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What drives the liquidity position of foreign-owned banks? The case of Poland

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Abstract

The study investigates the drivers of the liquidity position of foreign-owned banks based on a sample of Polish commercial banks during the years 2004-2014. The main aim of this research is to identify the factors influencing the changes in the liquidity position of foreign-owned banks, with a special interest in the bank-specific factors of their parents as well as the macroeconomic conditions and market characteristics of the home countries. Bank-specific factors and the macroeconomic conditions and market characteristics of the host country have also been taken into account. The study reveals that the liquidity position of foreign-owned banks was mostly driven by changes in the profitability of households' loans in the host country, the expected cash flows of the banks, the credit supply of the banks and the capital adequacy of the parent banks. In addition, the results of the pooled ordinary least square regressions indicate that the changes in the liquidity position of the foreign-owned banks were partly driven by the changes in private sector indebtedness in the host country, the relative importance of these banks within the groups' structures and the profitability of the parent banks (these findings are relevant for the dependent variable, which is defined as liquid assets that are inclusive of interbank loans relative to the total assets), and the changes in the credit quality of the banks, as well as the credit quality of the home countries' banking sectors (these findings are relevant for the

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dependent variable, which is defined as liquid assets that are exclusive of interbank loans relative to the total assets). The link with the changes in the macroeconomic conditions and market characteristics of the home countries proved to be the weakest among the examined factors.

JEL classification numbers: C23; G21; G32
Keywords: liquidity risk, banking risk, liquidity position determinants, panel data.

1 Introduction

In the course of the privatization process and the subsequent consolidation processes, which started in the early nineties, Poland has become a host to many foreign-owned banks. Since then, there has been a long debate on the pros and cons of the Polish banking sector ownership structure.
Privatization has created a more open and competitive environment for banks, which required the introduction of modern methods of risk management and greater transparency. In the absence of domestic private capital, foreign investors often served as the sole entities that were capable of becoming strategic investors and, as such, were able to effectively control and financially support banks and transfer knowledge and technologies [1]. Notwithstanding the benefits of allowing foreign investors to acquire a significant share of the Polish banking sector, significant risks arise from such an ownership structure. Kawalec & Gozdek pointed to an increased dependence of foreign-owned banks on the financial standing of the entire banking groups to which they belong, as well as on the economic conditions in the home countries and an associated risk of contagion [2]. The recent financial crisis of 2007-2009 proved that Polish commercial banks could not avoid becoming affected by the worsening conditions of the European Union economies as well as the financial standing of their foreign parents. Indeed, certain acquisitions and mergers of parent banks, forced by their deteriorating situation or required by the European Commission to aid them with public funds, necessitated deleveraging through the sales of the Polish subsidiaries [3]. The Polish banks, however, did not require deleveraging, nor did they require any type of public financial support [4]. Kawalec & Gozdek also highlighted the potential risk of making political decisions abroad, which could influence the financing of strategic sectors of the Polish economy [2]. Moreover, the authors suggested that the principle of maximum harmonization, which is already present in the European Union regulatory framework, may prevent the supervisory authorities from taking effective supervisory measures. This might be actually the case if the foreign-owned banks were exempted from meeting the liquidity requirements envisaged under part six of 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 [5] on a solo basis.This is, however, a subject for a different study.
The aim of this study is to assess the drivers of the liquidity position of the foreign-owned banks established in Poland. The analysis is based on a sample of both foreign-owned and domestic banks and covers the period of 2004-2014.
This study hypothesizes the following:
H1: The changes in the liquidity position of banks can be influenced by changes in bank-specific factors.
H2: The changes in the liquidity position of banks can be influenced by changes in macroeconomic and market conditions of the host country.
H3: The changes in the liquidity position of the foreign-owned banks can be influenced by changes in the bank-specific factors of their parents.
H4: The changes in the liquidity position of the foreign-owned banks can be influenced by changes in the macroeconomic and market characteristics of the home countries.
This paper is structured as follows. First, an overview of the related literature is provided. Second, the data and sample selection are described. Third, an empirical specification and description of the results of the ordinary least square regression are presented. Last, the main findings from the research are discussed.

