid assets by other institutions belonging to the network or IP. In contrast, the Basel rules do not recognise such outflows. Additionally, the delegated act recognises funding committed by the central institution, which can be treated as liquid assets by the

members of a cooperative network or an IPS, and assigns a 75% run-off rate to the committed principal amount of this liquidity funding[47].

Certain differences in terms of the outflow rates can be identified for other liabilities, as highlighted in Table 4.

**Table 4. Liabilities resulting from secured lending
and capital market-driven transactions maturing within 30 calendar days**

Item	Run-off rate under the DA	Run-off rate under Basel III
Liabilities collateralised by assets that would qualify as L1 assets, except for extremely high quality covered bonds, or if the lender is a central bank	0%	0%
Liabilities collateralised by assets that would qualify as extremely high quality covered bonds	7%	15%
Liabilities collateralised by assets that would qualify as level 2A assets	15%	15%
Liabilities collateralised by residual loans, fully guaranteed residential loans or auto loans and leases	25%	100% (25%)[a]
Liabilities collateralised by assets that would not qualify as liquid assets and the lender is the domestic central government, a domestic public sector entity or a multilateral development bank	25%	25%
Liabilities collateralised by assets that would not qualify as liquid assets and the lender is the central government, a public sector entity of the Member State or of a third country in which the credit institution has been authorised or has established a branch, or a multilateral development bank	25%	100%
Liabilities collateralised by commercial loans or consumer loans	35%	100%
Liabilities collateralised by corporate debt securities that would qualify as level 2B assets	50%	50%
Liabilities collateralised by shares that would qualify as level 2B assets	50%	50%
Liabilities collateralised by assets that would not qualify as liquid assets, except where the lender is a central bank	100%	100%

[a] A 25% run-off rate applies with regard to residential mortgage backed securities, according to par. 155 of Basel III.

Source: own work based on the Article 28(3) of the delegated Regulation and paragraph 11–115 of Basel III.

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[47] See Article 31(7) of the delegated Regulation.

As can be seen from Table 4, the approach towards secured funding proposed under the delegated act is less strict than under Basel III, which might lead to a higher average level of LCR. The differences mainly concern the liabilities collateralised by those categories of assets which are subject to a preferential treatment under the delegated act, i.e. high quality covered bonds, auto loans and leases, and commercial or consumer loans. The delegated act also offers priority to liabilities collateralised by non-high quality liquid assets in the event that the counterparty is the central government, a public sector entity of the Member State or of a third country in which the credit institution has been authorised or has established a branch, or a multilateral development bank. In contrast, under Basel III, this derogation applies to liabilities that are not backed by Level 1 or 2 assets, only where the lender is the domestic sovereign, public sector entity or multilateral development bank.

In addition to the information presented in the tables above, the delegated act widens the scope of clients eligible to a 40% run-off rate[48] by adding credit unions and personal investment companies, which would be assigned a 100% run-off rate under Basel III[49]. Also, Article 30 of the delegated act specifies additional outflows related to collateral posted by a credit institution for off-balance sheet contracts and credit derivatives other than cash and L1 assets (with a 20% run-off rate) and collateral in extremely high quality covered bonds (with a 10% run-off rate). In contrast, collateral in extremely high quality covered bonds should be assigned a 20% run-off rate according to Basel III[50]. The delegated act also allows for the preferential treatment of deposits within a group or an IPS[51]. Competent authorities may, under certain conditions, authorise the application of symmetrical outflow and inflow rates for undrawn credit and liquidity facilities between two credit institutions belonging to a single group or to the same IPS, provided that the credit institutions are established in the same Member State[52]. The derogation may be applied to cross-border flows on the basis of additional criteria, including special legally binding arrangements, and the liquidity risk profile and liquidity risk management of the relevant credit institutions for this treatment.

A general overview of the outflow rates allows the assumption that the LCR will increase due to the divergences identified herein as regards the calculation of outflow rates.

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[48]   See Article 28(1) of the delegated Regulation.
[49]   Compare par. 109–111 of Basel III.
[50]   See par. 199 of Basel III.
[51]   Compare Article 29 of the delegated Regulation.
[52]   See Article 29 and paragraph 15 of the delegated Regulation.

3.2. Liquidity inflows

The credit institutions should calculate liquidity inflows over a 30 day period. The liquidity inflows should include contractual inflows as well as exposures that are not overdue, for which the credit institution has no reason to expect non-performance over 30 consecutive days[53]. Certain inflows should be subject to lower inflow rates. Table 5 presents several divergences from the Basel rules.

Table 5. Selected inflow rates

Item	Inflow rate under the DA	Inflow rate under Basel III
Monies due that the credit institution owing those monies treats as operational deposits, with the exception of deposits from credit institutions placed with the central institution which are considered liquid assets for the depositing credit institution (Art. 32.3(d) of the DA and par. 156–157 of the Basel III)	5%[a]	0%
Undrawn committed liquidity facilities from the central bank which are recognised as liquid assets (Art. 32.3(g) of the DA)	0%	–
Assets with an undefined contractual end date (Art. 32.3(i) of the DA and par. 152 of the Basel III)	20%	0%
New obligations entered into (Art. 32(7) of the DA)	0%	–

[a] A 5% inflow rate shall only be applied when a corresponding symmetrical inflow rate cannot be established. See Article 32.3(d) of the delegated Regulation.

Source: own work.

The approach towards the calculation of inflows under the delegated act differs slightly from the Basel accord. One difference concerns monies due from customers, classified as operational deposits, which should receive a symmetrical inflow rate if possible or a 5% inflow rate, whereas they should be assigned a 0% inflow rate as stated by the Basel Committee. Another difference applies to assets with an undefined contractual end date, which should receive a 0% inflow rate under Basel III, but have been assigned a 20% rate under the delegated act. What is more, the approach to collateral swaps which mature within 30 calendar days differs in that an inflow under the delegated act should be calculated as the excess liquidity value of the assets lent net of the liquidity value of the assets borrowed, whereas there

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[53] See Article 32 of the delegated Regulation.

are fixed rates set under Basel III, corresponding to the underlying asset type[54]. The delegated act also provides a possibility for the preferential treatment of inflow rates for undrawn credit and liquidity facilities within a group or an IPS, on condition that a competent authority allows for such treatment[55].

The last area of concern in this study regards inflow caps. The reason for imposing the 75% cap on total expected cash outflows was to encourage banks to maintain a minimum amount of the liquidity buffer equal to 25% of the total cash outflows, while minimising the reliance on expected cash inflows[56]. The delegated act allows for certain derogations from the 75% cap, which are not compatible with Basel rules. The following inflows may be fully or partially exempted from the cap[57]:

❖ inflows where the provider is a parent or a subsidiary of the credit institution or another subsidiary of the same parent institution,

❖ inflows from deposits placed with other credit institutions within a group,

❖ interdependent inflows including inflows from loans related to mortgage lending, or promotional loans or from a multilateral development bank or a public sector entity that the credit institution has passed through.

What is more, specialised credit institutions may be exempted from the cap on inflows under certain conditions when they are dealing with businesses such as leasing and factoring, or they may be subject to the 90% cap if their main activities involve financing for the acquisition of motor vehicles or consumer credit[58].

4. CONCLUSION

The delegated act proposed by the European Commission entails a number of adjustments which lead to certain divergences from the internationally acknowledged approach of the Basel Committee. A summary of these deviations is presented in table 6.

Taking the abovementioned adjustments into consideration, it may be assumed that the application of the delegated act will lead to an average increase in the liquidity coverage requirement. The consequences, however, may vary by country due to significant differences in the level of development of financial markets. A precise assessment of the scale of the impact would be possible if a quantitative study was proposed.

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[54] See par. 145–146 of Basel III.
[55] See Article 34 of the delegated Regulation.
[56] See par. 144 of Basel III.
[57] See Article 33(2) of the delegated Regulation.
[58] See Article 33(3)–33(5) of the delegated Regulation.

Table 6. Main divergences of the delegated act from the Basel accord

Item	Adjustment proposed by the EC	Expected impact on the LCR
Diversification requirement	Widening the scope of exemptions	positive
Requirement to test market access	Widening the scope of exemptions	positive
High quality liquid assets	Broadening the range of high quality liquid assets through the inclusion of: – deposits and other funding in cooperative networks and institutional protection schemes (IPS), and – collective investment undertakings (CIUs)	positive
Eligible assets issuers	Extending the range of qualifying issuers of high quality liquid assets	positive
Liquid assets characteristics	Narrowing the list of liquid assets features	positive
Level 1 assets	Broadening the range of extremely high quality liquid assets by: – the inclusion of covered bonds of credit quality step 1 – the preferential treatment of sovereigns of the European Union Member States	positive
Level 2B assets	Broadening the range of high quality liquid assets through the inclusion of: – ABS other than those backed by residential loans, – restricted-use committed liquidity facilities provided by central banks	positive
Liquidity outflows	Introduction of fixed outflow rates with regard to stable retail deposits	possibly negative
Liquidity outflows	Preferential treatment of liabilities collateralised by high quality covered bonds, auto loans and leases, commercial or consumer loans	positive
Liquidity outflows	Preferential treatment of funding committed to members of cooperative networks and IPS by the central institution	positive
Liquidity outflows	Preferential treatment of certain liabilities resulting from secured lending and capital market-driven transactions	positive
Liquidity outflows	Widening the scope of clients eligible for a 40% run-off rate	positive

Item	Adjustment proposed by the EC	Expected impact on the LCR
Liquidity outflows	Preferential treatment of collateral in extremely high quality covered bonds	positive
Liquidity outflows/inflows	Preferential treatment of undrawn credit and liquidity facilities within a group or IPS	positive
Liquidity inflows	Application of an symmetrical inflow rate to operational deposits	positive
Liquidity inflows	Preferential treatment of assets with an undefined contractual end date	positive
Liquidity inflows	Altering the approach to collateral swaps	n/a
Liquidity inflows	Imposing exemptions regarding inflow caps	positive

Source: own work.

The adjustments proposed by the EC are mainly aimed at increasing the LCR and their main purpose is to facilitate lending and boost economic growth. Therefore, it can be concluded that the prudential objective of the liquidity requirement cannot be assured. Another drawback of the liquidity regulation, in general, is the creation of a set of uniform indicators, regardless of the liquidity risk profile of individual institutions.

Abstract

The article presents the principal conclusions from the analysis of the delegated act on the liquidity coverage requirement adopted by the European Commission in October 2014. The delegated act was analysed in line with the Basel IIII accord in order to identify the main differences and to assess whether the alterations proposed by the European Commission pose a threat to the prudential objective of the liquidity regulation. The main conclusion is that the prudential objective of the liquidity coverage requirement cannot be assured as the majority of changes proposed to the delegated act, as compared with the Basel rules, lead to an increase in the average level of the ratio, while the main purpose of the European Commission was to stimulate growth and facilitate lending to the real economy.

Key words: liquidity risk, bank risk management, liquidity regulation

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THE EFFECT OF RECENT CHANGES IN FOREIGN BANKS' BEHAVIOR ON BANKING SECTOR CONCENTRATION – FIRST EVIDENCE FROM 53 COUNTRIES[1]

1. INTRODUCTION

Over the last two decades many countries, particularly developing ones, have experienced a massive expansion of foreign banks. Their presence has been particularly seen in Latin America, Europe and Central Asia. This phenomenon has mainly been driven by increased liberalization of financial markets and deregulation in the form of the removal of entry barriers and introduction of technological innovations (Crystal et al., 2002). Indeed, in 41 percent of all emerging economies over 50 percent of the banking asset belongs to foreign-owned banks (Claessens et al., 2008). There are undoubtedly many benefits associated with foreign banks' presence in developing countries. These are increased competition in the banking sector of the host countries, better resource allocation, higher quality of domestic banking services and lower overall costs (Levine, 1996; Crystal et al., 2002). However, the experience of the recent financial crisis has

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also shown that countries whose banking sectors rely heavily on the participation of foreign financial institutions can be more affected by the financial crisis. This is due to the banking sector of these countries being highly dependent on the situation in the countries where the parent banks operate (Allen et al., 2014). Moreover, de Haas and van Lelyveld (2010) state that weak parent banks may reduce or even completely discontinue their support during the financial crisis. It may even happen that financially weak parent banks will need support from their subsidiaries – a situation that took place in Russia and the Czech Republic at the end of 2008 when Lehman Brothers announced bankruptcy. In addition, many parent banks have decided to sell their operations in the emerging countries to increase their capital base.

The phenomenon of increased expansion of foreign banks was additionally accompanied by an intense consolidation process that had already started in the second half of the 1990s (Carletti et al., 2002). Bikker and Spierdijk (2009) state that this massive consolidation has been characterized by a major drop in the number of banks, higher concentration levels and the increase of the largest banks' market share. Interestingly, we have recently started to observe a reverse in this trend. We have noticed a large scale withdrawal of foreign banks from countries where those institutions represent a significant part of the banking sector. Poland alone has experienced a withdrawal of such banks as AIG Bank, Fortis Bank, Allianz Bank, West LB and KBC Group. The process of foreign bank withdrawals might thus once again change the concentration levels in the banking industry and as a result give rise to stability concerns.

The aim of this paper is therefore to assess how the changes in international banking over the past decade have changed the concentration of banking sectors worldwide. In particular, we try to assess how foreign banks' withdrawals have been affecting the concentration of the banking sectors. Although there have been a number of studies into the consolidation process on banking sector concentration (Carletti et al., 2002; Yeyati and Micco, 2007; Uhde and Heimeshoff, 2009), little has been written on the impact of the foreign banks' withdrawals on the banking industry concentration levels. In theory, we might expect two opposite effects of foreign banks' withdrawals on banking sector concentration. On the one hand, foreign banks withdrawing might lead to a greater concentration of the banking sector and thus increase all the negative mechanisms in the banks as "too big to fail", "too important to fail" decreasing the market discipline and thus encouraging the power banks to take on greater risk (Beck et al., 2006). This will be the case when the withdrawal occurs through the process of consolidation and a large domestic institution takes over the business of a divested bank. Such a situation has happened for example in Poland when the large domestic PKO BP bank decided to take over the activities of Nordea Bank Poland, increasing its market share from 15 to 18 percent and becoming the bank with the largest market share on the Polish

market. Indeed, Bikker and Haaf (2002) and Bikker and Spierdijk (2009) show that such takeovers increase the power and dominance of single banking institutions. On the other hand, foreign banks' withdrawals might also have a negative effect on concentration when a large dominant bank decides to close its operation and its business is divested among many banking players. In turn, such changes in the banking industry might break up the power of single institutions in the industry and decrease the concentration level. Efthyvoulou and Yildirim (2013), analyzing the changes in power of banks in the CEE countries before and after the mortgage crisis, do not find any significant changes. This might point toward a decreasing effect of foreign banks' withdrawals on banking sector concentration. Moreover, withdrawals might also be enhanced by greater market discipline (Hasan et al., 2013), which will have a positive effect on banking sector stability. Considering the importance of banking sector concentration on banking sector stability, the changes in this environment seem to be of great importance for policy-makers.

We want to fill the gap in the existing research literature and assess how foreign banks' withdrawals have affected the banking sector concentration. Our sample includes 53 countries over the period 1997–2008. We measure the changes in the banking concentration using the Herfindahl-Hirschman index. This measure has been commonly used in the banking literature to measure concentration and is the one most commonly employed by regulators. Moreover, in addition to other studies our analysis takes a deeper outlook than just the asset approach. We also analyze the concentration level on loan and deposit markets, and group the analyzed countries into 7 regions: Africa, Asia, Australia and Oceania, Central and Eastern Europe, Central and South America, North America and Western Europe.

The main findings in terms of banking concentration can be listed as follows. Firstly, the overall picture that emerges from the evolution of the Herfindahl-Hirschman indices suggests that the changing behaviour of banking concentration is rather mixed. In the case of developing regions (Africa, Asia, CEE countries) the sample could be split into two periods: from 1995 to 2000 and from 2000 to 2008. The first period was characterized by higher concentration levels, which can be explained by the fact that the foreign banks' expansion at that time was not yet at an advanced stage. The second period was characterized by lower concentration levels attributed to the emergence of foreign banks. In the case of developed regions (North America and Western Europe) the concentration levels were increasing at a constant rate. Secondly, the majority of the analyzed countries have experienced a higher degree of banking concentration after 2007. This behaviour may be attributable to the changes which happened on the banking market during the financial crisis of 2007. We have noticed a consolidation process in many countries as a result of divestment of banking activities. Our empirical investigation supports the hypothesis that foreign banks' withdrawals, in general, positively affect banking sector concentration, causing it to increase. The greatest magnitude of this effect

is seen with regard to the deposit market. The results might suggest that banks with a greater customer base are more likely to be sold off – results consistent with the findings of Hryckiewicz and Kowalewski (2011). Surprisingly, however, we do not notice a greater effect of the acquisition of divested banks on banking sector concentration, as compared to other forms of withdrawals. This might suggest a tendency for banking operations to be split up among many market players, especially when the foreign bank has been struggling with financial problems.

The remainder of the paper is structured as follows. Section 2 presents an overview of the literature. Section 3 describes the sample data. Section 4 presents the evolution of the Herfindahl-Hirschman index for the regions analyzed. Section 5 describes the model, and Section 6 discusses the empirical results. Finally, Section 7 concludes the discussion.

2. LITERATURE OVERVIEW

The literature review on determinants of concentration levels in various countries can be considered for two periods: the consolidation process, which happened in the 90s and early 2000s, and the period afterwards. During the first period we could notice a trend in worldwide consolidation of banks. Bikker and Spierdijk (2009) state that this massive consolidation was characterized by a major drop in the number of banks, higher concentration levels and increase in the largest banks' market share. This process has occurred within countries and across countries as well as within business lines and across business lines (OECD, 2010). As a result of the consolidation process, countries like Australia, Canada, Belgium, France, Netherlands and Sweden have experienced high levels of banking concentration (Carletti et al., 2002). Consequently, the consolidation trend has also led to an increase in the power of banks in many countries (Bikker and Spierdijk, 2009). Nevertheless some countries have stayed resistant to the consolidation trend, for example United States or Germany.

During this period developing countries experienced a massive expansion of foreign banks. This phenomenon was mainly driven by increased liberalization of financial markets and deregulation in the form of the removal of entry barriers and introduction of technological innovations. Clarke et al. (2003) find that this trend was particularly pronounced in countries like Argentina, Chile, Czech Republic, Hungary and Poland, where more than 50 percent of all banking assets are controlled by foreign banks. Similarly, Crystal et al. (2002) report that the expansion of foreign banks was particularly prevalent in Latin America and Eastern Europe, where foreign ownership accounts now for 50 percent of banking system assets. The increas in foreign banking ownership has mostly been proven to have a positive effect on domestic banking sector. Claessens and van Horen (2012) argue

that concentration has decreased in those countries, yet competition has increased. The authors indicate that foreign banks may enhance competition since they are characterized by greater operational efficiency. Their marginal costs are lower due to the economies of scale, so are their funding expenses as a result of the better access to liquidity provided by their parent banks. Similar results find De Haas and van Lelyveld (2010). The authors claim that foreign owed banks foster competition as they have better lending opportunities on international financial markets. Weill (2011), however, studies the evolution of competition in all European Union countries in the 2000s. The author reports that in general banking competition has improved and developing countries of the EU tend to converge towards the same competition levels that are achieved by developed countries in the European Union. Pawlowska (2012) however argues that the concentration level of the Polish banking sector increased significantly between 2000 and 2006. This was mainly a result of the consolidation process realized by large banks during this period. Overall, though, the concentration level of the Polish banking sector has been assessed as moderate.

Contrary to the trend observed in the 90s and the beginning of the 2000s in many countries, we have recently noticed a reverse process in the financial market structure. Many foreign banks have decided to withdraw from countries where they constituted a significant part of the banking sector. Hryckiewicz and Kowalewski (2011) notice that in times of financial crises the probability that a foreign bank will withdraw its operations from the host country or sell its subsidiaries or branches increases significantly. De Haas and Lelyveld (2003) state, however, that a deteriorating economic situation in the home country may force parent banks to sell their subsidiaries. The authors claim that foreign operations are the first to be scaled down. Poland alone has recently experienced the withdrawal of such banks as AIG Bank, Fortis Bank, Allianz Bank, West LB, KBC Group and Nordea Bank. This phenomenon might have had serious consequences, as it has certainly impacted the levels of concentration and competition of the banking industry.

In the empirical literature, there is no evidence how the foreign banks' withdrawals affect banking sector concentration. In theory, however, we can expect two opposite effects. Firstly a positive one – withdrawal of foreign banks s causes an increase in banking sector concentration as a result of the consolidation process between withdrawing and existing banks in a country. This may lead to greater concentration in the banking sector, increase negative mechanisms in the "too big to fail", "too important to fail" banks, thus encouraging the power of banks to take a greater risk. Indeed, according to a report issued by OECD (2010) the mergers that took place during the recent financial crisis have significantly increased the concentration levels of the banking industry. Consistently, the report argues that between 2005 and 2009 the United States experienced an 8 percent increase in the deposit market share of the top five financial institutions while France saw a rise

of 3 percent. A similar change has also been observable in the loan market. Thus, the process of consolidation associated with the foreign banks' withdrawals has certainly changed the concentration and competition levels in the banking industry and as a result has given rise to stability concerns. On the other hand, foreign bank withdrawals may also lead to a decrease in banking sector concentration. Such a situation might happen when a divesting bank closes its operation due to losses, or an asset of such a bank has been split among many banking players. For example, Pawlowska (2012) finds that concentration in the Polish banking sector decreased during the mortgage crisis. However Efthyvoulou and Yildirim (2013) find that, for the majority of CEE countries, the power of banks did not significantly change during the financial crisis of 2007–2010.

