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Assessment of banks asset and liability management: problems and perspectives (case of Lithuania)

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Abstract

Asset and liability management is one of the most important risk management measures at a bank. It is one of most important tool for decision making that sets out to maximize stakeholder value. Nevertheless it is important to track the external factors of the asset and liability management in the market to remain in the long term and to prepare for negative effects. Banking sector analysis could be the instrument to measure the sustainability of the country's financial sector. This paper showed Lithuanian banking sector asset and liability management activity and make assumptions of how sustainable the sector are during the different business cycle stages and how banks can manage their risks according to business cycles. The analysis revealed that banks tend to take more risk over time. The cycles of bank assets and liability are not identical to the cycles of business activity level, therefore it is seen that banks manage their assets and liability and attempt to influence their activity and profitability. The results indicate why the banks tend to enhance their risk levels before and during the financial crisis.

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Keywords: asset and liability management (ALM); banks; risk management; interest rate risk; balance sheet management.

1. Introduction

Asset and liability management is the one of major problem in banking. ALM plays a very important role bringing together the different activities of the bank. Appropriate liquidity and balance sheet management is a key factor in ensuring the bank's business and its continuity. More recently, even the major international financial

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institutions have been faced with serious liquidity problems and even took some outside help. This shows that the importance of APV was not evaluated or it was not properly executed. This has led to the financial market supervisory authorities around the world have taken action to ensure that financial institutions should have an effective ALM mechanism.

There are a lot of research analyzed ALM problems in different contest. Ventura Bravo & Pereira da Silva (2006), Gulpinar & Pachamanova (2013), Birge & Judice (2013), Kusy & Ziemba (1986) analyzed different ALM techniques. Some researches (Tektas, Nur Ozkan-Gunay, & Gunay, 2005; Das, Lu, Papaioannou & Petrova, 2012) examine the ALM during financial crisis. The authors (Claessens & van Horen, 2012) analyzed which banks – foreigner or domestic – perform better depending on ALM. There are several scientific studies (Romanyuk, 2010; Amenc, Martellini, & Ziemann, 2007; Mitra & Schwaiger, 2011; Zenios & Ziemba, 2006; Brick, 2012; Henroid, 2007) analysed some background information about ALM techniques, banking portfolio management according risk and asset allocation.

Therefore relevance and importance of the problem being investigated enables to developed research in this area. *The aim of this paper* is to analyze Lithuanian banking sector ALM activity and make assumptions of how sustainable the sector was during the different business cycle stages and how banks can manage their risks according to business cycles.

The article consists of five sections. The second section presents the literature review highlighting the principal role of ALM. Third section provides a brief methodological research techniques background and its application. Results of the study are presented in section four, and section five concludes the paper.

Nomenclature

ALM Asset and liability management

2. Literature review

ALM is a generic term that is used to refer to a number of things by different market participants. The principal objective of the ALM function is to manage interest-rate risk and liquidity risk. It also sets overall policy for credit risk and credit risk management, although tactical-level credit policy is set at a lower level within credit committees. Although the basic tenets of ALM would seem to apply more to commercial banking, rather than investment banking, in reality it is important that it is applied to both functions. A trading desk still deals in assets and liabilities, and these must be managed for interest rate risk and liquidity risk. In a properly integrated banking function, the ALM desk will have a remit covering all aspects of a bank's operations.

ALM deals with the optimal investment of assets in view of meeting current goals and future liabilities. Choudhry (2007) said, that the definitions of assets, liabilities, and risks are specific to each institution, but, very generally, assets may be viewed as expected cash flows, and liabilities as expected cash outflows. Although short-term risks arising from the possibility that an institution's assets will not cover its short-term obligations are important to assess and quantify, ALM is usually conducted from a long-term perspective. As such, ALM is considered a strategic discipline as opposed to a tactical one.

Mitra & Schwaiger (2011) explain, that ALM is a financial (analytic) tool for decision making that sets out to maximize stakeholder value. Its overall objective is to make judicious investments that increase the value of capital, match liabilities and protect from disastrous financial events. An integrated asset and liability management model sets out to find the optimal investment strategy by considering assets and liabilities simultaneously. Simply stated, the purpose of such an approach is to reduce risk and increase returns.