2 Literature review

It is crucial for banks to ensure that they maintain a buffer of high-quality liquid assets on an ongoing basis to satisfy any liquidity needs arising from maturity mismatches that are inherent to banks as well as to safeguard themselves from liquidity shocks in times of stress. There is vast literature concerning the determinants of the liquidity position of banks. Many authors modelled the liquidity position of banks through ratios calculated based on the concept of liquid assets [6]-[16]. Others have modelled the liquidity gaps [17], the ratio of loans to deposits [18] or the supervisory liquidity ratios' approximations [19]. In addition, Vodová conducted a wide range of research concerning the liquidity determinants of commercial banks in different Visegrad countries [20]-[27].
The uniqueness of this study stems from the fact that it does not examine the determinants of the liquidity position of banks as such. Instead, it seeks to answer the question of how liquidity dynamics shift with changing economic and market conditions and banks' idiosyncratic risk factors. Additionally, the study focuses on the liquidity management behaviour of the foreign-owned banks, which is of particular importance for host countries such as Poland.

3 Data and sample description

As presented in Table 1, the sample covers Polish commercial banks for the years 2004-2014, including both foreign-owned and domestic banks. The average coverage of the banking sector assets was approximately 85% throughout the examined period.

Table1: Sample description for the years 2004-2014

2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Average**
Percentage coverage of the banking sector assets											
82%	83%	87%	86%	88%	87%	85%	83%	84%	85%	87%	**85%**
Number of banks examined											
17	18	19	19	19	19	19	19	19	18	17	**18**
of which are foreign-owned banks											
13	13	14	14	14	14	14	14	14	13	12	**13**

Source: own work.

Foreign-owned banks are considered those whose majority of shares (more than 50%) is owned by foreign investors. Such an approach for determining whether banks are foreign-owned is common in the existing literature [28]. Detailed information about the ownership status, the names of the parent companies and the countries of origin (which were determined mainly by the headquarters' location) is presented in Table 2.

Table 2: Ownership structure of the banks examined

Bank name	**Status (foreign-owned vs. domestic)**	**Parent name (if foreign-owned)**	**Country of origin**
1. Bank BPH SA[1]	foreign-owned	HypoVereinsbank Group (from 2004 – 2005) / UniCredit Group (from 2006 – 2007) / General Electric Company (from 2008 – 2014)	Germany / Italy / USA
2. Bank Gospodarki Zywnosciowej SA[2]	domestic / foreign-owned	government (in 2004) / Rabobank Group	Ireland
3. Bank Handlowy w	foreign-	Citigroup, Inc.	USA

Warszawie SA	owned		
4. Bank Millennium SA	foreign-owned	Banco Comercial Portugues Group	Portugal
5. Bank Ochrony Srodowiska SA	domestic	-	Poland
6. Bank Polska Kasa Opieki SA	foreign-owned	UniCredit Group	Italy
7. Bank Zachodni WBK SA	foreign-owned	Allied Irish Bank Group (from 2004 – 2010) / SantanderGroup (from 2011)	Ireland / Spain
8. BNP Paribas Bank Polska SA	foreign-owned	Fortis Group (from 2004 – 2007) / BNP Paribas Group (from 2008)	Belgium / France
9. Deutsche Bank Polska SA[3]	foreign-owned	Deutsche Bank Group	Germany
10. Getin Holding SA	domestic	-	Poland
11. ING Bank Śląski SA	foreign-owned	ING Groep N.V.	Netherlands
12. Kredyt Bank SA (until 2013) [4]	foreign-owned	KBC Group NV	Belgium
13. mBank SA (formerly known as BRE Bank)	foreign-owned	Commerzbank Group	Germany
14. Nordea Bank Polska SA	foreign-owned	Nordea Group	Sweden
15. Powszechna Kasa Oszczędności Bank Polski SA	domestic	-	Poland
16. Raiffeisen Polbank SA (formerly known as Raiffeisen Bank Polska SA)	foreign-owned	Raiffeisen Zentralbank Group	Austria
17. Bank Pocztowy	domestic	-	Poland
18. Crédit Agricole Bank Polska SA (formerly known as LUKAS Bank SA)	foreign-owned	Crédit Agricole Group	France
19. PLUS Bank SA (formerly known as Invest-Bank SA)	domestic	-	Poland

[1] In November 2005, HypoVereinsbank was taken over by UniCredit Group. General Electric Group acquired a majority share in BPH bank in June 2008.