3. DATA DESCRIPTION

3.1. Sample

The data on foreign bank withdrawal was hand-collected using Bureau van Dijk's Bankscope and Zypher databases as well as various public resources such as annual reports and newspapers. Moreover, the same database on foreign banks' withdrawals was used by Hryckiewicz and Kowalewski (2011) in the paper "Why do foreign banks withdraw from other countries" published in International Finance Vol. 4 in 2011. We can therefore consider highly reliable.

In our study, we define withdrawal from a host country as a parent bank closing its subsidiary or selling it to an investor. We consider the term foreign bank subsidiary to mean locally incorporated banks with over 50% foreign ownership. Based on these criteria we identified 140 foreign bank divestments in 53 different countries during the period 1997–2008. In our sample, most of the foreign bank subsidiaries were liquidated by sale to a domestic or foreign investors. The sample includes commercial and savings banks but excludes state banks and agencies of foreign banking operations. The countries considered are: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, Colombia, Croatia, the Czech Republic, Denmark, El Salvador, France, Germany, Guatemala, Honduras, Hong Kong, Hungary, Indonesia, Ireland, Israel, Italy, Japan, Kenya, Kyrgyzstan, Latvia, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Panama, Paraguay, Peru, the Philippines, Poland, Portugal, Romania, Singapore, Slovakia, Spain, Suriname, Switzerland, Thailand, Turkey, Ukraine, the United Kingdom, Uruguay, the USA, Uzbekistan and Venezuela. In order to obtain a better outlook of how the banking sector concentration has been changing, we grouped all the analyzed countries into 7 regions: Africa, Asia, Australia and Oceania, Central and Eastern Europe, Central and South America,

North America and Western Europe. Table 1 presents the number of foreign banks' divestment by host country over the period 1997–2008.

**Table 1. Number of banks in the sample used
for the Herfindahl-Hirschman Index**

Number of banks in the sample used							
	Africa	**Asia**	**Australia and Oceania**	**Central and Eastern Europe**	**Central and South America**	**North America**	**West Europe**
1995		13	6	21	57	18	43
1996		15	7	34	56	19	101
1997		20	7	44	56	18	103
1998		20	7	49	66	20	114
1999		31	7	55	72	24	119
2000	4	34	8	59	95	29	138
2001	4	29	8	54	102	31	155
2002	3	31	7	67	104	30	169
2003	4	29	6	64	95	27	178
2004	9	28	9	75	86	26	182
2005	9	29	9	79	85	25	196
2006	10	26	10	77	84	25	192
2007	8	26	10	72	80	25	182
2008		6	6	25	51	24	65
Total	**51**	**337**	**107**	**775**	**1089**	**341**	**1937**

Note: Regions are defined as following: Africa includes Kenya; the Asian region includes Hong Kong, Indonesia, Israel, Japan, Kyrgyzstan, Philippines, Thailand, Singapore, Turkey, Uzbekistan; Australia and Oceania includes Australia and New Zealand; the Central and Eastern European region includes Austria, Bulgaria, Croatia, the Czech Republic, Hungary, Latvia, Poland, Romania, Slovakia and Ukraine; Central and South America includes Argentina, Bolivia, Brazil. Chile, Colombia, El Salvador, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, Suriname, Uruguay and Venezuela; North America includes Canada and the USA, and finally the Western European region includes Belgium, Denmark, France, Germany, Ireland, Italy, Luxemburg, the Netherlands, Norway, Portugal, Spain, Switzerland and the United Kingdom.

Source: BankScope.

To investigate the effect of foreign banks' withdrawals on the banking sector's concentration we additionally collected financial data for all their peers. However

banks which lacked variables needed to calculate the concentration ratio and its determinants were eliminated. Our panel is therefore unbalanced, includingatotal of 4,239 observations. Data on a country's variables were collected from the OECD and World Bank. Table 2 shows our sample properties.

Table 2. Number of foreign bank divestments by host country and year

Countries	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Argentina		1				4	1	1	1	1	1		10
Australia		1										1	2
Austria		1	1		1								3
Belgium			1					1	1				3
Bolivia										1			1
Brazil			2			1	4			1			8
Bulgaria				1									1
Canada								1	1				2
Chile							1			1			2
Colombia							1		1				2
Croatia							1			1			2
Czech Republic						1	1	1		1		1	5
Denmark								1	1				2
El Salvador											1		1
France						1	2	1		1	1		6
Germany		1	1				1					1	4
Guatemala							1			1			2
Honduras							1				1		2
Hong Kong							1	2					3
Hungary		1		1	1		1			1			5
Indonesia				1	3	1	2						7
Ireland									1				1
Israel								1					1
Italy												3	3
Japan						1						1	2
Kenya					1								1

Countries	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Kyrgyzstan				1									1
Latvia				1									1
Luxemburg					2	1		1		1			5
Mexico							1						1
Netherlands							1						1
New Zealand							1						1
Norway											1		1
Panama				1	2		1		1	1			6
Paraguay								1		1	1	1	4
Peru										1			1
Philippines				1									1
Poland						2	1						3
Portugal					1			1					2
Romania				2	1								3
Singapore											1		1
Slovakia											1		1
Spain	1	2	1				1						5
Suriname				1									1
Switzerland				1	2		1	1			1		6
Thailand								1					1
Turkey			1					1		1			3
Ukraine													0
United Kingdom									1	1			2
Uruguay									1				1
USA					2	1	1						4
Uzbekistan										1			1
Venezuela						1				1			2
Total	**1**	**7**	**7**	**11**	**16**	**14**	**26**	**15**	**9**	**17**	**6**	**11**	**140**

4. CONCENTRATION OF THE BANKING SECTORS – EVOLUTION OF THE HH INDEX

4.1. HH Index as concentration measure

We use the Herfindahl-Hirschman Index (HHI) to measure banking sector concentration, as this is the most frequently used measure of market structure, especially in the banking sector (for example Fernández de Guevara et al., 2005). It is defined as the sum of the squared market shares:

$$H = \sum_{i=1}^{N} s_{it}^2 \qquad (1)$$

where:
s_{it} – stands for the market share of a bank i and time t
N – indicates the number of banks on the market

A market share is the ratio of a bank's total assets to the total assets in a banking industry. A Herfindahl-Hirschman index below 1 percent represents highly competitive market, while a Herfindahl-Hirschman between 1 percent and 15 percent indicates an unconcentrated market. A Herfindahl-Hirschman between 15 percent and 25 percent indicates moderate concentration while a Herfindahl-Hirschman index above 25 percent means a highly concentrated market.

4.2. Evolution of the Herfindahl-Hirshman Index

We start by exploring the evolution of banking sector concentration over the period 1995–2008 for each country and each year as well as grand averages for 7 regions and years. However the interpretation of the data for the year of 2008 should be explored carefully due to the lack of many financial data for our sample banks at the time of data collection, which undoubtedly boosted the index for some countries. Nevertheless we decided to include this year for the purpose of our analysis to see the changes in the trend in the concentration ratio in individual countries. The regions considered are Africa, Asia, Australia and Oceania, Central and Eastern Europe, Central and South America, North America and Western Europe. Table 3 presents the estimated banking concentration (measured by the Herfindahl- Hirschman index in terms of total assets) for each region and year, as well as the resulting averages for all regions and all years. Figures 1–7 show the evolution of banking concentration in terms of total assets, total loans and total deposits for each region.

Table 3. Descriptive statistics for Herfindahl-Hirschman Index

Variable	Obs.	Sample period (1997–2008)			
		Mean	StDv	Min	Max
HHI for asset	4239	0.365	0.25	0.04	0.98
HHI for loans	4220	0.385	0.255	0.05	0.98
HHI for deposits	4222	0.391	0.266	0.05	0.98
Net new entry	4251	0.04	0.17	–0.45	0.50
Inflation rate	4251	2.73	2.19	–3.69	9.27
Entry restrictions	4250	66.99	17.42	20.00	90.00
Property rights	4250	70.08	21.77	25.00	90.00
GDP per capita (log)	4251	9.47	1.24	5.77	11.63
Deposit growth	4246	16.69	23.73	–52.34	87.82

The overall picture that emerges from the evolution of the Herfindahl-Hirschman indices suggests that the changing behaviour of banking concentration is rather mixed. In the case of developing regions (Africa, Asia, CEE countries) the sample could be split into two periods: from 1995 to 2000 and from 2000 to 2008. The first period was characterized by higher concentration levels which can be explained by the fact that the foreign banks' expansion at that time was not yet at an advanced stage. The second period was characterized by lower concentration levels after 2000 when we could notice a significant emergence of foreign banks. Moreover, the process of bank consolidation intensified during this period. In the case of developed regions (North America and Western Europe), the concentration levels increased at a constant rate. Nevertheless, almost all regions experienced higher concentration levels in 2008, which may be attributable to the experience of the recent financial crisis during which many parent banks decided to withdraw from host countries. Below we present a brief description of the changing behaviour of banking concentration by region.

Africa

The Herfindahl-Hirschman indices for this region range from 17.2 percent to 42.3 percent.[2] There is greater concentration in bank loans than in bank deposits or total assets. The banking concentration pattern can be split into two periods – the first covers the years from 2000 to 2003 with HHI equal on average to 40 percent, and the second one covers the years from 2004 to 2007 with HHI equal on average to 20 percent. The reason for this is that until 2000 few foreign banks

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[2]   Please note that banks' financial data are available for this region yet since 2000.

were operating in African countries. This is particularly true of countries like Algeria and Kenya. Only since the 2000s has there been a noticeable emergence of foreign banks like Societe Generale, Citibank, Barclays Bank or ABN Amro Bank.

Figure 1. Banking concentration by region
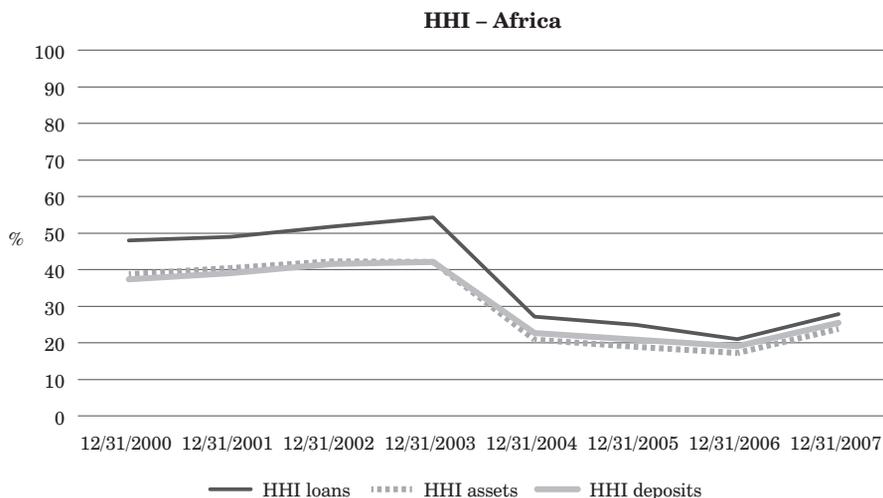
Source: BankScope and own elaboration.

Asia

For banks operating in Asia, the BankScope provides data for the whole period analyzed, that is for the years 1995 to 2008. The Herfindahl-Hirschman indices for that region range from 22.6 percent to 99.8 percent and the changing trend for bank deposits, loans and total assets is rather mixed, with some countries being more concentrated than others. The most concentrated countries in this region are Israel, Kyrgyzstan, the Philippines, Singapore, Thailand, Turkey and Uzbekistan. Countries in this region which have a lower banking concentration are Hong Kong and Indonesia which average 40 percent and 49 percent, respectively. As in Africa, the banking concentration pattern for Asia can be split into two periods - the first covers the years from 1995 to 2001 with HHI equal on average to 98 percent, and the second one covers the years from 2001 to 2008 with HHI equal on average to 30 percent. It should also be emphasised that in 2008 there was a notable increase in banking concentration ranging from 63.7 percent for bank loans to 76 percent for bank assets. All countries from this region, excluding Indonesia, experienced an abrupt increase in banking concentration. This situation can be explained by the events of the recent financial crisis where many banks have merged, been taken over or decided to sell their subsidiaries. Indonesia is the country which

experienced the highest number of withdrawals, particularly between 2000 and 2003. However, when it comes to the changing behaviour of banking concentration during the first two periods, we assume that it could have been influenced by the events of East Asian Economic crisis of 1997. Countries that have been affected by the Asian crisis were characterized by a high degree of banking concentration. This particularly refers to the Philippines, Thailand and Singapore. Following the Asian crisis, the banking sector of some Asian countries has become more fragmented.

Figure 2. Banking concentration by region
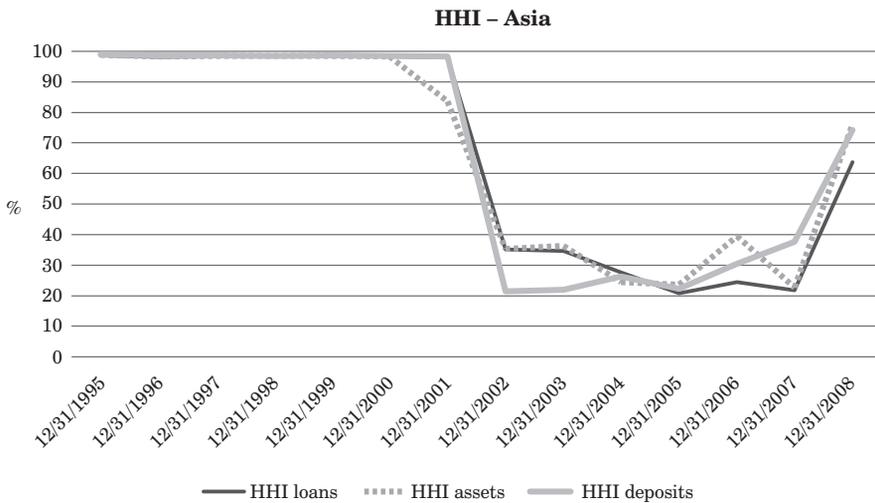
Source: BankScope and own elaboration.

Australia and Oceania

The Herfindahl-Hirschman indices range from 22.1 percent to 32.6 percent and show a consistent trend averaging 24.5 percent over the whole analyzed period. In 2008 alone the banking concentration in that region experienced a more significant increase of 10 percent. This was particularly influenced by the changing behaviour of banking concentration in Australia, as New Zealand displays a rather stable trend. Similar findings are outlined in the report issued by Deloitte (2014) on competition in retail banking where it is stated that following the global financial crisis of 2008, Australia has experienced an increase in banking concentration. This situation has been influenced by bank acquisition processes and withdrawals from the market. As regards the concentration for bank loans, deposits and total assets, the trend is similar over the period analyzed.

Figure 3. Banking concentration by region

HHI – Australia and Oceania
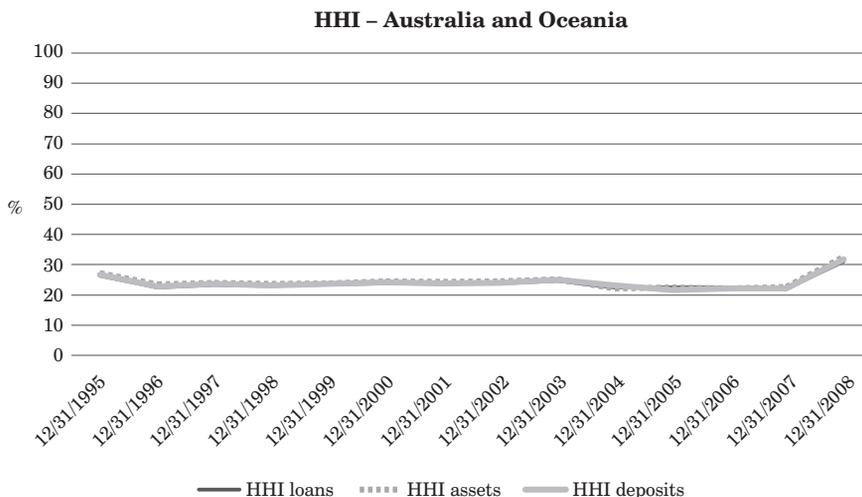
Source: BankScope and own elaboration.

Central and Eastern Europe

The Herfindahl-Hirschman indices for the CEE region range from 16.1 percent to 93.8 percent and the changing trend for bank deposits, loans and total assets is rather mixed. The most concentrated banking sectors are in Hungary (averaging 70 percent for the whole period), Austria (averaging 65 percent for the whole period) and countries like Latvia, Romania or Slovakia with HHI averaging at approximately 50 percent for the whole analyzed period. Countries with relatively low degrees of concentration are Poland (averaging 35 percent for the whole period analyzed), the Czech Republic (averaging 26 percent for the whole period analyzed) and Croatia (averaging 33 percent for the whole period analyzed). The banking concentration pattern for the CEE region displays a consistent trend with the exceptions of 2001 and 2008, when the majority of CEE countries experienced an increase in the concentration levels of the banking industry. However, as has already been noted this major increase in the banking concentration in 2008 can be skewed due to some missing financial data from banks for this period. Nevertheless, as in the case of the Asia and Australia and Oceania regions, the CEE countries have also experienced an increase in banking concentration as a result of the recent financial crisis, whereas the higher reported concentration in 2001 can be attributed to the bank consolidation process that has intensified in developing countries since the 2000s or even since the second half of the 1990s (Carletti et al., 2002). Countries that have experienced rather a diverging trend as regards the

concentration for bank total assets, loans and deposits are Austria, Hungary and Romania. In the case of the rest of the CEE countries, the concentration for bank total assets, loans and deposits shows rather a consistent trend.

Figure 4. Banking concentration by region

HHI – Central and Eastern Europe
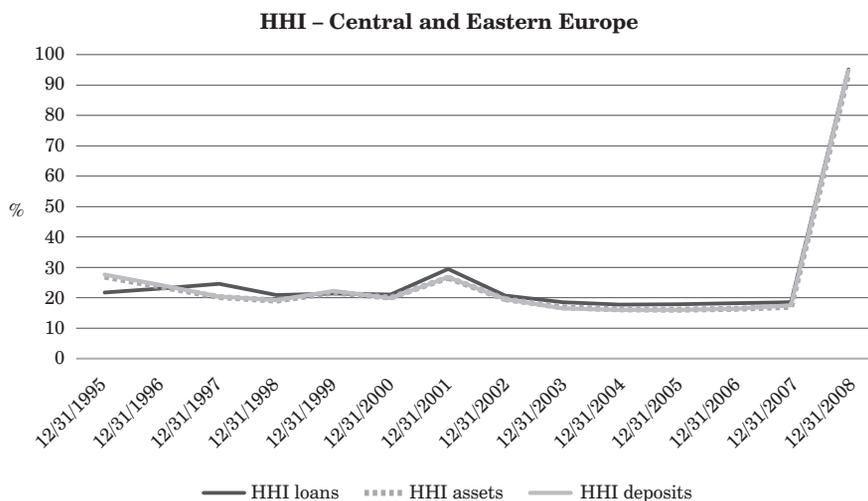
Source: BankScope and own elaboration.

Central and South America

The Herfindahl-Hirschman indices for the Central and South America region range from 16.9 percent to 38.4 percent, and the banking concentration averages 27.9 percent over the whole sample period[3]. As regards the concentration for bank loans, deposits and total assets, this follows a similar trend over the analyzed period with the exceptions of Guatemala and Mexico. In the case of these two countries the trend is mixed. From 1995 to 2000 the concentration for bank loans in Guatemala exceeded the concentration for bank deposits and total loans. Also, the banking concentration in Mexico does not display a consistent trend since concentration for bank total assets exceeds concentration for bank loans and deposits until 1997 and then the trend was reversed, with concentration for bank loans and deposits exceeding the concentration for bank total assets. The most concentrated banking sectors are in Peru (averaging 86 percent over the whole period), Honduras (averaging 81.5 percent over the whole period), Bolivia (averaging 77.5 percent over the whole period), Venezuela (averaging 65.6 percent

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[3] There are some missing observations for banks in Uruguay for years 1995–1998, and for banks in Suriname for years 2002–2008.

over the whole period), Mexico (averaging 56.1 percent over the whole period) and El Salvador (averaging 50.8 percent over the whole period). Brazil is the country characterized by the lowest degree of banking concentration in that region. Overall, the banking concentration for the Central and South America region displays an increasing trend. Notably, after 1999 the majority of countries from that region experienced an increasing concentration in the banking sector. Chortareas et al (2011) state that deregulation and liberalization that started in the early 1990s encouraged merger and takeover activities. Thus, higher concentration levels can be attributed to both the banks' consolidation process and to foreign banks' withdrawals. Central and South America is the region with the highest number of foreign banks' withdrawals. Like in other regions the banking concentration has increased since 2007, however not as significantly as in the case of the Asia or CEE regions.

