

DID THE ECONOMIC CRISES INFLUENCE THE STRUCTURE OF ASSETS-LIABILITIES IN BANKS?

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Abstract: Due to the important role of the banks in the financial sector and their systemic importance it is imperious to understand the relation and the influence between banks assets and liabilities.

We apply the canonical correlation analysis, developed by Hotelling (1936), on a dataset of 59 banks for the 2005-2011 period, we observe that after 2009 there is a decline in the level of loans from 61% to 58% of total assets. We find that the correlation between asset and liabilities remains strong in the 2008-2009 period.

The use of derivatives is affected in 2009-2010, but the pre-crisis level are exceeded in 2011; also for the analysed banks the proportion of fixed assets decline from over 1.2% in 2005 to under 0.9% in 2011, this may be due to the use of technology and automation on a larger scale, this trend is not influenced by the financial crises but by structural factors. Regarding the level of capital and equity it can be observed that there is an upward trend between 2008-2010 due to regulatory and market conditions. The level of customer deposits is over 40% for all the analysed period, with a change in dynamic after 2007 when the proportion of deposits has an upward trend.

We find that exists a moderate and inverse correlation between Loans and Loans and advances to Banks, Trading Securities, Derivatives and Deposits from Banks; also the level of deposits is correlated directly and moderately with the level of loans, also we observe that deposits are moderately and inverse correlated with the level of deposits from banks.

This shows that the analysed banks adapted their strategies and manage to maintain their balance sheets at values similar with those before the crisis.

Keywords: bank assets-liabilities, correlation, financial crises, balance sheet

JEL classification: C31, G21, G01

1. Introduction

Asset liabilities management (ALM) is defined as the strategic management of the balance sheet by (Rosen & Zenios, 2006), (Romanyuk, 2010) □ considers that ALM (assetliabilities management) purpose is the “optimal investment of assets in view of current goals and future liabilities”, (Novickytė & Petraitytė, 2014) □ considers that ALM is an important risk management measure for the banking sector. (Zenios & Ziemba, 2007) □ classify the ALM (asset-liabilities management) models as : single period-static models, multiple period static mode, single period stochastic model, multi period stochastic model; these models are treated extensively in (Markowitz, 1952) □ , (Sharpe & Tint, 1990) □ , (Carino et al. 1994) □ , (Dempster & Consigli, 1996) □ , (Consiglio, Flavio, Cocco, Zenios, & others, 2007) □ .

In order to measure the relation between asset and liabilities different methods have been used. (DeYoung & Yom, 2008)□, (Simonson, Stowe, & Watson, 1983)□, (Obben & Shanmugam, 1993), (Obben, 1992)□, (Jaiswal, 2010)□, (Cocoza, Curcio, & Gianfrancesco, 2010)□ uses canonical correlation analyses to study the assets-liabilities dependency in banks.

While (Lai & Kabir Hassan, 1997)□ uses a simultaneous equation model to determine the net interest margin and maturity gaps.

(Mommel & Schertler, 2010)□ uses two measures derived from the pairwise correlation coefficients: a weighted sum of squared pairwise correlations and the coefficient of determination R^2 for a linear equation with the dependent variable being a single asset/liabilities position and the independent variables being the structure of liabilities/assets.

The level of bank profitability depends on bank specific variables (Alexiou & Sofoklis, 2009)□, macroeconomic factors (Alper & Anbar, 2011; P Athanasoglou, Delis, & Staikouras, 2006)□, economic cycles (PP Athanasoglou & Daniilidis, 2011; Bolt & Haan, 2012), also the structure of financial institution has an impact on banks performance (P Athanasoglou et al., 2006).

The differences in the structure of asset-liabilities influences the levels of bank profitability (DeYoung & Yom, 2008), others factors being the regional context and local conditions (Flamini, McDonald, & Schumacher, 2009)□, the industry concentration (Perera, Skully, & Chaudrey, 2013), while the difference between regulation seem to be uncorrelated to banks performance (Beltratti & Stulz, 2012)□ □.

Analysing the structure of asset-liabilities of commercial banks in U.S. between 1990 and 2005 (DeYoung & Yom, 2008) found that for smaller banks the dependence between asset-liabilities is lower compared to larger banks, for all analysed banks there is a decline in time between asset-liabilities dependence. They observe that the correlation between long-term loans and core deposits are constant over the analysed period, also there is a convergence in the structure of asset-liabilities for large banks and small banks.

(Mommel & Schertler, 2010) analysed the structure of asset-liabilities for German universal banks for the 1994-2007 period, observing a similar pattern with U.S. (DeYoung & Yom, 2008), respectively the dependence between asset-liabilities and liabilities declined over time, this decline seems to be related with the use of derivatives instruments.