[2] Bank Gospodarki Zywnosciowej was a government-owned bank until late 2004, when Rabobank Group and European Bank for Reconstruction and Development acquired approximately 14% and 15% shares each, respectively. Rabobank Group owned 35% of shares in 2005. It became a single controlling investor in 2008, however it is assumed in this study that Rabobank has already been in control of Bank Gospodarki Zywnosciowej since 2005.
[3] Deutsche Bank Polska and Deutsche Bank PBC formally merged in 2014, however, financial data for these two banks was merged for the years 2004-2014, taking into account the fact that they were owned by a single investor (Deutsche Group) throughout the whole period examined.
[4] In 2013, Bank Zachodni WBK took over Kredyt Bank.
Source: own work.

Data on individual bank characteristics were taken from the banks' financial statements, whereas data on macroeconomic factors and market characteristics were drawn from publicly available resources. The data panel is unbalanced.

4 Variables selection

4.1 Dependent variable

The dependent variable indicating the liquidity position of banks has been defined as the ratio of liquid assets to the total assets (also called *the liquidity buffer* in this study).The liquid assets include cash and balances with central banks, loans to banks (assuming that these exposures have been mostly short-term since the financial crisis of 2008), trading securities (debt and equity securities only, without derivatives) and securities available for sale. The approach is consistent with the studies conducted by Koch & MacDonald [29],Cerutti, Hale &Minoiu [30], Yan, Hall & Turner [31], Vodová [25], and Brei, Gambacorta & von Peter [32], although it does not allow for consideration of the regulatory requirements envisaged under the Commission Delegated Regulation (EU) 2015/61 of 10 October 2014 *to supplement Regulation (EU) No 575/2013 of the European Parliament and the Council with regard to liquidity coverage requirement for credit institutions* [33], which stipulates the conditions for recognizing assets as liquid. The delegated regulation (EU) 2015/61 is fairly new; therefore, it would not even be possible to gather data for the years preceding its introduction. Consequently, the liquid assets are defined in a simplified way in this study, which is commonly acknowledged in worldwide scientific research.
The financial crisis of 2008 showed an increased counterparty risk, which led to the reduction of interbank funding. Banks responded to the prevailing uncertainty by shortening maturities of bilateral exposures and setting lower limits. Hence, it is arguable that loans to other banks should be deducted from the liquidity buffer. It is, therefore, possible to define the dependent variable in two ways — inclusive or exclusive of the presumably short-term interbank loans. The panel plots reflecting group means of the dependent variables are presented in Figure 1.

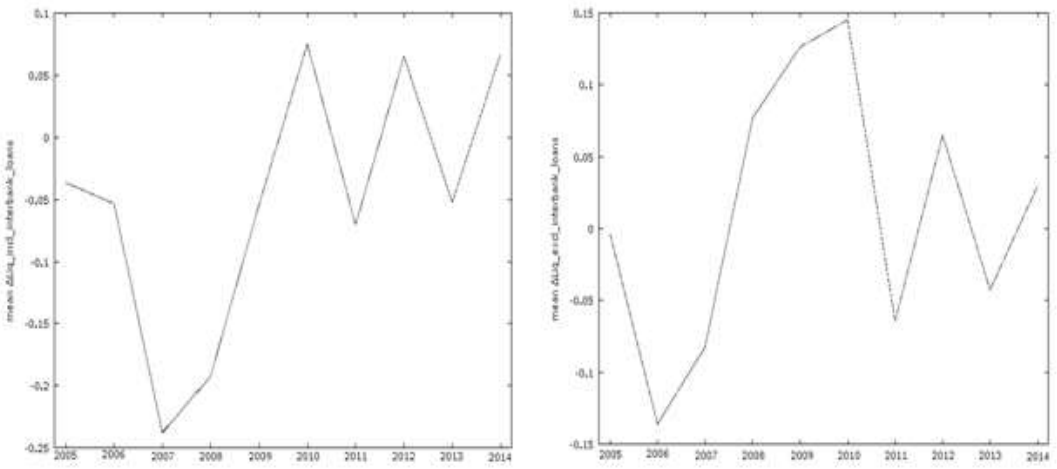

Figure 1: Means of the dependent variable inclusive (on the left) and exclusive (on the right) of the interbank loans