Figure 5. Banking concentration by region
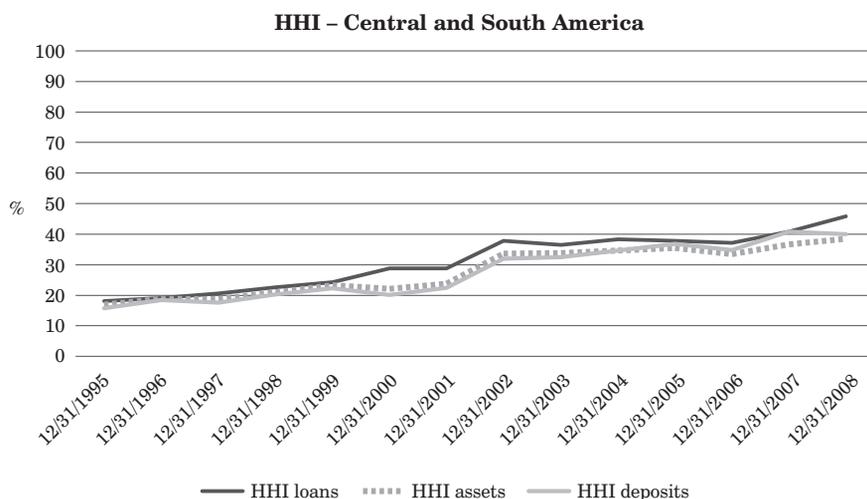
Source: BankScope and own elaboration.

North America

The Herfindahl-Hirschman indices for the North America region range from 21.8 percent to 36.6 percent, and the banking concentration averages 28.1 percent over the whole sample period. The changing trend for bank deposits, loans and total assets concentration is rather mixed. As regards Canada, the concentration for bank loans exceeds the concentration for total assets and deposits over the whole period, while with regard to the United States the concentration for bank loans is lower than the concentration for bank total assets and deposits, although the trend

has reversed since 2003. Also, Canada has a notably more concentrated banking sector than the banking sector of the United States. The banking concentration for the North America region displays a mixed trend. However in the case of Canada, the banking concentration displays an increasing trend whereas in the case of the United States the banking concentration is relatively low and stable. We have not observed significant changes in the concentration ratio in that region following the financial crisis of 2007.

Figure 6. Banking concentration by region

HHI – North America
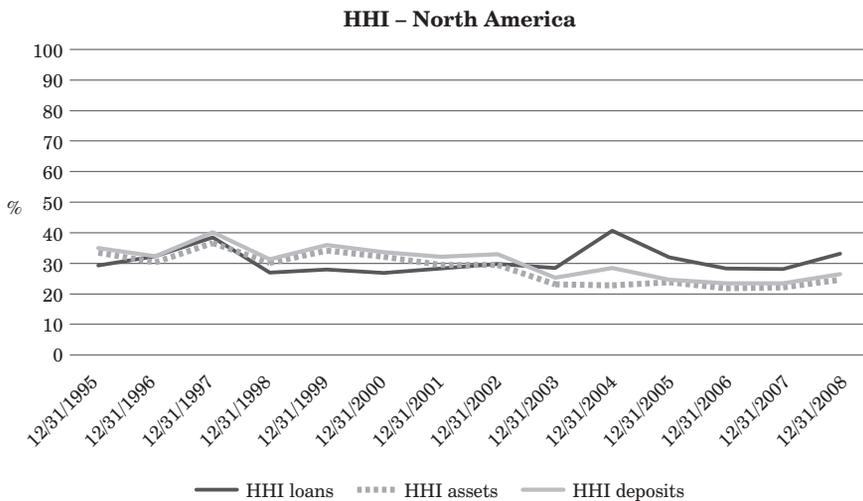
Source: BankScope and own elaboration.

Western Europe

The Herfindahl-Hirschman indices for the Western Europe region range from 2.3 percent to 22.9 percent, and the banking concentration averages 6.1 percent over the whole sample period. As regards the concentration for bank loans, deposits and total assets, it follows a similar trend over the analyzed period. The most concentrated banking sectors are in Portugal, Switzerland and the Netherlands with banking concentration averaging 74.7 percent, 69.4 percent and 61.4 percent respectively. Spain and Luxembourg are the countries characterized by the lowest degree of banking concentration in this region with HHI averaging 13.6 percent and 14.8 percent respectively. The banking concentration for the Western Europe region displays a consistent trend. However, in 2008 the majority of Western European countries experienced an increase in the concentration of the banking sectors. For the region as a whole, this figure increased by nearly 20 percent.

However, as has been already noted this significant increase in the banking concentration in 2008 may have been overstated by a lack of financial data for our sample banks in this region.

Figure 7. Banking concentration by region
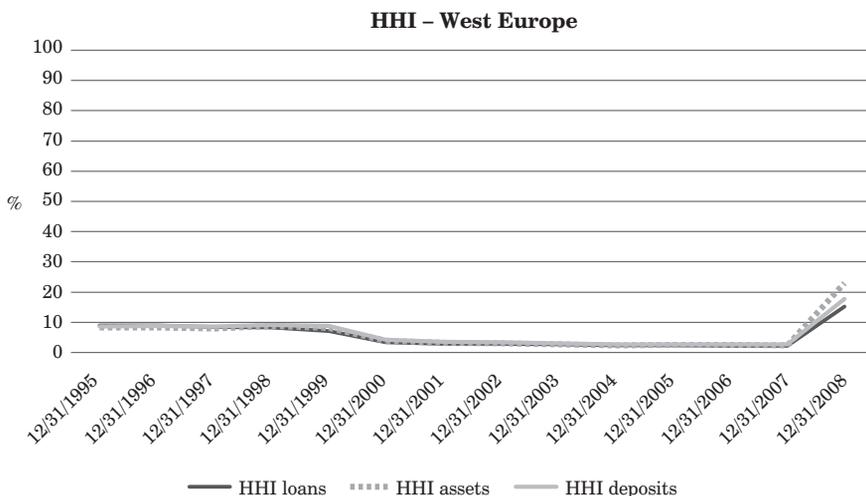
Source: BankScope and own elaboration.

5. THE RELATIONSHIP BETWEEN FOREIGN BANKS' WITHDRAWALS AND CONCENTRATION – EMPIRICAL MODEL

In order to test how changes in the banking structure have influenced the concentration in the banking sector, we regress three concentration measures defined as the Herfindahl-Hirschman index for bank total assets, total deposits and total loans. However in case of the Herfindahl-Hirschman index for total deposits and total loans we use total assets as a proxy for total banking output. The final regression estimated to analyze the determinants of the Herfindahl Hirschman Index takes the following form:

$$\text{HHI}_{\text{TASSETS}} = \beta_0 + \beta_{1\textit{WITHDRAWAL\_DUMMY}} + \beta_{2\textit{NET\_NEW\_ENTRY}} + \\ + \beta_{3\textit{INST\_RESTRICTION}} + \beta_{4\textit{INST\_PROPRIGHTS}} + \beta_{5\textit{INFLATION\_RATE}} + \beta_{6\textit{LN\_GDP}} + \varepsilon \quad (2)$$

$$\text{HHI}_{\text{TLOANS}} = \beta_0 + \beta_{1\textit{WITHDRAWALDUMMY}} + \beta_{2\textit{NETNEWENTRY}} + \\ + \beta_{3\textit{INSTRESTRICTION}} + \beta_{4\textit{INSTPROPRIGHTS}} + \beta_{5\textit{INFLATIONRATE}} + \beta_{6\textit{LNGDP}} + \varepsilon \quad (3)$$

$$\text{HHI}_{\text{TDEPOSITS}} = \beta_0 + \beta_{1WITHDRAWALDUMMY} + \beta_{2NETNEWENTRY} +$$
$$+ \beta_{3INSTRESTRICTION} + \beta_{4INSTPROPRIGHTS} + \beta_{5INFLATIONRATE} + \beta_{6LNGDP} + \varepsilon \quad (4)$$

We use Withdrawal dummy where 1 indicates that a bank withdrew its operations from a given country and 0 indicates that there was no withdrawal by the bank. We expect that bank withdrawals contribute to a greater concentration of the banking system.

Net new entry, which is measured by the percentage change in the number of organizations in the market. This variable was applied in the study conducted by Rhoades (2000) into the bank mergers and banking structure in the United States in 1980 and 1998. This was the most significant variable among other explanatory variables of the market structure in the United States. Rhoades (2000) states that the result obtained indicates that with a decrease in the percentage change of the number of organizations on the market, the Herfindahl-Hirschman Index tends to increase less compared to markets with smaller decreases

Institutional variables are represented by two components of the Economic Freedom Index: financial freedom and property rights. We expect that a higher value of the institutional variables can decrease the Herfindahl-Hirschman Index as greater financial freedom and hence lower barriers imposed on foreign banks entry may increase the number of participants in the banking market and hence decrease its concentration. According to Gonzales (2009), if the number of market participants influences the market competitiveness (Claessens and Laeven, 2004), it is probable that restrictions on banking may lead to a situation where less efficient firms will be taken over by more efficient firms. Stricter restrictions on foreign banks entry may thus contribute indirectly to diminished market concentration and the more efficient banks' market share.

We also include Macroeconomic variables proxied by the inflation rate and the natural logarithm of GDP. Demirgüç-Kunt et al. (2004) indicate that a higher level of inflation increases banks' margins and profitability whereas the natural logarithm of GDP has been applied in order to control for the effect of a country's size. Efthyvoulou and Yildirim (2013) argue that the effects of inflation on banks' profitability are ambiguous. Angelini and Cetorelli (2003) state that in an inflationary environment banks are characterized by a higher degree of risk premiums. Demirgüç-Kunt and Huizinga (2000) indicate that in an inflationary environment bank expenses may be higher as a result of a greater number of transactions as well as an expansion of branches.

In the robustness analysis we also include the *Deposits growth*, which is measured as the ratio of a bank's deposits to total market deposits. According to Smirlock (1985), rapid growth of deposits provides better profit opportunities for banks that are operating on the market. For this reason we expect that greater increases in the deposits growth reflect increasing market power of financial institutions, which may translate into higher concentration levels.

Table 4 presents the descriptive statistics for our data and Table 5 presents the correlation matrix.

Table 4. Evolution of banking concentration by region.
The Herfindahl-Hirschman Index (%)

Year(s)	Africa	Asia	Australia and Oceania	Central and Eastern Europe	Central and South America	North America	Western Europe
1997		98.50	24.10	20.20	18.70	36.60	7.90
1998		98.50	23.70	19.10	20.90	30.10	8.70
1999		98.50	23.90	21.80	23.30	34.10	8.10
2000	38.70	98.40	24.50	20.10	22.10	32.20	3.80
2001	40.40	83.60	24.30	26.60	23.80	29.50	3.20
2002	42.30	35.40	24.50	19.60	33.60	29.40	3.10
2003	42.00	36.30	25.10	16.80	33.90	23.00	2.70
2004	20.90	24.40	22.10	16.10	34.70	22.80	2.30
2005	18.80	23.60	22.40	16.10	35.50	23.80	2.50
2006	17.20	39.50	22.10	16.40	33.40	21.80	2.40
2007	23.80	22.70	22.70	17.10	36.60	22.10	2.40
2008		76.00	32.60	93.80	38.40	24.70	22.90
1995–2008	**30.50**	**66.60**	**24.50**	**25.30**	**27.90**	**28.10**	**6.20**

Source: BankScope and own elaboration.

As we can see from Table 4, our data does exhibit great variation. This, however, is not surprising given the large sample of both developing and developed countries in our analysis. In particular, the HH indices indicate that countries differ in their concentration ratios, which was also widely discussed in the previous section. The correlation matrix shows that our data does not exhibit any multicollinearity problems. We only notice a high and positive correlation between property rights variable and GDP per capita, which might indicate that more institutionallydeveloped countries are also more economically developed.

Table 5. The data presents the correlation matrix for the major variables used in our analysis

	HHI for asset	HHI for loans	HHI for deposits	withdraw-dummy	Infl. rate	entry rest.	proper. rights	gdpper-capita	net new entry
HHI for asset	1								
HHI for loans	0.875*	1							
HHI for deposits	0.931*	0.922*	1						
withdrawal dummy	0.026	0.018	0.020	1					
inflation rate	0.046*	0.025	0.033*	0.002	1				
entry restrictions	–0.019	–0.070*	–0.015	–0.027	–0.112*	1			
property rights	0.044*	0.078*	0.111*	–0.077*	–0.141*	0.542*	1		
gdppercapita	–0.072*	–0.038*	0.002	–0.079*	–0.187*	0.538*	0.795*	1	
net new entry	0.004	0.035*	0.007	–0.027	0.023	–0.013	–0.024	–0.101*	1
change in deposits	0.107*	0.101*	0.096*	0.019	0.002	–0.067*	–0.047*	–0.087*	0.075*

* indicates significance level of at least 5%

6. THE EFFECT OF FOREIGN BANKS' WITHDRAWALS ON BANKING SECTOR CONCENTRATION – EMPIRICAL RESULTS

Analyzing the evolution of the concentration across various countries, it is difficult to state unambiguously how the foreign banks' withdrawals have affected the concentration of the domestic banking markets. In some countries we have observed an increasing trend in concentration ratios as in Western Europe, in others we do not notice such an unambiguous correlation. This is in line with the theoretical literature that suggests that foreign banks' withdrawals might impact the concentration ratio in either direction depending on the nature of the transaction.

To empirically test the effect of foreign banks' withdrawals on banking sector concentration for bank asset, loans, and for deposits, we calculate the models presented in the Section 5. Table 6 presents the results on the effect of foreign banks' withdrawals on banking sector concentration over the entire sample period.

Table 6. The effect of foreign banks' withdrawals on banking sector concentration
The empirical results present the OLS estimation on the full sample.
The robust standard errors have been clustered on the country-level

	HHI for total asset		HHI for total loans		HHI for total deposits	
	Coeffi-cient	t-stati-stic	Coeffi-cient	t-stati-stic	Coefficient	t-statis-tic
Withdrawal dummy	0.038**	2.020	0.034*	1.750	0.041**	2.020
Inflation rate	0.000	1.300	0.000	0.360	0.000	1.250
Entry restrictions	0.000	–0.140	–0.002	–0.850	–0.001	–0.530
Property rights	0.004**	2.270	0.005**	2.410	0.005**	2.330
GDP per capita (log)	–0.070**	–1.980	–0.059	–1.580	–0.055	–1.460
Net new entry	–0.019	–0.640	0.015	0.490	–0.009	–0.270
Constant	0.753**	2.600	0.732**	2.580	0.662**	2.150
R2	**0.13**		**0.19**		**0.21**	
Number of observations	**4664**		**4660**		**4662**	

*** indicate significance level at 1%; ** indicate significance level at 5%; * indicates significance level at 10%.

The results indicate that foreign banks' withdrawal leads to a greater banking sector concentration. The withdrawal dummy is positively and statistically significantly correlated with all HH indices. This result is consistent with the OECD report (2010) arguing that foreign banks' withdrawals have affected the concentration of the banking sector and the intensity of competition after the mortgage crisis. Importantly, we notice that the highest correlation between foreign banks' withdrawal and the HHI for total asset, which has a significance level of 5%. With the latter two (HHI for total loans and deposits) we find such a correlation with a 10 percent significance level. This result might point towards an increase in the size of the existing banks. Interestingly, we also notice that the highest magnitude is for the concentration measure for total deposits. The results might support the findings of Hryckiewicz and Kowalewski (2011) that parent banks decide to sell their most profitable subsidiaries with a wide customer base to get the highest price. This might indicate a greater concentration on the deposit market. Weaker banks might be liquidated or split up among many investors.

Analyzing the effect of other explanatory variables, we find that the institutional variable proxying for property rights is statistically significant at a 5 percent significance level and its coefficient exhibits a positive sign. The result obtained is, however, contrary to our expectations since the coefficient of this independent variable is positive which means that a greater degree of property right protection in a given country increases concentration for bank total assets. We would have rather expected that greater protection of property rights would lead to lower banking concentration since, there would be greater entry of foreign banks and hence the overall number of financial institutions in a given country would increase. However, this result may also mean that greater protection of property rights increases the market power of the banks operating in a given country and this translates into higher levels of banking concentration. Among macroeconomic variables, GDP per capita becomes statistically significant, although showing a negative sign. The result seems to suggest that less developed countries are characterized by greater concentration for both bank total loans and deposit market. The result is consistent with many existing studies.

As already argued, our sample has suffered from limited bank coverage provided by our data provider. This is especially true for African countries. Moreover, 2008 was also not fully covered at the time of our data collection, therefore we estimate the model excluding both the African region and the year 2008 to see how these shortcomings in our database could impact our results. Table 7 presents these results.

As can be seen, the results remain the same as in the previous table. We notice that the withdrawal dummy has a positive and statistically significant impact on the concentration ratio of the countries analyzed. Consequently, the result suggests that foreign bank's withdrawal increases the concentration of the banking sectors.

As a result, the withdrawals might lead to greater power of the remaining banks. The reason for such an effect might come from the fact that most of the withdrawals occur through acquisition of the divested bank by domestic competitors, at the same time increasing the concentration ratio.

Table 7. The effect of foreign banks' withdrawals on banking sector concentration
The empirical results present the OLS estimation excluding Africa and the year of 2008. The robust standard errors have been clustered at the country level

	HHI for total asset		HHI for total loans		HHI for total deposits	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Withdrawal dummy	0.035**	1.990	0.031*	1.660	0.037*	1.940
Inflation rate	0.000	1.380	0.000	0.420	0.000	1.330
Entry restrictions	0.000	−0.170	−0.002	−0.840	−0.001	−0.520
Property rights	0.004**	2.250	0.004**	2.370	0.004**	2.320
GDP per capita (log)	−0.064**	−2.000	−0.054	−1.580	−0.052	−1.490
Net new entry	−0.039	−1.510	−0.013	−0.480	−0.032	−1.090
Constant	0.734***	2.680	0.717***	2.670	0.651***	2.240
R2	**0.11**		**0.21**		**0.22**	
Number of observations	**4224**		**4220**		**4222**	

*** indicates significance level of 1%; ** indicates significance level 5%; * indicates significance level of 10%.

In order to verify the hypothesis that withdrawals through acquisition do indeed create higher concentration of the domestic banking sectors, we run the regressions including the acquisition dummy variable. The *acquisition* variable takes a value of 1 if withdrawal occurs through acquisition of the divested bank, and zero for all other forms of withdrawals. A positive and statistically significant coefficient of this variable would indicate that withdrawal through acquisition of the divested bank by an existing bank on a market generates a greater effect on the concentration ratios than any other form of withdrawals. Table 8 presents the results.

Table 8. The effect of the form of foreign banks' withdrawals on banking sector concentration

The empirical results present the OLS estimation excluding Africa and the year of 2008. Additionally, we include the acquisition dummy that equals one if withdrawal occurs through a takeover of a divested bank by a domestic bank or government, otherwise it takes zero. The robust standard errors have been clustered at the country level

	HHI for total asset		HHI for total loans		HHI for total deposits	
	Coefficient	t	Coefficient	t	Coefficient	t
Withdrawal dummy	0.042**	2.590	0.040**	2.130	0.045**	2.540
Acquisition dummy	0.036	1.200	0.057*	1.850	0.052	1.600
Inflation rate	0.000*	1.660	0.000	0.650	0.000	1.620
Entry restrictions	0.000	–0.080	–0.002	–0.770	–0.001	–0.430
Property rights	0.004**	2.280	0.004	2.410**	0.004**	2.360
GDP per capita (log)	–0.063*	–1.970	–0.054	–1.550	–0.051	–1.460
Net new entry	–0.037	–1.420	–0.011	–0.390	–0.030	–1.010
Constant	0.708**	2.590	0.694	2.580**	0.625**	2.140
R2	**0.154**		**0.145**		**0.161**	
Number of observations	**4224**		**4220**		**4222**	

*** indicates significance level of 1%; ** indicates significance level of 5%; * indicates significance level of 10%.

The estimation results indicate that withdrawal of foreign banks increases the concentration of the domestic banking sectors. All withdrawal dummies are statistically significantly correlated with the HH indices and exhibit positive signs. Again, the we notice highest effect with respect to HHI for deposits. Surprisingly, our results also document that acquisition dummy itself is not statistically significant, which would suggest that withdrawals through acquisitions do not exhibit higher effects on concentration than any other forms. This result seems to be inconsistent with some studies that suggest that the consolidation of the banking industry which happened as a result of the mortgage crisis has increased the concentration of the banking sectors (OECD, 2010), especially in developed countries. However, this is consistent with studies on less advanced countries, such as CEE countries, which claim that despite many withdrawals of foreign banks from these countries, the concentration of the banking sectors has not changed

significantly. In the case of loans, we report a statistically significant effect of this variable on our concentration measure, yet at a 10 percent significance level. The result might suggest that banks with better portfolio quality are more likely to be sold off to the investors entirely, causing higher concentration on the loan market. Weaker banks might be either split among many investors or acquired by governments to limit potential contagion effects coming from their liquidation (the example of the Latin American countries), thus without any significant change on the concentration ratio as compared to other forms of withdrawal.

6.1. Robustness Check

Finally, to check the robustness of our results, we add into our regressions a variable proxying market opportunities in the domestic market. According to Smirlock (1985) the rapid growth of deposits provides better profit opportunities for banks operating on the market. For this reason we expect greater increases in the deposit growth to reflect an increasing market power of financial institutions, which may translate into higher concentration levels. Consistently, we include into our regressions the variable Deposit growth. Table 9 presents the result of the estimations.