The rest of the paper has the following structure section 2 presents the data and the methodology. Section 3 describes the main results, and Section 4 provides some concluding remarks.

2. Data and the methodology

The dataset used consists of annually financial information for 59 banks (Annexes 1), the analysed period is from 2005 until 2011, the dataset is from the Bankscope database.

We apply the canonical correlation analysis, developed by (Hotelling, 1936)□, this technique extends the correlation analysis from two variables to a set of two variables, respectively $X = [X_1, X_2, \dots, X_p]$ and $Y = [Y_1, Y_2, \dots, Y_n]$.

The assets/liabilities set of variables are presented in Table 1. With the exception of total liabilities/assets all the variables all calculated as proportion of total assets.

Table 1. Variables description

Assets		Liabilities	
v1	Loans	v11	Total Customer Deposits
v2	Loans and advances to Banks	v12	Deposits from Banks
v3	Trading Securities	v13	Other:deposits/short-term borrowings
v4	Derivatives	v14	Total Long Term Funding
v5	Available for Sale Securities	v15	Derivatives and Trading Liabilities
v6	Cash and Due From Banks	v16	Non interest bearing liabilities
v7	Fixed Assets	v17	Hybrid Capital
v8	Goodwill	v18	Common Equity
v9	Other non-earning assets	v20	Total assets/ Total liabilities

(DeYoung & Yom, 2008)□ show that the canonical correlation can be interpreted as follow: if there is a canonical correlation between assets/liabilities and also there exist a strong connection between the canonical loadings and the linear combination of assets/liabilities then it can be concluded that exists a dependence between the X_i and Y_j variables.

3. Results

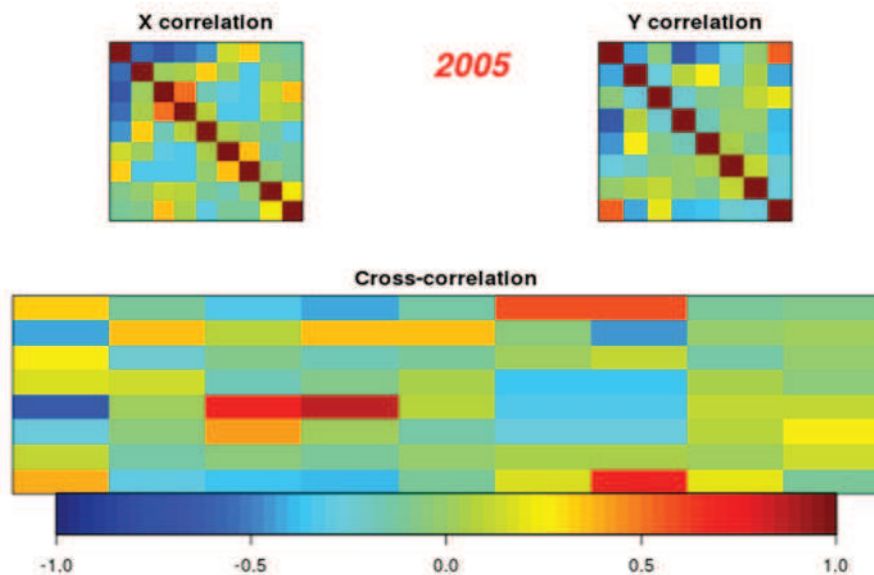
The assets/liabilities set of variables presented in Table 1 are calculated as proportion of total assets, with the exception of total assets/liabilities.

For assets the biggest component are loans with a mean value of 59.08% of total assets, also Loans and advances to Banks, Trading Securities, Derivatives, Available for Sale Securities have a mean value between 5% and 9% of total assets, with the rest of the variables representing under 3% of total assets. In the case of liabilities the highest component is represented by Total Customer Deposits with a mean value of 40.98% of total liabilities, Deposits from Banks represents 10.49% and Total Long Term Funding represents 20.64% of total liabilities, the rest of the liabilities variables: Other deposits/short-term borrowings, Derivatives and Trading Liabilities, Non interest bearing liabilities, Hybrid Capital, Common Equity representing under 10% of total liabilities.