From the Figure 1. it can be observed that the tendencies for change between the two dependent variables were similar over the examined years. It can be confirmed that banks, on average, began significantly decreasing their liquidity buffers in 2006, whereas in 2007, the negative rate of change was particularly pronounced in the case of interbank loans. The highest growth rate of the liquidity buffers took place in 2010, regardless of whether the liquidity buffers included interbank exposures. The rate of change of the liquidity buffers for the years 2011-2014 varied from one year to another.

4.2 Independent variables

The set of independent variables examined in this study is defined in Table 3. Only explanatory variables that indicated a linear correlation with the dependent variable (>0.3) were taken into consideration. The independent variables were grouped into four categories: the bank-specific factors, the macroeconomic conditions and market characteristics of the host country, the parent bank-specific factors, and the macroeconomic conditions and market characteristics of the home countries.

To evaluate the extent to which the relative importance of foreign-owned banks within their foreign parent groups influences the liquidity management of foreign-owned banks, two measures have been proposed: the share of the subsidiary to the parent's own funds and the share of the subsidiary to the parent's total deposits. These measures have been interacted with the dummy variable *foreign*, which takes a value of 1 if a bank is foreign-owned.

To explore the role of the parent banks and the market or economic characteristics of the home countries in the liquidity management of foreign-owned banks, the independent variables reflecting the parent bank-specific factors, the

macroeconomic conditions and market characteristics of the home countries have also been interacted with the dummy variable *foreign*.
To account for the bank mergers and acquisitions, the dummy variable *mergers* has been proposed, which turned out to be insignificant in both regression models presented further in this study.

Table 3: Independent variables

Concept	Measurement	Symbol
I. Bank-specific factors		
Credit quality	loan loss reserves/gross customer loans	CredQual_v1
Credit quality	impaired loans/total gross loans	CredQual_v2
Capital adequacy	tier I/(capital adequacy*12,5)	CapAdeq
Cost of funding	interest expense/liabilities from customers	CostFund
Cash flow mismatches	inflows contractually due within 3 months/outflows contractually due within 3 months	CashFlow
Stability of funding	(customer term deposits + bank own bonds)/gross customer loans	StabFund
Credit supply	gross households' loans/total households' deposits	CredSuppl
Intragroup funding	intragroup liabilities/total financial liabilities	IntragroupFund_v1
Intragroup funding	(liabilities to group affiliates (excluding subsidiaries) + contingent liabilities received from parent entity and other group members)/total assets	IntragroupFund_v2
Relative importance within the banking group	own funds of foreign-owned bank/own funds of the parent bank	GroupImp_v1
Relative importance within the banking group	total deposits of foreign-owned bank/total deposits of the parent bank	GroupImp_v2
II. Macroeconomic conditions and market characteristics (host country)		
Credit quality	bank non-performing loans to the total gross loans (%)	CredQual_host
Profitability	households' interest rates for outstanding loans	Profit_host
Private sector indebtedness	private sector debt (% of disposable income)	PrivSectorIndebt_host

Economic development	GDP per capita	EconDev_host
Risk premium	WIBOR 3M – central bank interest rate for main refinancing operations	RiskPrem_host
Market stress	CISS, Stress sub-indice - Bond Market - realised volatility of the German 10-year benchmark government bond index, yield spread between A-rated non-financial corporations and government bonds (7-year maturity bracket), and 10-year interest rate swap spread	MarketStres_host
Unemployment	unemployment rate	Unemploy_host
Financial depth	loans to nonfinancial sector/GDP	FinDepth_host
III. Parent bank-specific factors		
Assets quality	asset writedowns/total assets	AssetQual_parent
Capital adequacy	own funds/(capital adequacy*12,5)	CapAdeq_parent
Profitability	operating income/total assets	Profit_v1_parent
Profitability	operating expenses/financial result from banking activity	Profit_v2_parent
Business model	interest income/operating income	BusinessMod_parent
Cash flow mismatches	inflows contractually due within 3 months/outflows contractually due within 3 months	CashFlow_parent
IV. Macroeconomic conditions and market characteristics (home countries)		
Credit quality	bank non-performing loans/total gross loans	CredQual_home
Cost of funding	households' interest rates for new term deposits	CostFund_home
Financial development	stock market capitalization (% GDP)	FinDev_home
Market stress	CISS, Stress sub-indice - Bond Market - realized volatility of the German 10-year benchmark government bond index, yield spread between A-rated non-financial corporations and government bonds (7-year maturity bracket), and 10-year interest rate swap spread (średnie)	MarketStress_home
Financial depth	total credit/GDP	FinDepth_home