Table 9. Robustness check: the effect of foreign banks' withdrawals on banking sector concentration after controlling for deposit change as market opportunities control
The empirical results present the OLS estimation excluding Africa and the year 2008. To verify the robustness of our analysis we additionally include changes in the deposits. The robust standard errors have been clustered at the country level

	HHI for total asset		HHI for total loans		HHI for total deposits	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Withdrawal dummy	0.036*	1.720	0.032*	1.500	0.039	1.740
Inflation rate	0.000	1.400	0.000	0.430	0.000	1.350
Entry restrictions	0.000	–0.110	–0.002	–0.820	–0.001	–0.500
Property rights	0.004**	2.210	0.004**	2.360	0.004**	2.270
GDP per capita (log)	–0.067*	–1.870	–0.057	–1.490	–0.053	–1.370
Net new entry	–0.024	–0.810	0.010	0.330	–0.015	–0.430

	HHI for total asset		HHI for total loans		HHI for total deposits	
	Coefficient	t-stati-stic	Coefficient	t-statis-tic	Coefficient	t-statis-tic
Change in deposits	0.000*	1.750	0.000*	1.650	0.000*	1.720
Constant	0.731**	2.470	0.712**	2.460	0.640**	2.040
R2	**0.14**		**0.22**		**0.23**	
Number of observations	**4224**		**4220**		**4222**	

*** indicates significance level of 1%; ** indicates significance level of 5%; * indicate significance level of 10%.

As we can see, the estimations prove the robustness of our results. The variable coefficients do not change considerably. We can still notice a positive effect of the withdrawal dummy on HHI for total asset and total loans, however we lose its statistical significance for HHI deposits. The result might suggest that greater market opportunities discourage banks from withdrawing from the market, and in turn might foster competition between the banks on the deposit market. We thus notice a drop in the statistical significance of the withdrawal dummy on HHI for deposits. The new Deposit growth variable is statistically significant, yet at 10 percent of significance level. All other effects remain unchanged.

7. CONCLUSIONS

The structure of the financial system has undergone many changes over the last two decades. The foreign banks' expansion, the process of bank consolidation and the large scale of foreign banks' withdrawals have undoubtedly influenced the changing pattern of banking concentration.

The objective of this paper was to assess how foreign banks' withdrawals affect banking sector concentration. This research question is of great importance due to changes in foreign banks' behaviour over the past decade and to the importance of banking sector concentration on financial stability. Our regression model was run over the period 1997–2008 for 53 countries, however to spot trends in the evolution of banking sector concentration we analyze the HHI indices since 1995.

Our results prove that foreign banks' withdrawals contribute to higher levels of banking sector concentration. We notice the highest magnitude of the coefficient with respect to HHI for deposits. Interestingly, we cannot find that acquisitions of the divested banks by domestic banks generate higher effects than any other

forms of withdrawals, which can possibly be explained by the nature of the transaction. This in turn depends on the financial condition of the parent bank and its subsidiary. Finally, our results seem to be robust to many specifications.

The analysis of the determinants of banking concentration also shows the importance of property right protection and the degree of the countries' development in explaining the differences in the concentration of the banking industry. Our conclusions indicate a rise worthy of concern for policy-makers about the banking sector stability in the post-crisis period.

Abstract

The aim of this paper is to assess the impact of foreign banks' withdrawals on banking sector concentration. The past decade has been characterized by large scale foreign bank withdrawals from countries where these institutions represent a significant part of the banking sector. An empirical analysis has been conducted for the banking sectors of 53 countries over the period 1997 to 2008. The major finding is that the foreign banks' withdrawals are positively correlated with banking concentration. The greatest magnitude of the effect can be seen with respect to the deposit market. Surprisingly, however, we do not notice any greater effect of acquisition of divested banks on banking sector concentration as compared to other forms of withdrawals. This might suggest a tendency to split up banking operations among many market players.

Key words: bank concentration, banks' withdrawals, financial stability

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Dorota Skała[*]

BANK PERFORMANCE AND LOCAL ECONOMIC CONDITIONS. ARE POLISH COOPERATIVE BANKS VULNERABLE TO REGIONAL DOWNTURNS?

1. INTRODUCTION

The serious problems experienced in 2014 by some Polish credit unions ('SKOK') raise questions about the stability of the Polish small financial institutions sector. Credit unions, which are not banks and not subject to Polish banking law, are likely to experience further distress due to their undercapitalisation (KNF 2014a). On the other hand, the Polish cooperative banking sector is very robust, with strong profitability, a solid client base and high capital adequacy ratios (KNF 2014b).

Polish cooperative banks are relatively small and strongly linked to their local environments. This has positive implications for their lean structures, capacity to adapt to changing conditions and in-depth client knowledge. On the other hand, their activities are heavily concentrated on lending to local clients and a deterioration in their core regions may strongly affect their performance. Despite the strong macroeconomic indicators reported at a national level in Poland, significant regional differences emerge. The aim of our paper is to assess whether cooperative banks are vulnerable to changes in their local economies. As far as we know, this is the first empirical analysis that links cooperative bank performance

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and growth to regional economic conditions. If such a relation exists, it has strong policy implications. National supervisors should account not only of scenarios of general macroeconomic turndowns, but should take into consideration regional downturns that may affect probabilities of default by cooperative banks. The structure of the paper is as follows: we start with a brief literature review, which is followed by a description of our methodology and data. We then present estimation results and discussion, and conclude.

2. LITERATURE REVIEW

The financial crisis of 2007–2009 has stimulated a discussion of ideal banking models and some authors underline the importance of simple, small-scale banking (Vallascas and Keasey, 2012). Poland represents the largest banking sector in Central Europe, but it is strongly dominated by a few large commercial banks. The five largest banks represented 46% of total Polish banking sector assets at the end of 2013 (KNF, 2015). As a result, the Polish cooperative sector with just under 7% of total assets is rarely studied, especially in empirical analyses, including individual bank data. This is also possibly due to problems with accessing financial data, as – in contrast to Western European counterparts – Polish cooperative banks are not included in commercial bank data products, such as Bankscope[1]. Miklaszewska and Kil (2014) provide a description of recent developments in average profitability of Polish cooperative banks, while Szambelańczyk (2006) provides the most comprehensive study of the Polish cooperative banking sector.

Among international samples, Fiordelisi and Mare (2014) perform a comprehensive study on c. 2,500 cooperative banks from five EU countries encompassing the period 1998–2009, and find a positive effect of competition on bank stability. Market power has a negative effect on bank soundness, which also persists during the financial crisis. On the other hand, they find that homogeneity in the cooperative banking sector enhances bank soundness. Expansion into non-traditional banking activities, such as non-interest income activities, could lead to higher insolvency risk.

An analysis of Italian cooperative banks between 1997 and 2009 performed by Fiordelisi and Mare (2013) emphasises that more efficient banks have a higher probability of survival. More skilful managers who succeed in minimising costs, maximising revenues and maximising profits increase banks' survival time. In addition, traditional financial ratios may be used to predict bank distress in the cooperative sector. Thus, profitability has strong implications for future defaults

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[1] Bankscope only includes 3 Polish cooperative banks, including BGŻ (which is in fact a commercial bank), BPS (an associating bank) and one other cooperative bank.

and the analysis that follows in our paper allows more light to be shed on the fragility of the cooperative sector in Poland.

Hesse and Cihak (2007) provide evidence that cooperative banks had lower insolvency risk than commercial and savings banks in the 1994–2004 period for 29 OECD countries. This is mainly due to the lower volatility of returns of cooperative banks, which offsets their lower capitalisation and profitability. They also find that larger banks are more stable in general. Cooperative banks' stability is positively related to higher diversity in their activities, in contrast to commercial banks, where diversity is already high so further increases in diversification lead to lower stability. They also find that cooperative banks undercharge for loans, compared to commercial banks.

Goddard et al. (2008a) analyses the effects of diversification in activities of US credit unions and finds two primary effects. On one hand, returns from non-interest activities are higher, but on the other hand more diversified credit unions have lower returns than more specialised institutions. The second effect seems to dominate, especially for smaller credit unions that do not have the expertise or scale to benefit from non-core products. The largest institutions may, however, benefit from diversification. In addition, he finds that larger credit unions have higher returns, both adjusted and unadjusted for risk. In addition, the volatility of these returns is lower. Higher capital rates are positively related to risk-adjusted profitability. Goddard et al. (2008b) indicate that individual credit unions' policies are more important in explaining performance diversification than sector effects. De Jonghe (2010) finds that banks with higher non-interest income have more risk. Small and better capitalised banks are better able to face adverse economic conditions.

Closely related to our paper is an analysis by Furlong and Krainer (2007), who study the link between commercial banks and the economic conditions of markets on which they operate. They find a significant relation between regional economic shocks and bank performance. In addition, they find that shocks tend to bring out dispersions in bank performance, due to the differing degrees of exposure to local economies that these banks experience. In a related study of community banks, Yeager (2004) finds that economic shocks in the form of unemployment rate changes do not significantly affect the performance of banks located in the areas where such shifts take place. We verify whether the regional economic environment affects the performance and growth of Polish cooperative banks, which may allow policy conclusions to be drawn for the national supervisors. The issue is also important for cooperative banks themselves, as according to a study by Miklaszewska and Kil (2014) cooperative banks believe that their greatest vulnerability lies in credit risk and originates from possible macroeconomic deterioration.

3. METHODOLOGY AND DATA

The main aim of this paper is to study the relationship between cooperative bank performance and growth, and the local macroeconomic environment in which these banks operate. Our bank sample includes 365 cooperative banks, associated under one associating bank, so the group is homogenous with regards to 'internal' reporting and supervising standards, as well as intra-group funding possibilities[2]. The sample includes data for the period between 2008–2012[3]. We match the bank dataset with Polish Statistical Office (GUS) data on regions (*Local Data Bank*). The activities of Polish cooperative banks are concentrated in their core regions and they were initially only allowed to carry out transactions with clients from the districts ('poviats') where those banks were headquartered. Current regulations allow larger banks to broaden their activities to regions ('voivodships') and the largest banks to extend nationwide (Act on cooperative banks, their association and associating banks 2000). However, we assume that poviats are the main areas of activity for cooperative banks and they are most affected by economic developments in their local communities.

In order to assess the relation between bank profitability and local macroeconomic environment, we calculate the following equation:

$$Bank\ profitability_{i,t,j} = \alpha + \beta_1 Local\ macroeconomic\ environment_{j,t} + \\ + \beta_2 Bank\ control\ variables_{i,t} + v_i + \varepsilon_{i,t} \qquad (1)$$

Equation 1 is a static panel data approach, with fixed effects of v_i that are unchanged for every bank and may represent such unobserved bank characteristics as corporate culture, client services etc. ε is the random error. Subscript i represents bank, t – the year and j – the poviat.

The dependent variable is bank profitability, represented by a few measures. The main profitability measure is return on assets, ROA, which is the relation of bank net income to total assets. However, net income does not always fully reflect underlying bank profitability, due to the phenomenon of income smoothing (see e.g. Bouvatier et al. 2014). Within income smoothing, banks use loan loss provisions to smooth their bottom line by making higher reserves when income is strong and diminishing provisions when earnings suffer. Thus we also use the ratio of operating income to assets (OROA), which includes pre-provisioning income instead of net income. The third profitability ratio is net interest margin (NIM),

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[2]   Our dataset covers around two thirds of the total cooperative bank population in Poland. We believe this is fairly representative of the whole sector.

[3]   The anonymised bank data was received from Bank Polskiej Spółdzielczości. The author is very grateful to BPS for help in compiling the dataset.

which is the ratio of net interest income to total assets. The cost-income ratio indicates the ability of a bank to maintain a lean cost structure and may also be related to local macroeconomic conditions. In more challenging environments, banks may have to invest more heavily in credit risk assessment systems and attract higher quality and better paid staff. Last but not least, we study future profitability perspectives for banks, which we proxy through bank growth (*Asset growth*). Banks experiencing obstacles in their expansion rates are less likely to bring significant benefits in the form of strong profitability in the future.

Local macroeconomic environment is symbolised by the level of registered year-end unemployment in poviat j. Alternatively, we also use unemployment growth to verify how changes in economic conditions affect the performance and growth of cooperative banks. In cross-country comparisons, the main macroeconomic proxy is usually the level of GDP per capita or GDP growth. However, no such indicators are available for poviats. Changes in unemployment reflect a worsening or improvement of economic perspectives for the local population and SMEs, both of which form the bulk of cooperative bank clientele.

Bank control variables include a few conventionally used indicators that reflect the business model of a bank. They consist of bank size (natural logarithm of total assets), the share of fees in total operating income, the share of loans in total assets and deposits to assets ratios. We do not use any winsorising or centile exclusions, as there are no significant outliers in the sample. The only cut-off point is the 1 and 99 centile exclusion applied to the variable *Asset growth*, to exclude large mergers or acquisitions. Descriptive statistics of the main variables are displayed in Table 1, while Table 2 shows the correlation results.

All three profitability ratios are positively correlated, so higher net interest margins and pre-provisioning income translate to higher net income, despite the existence of income smoothing. The relation between ROA and bank asset growth is also positive, indicating that banks with a stronger expansion potential attain higher returns. Banks with a lean cost structure achieve better return on assets, but also have a higher interest margin and a more dynamic rate of growth.

We illustrate the main trends in profitability and growth of the banks in our sample between 2008–2012 in Figures 1–5. Average profitability of the cooperative sector is shown in Figure 1. A sharp decrease in net interest margin experienced in 2009 led to a drop in overall profitability in the same period. Although margins and pre-provisioning profitability picked up in 2010, this has not fully translated to an increase in ROA by the end of 2012. A partial explanation of this is presented in Figure 2, which shows the average bank size and level of average unemployment in the period studied.

Table 1. Descriptive statistics of main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	2143	1.382	0.641	-5.238	4.590
OROA	2097	1.952	0.728	-0.523	9.205
NIM	2143	4.543	0.896	2.356	8.442
Cost income	2508	64.242	9.436	34.205	100.393
Asset growth	1782	10.621	9.465	−38.198	81.079
Loans/assets	2151	87.337	12.887	16.634	97.977
Deposits/assets	2116	83.556	6.100	0.000	94.609
Fee share	2500	25.396	6.628	−2.548	58.865
Size	2151	18.112	0.847	16.191	21.528
Unemployment	2202	13.855	5.104	1.900	33.800

Notes: ROA is the relation of net income to total assets in year t, OROA is the relation of pre-provisioning income to total assets in year t, NIM is the relation of net interest income to total assets in year t, Cost income is the relation of non-operating expenses to operating revenues in year t, Asset growth is the rate of growth of total assets between year t–1 and t, Unemployment is the year-end rate of registered unemployment in poviat j, Loans/assets are total loans to total assets in year t, Deposits/assets are total deposits to total assets in year t, Fee share is the share of net fees in total operating income, Size is the natural logarithm of total assets.

Figure 1. Average bank profitability: ROA, operating ROA and NIM between 2008–2012
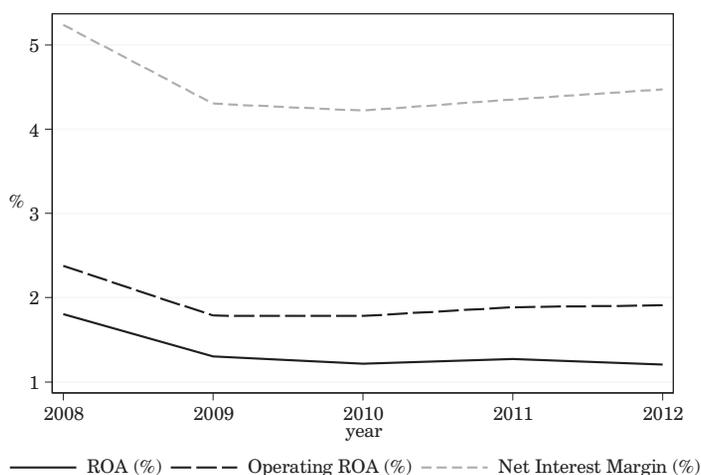
Notes: own calculations

Table 2. Correlation table for the main variables

	ROA	OROA	NIM	Cost income	Asset growth	Loans/ assets	Depo-sits/ assets	Fee share	Size	Unem-ployment
ROA	1									
OROA	0.7563*	1								
NIM	0.5043*	0.5950*	1							
Cost income	−0.6006*	−0.7499*	−0.1309*	1						
Asset growth	0.0703*	0.0467	−0.1418*	−0.1997*	1					
Loans/assets	0.1158*	0.0916*	0.0259	−0.1455*	0.0257	1				
Deposits/assets	−0.4596*	−0.5144*	−0.4958*	0.2947*	0.1532*	−0.0446	1			
Fee share	−0.2589*	−0.3661*	−0.2761*	0.4683*	−0.0538	−0.1508*	0.1618*	1		
Size	−0.3478*	−0.3059*	−0.5504*	0.0435	0.1663*	−0.0719*	0.6476*	−0.0058	1	
Unemployment	−0.0023	−0.0133	0.0578	0.0705*	−0.0957*	0.1118*	−0.0707*	0.1680*	−0.1031*	1

Notes: ROA is the relation of net income to total assets in year t, OROA is the relation of pre-provisioning income to total assets in year t, NIM is the relation of net interest income to total assets in year t, Cost income is the relation of non-operating expenses to operating revenues in year t, Asset growth is the rate of growth of total assets between year t−1 and t, Unemployment is the year-end rate of registered unemployment in poviat j, Loans/assets are total loans to total assets in year t, Deposits/assets are total deposits to total assets in year t, Fee share is the share of net fees in total operating income, Size is the natural logarithm of total assets. * corresponds to a significance level of 0.1.

Figure 2. Average unemployment in poviats and bank size between 2008–2012
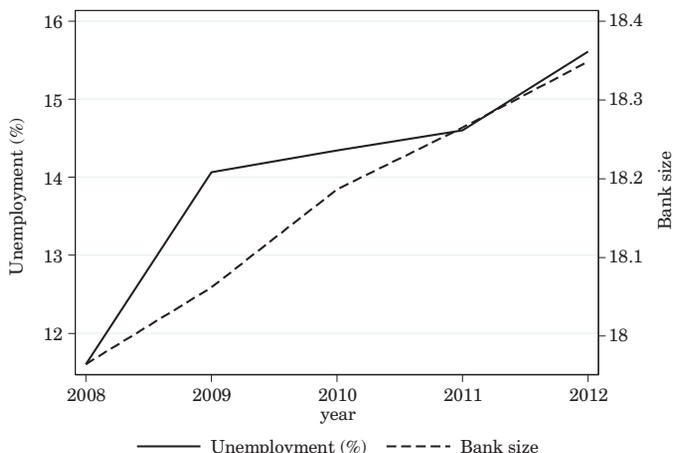
Notes: own calculations

The consistent growth in unemployment levels that started with a steep rise in 2009 has not been accompanied by stagnation in bank growth in the cooperative sector. Despite weak labour market conditions, cooperative banks have continuously expanded their activities. In addition, ROA and NIM levels remain very high in relation to commercial bank standards, even if average unemployment levels seem to have hindered profitability growth within the cooperative sector.

In order to assess the effect of macroeconomic changes on bank profitability and growth in more detail, we introduce three subsamples of banks, divided by size. Banks with an average size (per total period) under the 33 percentile are classified as small, between 33 and 66 percentile as medium and above 66 percentile as large. Figure 3 displays the differences in average performance between the subsamples.

Small banks consistently displayed the highest profitability throughout the sample period, massively exceeding average ROA of medium and large banks by approx. 0.3–0.4 p.p. This may be partly due to the elevated net interest margin attained by small banks, shown in Figure 4.

The level of NIM seems to be strongly related to bank size, which is visible in the correlation results in both Table 2 and Figure 4. The business model of the largest cooperative banks is much closer to that of commercial banks and their interest margins also converge. Last but not least, it is possible that small banks function in different macroeconomic environments than large institutions. In order to illustrate this, we display the average unemployment levels for the three subgroups in Figure 5.

Figure 3. Average ROA in subgroups of small, medium and large banks, between 2008–2012
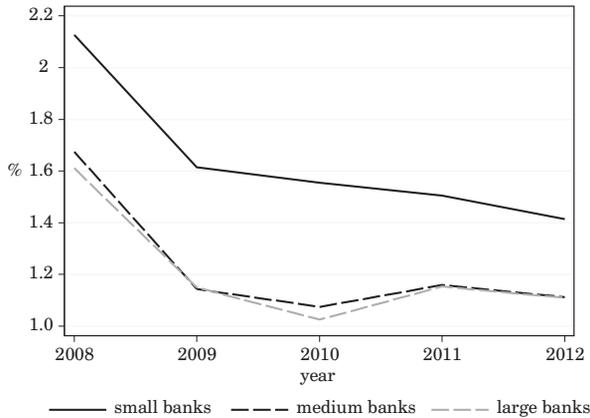
Notes: own calculations

Figure 4. Average NIM in subgroups of small, medium and large banks, between 2008–2012
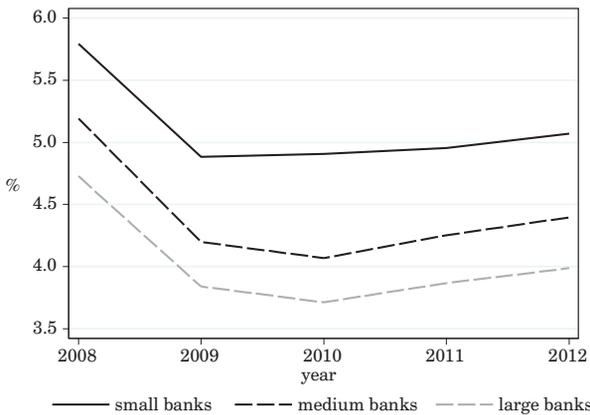
Notes: own calculations

Large banks are based in the areas with the lowest unemployment levels, in comparison to medium and small banks, so their operating environment should enhance their profitability levels and growth ratios. Correlation results and the analysis of means seem to contradict this conclusion, as it is the smallest banks that report the highest average profitability. These differences indicate that it is important to include subgroup estimations in our analyses, in addition to the total sample treatment.