Table 2. Summary Statistics, using the observations 1:2004 - 59:2011

Variable	Mean	Median	Minimum	Maximum
v1	59,0838	61,6867	17,5373	88,7894
v2	7,65929	6,07342	0,397919	44,2439
v3	7,51029	4,64180	0,00000	41,0035
v4	5,05425	1,96248	0,00000	47,9694
v5	8,68860	7,79627	0,00000	37,6212
v6	2,15294	1,56335	0,00528082	10,2616
v7	1,01283	0,862508	0,0266193	3,94236
v8	0,633171	0,341777	0,00000	5,68247
v9	2,99358	2,49843	0,311273	41,0081
v11	40,9842	42,8192	2,31570	83,7711
v12	10,4890	8,46339	0,124582	38,3089

v13	7,42866	6,27819	0,00000	45,4141
v14	20,6430	19,5038	0,00000	82,9171
v15	7,28800	2,79549	0,00000	50,0514
v16	6,73188	4,14270	0,885306	41,3902
v17	0,813204	0,668539	0,00000	3,94729
v18	4,99731	4,67106	0,00000	15,5639
v20	506187,	133738,	763,200	3,54397e+06
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
v1	15,7198	0,266059	-0,708871	0,0320590
v2	6,09592	0,795886	2,46616	9,18338
v3	8,60950	1,14636	1,72177	2,85563
v4	6,96158	1,37737	2,50260	7,68741
v5	6,28013	0,722801	1,08123	1,89438
v6	1,82374	0,847094	1,45451	2,05295
v7	0,773061	0,763268	1,13203	1,30423
v8	0,848932	1,34076	2,37829	6,59562
v9	3,08407	1,03023	7,07196	71,6398
v11	15,1304	0,369177	-0,00674687	0,0180519
v12	7,99165	0,761907	1,07678	0,669515
v13	7,45616	1,00370	1,17697	1,99835
v14	12,5066	0,605850	1,34707	4,11320
v15	9,75927	1,33909	1,98040	3,84285
v16	6,44075	0,956754	2,60729	9,47275
v17	0,753401	0,926460	1,28749	1,83444
v18	2,56090	0,512455	0,853451	0,874887
v20	713676	1,40990	1,84374	2,95162



In Fig. 1 we present the evolution of the mean of total assets and it can be observe that the highest level of assets is in 2008, with a mean value of the analysed sample of 5.7 billion; after an initial shock in 2009 the mean value drops to 5.4 billion. In 2010-2011 the

evolution of total assets is upwards with a mean value of the analysed sample of 5.6 billion in 2011, this shows that the analysed banks adapted their strategies and manage to maintain their balance sheets at values similar with those before the crisis.

Fig. 1 Evolution of Total Assets 2005-2011



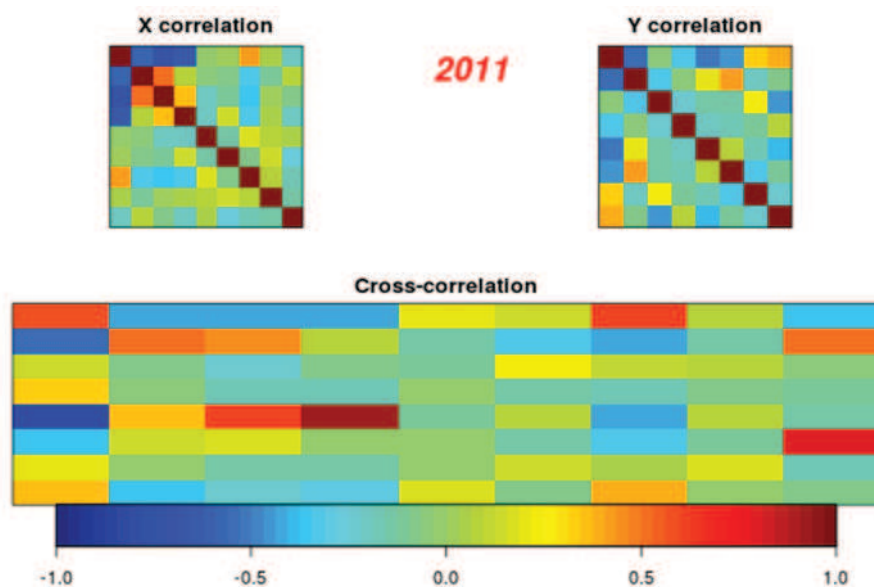
The canonical correlation analysis presented in Table 3

show that for the analysed dataset the dependence between asset and liabilities increases slightly after the financial crisis.