Source: own work.

It was impossible to test the stationarity of the variables because missing values were encountered. However, to satisfy the assumptions of the linearity and stationarity, the first differences of the variables' logarithms were taken. This leads to the interpretation of the regression coefficients in terms of the dynamics of changes of the dependent variable that were driven by the changes in the independent variables.

5 Empirical specification

The baseline empirical model has been defined as follows:

$$\Delta Liq_{it} = \beta_1 \Delta B\_host_{it} + \beta_2 \Delta MM\_host_{it} + \beta_3 \Delta B\_parent_{jt} + \beta_4 \Delta MM\_parent_{jt} + \varepsilon_{ijt}$$

where:
$i = 1, 2, 3, \ldots, 19$; $j = 1, 2, 3, ..., 14$; $t = 1, 2, 3, \ldots, 11$
ΔLiq_{it} – growth rate of the dependent variable (including or excluding the interbank loans)
ΔB_host_{it} – growth rates of the bank-specific factors
ΔMM_host_{it} – growth rates of the macroeconomic and market characteristics of the host country
ΔB_parent_{it} – growth rates of the parent banks' specific factors
ΔMM_parent_{it} – growth rates of the macroeconomic and market characteristics of the home countries
ε_{ijt} – disturbance term
The subscript *i* represents the respective Polish commercial bank, the subscript *j* represents the respective parent bank (in the case of the foreign-owned banks), and the subscript *t* represents the respective year. The dependent variable and the independent variables vary between banks and over time.

6 Results

The aim of the research is to find a model in which all independent variables can be regarded as statistically significant to assess the determinants of the changes of the bank liquidity buffers, particularly those that are foreign-owned. Below are the results of two estimations. In the first regression model, the dependent variable has been defined as inclusive of the interbank loans, whereas in the second regression model, the dependent variable has been defined as exclusive of the interbank loans.

6.1 The liquidity buffer inclusive of the interbank loans as the dependent variable

The results of the first pooled ordinary least square regression are presented in Tables 4 and 5. The dependent variable used in this estimation was defined as the liquid assets inclusive of the interbank loans relative to the total assets.
The results indicate that the changes of the liquidity buffers of banks were negatively driven by the changes in the profitability of households' loans outstanding (Δ*Profit_host*) and the private sector indebtedness (Δ*PrivSectorIndebt_host*) in the host country, which means that an increase in the growth rates of these exogenous factors led to a decrease in the growth rates of the banks' liquidity buffers, ceteris paribus. It can be therefore assumed that the more profitable the loans were (Δ*Profit_host)* and the more indebted the households were (Δ*PrivSectorIndebt_host*), the lower were the growth rates of the bank liquidity buffers. On the other hand, the higher the growth rates of incoming cash flows within 3 months relative to outgoing cash flows within 3 months were (Δ*CashFlow*), the higher were the growth rates of the bank liquidity buffers. The changes in the liquidity buffers of the banks examined for the years 2004-2014 were also negatively affected by the changes in the banks' credit supply, which was measured as the total gross households' loans relative to the total households' deposits (Δ*CredSuppl*). What is more, the growth of the relative importance of the foreign-owned banks in terms of their share in the parents' own funds (Δ*GroupImp_v1*) led to the decrease in the growth rates of the liquidity buffers of the foreign-owned banks. The reason for this may be that the more important the subsidiary was within the group structure, the more liquidity was transferred to its parent, which is not desirable from the perspective of the host country. On the other hand, it is also possible that foreign-owned subsidiaries that were relatively important from the perspective of the groups in which they operated relied more heavily on the off-balance sheet commitments of their parents to provide liquidity in the form of credit lines, which made them reluctant to increase their liquidity buffers. It is interesting to note that the economic conditions and market characteristics of the home countries were found to be insignificant for the liquidity management of the foreign-owned banks. Nevertheless, it was found that the growth rate of the capital adequacy ratios of the parent banks (Δ*CapAdeq_parent*) positively influenced the growth rate of the liquidity buffers of the foreign-owned banks. This may lead to the conclusion that the better capitalized the parent banks were, the less liquidity was transferred from their overseas subsidiaries, which is prudentially sound from the perspective of the host country. What is more, an increase in the growth rate of the relative share of the operating expenses in the financial results from the banking activities of the parent banks (Δ*Profit_v2_parent*) was found to negatively affect the growth rate of the liquidity buffers of the foreign-owned banks.