Figure 5. Average unemployment rate in poviats for small, medium and large banks between 2008–2012
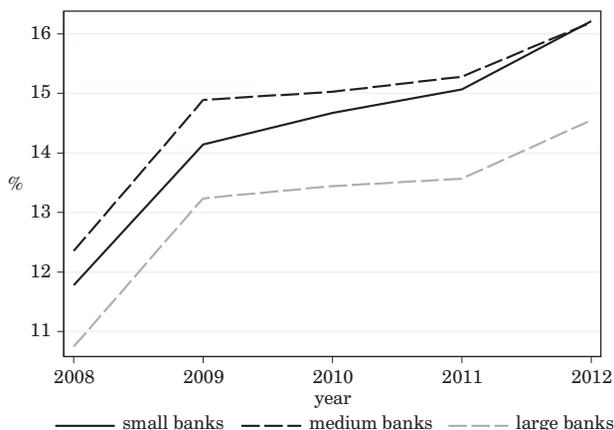
Notes: own calculations

4. EMPIRICAL RESULTS

Results of estimation of equation 1 are presented in Table 3. These results confirm that cooperative bank performance is strongly linked to the economic situation of the poviats where banks are headquartered. Higher unemployment is related to lower interest margins and lower pre-provisioning results, which translate into decreased profitability at the net income level. All coefficients for these profitability ratios are negative and strongly significant, an effect which persists even after including or excluding some control variables (not shown).

Costs are higher in banks situated in regions with labour market problems and this may stem from the higher expense of seeking out less risky customers and performing a more meticulous credit risk assessment, in terms of systems and high quality staff. Higher unemployment limits the expansion opportunities for cooperative banks, visible in the negative relation between asset growth and unemployment.

Coefficients of the control variables confirm the tentative results based on the mean analysis and correlations. There is a negative relation between bank size and profitability, expressed as the net interest margin and operating or regular ROA. On the other hand, the relation between size and cost efficiency is statistically insignificant, indicating that smaller banks are not necessarily better cost controllers. In addition, larger banks have better growth possibilities and they manage to expand their activities, which is visible through the positive relation between size and asset growth.

Table 3. Bank profitability and growth versus local economic environment between 2008–2012

	ROA	OROA	NIM	Cost income	Asset growth
	–1	–2	–3	–4	–5
Unemployment	–0.0489***	–0.0393***	–0.0400***	0.5409***	–1.3333***
	[0.008]	[0.008]	[0.006]	[0.077]	[0.157]
Loans/assets	0.0021	–0.0009	–0.0001	0.0187	–0.0256
	[0.001]	[0.001]	[0.001]	[0.013]	[0.026]
Deposits/assets	–0.0134*	–0.0162***	–0.0349***	0.0961	1.2380***
	[0.007]	[0.006]	[0.005]	[0.062]	[0.126]
Fee share	–0.0533***	–0.0830***	–0.1395***	0.7573***	0.2000**
	[0.005]	[0.004]	[0.003]	[0.042]	[0.085]
Size	–1.0064***	–0.9484***	–2.0499***	–0.383	6.3779***
	[0.101]	[0.091]	[0.072]	[0.914]	[1.863]
Constant	22.6200***	23.2873***	48.8062***	34.6714**	–193.0554***
	[1.700]	[1.537]	[1.217]	[15.433]	[31.458]
No_of_obs	1726	1708	1726	1726	1726
No of banks	365	364	365	365	365
R-Squared	0.2627	0.3532	0.7224	0.2683	0.1394

Notes: ROA is the relation of net income to total assets in year t, OROA is the relation of pre-provisioning income to total assets in year t, NIM is the relation of net interest income to total assets in year t, Cost income is the relation of non-operating expenses to operating revenues in year t, Asset growth is the rate of growth of total assets between year t–1 and t, Unemployment is the year-end rate of registered unemployment in poviat j, Loans/assets are total loans to total assets in year t, Deposits/assets are total deposits to total assets in year t, Fee share is the share of net fees in total operating income, Size is the natural logarithm of total assets. *, ** and *** correspond to significance levels of 0.1, 0.05 and 0.01 respectively. Standard errors are given in brackets.

Cooperative bank profitability is linked to its funding structure: a higher share of deposits in assets implies weaker results. This is due to the cost of attracting the savings necessary to expand loan activities. On the other hand, banks with higher deposits grow more rapidly and may see their profitability increase in the future. The share of loans in total assets does not determine profits or bank expansion.

As the share of loans and share of deposits may be interrelated, we exclude the share of deposits from the estimation and results for loan to assets ratios remain unchanged (not shown). In order to assess the adjustment of profitability in reaction to changes in local unemployment levels, we re-estimate Equation 1 and replace unemployment levels with annual unemployment growth. The results

are shown in Table 4. The main results are sustained, with the same signs and statistical significance of coefficients of similar magnitude.

Results from the main estimation indicate that cooperative banks are sensitive to changes in the local economic environment. At the same time, profitability depends on bank size, so there is a possibility that differently sized banks react differently to economic developments in their local environment. In order to study this in more detail, we re-estimate equation 1 on the three subsamples defined in the previous section. The results for the main profitability indicators ROA, OROA and NIM are shown in Table 5, while cost income and asset growth are depicted in Table 6.

Table 4. Bank profitability and growth versus local economic environment between 2008–2012 (including unemployment growth)

	ROA	OROA	NIM	Cost income	Asset growth
	–1	–2	–3	–4	–5
Unemployment growth	–0.3586***	–0.3772***	–0.3786***	5.4249***	–10.9037***
	[0.071]	[0.064]	[0.051]	[0.641]	[1.318]
Loans/assets	0.0021	–0.001	–0.0001	0.0181	–0.0242
	[0.001]	[0.001]	[0.001]	[0.013]	[0.026]
Deposits/assets	–0.009	–0.0140**	–0.0322***	0.0626	1.3461***
	[0.007]	[0.006]	[0.005]	[0.061]	[0.125]
Fee share	–0.0499***	–0.0778***	–0.1343***	0.6791***	0.3236***
	[0.005]	[0.004]	[0.003]	[0.044]	[0.090]
Size	–1.2922***	–1.1506***	–2.2593***	2.3565***	–1.096
	[0.077]	[0.070]	[0.055]	[0.696]	[1.431]
Constant	26.6874***	26.1162***	51.7064***	–2.9378	–87.7368***
	[1.408]	[1.265]	[1.001]	[12.650]	[26.023]
No. of obs.	1726	1708	1726	1726	1726
No. of banks	365	364	365	365	365
R-Squared	0.2585	0.3572	0.7249	0.2798	0.1372

Notes: ROA is the relation of net income to total assets in year t, OROA is the relation of pre-provisioning income to total assets in year t, NIM is the relation of net interest income to total assets in year t, Cost income is the relation of non-operating expenses to operating revenues in year t, Asset growth is the rate of growth of total assets between year t–1 and t, Unemployment growth is the rate of growth in year-end rate of registered unemployment in poviat j, Loans/assets are total loans to total assets in year t,, Deposits/assets are total deposits to total assets in year t, Fee share is the share of net fees in total operating income, Size is the natural logarithm of total assets. *, ** and *** correspond to significance levels of 0.1, 0.05 and 0.01 respectively. Standard errors are given in brackets.

Table 5. Bank profitability measures versus local macroeconomic environment – estimation results on subsamples of small, medium-size and large banks, between 2008–2012

	ROA small banks −1	ROA medium banks −2	ROA large banks −3	OROA small banks −4	OROA medium banks −5	OROA large banks −6	NIM small banks −7	NIM medium banks −8	NIM large banks −9
Unemployment	−0.0416***	−0.0359**	−0.0425***	−0.0244*	−0.0274*	−0.0406***	−0.0397***	−0.0284***	−0.0286***
	[0.014]	[0.015]	[0.016]	[0.014]	[0.014]	[0.012]	[0.012]	[0.010]	[0.010]
Loans/assets	0.0023	0.0031	0.0005	0.0012	−0.0021	−0.0014	−0.0002	0.0001	0.0001
	[0.002]	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Deposits/assets	0.0082	−0.0274*	−0.0154	−0.0007	−0.0112	−0.0190*	−0.0317***	−0.0373***	−0.0229***
	[0.010]	[0.014]	[0.013]	[0.010]	[0.014]	[0.010]	[0.009]	[0.010]	[0.008]
Fee share	−0.0462***	−0.0553***	−0.0595***	−0.0726***	−0.0846***	−0.0939***	−0.1298***	−0.1516***	−0.1415***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]	[0.006]	[0.007]	[0.006]	[0.005]
Size	−1.4583***	−1.0476***	−0.9409***	−1.4835***	−0.9580***	−0.8556***	−2.1926***	−2.2805***	−1.9809***
	[0.198]	[0.186]	[0.157]	[0.195]	[0.177]	[0.120]	[0.172]	[0.124]	[0.095]
Constant	27.7454***	24.2456***	22.5191***	30.0116***	22.9353***	22.7874***	49.2988***	53.3211***	47.7617***
	[2.983]	[3.176]	[2.970]	[2.947]	[3.004]	[2.265]	[2.591]	[2.109]	[1.803]
No_of_obs	562	575	589	552	571	585	562	575	589
No of banks	121	120	124	121	120	124	121	120	124
R-Squared	0.3062	0.2459	0.258	0.3293	0.313	0.4627	0.6451	0.7657	0.7717

Notes: ROA is the relation of net income to total assets in year t, OROA is the relation of pre-provisioning income to total assets in year t, NIM is the relation of net interest income to total assets in year t, Cost income is the relation of non-operating expenses to operating revenues in year t, Asset growth is the rate of growth of total assets between year $t-1$ and t, Unemployment is the year-end rate of registered unemployment in poviat j, Loans/assets are total loans to total assets in year t, Deposits/assets are total deposits to total assets in year t, Fee share is the share of net fees in total operating income, Size is the natural logarithm of total operating income, Size is the natural logarithm of total assets, Small banks are banks with average size (per total period) under the 33 percentile, Medium banks with average size between 33 and 66 percentile, Large banks with average size of above 66 percentile. *, ** and *** correspond to significance levels of 0.1, 0.05 and 0.01 respectively. Standard errors are given in brackets.

Table 6. Bank growth and cost-income ratio versus local macroeconomic environment – estimation results on subsamples of small, medium and large banks, between 2008–2012

	Cost income	Cost income	Cost income	Asset growth	Asset growth	Asset growth
	small banks	medium banks	large banks	small banks	medium banks	large banks
	–1	–2	–3	–4	–5	–6
Unemploy-ment	0.3172**	0.3802***	0.6827***	–1.1836***	–1.2779***	–1.7552***
	[0.134]	[0.132]	[0.141]	[0.268]	[0.283]	[0.279]
Loans/assets	0.005	0.0232	0.0185	–0.0092	–0.0681	0.0053
	[0.022]	[0.021]	[0.024]	[0.045]	[0.044]	[0.047]
Deposits/assets	0.0242	–0.0609	0.0438	1.0923***	1.3589***	1.1205***
	[0.101]	[0.125]	[0.118]	[0.202]	[0.267]	[0.234]
Fee share	0.5822***	0.8118***	0.9057***	0.4829***	0.1159	0.0216
	[0.074]	[0.072]	[0.072]	[0.148]	[0.153]	[0.143]
Size	3.8734**	1.7765	–2.252	12.2612***	6.3625*	3.7582
	[1.919]	[1.607]	[1.388]	[3.846]	[3.438]	[2.748]
Constant	–25.6122	10.4267	69.2944***	–282.5379***	–199.4159***	–134.8289***
	[28.864]	[27.401]	[26.257]	[57.850]	[58.595]	[51.993]
No_of_obs	562	575	589	562	575	589
No of banks	121	120	124	121	120	124
R-Squared	0.1621	0.2864	0.3755	0.178	0.1213	0.164

Notes: ROA is the relation of net income to total assets in year *t*, OROA is the relation of pre-provisioning income to total assets in year *t*, NIM is the relation of net interest income to total assets in year *t*, Cost income is the relation of non-operating expenses to operating revenues in year *t*, Asset growth is the rate of growth of total assets between year *t-1* and *t*, Unemployment is the year-end rate of registered unemployment in poviat j, Loans/assets are total loans to total assets in year *t*, Deposits/assets are total deposits to total assets in year *t*, Fee share is the share of net fees in total operating income, Size is the natural logarithm of total assets, Small banks are banks with average size (per total period) under the 33 percentile, Medium banks with average size between 33 and 66 percentile, Large banks with average size of above 66 percentile. *, ** and *** correspond to significance levels of 0.1, 0.05 and 0.01 respectively. Standard errors are given in brackets.

The results presented in Table 5 outline some differences in the relation between profitability and local macroeconomic environment, depending on the size of the bank. In terms of ROA, all bank samples are found to display similar sensitivity to unemployment. In all three cases, higher local unemployment translates to lower

overall profitability. Pre-provisioning profit results indicate that large banks are most vulnerable to employment problems, while the relation between operating profit and unemployment within the small and medium-sized banks group is less statistically significant and smaller. Taken together with the total net income result, this may indicate that small banks are negatively affected by unemployment hikes at the level of loan loss provisions. Increasing employment problems surface through difficulties with credit quality and are visible only after accounting for provisions. Conversely, small banks suffer most at the level of net interest margin, even though all three groups are affected.

Large banks display the strongest link between unemployment and cost efficiency in economic terms.Being headquartered in a region with lower employment rates affects cost income ratios much more in this subsample than in the small bank subsample. Where asset growth is concerned, large banks are mostly troubled by unemployment. Small banks with more supple structures are nevertheless possibly better able to adapt to changing labour market conditions and sustain growth. On the other hand, large banks may also experience some obstacles to further expansion, as due to their size they are more vulnerable to competition from universal banks. Large cooperative financial institutions may lose some of their competitive advantages that are mostly visible on small markets – profound client know-how, more meticulous credit risk assessments and knowledge of local economic perspectives.

Last but not least, we study the reaction of cooperative banks to changes in unemployment levels that could be defined as a local economic 'downturn' or 'revival'. In order to identify such situations, we use changes in unemployment levels, where annual variations surpass 1 p.p. Increases in unemployment of above 1 p.p. are regarded as 'downturns', decreases by over 1 p.p. are 'revivals' and both are symbolised by dummy variables for the year the change took place. Thus, the estimated equations take the following forms:

$$Bank\ profitability_{i,t,j} = \alpha + \beta_1 Local\ macroeconomic\ environment_{j,t} + \\ + \beta_2 Bank\ control\ variables_{i,t} + \beta_2 Downturn + v_i + \varepsilon_{i,t} \quad (2)$$

$$Bank\ profitability_{i,t,j} = \alpha + \beta_1 Local\ macroeconomic\ environment_{j,t} + \\ + \beta_2 Bank\ control\ variables_{i,t} + \beta_2 Revival + v_i + \varepsilon_{i,t} \quad (3)$$

The results of estimating Equations (2) and (3) are presented in Table 7. The analysis of coefficients of the profitability variables shows that an increase in local unemployment rates by at least 1 p.p. has a negative impact on net interest margin and operating results. Bank profitability suffers due to lower margins and lower fees. Although the coefficient for ROA is also negative, it lacks statistical significance. According to the income smoothing theory, banks may be able to smooth out weaker operating earnings through less abundant loan loss provisions and soften the blow at the net income level.

Table 7. Bank performance and growth versus regional economic revivals and downturns between 2008–2012

	ROA	ROA	OROA	OROA	NIM	NIM	Cost income	Cost income	Asset growth	Asset growth
	–1	–2	–3	–4	–5	–6	–7	–8	–9	–10
Unemployment	-0.0410***	-0.0285***	-0.0250***	-0.0210**	-0.0229***	-0.0204***	0.3555***	0.3459***	-1.1556***	-1.0801***
	[0.010]	[0.009]	[0.009]	[0.009]	[0.007]	[0.007]	[0.086]	[0.085]	[0.176]	[0.174]
Loans/assets	0.0022	0.0021	-0.0009	-0.001	-0.0001	-0.0001	0.0186	0.0181	-0.0243	-0.0238
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.013]	[0.013]	[0.026]	[0.026]
Deposits/assets	-0.0133*	-0.0148**	-0.0162***	-0.0176***	-0.0346***	-0.0360***	0.0952	0.1089*	1.2250***	1.2031***
	[0.007]	[0.007]	[0.006]	[0.006]	[0.005]	[0.005]	[0.062]	[0.062]	[0.126]	[0.126]
Fee share	-0.0527***	-0.0492***	-0.0812***	-0.0795***	-0.1373***	-0.1358***	0.7315***	0.7201***	0.2349***	0.2655***
	[0.005]	[0.005]	[0.004]	[0.004]	[0.003]	[0.003]	[0.042]	[0.043]	[0.086]	[0.087]
Size	-1.0673***	-0.9732***	-1.0485***	-0.9236***	-2.1682***	-2.0249***	0.9037	-0.6487	5.0750***	7.1952***
	[0.103]	[0.100]	[0.093]	[0.090]	[0.074]	[0.071]	[0.934]	[0.909]	[1.907]	[1.853]
Downturn	-0.031		-0.0679***		-0.0814***		0.9188***		-1.1260**	
	[0.026]		[0.023]		[0.018]		[0.233]		[0.475]	
Revival		0.1560***		0.1346***		0.1441***		-1.4612***		2.3466***
		[0.036]		[0.033]		[0.026]		[0.329]		[0.671]
Constant	23.6063***	21.7104***	24.8767***	22.5874***	50.6653***	48.0460***	14.3015	42.3987***	-171.3627***	-210.7348***
	[1.734]	[1.701]	[1.564]	[1.537]	[1.235]	[1.214]	[15.669]	[15.450]	[31.976]	[31.500]
N	1726	1726	1708	1708	1726	1726	1726	1726	1726	1726
No of banks	365	365	364	364	365	365	365	365	365	365
R-squared	0.2618	0.2709	0.3558	0.3597	0.7251	0.7274	0.2741	0.2763	0.1443	0.1484

Notes: ROA is the relation of net income to total assets in year t, OROA is the relation of pre-provisioning income to total assets in year t, NIM is the relation of net interest income to total assets in year t, Cost income is the relation of non-operating expenses to operating revenues in year t, Asset growth is the rate of growth of total assets between year $t–1$ and t, Unemployment is the year-end rate of registered unemployment in poviat j, Loans/assets are total loans to total assets in year t, Deposits/assets are total deposits to total assets in year t, Fee share is the share of net fees in total operating income, Size is the natural logarithm of total assets. * , ** and *** correspond to significance levels of 0.1, 0.05 and 0.01 respectively. Standard errors are given in brackets.

Detetioration of the local economy also increases cost income ratios, as cost control is more challenging when all bank resources are used to maintain the client base and safeguard asset quality. Hikes in local unemployment are strongly negatively related to asset growth. On one hand, when the economy is stagnating, local businesses delay investments and are not seeking to expand their debt financing. On the other hand, expanding lending under pressure from a weakening labour market may result in credit risk problems later, so banks are not willing to grow under such circumstances either. As a result, not only does their current performance suffer, but also their perspectives for future profitability weaken.

When local labour markets recover, this is rapidly translated into improved cooperative bank performance. There is a significant hike in profitability ratios, both at the net interest and operating profit level, as well as on the net income side. Banks located in areas where economic upturns take place also have a leaner cost structure and their growth is visibly greater.

5. CONCLUSIONS

In our paper, we have analysed the relation between performance and growth of cooperative banks and the regional macroeconomic situation between 2008–2012. We have demonstrated that these financial institutions are right to be concerned about possible macroeconomic deteriorations (Miklaszewska and Kil 2014). Performance and growth of cooperative banks are strongly linked to regional economies, proxied by the unemployment rate. Banks headquartered in poviats with smaller labour market problems are able to report higher interest margins, healthier earnings and leaner cost structures. In addition, their growth is also more robust and thus they are able to feed into future profitability. Regional downturns and revivals are rapidly translated into bank results, with hikes in unemployment paired with weaker earnings of banks from the region. We have also demonstrated that despite homogeneity in business models, the supervisory context and funding possibilities, there is heterogeneity in the relation between local economic conditions and performance. As a result, the stability of the – generally robust – Polish cooperative sector should be considered alongside changes in the regional economies in which these banks operate. Unfavourable developments in local poviats, not necessarily visible in national macroeconomic indicators, could adversely affect the stability of individual institutions. In times of diminished public confidence in the banking sector, this should be given particular consideration, to avoid bankruptcies of cooperative institutions that play a crucial role in local communities.

Abstract

The aim of this paper is to analyse the vulnerability of Polish cooperative banks to changes in macroeconomic environments within the poviats where those banks operate. We find that the profitability, cost income and growth of cooperative banks are strongly related to local conditions. Banks headquartered in poviats with lower unemployment are able to report healthier earnings and leaner cost structures, and face better growth prospects. Deteriorations and revivals in poviats are reflected in bank performance and growth, demonstrating the sensitivity of these banks to local developments not necessarily mirrored in national economic indicators. In addition, despite homogeneity within the cooperative banking sector, we demonstrate differences in the relation of performance and economic situation between subgroups of small, medium-sized and large banks.

Key words: cooperative banks, bank performance

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Milda Burzała*

DID THE CRISIS ON THE INTERBANK MARKET RUN PARALLEL TO THE CRISIS ON THE CAPITAL MARKET? A COSPECTRAL ANALYSIS

1. INTRODUCTION

The effects of the collapse of all financial market segments and of real goods markets outside the United States, i.e. in distant Asian and European countries, show that the financial crisis of 2007–2009 was global in nature. For analysts of the crisis it is important to find out whether or not financial market disturbances occurred simultaneously for different segments of this market. If certain lags are identified, this might be a basis for establishing the direction of capital flows. The research presented in this article deals with the changes that were observed on the interbank market and the capital market.