ALM is a future oriented process involving simultaneous asset and liability management to measure, monitor and control the impact of changing interest rates on the bank's earnings, asset value, liquidity and capital requirements (Brick, 2012).

Summarize, the ALM is simply combines several bank portfolios - asset, liabilities, and the difference between the banks received and interest paid – management processes into a single coordinated process. In other words, the

main feature of the ALM is coordinated and not broken the total bank's balance sheet management. ALM as a planning tool has evolved from the need to ensure the asset and liability time overlap for different time periods. Nowadays this process is much more complex, overlapping terms to ensure interest rate management using both static and dynamic simulations.

The main ALM purpose is to connect different bank activities into a single unit, facilitating liquidity and balance sheet management, which is crucial for ensuring the normal operation of the bank, service delivery and consistent and profitable growth of the bank. ALM provides timely identification potential problems and risks of operating in the bank's balance sheet and income. The most common problem occurs when the bank's liability costs are rising faster than revenues from the asset, or when falling interest rates asset income is declining faster than the liability side.

Birge & Judice (2013) research results enable simulation of bank balance sheets over time given a bank's lending strategy and provides a basis for an optimization model to determine bank ALM strategy endogenously.

The main ALM functions are interest risk, the structural differences between asset and liability and simultaneous liquidity management. Structural imbalances in the balance management are one of the main functions of ALM This can be grounded on the fact that liquidity management is mainly focused on the short term, while ALM increasingly the focus of attention for a long period of time in an effort to balance asset and liability terms with the cash-flow on both sides of the balance sheet.

The structural differences during ALM process are examined in several limits. The first is a static noncompliance evaluation, which consists of asset and liability division into groups according to the period and analysis of those groups reporting on funding shortages and surpluses during periods. Such an assessment must be carried out regularly according all the time changing the structure of bank balance. This feature is important to evaluate the individual and the group's sensitivity to interest rate changes. Dynamic assessment of non-compliance is invoked when needed to assess possible ALM invoked hedging instruments, such as swaps the effect of discrepancies.

More attention should give on ALM process management the interest rate sensitivity. There are some of the key interest rate sensitivity assessment and management techniques. The first, the sensitivity of non-compliance reports indicating the breakdown of cash flows over time should be taken with respect to the sensitivity of the asset and liability interest and revaluation options. DV01 or PVBP (Price Value of a Basis Point) ratio is used to evaluate how much change in the market value of the interest rate change of one basis point (0.01%). Banks managing interest rate risk on its balance sheet often sets the visible range. Another measure is net interest income (NII) sensitivity changes to interest rates (Asset and..., 2009; Practices and..., 2011).

Liquidity management feature is not limited to the management of liquidity gaps. Comprehensive ALM process involves the determination of policy and liquidity, contingency resolution plans and liquid asset holding, ensuring liquidity risk in the desired level.

3. Data and empirical methodology

ALM will be analysed by using relative index and time series components (Asteriou, 2006). According to the data availability, the correctness and comparability of the data throughout the period, the analysis include ALM risk related indicators research and the hypothesis testing to investigate the most important phenomenas (Table 1).

The analysis of the Lithuanian banking sector time series of assets and liabilities and hypotesis testing will enable to draw conclusions about the stability of financial markets, the risks and behavior changing during various phases of the economic cycle.

The seasonality of the time series is excluded using X12-ARIMA analysis tool pack. These methods are used in USA statistical agencies and are widely acceptable as a proper instrument to smooth the named data. The cyclicality is excluded using Hodric-Prescot filter. This instrument enable so extract the cyclical component of time series. The only drawback of the used method is that the marginal values of the time series can not be analysed and evaluated. The trend component is not analysed because the financial crisis of 2008 determined the change in the lont term trend and the assumptions is not valuable.

The selection of the indicators (Table 1) was based on the data availability, comparability and based on other scientific research (Lakštutienė, 2008; Levine, 2000). It can be stated that all the indicators are quite generic and can

be criticized, but it is found that they are often used in scientific articles and can adequately describe the processes

Table 1. Indicators and hypothesis

under investigation.