Table 3. Canonical correlation

	2005	2006	2007	2008	2009	2010	2011
1	0.95	0.946	0.95	0.966	0.964	0.976	0.979
2	0.76	0.75	0.79	0.80	0.75	0.78	0.92
3	0.60	0.72	0.67	0.63	0.66	0.68	0.62
4	0.58	0.52	0.65	0.52	0.55	0.54	0.49
5	0.45	0.40	0.44	0.44	0.50	0.46	0.34
6	0.27	0.32	0.31	0.26	0.39	0.40	0.19
7	0.15	0.21	0.20	0.23	0.23	0.15	0.08
Wiks test	0.0122*	0.011*	0.007*	0.007*	0.007*	0.004*	0.002*

Fig. 2. Correlation and cross-correlation of assets-liabilities



In Fig.2 we present the correlation and cross-correlation between asset-liabilities, it can be observed that exists a moderate and inverse correlation between Loans and: Loans and advances to Banks, Trading Securities, Derivatives and Deposits from Banks; and a strong and inverse correlation to Derivatives and Trading Liabilities. The level of deposits is correlated directly and moderately with the level of loans, also we observe that deposits are moderately and inverse correlated with the level of deposits from banks.

For analysed sample of 59 banks we find that Equity is weakly and directly correlated with: Loans, Fixed Assets, Customer Deposits; and weakly and inversely correlated with: Loans and advances to Banks, Trading Securities, Derivatives, Derivatives and Trading Liabilities and Hybrid Capital.

4. Conclusion

Due to the important role of the banks in the financial sector and their systemic importance it is imperious to understand the relation and the influence between banks assets and liabilities.

We observe that after 2009 there is a decline in the level of loans from 61% to 58% of total assets. The use of derivatives is affected in 2009-2010, but the pre-crisis level are exceeded in 2011; also for the analysed banks the proportion of fixed assets decline from over 1.2% in 2005 to under 0.9% in 2011, this may be due to the use of technology and automation on a larger scale, this trend is not influenced by the financial crises but by structural factors. Regarding the level of capital and equity it can be observed that there is an upward trend between 2008-2010 due to regulatory and market conditions. The level of customer deposits is over 40% for all the analysed period, with a change in dynamic after 2007 when the proportion of deposits has an upward trend.

This shows that the analysed banks adapted their strategies and manage to maintain their balance sheets at values similar with those before the crisis.

5. Annexe

Dataset			
Bank	ID	Bank	ID
Raiffeisen	RAI	Espirito Santo Financial Group	ESF
Erste Group Bank AG	EGB	OP-Pohjola Group	OP
Oesterreichische Volksbanken	OVV	BNP Paribas	BNP
Dexia	DEX	Crédit Agricole S.A.	CRA
KBC Bank NV	KBC	Société Générale	SC
Cyprus Popular Bank Public	CPB	Royal Bank of Scotland	RBS
Bank of Cyprus Group	BC	HSBC Holdings Plc	HSBC
Commerzbank AG	CB	Barclays Plc	BAR
Portigon AG	PT	Lloyds Banking Group Plc	LLO
Landesbank Berlin Holding	LB	Eurobank Ergasias SA	EBE
DekaBank Deutsche	DBD	National Bank of Greece SA	NBG
Danske Bank A/S	DB	Alpha Bank AE	AB
Jyske Bank A/S (Group)	JB	Allied Irish Banks plc	AIB
Sydbank A/S	SB	Bank of Ireland-Governor	BI
Nykredit Realkredit A/S	NR	Permanent TSB Plc	PER
Banco Santander SA	SAN	Intesa Sanpaolo	INT
Banco Bilbao	BIL	UniCredit SpA	UNI
Banco Popular Espanol SA	ESP	Banca Monte dei Paschi di Siena	BMP
Banco de Sabadell SA	BSA	Unione di Banche Italiane	UBI
Bankinter SA	BKI	ING Bank NV	ING
Rabobank Nederland	RBD	Nova Kreditna Banka Maribor d.d.	NKB
SNS Bank N.V.	SNS	Nordea Bank AB	NB
Caixa Geral de Depositos	CGD	Banco Pastor SA	PAS
Banco Comercial Millennium	MIL	Bilbao Bizkaia Kutxa, BBK	BBK
Unicaja - Montes de Piedad y Caja de Ahorros de Ronda	UNJ	Caja de Ahorros de Vitoria y Alava-Caja Vital	CVA
Caja de Ahorros y Monte de Piedad de Zaragoza, Aragon y Rioja-Ibercaja	CAI	Caja de Ahorros y Monte de Piedad de Gipuzkoa y San Sebastian-Kutxa	CMS
Banco BPI SA	BPI	Banca March SA	MAR
Skandinaviska Enskilda Banken AB	SEB	Caja de Ahorros y Monte de Piedad de Ontinyent	CMO
Svenska Handelsbanken	SHB	NLB dd-Nova Ljubljanska Banka	NLB
Swedbank AB	SWB		

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