Table 4: Model Pooled OLS(1) using 68 observations, including 11 cross-sectional units; time series length: minimum 1, maximum 9; dependent variable: Δ*Liq_incl_interbank_loans*

Variable	***Coefficient***	***Std. Error***	***t-ratio***	***p-value***
Δ*Profit_host*	−0.501643	0.164261	−3.054	0.0033 ***
Δ*PrivSectorIndebt_host*	−0.484575	0.137017	−3.537	0.0008 ***
Δ*CashFlow*	0.242728	0.0679384	3.573	0.0007***
Δ*CredSuppl*	−0.300059	0.162525	−1.846	0.0697*
Δ*GroupImp_v1*	−0.200799	0.0896119	−2.241	0.0287**
Δ*CapAdeq_parent*	0.630670	0.152183	4.144	0.0001***
Δ*Profit_v2_parent*	−0.209573	0.0877254	−2.389	0.0200**

Source: own work.

Table 5: Output from the regression analysis (1)

Mean dependent var	−0.071100	S.D. dependent var	0.199468
Sum squared resid	0.967958	S.E. of regression	0.125969
R-squared	0.678369	Adjusted R-squared	0.646734
F(7, 61)	18.37979	P-value(F)	6.59e-13
Log-likelihood	48.08272	Akaike criterion	−82.16543
Schwarz criterion	−66.62888	Hannan-Quinn	−76.00938
Rho	0.022075	Durbin-Watson	1.847500

Source: own work.

A linear correlation between the dependent and independent variables can be observed in Figure 2.