Indicator	Hypothesis			
Lavanage agaity and lightliting patie	H1: Seasonality affects the leverage (Fik ≠SFik);			
Leverage - equity and hadmines ratio	H2: Cyclicality affects the leverage (CFik \neq 0).			
The share of large in total areats	H3: Seasonality affects the loan component of bank total assets (FGik #SFGik);			
The share of loans in total assets	H4: Cyclicality affects the loan component of bank total assets (CFGik \neq 0).			
The shows of deposits in total assets	H5: Seasonality affects the share of deposits in total assets (FGik ≠SFGik);			
The share of deposits in total assets	H6: Cyclicality affects the share of deposits in total assets (CFGik \neq 0).			
CDD	H7: Cyclicality affects GDP (Zik ≠SZik);			
GDP	H8: Cyclicality affects GDP (CZik ≠0).			
	H9: There is a close link between the share of loans in total assets, the share of deposits in total assets, leverage and GDP ($R2>0,5$).			

The first two indicators reflects the risk level which the Lithuanian financial sector tend to take as it involves the major asset and liability items – loans and deposits and the better risk level reflected relative values nor absolute values. This is due to the fact that it is clear what part of the total financial sector assets are funded by deposits and how the financial resources are allocated.

There was an intention to include more well-known relative indicators such as provisioning, money and liquid balance sheets part of total assets, but the net amount of money and other analysis articles were excluded on the basis of correlation analysis (see Table 2). Provisions analysis is not possible because the changes in assessment metodology was made in 2008 and these indicators can not be compared over time and required data calculation can not be processed.

Leverage is the last financial sector indicator under use. It was chosen because it is related to the amount of equity the Lithuanian banks possess. Bank's equity is one of the most important indicators as almost all of the risk management requirements are related to this balance sheet. Thus, leverage is one of the key values which shows the proportion of the bank 's assets owned by shareholders.

GDP has been selected as one of the key indicators that describe the country's economic activity dynamics. This indicator is widely used in researches as the market activity level indicator. According to the authors, this is the most appropriate indicator to determine economic cycles, and this fact was approved after the cyclical component was extracted, and compared it with the actual economic fluctuations according to the other analysis (Kuodis, 2008).

The hypotesis are tested to identify weather the time series are effected by these processes and to distinguish the random component of these indicators to investigate the cyclical component dependence between the analysed data. Cyclical component analysis was selected due to the fact that the authors sought to determine the banks' risk management features in different stages of the economic cycle.

The analysis includes correlation coefficient assessment and Granger causality determination as it is the simplest and easily understood method to evaluate the relationship cohesion and to make right assumptions what is the cause of analyzed indicators.

The data is taken from non-consolidated Lithuanian commercial banks and foreign bank branches balance sheets, which are announced by the Bank of Lithuania. The analysis covers the period since the fourth quarter of 2000 to the second quarter of 2013 which is sufficient to investigate the effects.

4. Empirical results

4.1. Lithuanian commercial banks and branches of foreign banks ALM during 2000–2013

The period from 2000 to 2013 includes various phases of the economic cycle, which reflects both the internal and the external shock effects. Before a deeper econometric analysis, it is appropriate to review the basic ALM performance changes over the time (Fig. 1).



Fig. 1. Lithuanian banks main asset and liability indicators during 2000–2013 (primary axis: loans, deposits, total liabilities, total assests; secondary axis: cash and money in central bank, tangible and intangible assets, total equity) (Source: compiled by the authors based on Lietuvos komerciniu..., 2000–2013)

During the analyzed period the changes in Lithuanian bank's deposits, loans and other main accounts were similar (Fig. 1). The similarity can be linked to the factor that the loan portfolio is financed by deposits. This suggests that ALM policy tends to assume an increasingly greater risk for increasing profits. It is clear that such a process leads to an increase in the occurrence of moral hazard.

The purpose of the correlation matrix is to demonstrate the similarity between different balance sheet dynamics in Lithuanian banks and to approve or deny the selection of the main relative indicators which will be used in more detailed analysis. According to the relationship analysis, it is found that all the examined variables, except the tangible and intangible assets, has a close and direct relationship (Table 2). If a correlation coefficient values are greater than 0.8 it is believed that the relationship between the analyzed indicators is very strong. It is important to note that the relationship between loans and deposits is close to 1, thus this means that these indicators were moving identically during the analyzed period.