The situation on the U.S. capital market was represented by the stock market index Dow Jones Industrial Average (DJIA), whereas the situation on the interbank market was represented by the spread between the three-month LIBOR rate and the corresponding OIS rate. This is because the crisis on the interbank market was a crisis of confidence, and spreads represent both credit risk premiums and liquidity premiums on the interbank market (Sengupta & Yu, 2008; Thornton,

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2009; Płuciennik et al., 2013). These are therefore a good measure of the fears of a partner's insolvency on the interbank market.

The research hypothesis about the simultaneous occurrence of capital and interbank market disturbances was verified by using cospectral analysis. The transmission of crisis and market contagion concept is defined in the first section. The empirical research methodology adopted for the purpose of this article is presented in the second section. The third section describes the empirical study and provides the criteria for dividing the set of observations into a subset representing the time of crisis and a subset relating to the time of tranquillity. The results of this empirical study are discussed in the fourth section. The article closes with a summary and a list of essential references.

2. TRANSMISSION OF A CRISIS OR MARKET CONTAGION?

The transmission of a crisis should be distinguished from the process of contagion in financial markets. The transmission of a crisis occurs as a result of fundamental links (connections) between markets and usually happens much more slowly than market contagion, which is a very rapid process. Both of these concepts are defined on the World Bank's website (Definitions of Contagion, 2014). The term 'fundamental links' refers to real connections (mainly international trade) as well as financial and political links between markets. Empirical research shows that financial links play a major role in the process of contagion in markets (e.g. Dornbusch, Park & Claessens, 2000; Pericoli & Sbracia, 2003; Dungey et al., 2003). However, the process itself should not be only equated with the effects of financial links because it can also occur on markets that are not financially connected in any significant manner. Contagion effects can be observed as a result of financial shocks, the spread of uncertainty or investors' behaviour which is difficult to predict. The existing financial links do, however, amplify the contagion effect.

A broad definition of contagion, as proposed by the World Bank, is very general and consistent with the classical understanding of the transmission of shocks. According to this definition, contagion is the international transmission of shocks or the general spillover effects between markets. Contagion can occur both during "good" and "bad" times and it is not only associated with crises, but it is more intense in a time of crisis. Under the narrow definition of this concept, contagion is the transmission of shocks to other markets or an interdependence between markets that goes beyond the fundamental links between them and beyond the effects of common shocks. It is usually related to extraordinary events that are explained as being due to herding behaviour among investors and it is treated as comovement on markets. According to a very narrow definition of this term, contagion occurs when cross-market correlations increase significantly in the "time

of crisis" relative to the "time of tranquillity". In this case, it is also assumed that markets will react immediately and, therefore, simultaneous correlations between them are studied, whereas contagion effects are manifested in a phenomenon referred to as correlation breakdown.

It is assumed that if the correlation between certain markets does not increase significantly after a shock, the relationship between those markets is a result of the fundamental links between them (Forbes & Rigobon, 2002).

The basic problem associated with empirically studying contagion effects on the financial market is how to measure these effects (i.e. which method to use). If one assumes that it is shocks going beyond fundamental links that are to be studied, then one should think which model would be best for this purpose. If one decides to use correlation analysis, one should remember that correlation may increase not only as a result of contagion but also because of the interdependencies between markets.

The broad definition of contagion that has been provided by the World Bank requires the connections between markets to be identified. The possibilities for constructing a model of this kind largely depend on the extent to which such connections have been identified and on access to long, good quality and comparable time-series data. Because of the extent to which markets are currently interconnected as well as the numerous feedback loops, empirical research focuses on analysing the significance of particular contagion channels. At the same time it is assumed that every research method should control for fundamental links in some way. The concept of market contagion usually refers to the transmission of financial market disturbances within the same segment of this market (the money market, or capital or foreign exchange markets).

Investors' herding behaviour, i.e. orientation towards the reactions of others, as well as panic and self-fulfilling prophecy are usually mentioned among the causes of contagion in markets. It is emphasised in the literature that such behaviour among investors is, to a large extent, caused by information asymmetry.

On the interbank market, information, especially its completeness and symmetry, constitutes an important factor in maintaining liquidity. However, since information about a partner's credibility is expensive, banks usually use information that is publicly available (for example, assessments made by credit rating agencies), and interbank lending is largely based on mutual trust. The uncertainty that results from having incomplete and asymmetric information can lead some banks to withdraw from the market because the costs are too high. During the last crisis, banks refrained from entering into transactions on the interbank market and they faced greater liquidity shocks as a result of growing uncertainty about the amount of "bad assets" on banks' balance sheets. Those banks had to rely on their own funds and keep additional reserves to maintain liquidity, resulting in other banks having difficulty obtaining the necessary capital

(Heider, Hoerova & Holthausen, 2009). Here, the phenomenon of moral hazard also applies to banks with a strong market position, which may refrain from lending in order to generate additional profits. This, in turn, often causes other banks to sell off their assets at a reduced price (Allen, Carletti & Gale, 2009).

The capital market is closely related to the interbank market. Banks act as intermediaries between buyers and sellers of securities on the stock exchange. They themselves can also purchase stocks and shares in investment funds. However, their activity in this regard is restricted by the capital concentration limit (Szelągowska, 2013)[1], which applies for example, to holdings in banks, financial institutions and insurance companies. Therefore, banks' investment portfolios (in particular, banking corporations' portfolios) contain shares in investment funds and trust funds, investment certificates, shares in subsidiaries, and sometimes also stocks and shares in industrial companies as well as government debt securities (Pyka, 2012). This means that banks have a great impact on capital market transactions and, what is more, they themselves issue shares. The valuation of assets in the banking sector depends on banks' financial condition, and this sector plays a significant role in stock market capitalisation.

During the last financial crisis, banks held the vast majority of toxic collateralised debt obligations (CDO). Since subprime lending was becoming increasingly unprofitable, the demand for asset-backed commercial papers (ABCP) which were issued by securitisation funds and which were used to purchase debt declined. This forced banks to open lines of credit for securitisation funds and bring some CDOs onto their balance sheets, which significantly increased the demand for liquidity (Sławiński, 2007). In a situation like this one is compelled one to sell off other securities.

The financial crisis in 2007–2008 resulted from shocks related to a lack of liquidity on the interbank market. The strength of those shocks caused a significant growth of the system risk associated with integration and globalization of financial markets. Transmission mechanisms were started directly through banks interdependencies and indirectly through asset prices, hence the relation of interbank market and capital market should be considered as indirect.

Instability in any segment of the financial market, including the interbank market, can have negative consequences for the equity market. During the last financial crisis, a lack of confidence in the interbank market was reflected in rising interest rates on loans, and an increase of uncertainty on the capital market was manifested in a significant decline in stock market indices.

This empirical study attempted to answer the question of whether the financial crisis on the interbank market ran parallel to the crisis on the capital market and

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[1] In Poland a bank may not invest more than 10% of its own funds in shares in one entity or entities that are related by capital or management (Polish Financial Supervision Authority 2013).

whether the relationship between the crises on both markets resulted from the interdependencies between those markets or from contagion, or whether it should be analysed in terms of the transmission of a crisis.

3. FUNDAMENTALS OF COSPECTRAL ANALYSIS

Spectral and cospectral analysis is frequency domain analysis, does not involve higher than second moments and makes it possible to study details that are invisible when carrying out time domain analysis. This analysis is thus an important complement to results obtained by using other research methods. There is currently an extensive body of literature on the topic of spectral and cospectral analysis (Granger & Hatanaka, 1964; Priestley, 1981; Talaga & Zieliński, 1986; Hamilton, 1994; Koopmans 1995; Storch & Zwiers, 2004), so this section only presents those fragments of spectral and cospectral analysis which were used in the empirical research.

Mutual spectral analysis makes it possible to study the relationship between particular frequencies within two time series. Here the so-called cross-spectrum is the basic value, which can be written in complex form based on de Moivre's theorem:

$$S_{yx}(\omega) = \frac{1}{2\pi} \sum_{\tau=-\infty}^{\infty} K_{yx}(\tau) \cos \omega\tau - i \frac{1}{2\pi} \sum_{\tau=-\infty}^{\infty} K_{yx}(\tau) \sin \omega\tau =$$
$$= c_{yx}(\omega) - iq_{yx}(\omega) \quad \text{dla } \omega \in [-\pi, \pi], \tag{1}$$

where:

$K_{yx}(\tau)$ denotes a covariance of the two stochastic processes: Y_t and X_t,

$c_{yx}(\omega)$ denotes the co-spectrum (the real part of the cross-spectrum),

$q_{yx}(\omega)$ denotes the quad-spectrum (the imaginary part of the cross-spectrum).

It is assumed that these processes meet the assumptions of stationarity (with an expected value of zero) and ergodicity. The co-spectrum represents a covariance between the components of stochastic processes X_t and Y_t having the same phase, whereas the quad-spectrum measures the covariance of components that are shifted in the phase by $\pi/2$.

Cospectral analysis involves certain characteristics being derived, based on which two processes are compared.

The phase shift (which is measured in radians) identifies leads (or lags) of variable X with respect to variable Y (a positive value indicates a lead; a negative value indicates a lag) for frequency ω:

$$\phi_{yx}(\omega) = arctg\left(\frac{q_{yx}(\omega)}{c_{yx}(\omega)}\right) \quad dla \ \omega \in [-\pi; \pi] \tag{2}$$

The coherence coefficient is a measure of fit (R^2) in the regression of variable Y with respect to variable X for frequency ω:

$$K_{yx}^2(\omega) = \frac{c_{yx}(\omega)^2 + q_{yx}(\omega)^2}{S_x(\omega) \cdot S_y(\omega)}, \qquad 0 \le K_{yx}^2(\omega) \le 1 \; dla \; \omega \in [-\pi; \pi], \tag{3}$$

where $S_x(\omega)$, $S_y(\omega)$ denote the spectra of processes X_t and Y_t, respectively.

Croux, Forni and Reichlin's (1999) correlation coefficient is:

$$\rho_{yx}(\omega) = \frac{c_{yx}(\omega)}{\sqrt{S_y(\omega)S_x(\omega)}}, \qquad -1 \le \rho_{yx}(\omega) \le 1 \; dla \; \omega \in [-\pi; \pi]. \tag{4}$$

The following formula represents the coefficient of correlation between variables X and Y within frequency band ω_1 for two frequencies, ω_2 and $[\omega_1, \omega_2]$:

$$\rho_{yx}([\omega_1, \omega_2]) = \frac{\int_{\omega_1}^{\omega_2} c_{yx}(\omega)d\omega}{\sqrt{\int_{\omega_1}^{\omega_2} S_y(\omega)d\omega \int_{\omega_1}^{\omega_2} S_x(\omega)d\omega}}. \tag{5}$$

For $\omega_1=0$ and $\omega_2=\pi$ (the whole frequency domain) $\rho_{yx}([0,\pi])=\rho_{xy}$ in the time domain.

The given characteristics are estimated based on the smoothed values of the spectrum and cross-spectrum (Hamilton 1994; Storch & Zwiers 2004)[2].

4. THE EMPIRICAL RESEARCH

In empirical research related to cospectral analysis, one only considers those leads or lags at a given frequency which are associated with a high value of the coherence coefficient (for strongly correlated frequency components).It is therefore important that boundary values or confidence intervals should be established for coherence coefficients and the phase shift.

The following steps were included in the experimental design with regard to two samples from the time of tranquillity and the time of crisis:

A. Determining boundary values in order to assess the significance of coherence coefficients (Storch & Zwiers, 2004). It was assumed that insignificant relations were due to the impact of random factors.

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[2] The estimator of the spectrum of a stochastic process is not a consistent estimator, which means that its variance does not decrease as the sample size increases. In order to reduce variance the periodogram is smoothed, but this is done at the expense of losing the estimator's unbiasedness.

B. Checking the significance of the lead (lag) of the appropriate harmonics for frequencies related to significant coherence coefficients. The confidence intervals proposed by Goldman in 1957 (cited after Koopmans, 1995) were used for this purpose. The frequencies were thus divided into those that were associated with the lagged (leading) response of the studied variable and those that reflected simultaneous changes, i.e. comovements.

C. Analysing covariance and correlation for simultaneous, lagged and leading fluctuations.

D. Decomposing the variance of rates of return on a given index Y which is explained by changes in rates of return on another index X:

where:

– explained variance for lagged (leading) reactions,
– explained variance for simultaneous reactions,
– unexplained variance resulting from random factors.

For the purpose of theoretical analysis, it is reasonable to assume that simultaneous changes in rates of return occur as a result of the interdependence between markets (financial connections) or in response to events taking place in so-called third-country markets. Lagged reactions can be the result of contagion spreading to the market studied from another market (Burzała, 2014). Depending analysis for different segments of the financial market can form a basis for studying causality or the direction in which a crisis spreads and financial shocks are propagated. However, it is difficult to determine which changes are leading and which are lagged with respect to the studied changes in rates of return under conditions of their high volatility. This is why current research methods focus on analysing simultaneous changes, i.e. comovements, which means that it has been assumed that financial markets react immediately to financial shocks[3]. Figure 1, which presents the values of the Dow Jones Industrial Average index and the spread between the three-month LIBOR rate and the corresponding OIS rate, also indicates that this assumption is valid. Instability and an increase in the LIBOR-OIS spread could be observed starting from August 2007, which was when the French BNP Paribas announced information about difficulties associated with evaluating assets. It was exactly on 9 August 2007 that this bank suspended payments from three funds investing in the market of bonds secured by subprime mortgages. However, the spread increased most rapidly after the collapse of Lehman Brothers in September 2008. The chart presented here suggests that the changes on both markets occurred simultaneously – an increase in the spread is connected with a decline in the index.

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[3] Cf., among others, the Granger causality tests for expected values (1969) as well as causality in variance and causality in risk tests (Cheung & Ng 1996; Caporale, Pittis & Spagnolo 2002; Hong, Liu & Wang 2009).

Cospectral analysis makes it possible to compare the structures of time series, identify potential differences and differentiate between simultaneous and lagged (leading) changes within a given time series.

Figure 1. The Dow Jones Industrial Average and the LIBOR-OIS spread for the dollar market (16 August 2005–31 August 2009)
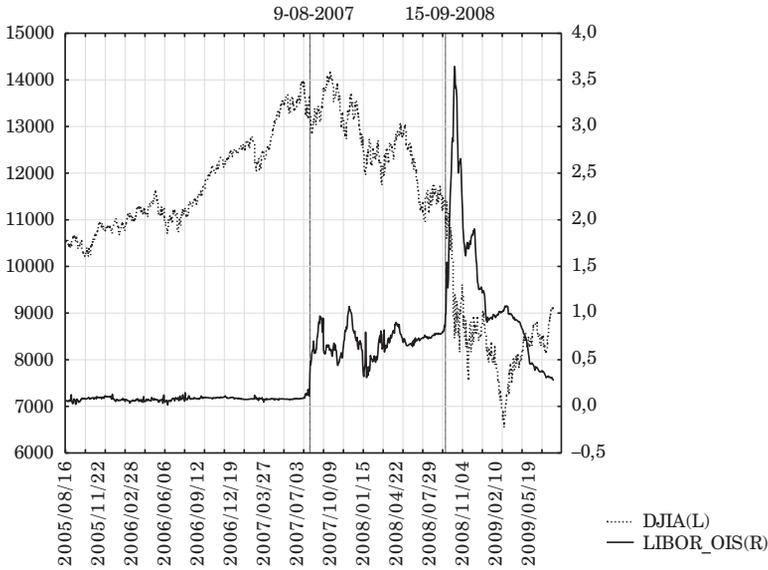
Source: based on data obtained from the Reuters and Stooq database.

The information about BNP Paribas's difficulties served as a basis for dividing the set of observations into two subsets (the time of tranquillity and the time of crisis). Among those who consider the day this information was announced to be the date that marks the beginning of the crisis were Baba, Packer and Nagano (2008) as well as Taylor and Williams (2009). Thus, the samples from the time of tranquillity and the time of crisis on financial markets contained the same number of observations (517) for both these periods.

Since the original time series were non-stationary, the study was conducted based on continuously compounded rates of return on the stock market index and the first changes in spread levels.

5. RESEARCH RESULTS

The smoothed values of the spectrum and cross-spectrum were estimated by using the Bartlett weights with the window's width $M = 31^4$. In tests related to spectral and cospectral analysis the number of degrees of freedom is replaced with the so-called equivalent number of degrees of freedom (EDF). For the Bartlett weights this number is 3T/M (Koopmans, 1995). For T = 518 observations (in the time of crisis and the time of tranquillity) the equivalent number of degrees of freedom that is used in tests is 50.

5.1. Significant coherence coefficients and the phase shift

The significance of coherence coefficients was assessed at a significance level of $\alpha = 0.01$. This means that coefficients lower than 0.174 were regarded as referring to insignificant relations that reflected the effects of random factors. The charts in Figure 2 present coherence coefficients.

As expected, the structure of relations between the stochastic processes analysed changed in the time of crisis. During the conventionally identified tranquillity period, significant relationships between rates of return on the stock market index and the first changes in spread levels were only observed within a narrow fluctuation band which lasted for less than three days. Significant relationships become stronger both for high- and lower-frequency fluctuations during the period of crisis. Lower frequencies correspond to medium-term fluctuations (10–16 days), which here lead to a considerable increase in the spreads analysed on the interbank market and a decline in the index on the capital market. During the crisis, significant relationships for high frequencies refer to short-term fluctuations which last for up to five days.

The significance of the phase shift was assessed at the same significance level, i.e. $\alpha = 0.01$. For comparison, the relevant charts presenting frequencies that are significant with respect to both the coherence coefficient and the phase shift (the grey, shaded area) are also shown in Figure 2 below the respective coherence coefficients.

At the beginning of this study it was assumed that all fluctuations which were significant with respect to the coherence coefficient and which did not exhibit a significant phase shift referred to comovements in the markets. However, for the time series analysed, no significant relationships were found with regard to these fluctuations.

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[4]   The researcher decides on the width of the window. The wider the window, the smoother the function and the smaller the estimator's variance; the narrower the window, the larger the estimator's variance but also the smaller the estimator's bias.

**Figure 2. Significant coherence coefficients and phase shifts
in the time of crisis**
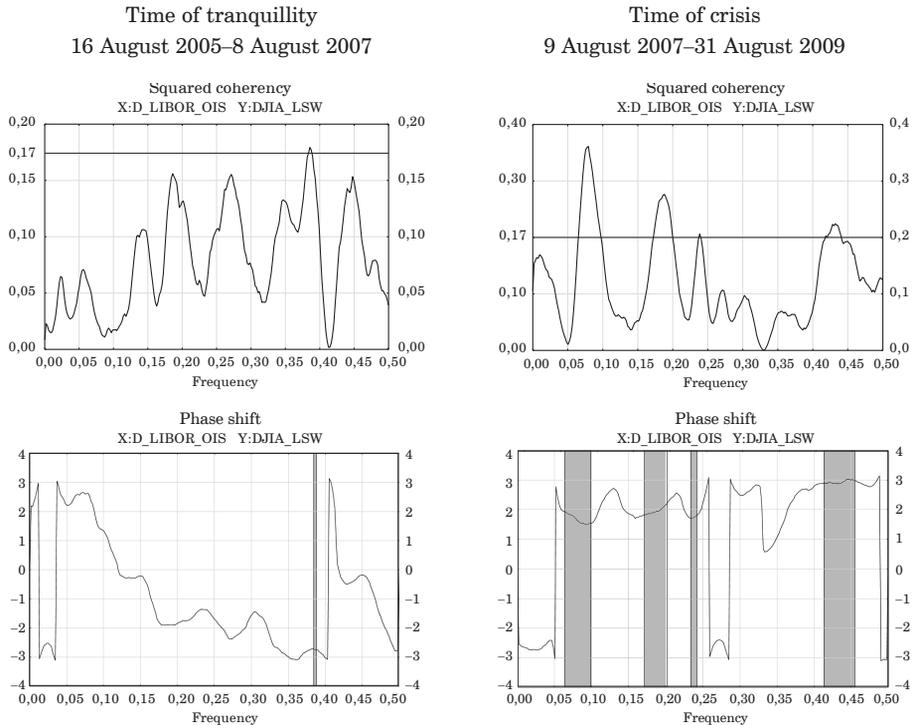
Source:own work.

Given the assumptions that are presented in the first section, the lack of significant comovements on financial markets both in the time of tranquillity and in the time of crisis shows that there are no direct interdependencies between these markets. Both leading and lagged changes on these markets can only indicate the occurrence of contagion effects. These reactions could not have been intensified due to the transmission of a crisis resulting from the strengthened interdependencies between these markets if the empirical study did not confirm that such interdependencies existed.

Significant change in the relationships between fluctuations was observed with regard to the phase shift. In the time of tranquillity a narrow band of significant fluctuations was related to a significant negative phase shift, which indicates that the capital market's reaction was leading with respect to changes on the interbank market (about one day). In the time of crisis a positive phase shift was significant, which shows that the reaction of the spread in the interbank market was leading

with respect to changes on the capital market. A significant lead of changes that occurred in the interbank market was not longer than two days within a short-term fluctuation band (lasting for up to one week), and it was slightly longer within a medium-term fluctuation band (from two to five days).

One should remember that this is frequency domain analysis and the rates of return that are observed in the time domain result from a combination of many harmonic components (as many as 258 in the studies). Therefore, one should not identify the phase shift between two harmonics with the market's reaction that is observed in the time domain. However, phase shifts between many harmonic components have a significant influence on the market's lagged reaction. An attempt at assessing the impact of lagged fluctuations is presented in the next section of this chapter.