Cash and money in central bank are related less than other indicators. It is obvious that Lithuanian banks do not tend to keep a large part of their assets in the most liquid form, because it is the least profitable investment (Fig. 1). The named indicator is related to a compulsory risk management requirement – mandatory reserve rate. In November of 2008 and January of 2013 the Bank of Lithuania lowered the required reserves rate as a result the cash and money kept in central banks dropped (Fig. 1) (The Bank..., 2013).

According to the correlation analysis it can be stated that assets, liabilities, loans and deposits fluctuate very similarly and this approve the result which were made during the graphical analysis. The combination of two investigated instruments can be regarded as a reasonable measure to make assumptions that financial resources are mainly accumulated from deposits, or loans and principally are used to finance the loan portfolio (Asteriou, 2006; Lietuvos komercinių..., 2000–2013).

	Cash and money in central bank	Loans	Deposits	Tangible and intangible assets	Total liabilities	Total equity	Total assets
Cash and money in central bank	1						
Loans	0.8488	1					
Deposits	0.8500	0.9954					
Tangible and intangible assets	-0.1980	-0.0204	-0.0593	1			
Total liabilities	0.8609	0.9925	0.9990	-0.0788	1		
Total equity	0.8957	0.9557	0.9525	-0.1713	0.9579	1	
Total assets	0.8660	0.9927	0.9985	-0.0859	0.9998	0.9638	1

Table 2. Correlation coefficients of main ALM indicators in Lithuanian banks (Source: compiled by the authors based on Lietuvos komerciniu..., 2000–2013)

Nonetheless it is seen that equity fluctuation is almost parallel to the total assets (not as much as loans and deposits) and this can be regarded as the result of Lithuania Bank's prudential requirements to commercial banks (The Bank of..., 2013). Capital adequacy ratio specifies the ratio of eligible bank capital and risk-weighted assets and off-balance sheet liabilities may not be lower than 8 per cent and this is the most important prudential requirement for the stated relationship.

On the basis of the correlation and graphical research are approved that the further analysis will include loans, deposits, and equity and total assets items. The following analysis includes the relative indicators which were chosen earlier.

There are two most important dates during the period of 2000–2013. The first date represents the second quarter of 2008 when deposits, loans and total assets of Lithuanian banks changed from the rising long term trend to the declining trend. As it is known, at the time the world was shocked by the global financial crisis, which also affected Lithuanian economy. The decrease in loans was a result of deposit reduction due to a population distrust of the financial sector and the policy of the foreign parent banks. The changes in a deposit trend were also caused by the negative effects from the foreign market and the fears of exchange rate devaluation, which had appeared several times in the press. Even though monetary policies should remain very accommodative until the recovery is well established and policymakers need to exercise vigilant supervision to assess the existence of potential and emerging financial stability threats, the risk level have not been changed heavily as the loans and deposits remained at a similar scale.



Fig. 2. The Provisioning level in Lithuanian banks (Source: compiled by the authors based on Lietuvos komerciniu..., 2000–2013)

The second date is the last quarter of 2011 the sharp and short lasting increase in cash was caused by the bankruptcy of the Bank of Snoras (Vasiliauskas, 2012). However, after the "safe" period had ended Lithuanian

banks came back to the previous policy and priorities. Such action may be regarded as a classic manifestation of ALM policy. A drop in deposits and loans is also apparent during this period, which was caused by the fear of society and distrust of financial sector stability. The same but less obvious phenomenon occurred at the end of 2012 when the activity of Ūkio bank was suspended and the need of liquidity enhanced (The Bank..., 2013).

During these two internal shocks the amount of deposits fall off which show that Lithuanian people are very sensitive to the shocks like these and that banks in Lithuania should be prepared for depositors panic if a similar problems occur in the future. Despite this fact the phenomenon of moral hazard is still noticeable.

The risk level increase can also be apparent in findings of provisioning (Fig. 2).

The procedure of calculating the provisions was changed in the early 2008, thus a certain research or a comparison within a time frame of this phenomena is not available. Some assumptions can be made. As it is seen, up until the first quarter of 2008 the amount of provisions was on a rise, thus this can be linked with a possibility to falsely decrease bank's taxable profits as well as the number growth of loans. After the start of 2008 the provisions were on a rise up until the mid-2010, but latter a growth decreased, this could have been affected by both: the policy of the central bank or a more conservative way of loan distribution and due to that the improved quality of the loan portfolio.



Fig. 3. The share of deposit and loans in total assets, leverage and GDP variation without seasonality (primary axis: the share of loans in total assests, the share of deposits in total assests, leverage; secondary axis: GDP) (Source: compiled by the authors based on Lietuvos komerciniu..., 2000–2013)

Operational risk enhancement is reflected by the growth of the proportion of deposits and loans in total Lithuanian bank's assets (Fig. 3). From the fourth quarter of 2000 to the fourth quarter of 2007 the named indexes almost levelled off. This suggests that the Lithuanian banks were more inclined to take more risks in their business. During the economic growth the increasing demand for loans to both households and business urged banks to take advantage of this opportunity and thereby increase their profitability and risk. The higher income increases, the more the Lithuanian banks were interested to take full advantage of the opportunities. The above phenomenon indicates that banks are profit-driven, rather than the stability enhancing. For this reason, it is observed as a relatively strong manifestation of moral hazard in the Lithuanian financial sector.

Before the last quarter of 2008 the leverage ratio and GDP had had an inverse relationship which can also indicate risk enhancement over the time. After the financial crisis stroke, the Lithuanian bank started to adapt more conservative policy; this is the reason why leverage and GDP variation became identical since then. Furthermore, there are indications that during and after the recession banks usually take conservative ALM policies because of increased comparative equity in total assets. According to the share of loans and deposits in total assets the conclusion might be similar but not the same. It can be seen that the risk ratio of these indicators are at the same level during the period since the named date. This is the result of stricter control of the banking sector after the financial crisis. The Bank of Lithuania had adopted tighter rules to the financial sector (The Bank..., 2013)

It is clear that the financial sector have suffered exceptional losses during the crisis because they had to cover their obligations to depositors as withdrawal of deposits increased at that time. Moreover a scale of nonperforming loans in the Lithuanian bank portfolio increased and had a negative impact on the banks performance.

From a theoretical ALM hand, if the banks tend to take more risk over time, it is essential to require comprehensive reconciliation of short-term assets with short-term liabilities, and long-term assets with long-term liabilities. Since the particularity of Lithuanian bank's balance sheets had changed in 2008 more detailed analysis is not possible, and the findings can be quite limited.

Finally, the results of the analysis allowed identifying the key indicators which affect ALM. Following indicators will be used to determine the relationship between the ALM and the country's economy in the next subsection of the article.

4.2. The analysis of relationship between ALM and the economic condition

In the previous section it was seen that there are certain trends in ALM in Lithuania. Now it is important to investigate whether the indicators and derived ratios are affected by the seasonal, cyclical, trend and random components and whether there is a connection between these factors and the country's GDP.

Using econometric and other evidence, this chapter finds that the analyzed indicators are affected by seasonality and cyclicality (Appendix A). This leads to the conclusion that the ALM policy faces the problem of taking these factors in to account. Thus, the ALM process must run continuously without interruption, and to respond not only to the credit supply and demand trends, but also to adapt to the certain cycles.

In this case the GDP reflects the country's economic cycle (Snieška, 2005). It is seen that the share of loans in total assets ratio is more sensitive to the economic cycles than the deposit. It is obvious that a large scale of loan portfolio consists of loans to businesses that are particularly dependent on the changes of economic condition and the income of households depends on the business performance also. Deposits show a much lower sensitivity to the GDP cyclical component, because this phenomenon is much more stable and depend on the expectations, interest rates and similar factors. If the central bank maintains confidence in financial sector stability, the depositors do not withdraw their deposits even if the business cycle crisis occurs.

Granger causality test was used to find out the right determinants of financial sector and economic indicators (Table 3).

No. of Granger causality test	$Cause \rightarrow result$	F statistic value
1.	The_share_of_loans \rightarrow GDP	F(2.44) = 0.013692
2.	$GDP \rightarrow The_share_of_loans$	F(2.44) = 5.5781
3.	The_share_of_deposits \rightarrow GDP	F(2.44) = 0.52382
4.	$GDP \rightarrow The_share_of_deposits$	F(2.44) = 2.4486
5.	Leverage \rightarrow GDP	F(2.44) = 0.30730
6.	$GDP \rightarrow Leverage$	F(2.44) = 1.1464

-1 able J . Oranger causanty test results (Source, combined by the autions based on Asteriou, 2000). Eletuyos komerciniu, $2000-20$	v the authors based on Asteriou, 2006: Lietuvos komerciniu, 2000–2013)	(Source: compiled by	v test results	Granger causalit	Table 3.
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The vector auto regression analysis known as Granger causality shows that the changes in loans and deposits share in total assets are determined by the changes in GDP. This method enables to ascertain that Lithuanian financial sector conform their ALM policy according the policy developments or anticipated changes.