5.2. Analysis of connections between the markets studied

It is worthwhile beginning this analysis by calculating the covariance and correlation coefficients together for all frequencies, which corresponds to time domain analysis. Negative covariances and correlations are the result of the diverse behaviour of the analysed time series during turmoil on the financial market. The results are presented in Table 1. They indicate that there was an insignificant increase in negative correlation for the whole frequency range[5]. The assessment of a change in the connections between markets which is made based on Pearson's correlation coefficient is not without its drawbacks[6]. Therefore, in the book titled *Selected Methods of Studying Contagion Effects in Capital Markets* (2014) the author proposes that weights should be created so that the results obtained can also be applied in studies that are carried out using different research methods. The proportion of comovements will show the strength of the interdependencies between the markets, whereas the proportion of lagged or leading changes will indicate the strength of contagion effects.

In an analysis of two markets, an adequate weight describing the importance of correlation (covariance) with regard to lagged (leading) changes would take the following form:

$$w^{K(L)} = \frac{\left|m^{K(L)}\right|}{\left|m^{K(L)}\right| + \left|m^{K(R)}\right|}, \qquad (6)$$

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[5] Fisher's transformation was used to assess the change in the correlation coefficient.

[6] The classical correlation coefficient is susceptible to outliers. One cannot correctly define the correlation coefficient based on this measure if the variance of variables is infinite. Moreover, this measure is not invariant to monotonic transformations (the correlation between a pair of variables is different from the correlation between the logarithms of those variables). Forbes and Rigobon (2002) point out that Pearson's correlation coefficient is a positive function of volatility and can result in overestimation of the relations between rates of return during a crisis.

where $m^{K(L)}$ denotes a measure of dependence (correlation or covariance) which results from significant fluctuations in the area of lagged (leading) changes, whereas $m^{K(R)}$ denotes a measure of insignificant interdependencies between the markets[7]. A similar method for constructing weights can be proposed for variance which is observed for different fluctuation bands. Table 1 presents weights that were constructed based on formula (6).

It is worth paying attention to the high negative correlation between fluctuations that were shifted in the phase during the tranquillity period (–0.386). This value results from low covariance and relatively small standard deviations. Consequently, a weight with a high value (0.86) is obtained within a very narrow fluctuation band. For the same reason, correlations with regard to lagged and insignificant changes in the time of crisis show low variability. Covariance is therefore a better measure of such relationships because it allows weights to be obtained reflecting the influence of fluctuations within a given band on the value of the measurement within the time domain. If one assumes that the value of covariance is the basis for this analysis, one can conclude that the covariance of the processes studied on the capital market and the interbank market in the time of crisis was small and was mainly the result of random factors, which is visible in a weight value of 0.74 for insignificant relationships. Thus, this means that only one fourth of the reactions on the capital market occurred as a result of changes that took place on the interbank market (as regards the estimated covariance).

This analysis of covariance deals with the relations between rates of return on stock market indices and increases in the LIBOR-OIS spread. A similar analysis can be carried out with regard to variance. Figure 3 presents the importance of variance resulting from insignificant relationships and lagged changes on the capital market (and leading changes in the interbank market) in the time of crisis. In this regard the present study confirms the conclusions that were drawn from the analysis of covariance (considerable importance of variance resulting from insignificant relationships).

The results that are presented in the paper show that the contagion effects which were observed on the capital market and which resulted from increased uncertainty on the interbank market were small but significant. The theories mentioned in the literature which explain financial crises relate to endogenous shocks which are predictable and which are related to a growing economic imbalance and usually manifested in the behaviour of specific macroeconomic indicators[8].

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[7] The structure of the formula for calculating weights depends on the number of bands that have been identified. Generally speaking, the denominator can be expanded by including measures of dependence for lagged, leading, and simultaneous fluctuations (cf. Burzała 2014).

[8] In the literature, three mechanisms that explain the occurrence of financial crises are usually mentioned. The first mechanism is connected with Mishkin's research and the theory of asymmetry, the second one with the idea of the financial accelerator (loans) and the third with Minsky's financial instability hypothesis.

Table 1. Weights describing the importance of the interdependencies between the markets in different fluctuation bands

time of tranquillity

changes with regard to	Variance X	Variance Y	covariance (Y,X)	correlation (Y,X)	variance X	variance Y	covariance (Y,X)	correlation (Y,X)
							Weights	
leading fluctuations on market Y	0.000004	0.006616	–0.000062	–0.386	2%	2%	11%	86%
insignificant fluctuations	0.000187	0.403836	–0.000525	–0.060	98%	98%	89%	14%
fluctuations within the whole frequency range	0.000191	0.410451	–0.000587	–0.066	100%	100%	100%	100%

time of crisis

changes with regard to	Variance X	Variance Y	covariance (Y,X)	correlation (Y,X)	variance X	variance Y	covariance (Y,X)	correlation (Y,X)
							Weights	
lagged fluctuations on market Y	0.001254	0.776	–0.00649	–0.208	28%	20%	26%	54%
insignificant fluctuations	0.003299	3.162	–0.01809	–0.177	72%	80%	74%	46%
fluctuations within the whole frequency range	0.004553	3.938	–0.02458	–0.184	100%	100%	100%	100%

Symbols: Y – rates of return on the DJIA stock market index, X – first increases in the LIBOR-OIS spread.

Source: own calculations

Contemporary financial crises are sudden and they are usually characterised by exogenous shocks which are difficult to predict. However, it is possible to build economic and financial structures that will be strong enough to minimise the losses incurred as a consequence of these crises. The last financial crisis drew attention to the need to introduce many micro- and macro-prudential regulations aimed at improving the stability of the financial system, but a description of those regulations is beyond the scope of this paper.

Figure 3. Importance of variance for different relationships in the time of crisis

variance for insignificant relationships
variance for significant relationships that are shifted in the phase
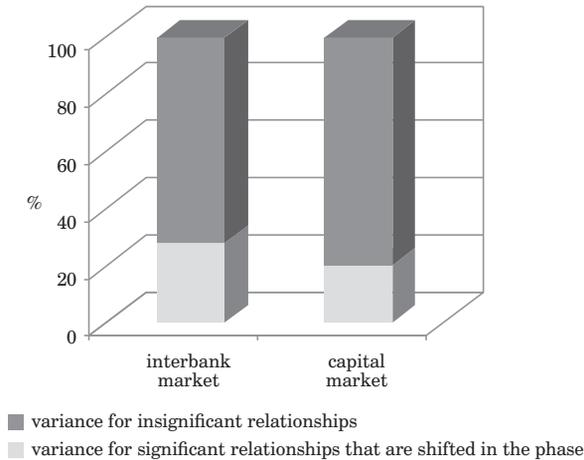
Source: own work.

6. SUMMARY

The results of empirical research that are presented in this article indicate that the covariance of the segments of the financial market studied in the U.S. was very low. This means that the capital market only showed a delayed reaction to single impulses coming from the interbank market in relation to certain crisis events. The study did not show significant simultaneous dependencies. The interactions between these markets were "more chaotic" than might be inferred by analysing the charts visually. The results of the study carried out using cospectral analysis, which are presented in this article, cannot be obtained by employing other research methods. This is because an analysis of the structure of the processes studied makes it possible to separately identify changes occurring within different fluctuation bands.

The lack of systematic (direct) links between these markets suggests that further time domain analyses should be carried out using methods that will make it possible to study shocks (such as event studies and probability or volatility models).

In the United States, special financial institutions and capital markets handle financing of investment projects (a market-oriented economy). It is worth verifying the conclusions presented in the article on the European markets, where banks are the main source of short and long-term capital (a bank-oriented economy). Market analysts emphasize that the Euro zone affected financial market structure change in Europe, nevertheless, research can result in very valuable conclusions.

Abstract

For analysts of the crisis it is important to find out whether financial market disturbances occurred simultaneously for different segments of this market. If certain lags are identified, this might form a basis to establish the direction of capital flows. The research hypothesis about the simultaneous occurrence of capital and interbank market disturbances was verified by using cospectral analysis. The results of empirical research that are presented in this article indicate that the covariance of the studied segments of the financial market in the U.S. was very low. This means that the capital market only showed a delayed reaction to single impulses coming from the interbank market in relation to certain crisis events.

Key words: financial crisis, interbank market, capital market, cospectral analysis

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CHARACTERISTICS OF DEPOSIT INSURANCE RESEARCH AND THE CHALLENGES AHEAD

1. INTRODUCTION

The evolution of research into Deposit Insurance Systems (DISs) may not reach back particularly far. The beginning of the history of DISs started with one of the most striking episodes in the history of economics, the Great Depression. Eighty two years ago, the Great Depression delivered a devastating blow to banking systems. Many retail depositors were – to put it bluntly – simply wiped out. This sparked a wide-scale rush to convert bank deposits into cash or gold. Similarly, the recent Global Financial Crisis triggered a wide range of problems for financial institutions all across the world. The desperation reflected in both episodes has provided us with a salient lesson, namely that, when undertaking a readjustment of the financial system, one element in particular stands out as the most valuable. That element is public confidence. Without it, management of a financial crisis is next to impossible. A lack of this can render futile all manner of clever and

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ambitious responses to economic turbulence, therefore it really is a most precious commodity worth nurturing and protecting.

The architects of a solution to the setbacks presented by both crises seem to have understood this, and that regaining and then maintaining public confidence required mechanisms to restore the financial system. The idea after the Great Depression was, consequently, the birth of deposit insurance, and after the Global Financial Crisis, reconstruction of the institutional financial architecture to which deposit insurance belongs. Recalling these two crises is justified because they were milestones in the history of DIS development. These two events had a huge impact on the deposit insurance industry and accelerated research in this domain.

The establishment of the first deposit insurance agency in the world's largest economy after the Great Depression ushered in an era of research and analysis in this field[1]. Over the years, this has varied in scope and magnitude, and has contributed to a number of related policy breakthroughs. Deposit insurance – both as a policy option and as a subject of study – has aroused the interest of politicians, policymakers, researchers and academics alike because of the impact that deposit insurance has on the banking system, on the behaviour of depositors and because of the different phenomena that it is linked to.

2. DEVELOPMENT OF DIS RESEARCH

Deposit insurance has been the subject of a number of theoretical and empirical studies. To classify these, we propose dividing the history of research on the topic of deposit insurance into five periods. Each has its own character, specificity and associated dilemmas. Also, the number of publications and intensity of research has been linked to the number of DISs all over the world as well as to the occurrence of crisis situations. The database of the International Association of Deposit Insurers (IADI), which consists of papers published in the years 1934–2012[2], is very helpful in the systemization of the respective research. A breakdown of the numbers of papers and the most popular sub-topics related to DISs is presented in Figure 1. The most popular are papers analyzing the funding of DISs (e.g. ex- ante vs. ex-post or burdens set on banks by the existence of DISs) as well as public policy objectives of DISs, their mandates and powers.

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[1] The establishment of the first DIS, in the form of the Federal Deposit Insurance Corporation (FDIC) was a truly breakthrough innovation – an adventurous step that took courage, especially in light of the fact that, for quite a long period, no other jurisdictions were bold enough to follow in those footsteps.

[2] IADI, *Bibliography of papers related to deposit insurance 1934–2012.*

Figure 1. Breakdown of DIS research fields in IADI database according to the number of papers published
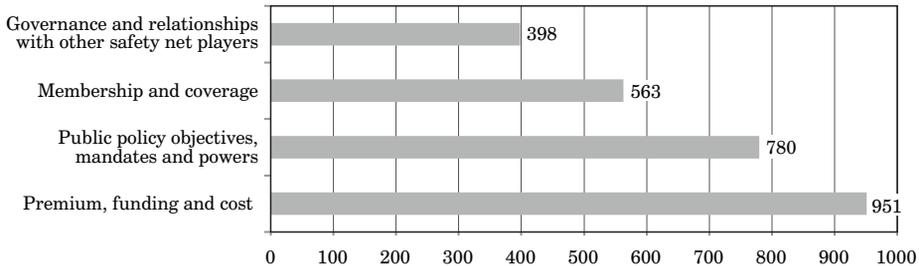
TThe bibliography ends covers the years up to 2012. The same papers may be included in multiple categories.

Source: own materials based on IADI, *Bibliography…, op. cit.*

2.1. The first period: 1930–1970

The first period, from the 1930s to about 1970, was a period in which deposit insurance was predominantly a fringe pursuit for economics researchers. This is not a surprise because at the end of that period only 9 jurisdictions had functioning DISs[3]. Among the most distinguished publications relating to DISs was a publication that analyzed the rationale for the very existence of deposit insurance written by Taggart and Jennings (1934), supporting the existence of deposit insurance. Other valuable publications from that time were written by Beaver (1966) and Altman (1968), who analysed predictors of company failures, which is very useful in DIS functioning. In general, there are three main policy conclusions resulting from the research of that period: the necessity of state involvement in the operation of DISs, ensuring emergency state funding for DISs and a need for cooperation between the DIS and the supervisor for effective operation.

2.2. The second period: 1971–1982

The period between 1971 and 1982 was a time of growing popularity of DISs, which saw the establishment of DISs in 9 new jurisdictions worldwide. The decade starting in 1971 was the time when research moved beyond the baseline question of "to be or not to be", because in this period academics broadened the scope of their research and discovered new questions awaiting answers. Researchers in the 1970s, for example Sharpe (1977) or Buser at al. (1981), examined the

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[3]   The numbers relate to jurisdictions with at least one DISs and are counted based on the compiled studies of IADI, *Annual Survey*, 2014 and Demirgüç-Kunt (2014).

optimal relationship of bank capital adequacy to the level of deposit protection and its impact on regulatory policies. Other academics, for example Kreps and Wacht (1971), searched for ways of protecting deposits that would constitute an alternative to a DIS. Still others, such as Bryant (1980), looked at the challenges of adequate DIS funding, admitting that even a well-funded DIS is not always able to protect the financial system from a bank run.

To briefly sum up the policy conclusions from that period, the consensus was that DISs should maintain only the minimum mandate and stay in a narrow pay-box model. Another was that deposit protection depends not only on the strength of a DIS but also on the regulatory and economic environment in which banks operate – which was the idea promoted by Horvitz (1975). Yet another of the policy conclusions was that participation in a DIS should be mandatory for banks, while the protection given to depositors should be sufficiently low to counteract moral hazard.

2.3. The third period: 1982–1993

The period 1983–1993 was a time of rising popularity of DISs all over the world, which bore fruit in the establishment of DISs in 22 new jurisdictions. The centre of gravity during this period shifted to concentrate research efforts on the side effects of the operation of deposit insurance. The most important and often quoted authors tested issues like moral hazard, information asymmetry and the excessive risk taking by banks, which was the domain of such distinguished authors as Pennacchi (1984), Thomson (1986) or Wheelock (1993). But the perspective of moral hazard as a research issue requires a more detailed explanation. As a problem it was known since the establishment of the FDIC in 1934, but the significance of this problem increased with the rapid spread of deposit insurance. This was also a time of extensive analyses of the costs and benefits of providing deposit insurance to a jurisdiction, carried out by Diamond and Dyvbig (1983). Academics examined the role of DISs in contagious bank runs, optimal coverage or protection, and tested principal-agent conflicts – done by Furlong (1984) or Kane (1989). The authors also pointed out that many DISs had defective systems of information collection, client monitoring, and risk management.

The policy conclusions from that period can therefore be summed up as a call for reforms in DISs, suggested by the research results. There was a general consensus among researchers that deposit insurance only benefits the banking system when it is properly designed and there are tools in place to mitigate moral hazard. It is also worth noting that at that time the FDIC was granted resolution powers (with the least cost solution instead of open bank assistance), making it the world's first modern resolution authority, which shows how ahead of its time this institution was[4].

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[4] Thanks to the reforms introduced by *Financial Institution Reform, Recovery and Enforcement Act* (FIRREA) in 1989 and *Federal Deposit Insurance Corporation Improvement Act* (FDICIA) in 1991.

2.4. The fourth period: 1994–2007

The fourth period lasted from 1994–2007 and saw a marked upswing in the establishment of deposit insurance agencies. This period was characterized by the formation of new systems, especially in Europe and on emerging markets. At that time DISs were established in 57 jurisdictions. However, a different approach to the institutional framework of the financial safety net brought about different designs of DISs among countries. At that time research was at its most dynamic and introduced new concepts for the mandate of DISs in the world. Some of the most distinguished authors dealing with DIS matters, such as Garcia (1996) and Beck (2001) engaged in discussions about the ex-post versus ex-ante approach to DIS funding, with arguments on both sides. Also, more sophisticated models of deposit insurance pricing and target funds were developed by Blinder and Wescott (2001) or Shibut (2002).

This period delivered various policy implications for DISs. These were the conclusions that it is the role of state authorities to take care of the proper structure of DISs because poorly designed systems can result in negative incentives in the banking sector – which was proved by Demirgüç-Kunt and Detragiache (1999). Researchers also observed that the purpose of the existence of a DIS is two-tier: the protection of small-scale depositors is one, but another is overall contribution to financial stability and crisis management. This gave the impulse for DISs to become part of the financial safety net, which was an idea developed by Goodhart (2004, 2006). One of the thoughts that seemed rather ahead of its time was the conclusion by Garcia (1999) that there are valuable synergies when the DIS acts as a receiver and can decide on the method of bank liquidation when it goes to a payout.

2.5. The fifth period: post 2008

Analysis of the previous four periods led to the general statement that for quite a long time both academics and policymakers had attached a lot of attention to analysing the impact of deposit insurance on bank risk taking and moral hazard, and how to set the premiums paid by banks. The same applied to the topic of funding, coverage level and optimal design. These problems were thoroughly investigated and led to the *status quo* prevalent in economics until 2007, but the necessary reforms were hindered by the prosperity of those times and the lack of need for extensive use of DISs in the past.

Therefore a completely new, fifth period was triggered in 2008 by the Global Financial Crisis and this is not yet concluded. It has brought a new reality to the institutional framework in which DISs participate. So far in this short period 22 jurisdictions (unconvinced before) have established a DIS. This period is characterised by discussion about the redefinition of the role of the DIS in the new

financial architecture. Researchers have admitted that the crisis underscored the fact that the systems have been designed in a pro-cyclical way – this was stressed by Laeven and Valencia (2008).

The main policy implications from this period are yet to emerge but for now the conclusion appears to be that the pre-crisis form of DIS functioning must be changed and a new shape must be formulated in order to meet the new challenges

– as postulated by Gros or Schonmaker (2013). The ex-ante variant of funding is the target form of funding, because only well-capitalized DISs are able to operate effectively in a crisis situation, as pointed out by Tomasic (2011). Moreover, DISs can play a key role in the process of crisis management and there should be a place for these institutions in the new financial architecture – as indicated by Tarr (2010). In this period, most visible is the strong development of the role and powers of DISs around the world, which is exemplified most strongly by North America and Asia. However, the EU has also stipulated the inclusion of crisis management components in deposit insurance systems with new directives. The related challenges ahead are described in the part 4.

3. CONTRIBUTION OF INTERNATIONAL ORGANIZATIONS

Wrapping up this historic overview of DIS research, it is necessary to briefly touch on the major sources of this research. The research on deposit insurance systems in all periods has been conducted not only by academics, but also by international organizations. Most noteworthy in this regard are the studies carried out by the World Bank, the IMF and the OECD. Studies on a significant scale are also being undertaken by the European Commission and the Financial Stability Board. The subject of deposit insurance also shows up in the studies of such recognized research entities as the Center for European Policy Studies or the National Bureau of Economic Research or FDIC's Center for Financial Research. In addition to this, numerous deposit insurance agencies and safety net players themselves are conducting research, particularly research of practical significance. Some noteworthy examples (in addition to the aforementioned FDIC) in this regard are the Canadian Deposit Insurance Corporation, the Korean Deposit Insurance Corporation, the Bank of England and the Central Bank of Holland.

IADI has also relatively recently begun supporting the deposit insurance research agenda by addressing the most current issues facing deposit insurers. The publications of a series of guidance and research papers on the subject of moral hazard mitigation, deposit insurance coverage, reimbursement systems or handling systemic crises can be mentioned[5]. Also, a number of postulates from research,

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[5] The full list of papers is available at IADI, *Research and Guidance, Papers*, www.iadi.org/Research.aspx?id=55 (access: 17 June 2015).

relating to the optimal design of DISs, were used in the *Core Principles for Effective Deposit Insurance Systems*, which are now a benchmark for jurisdictions to use in establishing or reforming their DISs[6].

Table 1. Breakdown of some DIS related databases in the years 2003–2013

Institution	Year	Scope of the DIS research
World Bank[a]	2003	181 jurisdictions
European Commission[b]	2011	27 EU countries
FSB[c]	2012	G-20 countries
IADI[d]	2012	81 jurisdictions
IMF[e]	2013	28 EU countries

[a] World Bank, *Banking Regulation Database*, 2003.
[b] EC, *JRC Report under Article 12 of Directive 94/19/EC as amended by Directive 2009/14/EC*, JRC, Unit G09, Ispra (Italy), 2011.
[c] FSB, *Thematic Review on Deposit Insurance Systems. Peer Review Report*, Basel 2012.
[d] IADI, *Annual Survey*, 2012.
[e] IMF, *Deposit Insurance. Technical Note*, Washington, March 2013.

Source: own materials.

Holistic research done by the institutions mentioned in the table above promotes the systematization of knowledge and enables international comparisons of DISs. These are needed to determine the different roles that the DIS fulfils in national financial safety nets all over the world. Thanks to the aforementioned researchers, it is possible to analyze the new trends in the development of DISs in the world.