In 2004 a notable increase of lending share in banking assets can be caused by the accession to the European Union and improved expectations. Since then Lithuanian market had not been fully recovered from Russian financial crisis, and suffered from political cycles and budgetary problems. Only in 2004 expectations have improved and the economy began to grow. According to the authors, the fact that the share of deposit and loan in total assets cycles moves differently to economic cycles, can be explained as result of the ALM, since the absolute values are closely linked to the country's GDP change. The same findings emerged after correlation analysis (Appendix B). It is difficult to explore these facts in detail since the accessibility of the necessary data is limited.

The cycles of deposit and loans in total assets, leverage and GDP can be analysed simultaneously (Fig. 4).



Fig. 4. The cyclical component of the share of deposit and loans in total assets, leverage and GDP (primary axis: the share of loans in total assets, the share of deposits in total assets, leverage; secondary axis: GDP) (Source: compiled by the authors based on Eurostat, 2013; Lietuvos komercinių..., 2000–2013)

The second reason of the increase of the lending share in banking assets is the European Union projects support funds which partially finance the projects of different areas. This enhances the demand of business loans also.

The cycle components denotes similar variation to the business cycle which means that operating performance depend on these factors. In the previous chapter it was analyzed the period when the financial crisis stroke. Here we can verify the same findings.

All things considered there is a high level of risk adapted in Lithuanian banking sector which cause high volatility of asset and liability related indicators. The banks which have less capital and market share should take additional measures to protect their operating efficiency during the business cycle and should take in to account all the risks involved.

The analysis helped to identify the cycles of analyzed data and determine the causality relationships between these processes. Even though the scientific literature it is known that the supply of credit is one of main determinants of the economic activities. The performed analysis helped to determine that in view to the risks between credit supply and economic activity exists a causal relationship is reversed.

4. Conclusion

The analysis of balance sheet items changes of commercial banks and foreign banks branches in Lithuania revealed that during the economic upturn financial sector tended to take more risk in ALM. During the economic shocks can be visible different variation. The moral hazard is apparent in Lithuanian financial sector as the most risky balance sheet items change in risk-free manner only after the Bank of Lithuania deploys conservative measures.

Lithuanian financial sector is sensitive to the other bank problems as the size of this sector is quite small and the society is sensitive to the negative news and events.

Empirical study showed that there is extremely close relationship among the assets and liabilities of commercial banks and foreign bank branches in Lithuania and GDP, although the relationship between the cyclical components are moderate. The Granger causality test showed that the ALM policy volatility is caused by the variations or expectations of variation in the economic cycle in Lithuania.

The ALM analysis showed that there are differences in relationship between the primary data and time series cyclical component of the same data. This can be equated as ALM effect. Despite the fact that there is some evidence that ALM policy tend to resist the economic cycle, there is evident that the risk had enhanced before the financial crisis in 2008 and since then it diminished moderately. This can be determined as the lesson learnt during the recession as risk enhancement caused a lot of damage to different commercial banks of Lithuania. As the banking sector in Lithuania is pro-cyclical, the banks should plan and forecast the different scenarios of their operational effectiveness as the higher risks involved might cause the higher losses.



Appendix A. The analyzed phenomenon cycle component in 2000-2013

Appendix B. The correlation matrix of analyzed indicators and cycle component

Cycle components	GDP	The share of loans in total assets	The share of deposits in total assets	Leverage	The absolute values without seasonality	GDP	The share of loans in total assets	The share of deposits in total assets	Leverage
GDP	1				GDP	1			
The share of loans in total assets	0.291826	1			The share of loans in total assets	0.918456	1		
The share of deposits in total assets	-0.22324	0.367927	1		The share of deposits in total assets	0.726639	0.867063	1	
Leverage	0.315267	-0.03934	-0.08022	1	Leverage	-0.63577	-0.76413	-0.73233	1

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