4. BIBLIOMETRIC ANALYSIS

It might be informative to draw a brief comparison between the volume of research done on DISs versus other safety net participants. A bibliometric analysis, the contemporary way of measuring the science and impact of research, can be quite informative. And here we refer to the papers relating in topic to "deposit insurance" in the two popular research databases: ScienceDirect and Web of Science. The former features a total of only 114 titles published in scientific journals. Another interesting statistic is that of these 114 titles, only 27 have been published since the beginning of 2008 (24%), arguably the most significant period from the point of view of DIS engagement and evolution. The second database –

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[6] IADI, *The Revised Core Principles for Effective Deposit Insurance Systems*, November 2014. World Bank uses Core Principles in the assessment of DIS performance, e.g. World Bank (2013).

Web of Science – is kinder to deposit insurance, containing 327 related articles, but also just 81 after 2007 (25%)[7].

Of course it needs to be borne in mind that DISs are the safety net participants with the shortest history, but just to give a comparison, papers on the respective functions of other safety net players are vastly more numerous in both databases. For example, titles with "monetary policy" show up in Web of Science 5,070 times, papers related to the topic "financial supervision" amount to 1,725 papers and "macroprudential policy" is the topic of 52 articles. This last one is less than deposit insurance but the genesis of the idea of macroprudential policy is very recent, basically dating from 2009. Such bibliometric comparisons are not rigorously comparative and meaningful, but they do give a perspective and show a gap in the research related to deposit insurance. The deposit insurance system, as a member of the financial safety net, remains largely unacknowledged in many jurisdictions.

Figure 2. The number of DIS related publications in the IADI database for each period
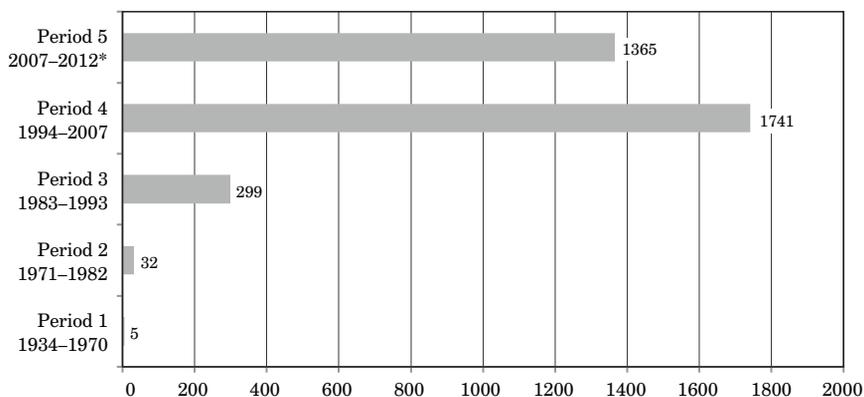
* The bibliography ends with the year 2012 although the fifth period has not yet concluded.

Source: own materials based on IADI, *Bibliography…, op. cit.*

5. NEW RESEARCH TOPICS

Highlighting earlier the large contribution of research to deposit insurance shows progress in research in the area of DISs, which has been impressive on the whole. Many questions remain unanswered, however. The dynamics of the crisis have made room for research to fill, and it is reasonable to increase activity

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[7]   The searches were done on 18 June 2015.

in this area. The post-crisis reality is diametrically different from the pre-2007 state of affairs. The scale of the recent financial crisis and the failure of numerous financial institutions means that deposit insurance agencies have faced the biggest challenge since their inception and this should be more comprehensively reflected in the research. Science has not yet managed to provide a convincing response to some of the most important issues currently facing deposit insurance. This is by no means a failure on the part of scientists, it is simply the natural order of things. The environment – and the structures and systems that are part of it – change and evolve, providing space and opportunities for researchers to explore.

More room for scientific inquiry is also supplied by the fact that DIS has a specific policy area. Because of its nature it has never truly settled into its own in the mainstream of economics theory. It is different from the other members of the financial safety net, yet it is beyond doubt that DISs are part of that safety net and the crisis management process. This specific area needs its respective research coverage, similar to how the other safety net participants are supported by extensive research.

There are now new opportunities to explore the course of the evolution of DISs because this role is currently laid out along multiple tracks. The variety of concepts being formulated for the development of deposit insurance system functionality demands scientific inquiry and verification.

To enumerate only one such opportunity, a less extensively tested research field is the relationship between the pay-box fund and the resolution fund in crisis management. It seems advisable to consider the issue of the desired target level of funding in the context of a diversity of mandates – particularly with respect to the relationship between a resolution authority mandate and a pay-box function, and determination whether they are substitutive or complimentary? The relationship between deposit insurance funds and resolution financial arrangements is closely linked to the bilateral relationship between reimbursement of covered deposits in insolvency and resolution proceedings.

This is connected with microeconomics and the issue of substitutability and complementarity of function with respect to a resolution versus pay-box mandate. In terms of functions, both these measures are mutually substitutable. This is because the transfer of covered deposits to a sound acquirer in a P&A or a bridge bank ensures that depositors have uninterrupted access to their savings, without triggering a reimbursement. The same result can be achieved through a bail-in, when a failing or likely to fail entity is recapitalized by its creditors.

However, in terms of their objective scope, reimbursement and resolution should be perceived as complimentary mechanisms. One of the preconditions for resolution is that such an action should be taken in the public interest and in some cases this condition may remain unsatisfied. What is more, it cannot be ruled out that some covered deposits may remain in a residual entity after resolution tools are exercised, although as a rule such a situation should not take place.

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The challenge of defining the relationship between reimbursement and resolution was faced by European Union bodies during drafting of the Bank Recovery and Resolution Directive. The approach adopted, which assumes the obligatory participation of DIS funds in financing resolution proceedings up to the net cost of reimbursement of covered deposits, mirrors the mutual substitutability of these two processes. At the same time, separation between DIS funds and resolution financing arrangements indicates that both functions are to exist in parallel in a crisis management framework because of the complementarity mentioned above.

It should also be emphasized that EU regulations envisage some additional limitations for the use of DIS funds in resolution – up to 50% of the target level – and it seems that this provision, providing additional safeguards for deposit insurers, indicates that the EU legislator has acknowledged the crucial significance of their function as a last resort measure where the resolution strategy fails[8]. The elaborated issue is only one of the dilemmas, so there really does appear to be room to undertake new topics of research.

6. CONCLUSION

Deposit insurance research started with the establishment of the first deposit insurance agency – FDIC in 1934. Academia, the policy and decision makers and international organizations have engaged in many research topics related to DISs over the years. The main areas of interest have been deficiencies in DIS functioning, optimal design or the proper way of DIS funding. However in comparison to other safety net players, DIS seems to be the least tested. Nowadays, all over the world financial systems are being redefined and the role of the DIS is changing in the post-crisis environment. The crisis responses adopted by decision-makers have given rise to a need to systematize policy actions and carry out a comprehensive assessment of their effectiveness. Policymakers supported by many institutions are developing new ideas that have practical carry-over into the real economy. In this context the new DIS role (post 2007) needs to be adequately supported by research, so that whatever solutions are being proposed have the support of the rigour of scientific inquiry. DISs should be supported by science and research especially in such new post crisis fields as resolution or crisis management.

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[8] Article 109 of the Directive 2014/59/EU of the European Parliament and of the Council of 15 May 2014 establishing a framework for the recovery and resolution of credit institutions and investment firms, Official Journal of the European Union L 173/190.

Abstract

The article aims to present the history of research relating to deposit insurance. It identifies the main fields of interest in selected periods of study, presents the policy conclusions and indicates papers written by the most popular authors handling these topics. Deposit insurers seem to be the least scientifically examined financial safety net participants. The post-crisis regulatory reforms in financial markets all over the world require a redefinition of the role of deposit insurance. The authors sum up the research in the field of deposit insurance performed so far and indicate the new research challenges and rationale for undertaking them.

Key words: deposit insurance research, engagement of deposit insurance in resolution

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Reviews

Piotr Masiukiewicz*

GLOBAL RISK – MONOGRAPH REVIEW

**Jan Krzysztof Solarz, *Shadow Banking. A Systemic Financial Innovation*
Wydawnictwo SAN, Warszawa–Łódź 2014**

1. THE GROWING POTENTIAL OF SHADOW BANKS

The parallel banking sector is still growing; however, less research and fewer publications are dedicated to it than to the banking sector. Jan Krzysztof Solarz takes up this subject in his latest book, whose strongest points include unique information, new statistics on the global approach and important references to the Polish reality.

In 2011 these entities had the following financial assets at their disposal (in billion dolars): on the global scale – USD 67 billion, in the USA – USD 23 billion, and in the Eurozone – USD 22 billion[1]. At the same time, the assets of the regulated banking in the USA amounted to USD 13 billion in 2011, whereas those of shadow banking

Were USD 8.5 billion. The share in the general financial intermediary activity of the non-bank intermediaries dropped from 27% in 2007 to 24% at the end of 2012. The intermediary activity of non-bank institutions is the equivalent of 117% of GDP of 20 countries and the Economic and Monetary Union. In 2007 this figure stood at 125%.

The book's author considers the financial sector to be oversized, as an excessively extended financial sector is deemed to be one in which its assets exceed 100% of GDP. When the size of the financial sector exceeds the needs of the real economic sector, then space opens for extraordinary profits and extreme populism – notes the author (p. 8).

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[1] *Shadow Banking: Scoping the Issues*, Financial Stability Board, Basel 2011.

2. BROAD OR NARROW MEANING OF SHADOW BANKING

In the Polish and foreign literature there are many definitions of parallel banking, and some authors define it through an object approach (a list of institutions), including insurance companies and financial advisory services, which is subject to discussion. The analyses and opinions presented in the work in question would be more understandable if a comparative analysis of notions and definitions from the literature was conducted at the beginning. These definitions appear in different places in the publication, and synonyms such as shadow banking, non-banking, parallel banking or para-banking are incidentally treated even as ideas with only slightly different meaning. The author did not consider the analysis published in this regard by W. Szpringer, who offered a broad definition; likewise, McCulley, who in 2007 defined *shadow banking* as a "big segment of financial intermediary activities, which is located beyond the balance sheets of regulated commercial banks or other deposit institutions"[2]. Finally, J. K. Solarz offered his own, broad definition, which I consider to be very interesting, though, incomplete (e.g. payment service companies or Provident do not use deposits), i.e.: *Parallel banking is a financial intermediary service using the functional equivalents of deposits to gain a competitive edge over the remaining participants of the regulated banking sector. It is a systemic financial innovation. Its essence consists of stretching hidden public or private guarantees over the depositors of functional equivalents of deposits* (p. 109). It could be assumed that equity is also an equivalent of deposits, but this is probably too far-fetched a presumption.

However, the definition of a para-bank cited by I. Góral is rather erroneous, as it in fact refers to pyramid schemes (p. 36).

3. THREATS TO STABILITY

The coexistence of both forms of the financial system leads to many unexpected external effects – claims J. K. Solarz. Firstly, the relative size of shadow banking determines the stability of the financial system. If it is relatively small compared to the size of the secondary market for its assets, then the banking system is stable. If it is large, however, then the financial system becomes fragile. Secondly, when regulated financial intermediaries establish shadow banking themselves, its scale does not have such negative consequences for the stability of the financial system. Thirdly, when legal arbitration appears, then the safety network for the financial system may turn out to be inadequate in order to prevent the occurrence of systemic risk. In my opinion, a fourth aspect should be added here, i.e. the

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[2] P. McCulley, *Teton Reflections*, PIMCO Global Central Banks Focus, no 9/2007.

appearance of unfair financial practices, such as financial pyramids, the black market for loans, etc., which jeopardize the financial security of households[3].

"We lack the time distance indispensable for mature reflection and disclosure of all actors and interests standing behind the development of parallel banking," writes J. K. Solarz. For supporters of the exogenous theory of money, parallel banking is an attempt to weaken the financial discipline, an innovation directed towards limiting it. For supporters of the partly endogenous nature of money, parallel banking is natural feedback preventing arbitrary imposition of the state's interest at the expense of the remaining actors on the financial market.

Parallel banking obviously increases the risk of a financial system if its activities are not transparent, it is not monitored and causes asymmetry of information. According to the author of the monograph: "The work on establishment of the Macroeconomic Financial Stability Board in Poland has become a good opportunity to review once again the question of risk management of the financial system. The Board's priority task should be to investigate the substance of parallel banking and to specify its influence on the stability of the financial system in Poland. The present work constitutes a contribution to such indispensable studies. One must not use myths or stereotypes in financial system risk management. An in-depth, comprehensive analysis of this systemic financial innovation is indispensable." (from the Foreword).

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In the first chapter, the author explains the notion of parallel banking (shadow banking) as product innovation, as process innovation, and parallel banking as attributional innovation. The author concludes, inter alia, that the final products of parallel banking are structured financial products and the functional equivalents of deposits – this list is far from complete (p. 28). The second and third chapters present the origin of shadow banking and statistics, with much unique data. The case studies presented are exceptionally valuable, one of the Bank of England and other. Some interesting deliberations on the function of lender of last resort lack the conclusion that contemporarily central banks offer this exclusively to classic banks. In the following chapter, theoretical aspects, including a review of research on parallel banking, systemic innovations and substitutes of deposits, are presented. The fifth chapter deals with the financial engineering used by para-banking entities.

The sixth chapter synthetically presents arguments concerning regulation of the shadow banking sector, including those in favour of abolishing regulatory arbitration and steps undertaken towards limiting negative external costs of the existence of parallel banking by the international community. The author points

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[3] P. Masiukiewicz, *Piramidy finansowe*, PWN, Warszawa 2015.

out that the parties to a transaction are often unable to specify which court is to solve their potential disputes, and what type of proceedings need to be undertaken. A new phenomenon is the scale of tax optimization (tax havens, etc.). According to the author of the monograph, one of the ways to curb this is to introduce light-touch laws into the financial services, e.g. good practices (professional, corporate, industry-related).

Chapter seven presents systemic premises for considering parallel banking a natural reaction to the complexity and globalization of the contemporary financial system. It is simultaneously an attempt to systemize the relations between the financial system risk and parallel banking. Parallel banking is not the reason for the materialization of systemic risk, but only a premise for its appearance, thus it is necessary to search for a solution satisfying the market needs in the conditions of its excessive regulation. The illustration of theoretical reflections is the situation of parallel banking in China (the boom of parallel banking for the richest is, at the same time, a litmus test allowing an assessment the political situation in that country).

The last chapter presents parallel banking in Poland[4]. J. K. Solarz poses the following questions: What types of financial services can be considered to represent shadow banking? What perspectives are there for shadow banking in Poland?

He also conducts some pertinent criticism of the authorities regarding the lack of decent statistics conducted for this sector (p. 191).

The author of the monograph has confined his analysis to parallel banking acting de lege artis; thus it does not include activity on the black lending market and financial pyramids, whereas omission of an analysis of payment service companies constitutes a certain deficiency. These companies have been a problem for authorities in recent years (bankruptcies, siphoning off resources) – for this reason a European Committee directive was passed in this regard, and in Poland an Act on Payment Services was adopted. The issuance of bitcoin, which is becoming a global problem and has been called a financial pyramid by N. Roubini[5], was not raised in the monograph, either.

Several passages of the publications raise reservations as to their relevance to the subject matter, for example the discussion of the history of money (pp. 10–15), table 2.2. (in Chapter 2)and initial public offerings (p. 91). The deliberations on the socially rational financial lever and on the good and bad lever (p. 100 and further) are debatable – the theory of financial lever only specifies economic efficiency (hence, for example, the problem of over-indebtedness and losses of enterprises). The statement that parallel banking is not under the supervision of numerous

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[4] K. Kozak, *Miejsce Shadow Banking w sektorze bankowym*, Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, nr 311/2013.

[5] *Dr Zagłada atakuje bitcoina. „To piramida finansowa"*, http://tvn24bis.pl/informacje,187/dr--zaglada-atakuje-bitcoina-to-piramida..., accessed on 13.05.2014.

regulatory bodies (…) is also outdated – after the subprime crisis, both in the USA and in the European Union, regulation and supervision were expanded to cover some of the shadow banks (the Dodd-Frank Act in the USA allowed FED to supervise any institution which can threaten financial security). In Poland the regulations and supervision covered co-operative credit unions and payment service companies. Moreover, SKOK credit unions were statutorily included in the deposit guarantee system, and the payment service companies were obliged to insure cash transactions.

4. CHINESE SHADOW BANKING
– A POLITICAL OR ECONOMIC PROBLEM?

The problem of parallel banking is growing quickly in China; national and local financial pyramids have started to appear. It seems the authorities have noticed this problem (J. Solarz also indicates this); however, without clear decisions by the Communist Party of China it will not be comprehensively solved. Because of the few publications available on Chinese shadow banks, it is worth devoting this example some more attention (it. 7.2 of the monograph).

The parallel banking sector in China includes the following:

a) non-banking institutions such as financial corporations, trusts and brokerage houses (UDS 250.76 billion),

b) non-financial institutions such as pawn shops (12.79), lending companies (24.52), venture capital (USD 5.67 billion),

c) private equity companies (USD 19.61 billion),

d) remaining informal financial institutions[6].

In recent years lending co-operatives and pawn shops have been of great importance (at 2012 year-end there were 6,084 pawn shops operating, and the total value of collateral amounted to USD 11.23 billion). The estimation for parallel banking in China in 2011 was EUR 596 billion. Only one fifth of this parallel banking activity is realized outside credit institutions. This would mean that nearly 80% of parallel banking is, directly or indirectly, controlled by the state authorities. The People's Bank of China assessed the scale of parallel banking at RMB 28.8 trillion in 2012, the Guangfa Securities Brokerage House estimated this sector in China at RMB 30 trillion, JP Morgan Chase at RMB 36 trillion in 2013[7].

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[6] Data for 2010 cf. L. Min, *Shadow Banking Activities and Its Supervision in China*, China Banking Regulatory Commission, Washington, 2011.

[7] N. Borst, *Shadow Deposits as a Source of Financial Instability: Lessons from the American Experience for China*, Policy Brief Peterson Institute for International Economics no 13/2013.

The parallel banking risk in China is connected with private banking. Managing the assets of this customer group in 2012 required the issuance of derivative financial instruments of a value exceeding the newly-granted bank loans (yuan 20 trillion). According to J.K. Solarz, in China the systemic risk of parallel banking does not appear as an external cost of credit securitization, because the advantage of backwardness protects China against this type of threat. The main source of systemic risk to parallel banking in China is managing the financial assets of the richest citizens of that country[8]. China has officially notified the Financial Stability Board that it was preparing an operational definition of ***shadow banking*** and a regulation strategy according to the Board's guidelines.

J. Solarz notices that the majority of texts on parallel banking in China perform a propagandist function and prophesy crisis. According to other reviewers of the Chinese economy, the advantage of backwardness of the Chinese financial system protects the country against the negative consequences of the development of parallel banking. Since 1979, a grey area has existed in China for personal loans and credit for small and medium enterprises. The risk of this market is diversified and does not constitute a threat of a systemic nature (p. 176). In the absence of a comprehensive diagnosis, it is advisable to subject trusts, management of well-to-do Chinese's assets, securitization, micro-financial funds and financial intermediary activity to regulations and supervision - there is no clear attitude towards shadow banks.

The bureaucratic reaction to the appearance of parallel banking is not based on the risk map – says J. Solarz. The central place on a professionally prepared risk map is occupied by trusts. At the end of 2011 the functioning of four quasi-trusts for residential real estate, which invested and managed state-owned real estate, was suspended. Another problem is the guarantee funds which have infected a significant part of the official financial sector of China (p. 178). These examples, in my opinion, should be complemented with one more significant illustration, i.e. ROSCAs peer- to-peer lending; many local associations which operated according to the rules of financial pyramids were closed down by the authorities, the majority of them between 2010–13[9]. Informal loans in China, as the author cites, amount to approximately yuan 3.5 trillion(p. 180).

According to information released by the Chinese authorities, the risk of parallel banking amounted to about 16.3% of GDP in 2013, which was less than in the European Union.

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[8] S. Hsu, J. Li, Y. Xue, *Shadow Banking and Systemic Risk in China*, Political Economy Research Institute, „University of Massachusetts Amherst Working Paper", no 349/ 2014.

[9] P. Masiukiewicz, *Piramidy finansowe...*, *op. cit.*

The People's Bank of China has been introducing rigorous controls over local and systemic risk in recent years - this has included strengthening the framing of the credit system, effective regulation and supervision, in order to prevent the risk[10].

RESUME

The monograph includes many valuable opinions from international experts, as well as the author's reflections, rich statistical material and interesting case studies. After each chapter it includes problems and questions for students, thus it has the nature of a handbook. But, in my opinion, it will also be an important source publication for all of those interested in researching the shadow banking sector and designing business models which do not pose a threat to financial stability from the sector in question; its closing up would probably be nonsense.

The author of the monograph rightly concludes that legal arbitration creates development potential for parallel banking - its limitation by means of European Union regulations and international standards is vital but insufficient. The demand for private money issued by parallel banking, e.g. for the excluded or those looking for inexpensive money, is decisive. The conclusion that the international aspect of origin and functioning of parallel banking has been ignored in the analyses conducted to date, and that it will increase in importance, is also significant. This also concerns financial pyramids, which in recent years have appeared on both a local and international scale.

I presume these problems are also worth discussing more broadly with undergraduate and doctoral students (which, after all, was the intention of Professor Jan K. Solarz); unfortunately, finance and banking handbooks give shadow banking only rudimentary coverage, if any.

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[10]   S. Hsu, J. Li, Y. Xue, *Shadow Banking and Systemic Risk...*, *op. cit.*