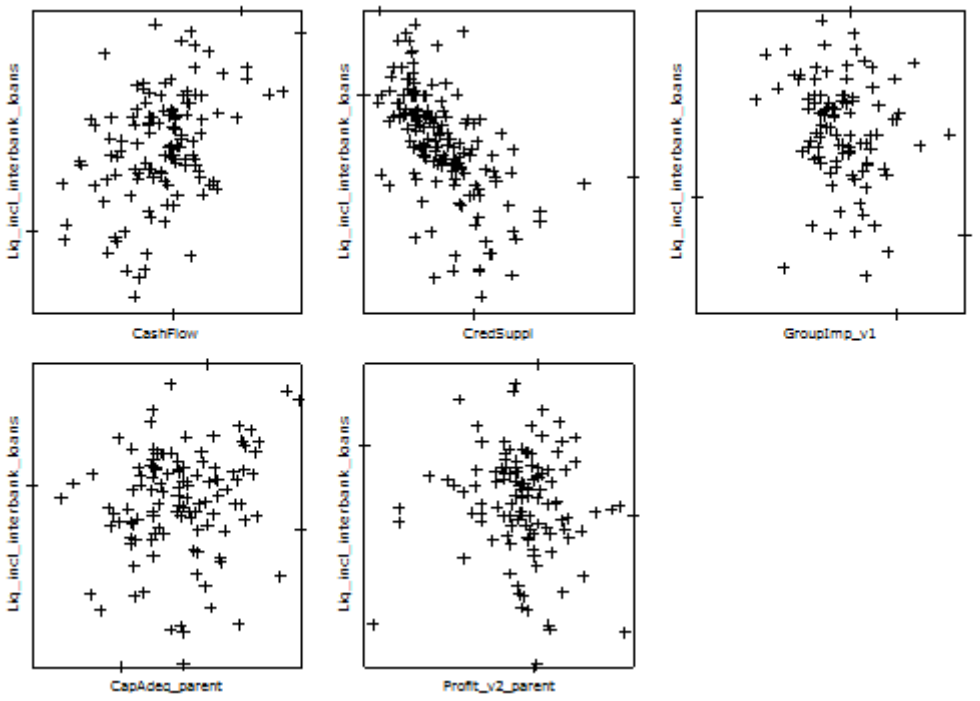

Figure 2: Multiple scatter plots for the dependent variable inclusive of the interbank loans

There are no multicollinearity concerns, as can be evidenced by the results of the Variance Inflation Factors test, which are summarized in Table 6.

Table 6: Variance Inflation Factors (1)

Variable name	**VIF**
Δ*Profit_host*	1.421
Δ*PrivSectorIndebt_host*	1.622
Δ*CashFlow*	1.102
Δ*CredSuppl*	1.6119
Δ*GroupImp_v1*	1.263
Δ*CapAdeq_parent*	1.171
Δ*Profit_v2_parent*	1.039
Minimum possible value = 1.0 Values > 10.0 may indicate a collinearity problem VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient between variable j and the other independent variables	

Source: own work.

The residuals are normally distributed, as shown in Figure 3. Additionally, the homoscedasticity condition can be satisfied (from White's test, the heteroscedasticity is not present with the p-value of 0.931597).

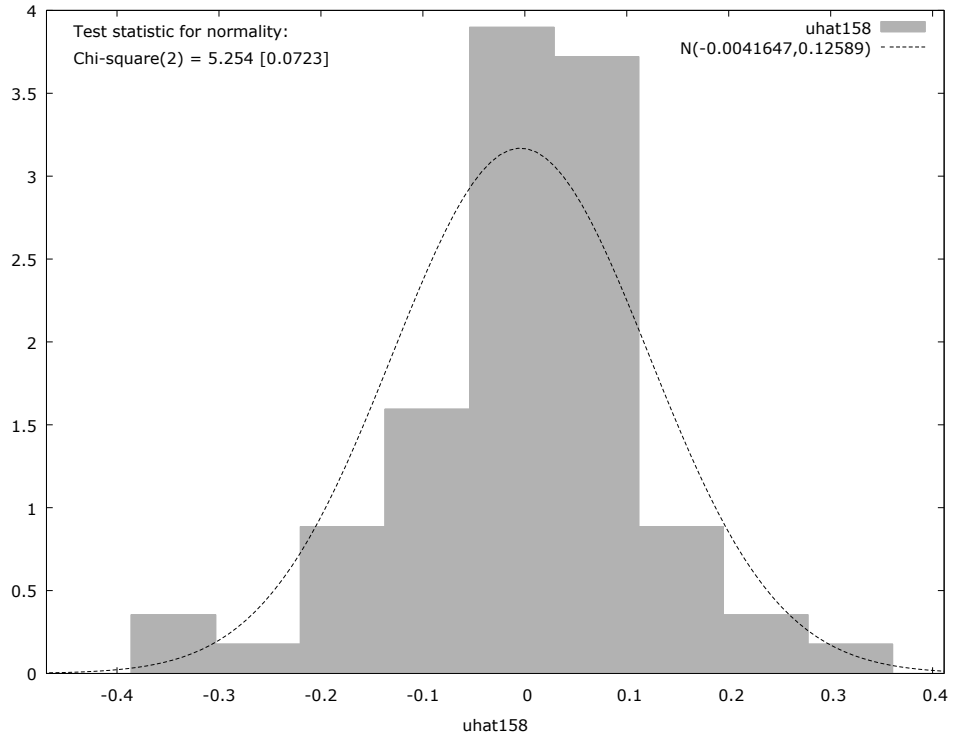

Figure 3: Distribution of residuals (1)

The diagnostic tests point to a proper specification. From the results of Durwin-Watson test, no first-order autocorrelation presence can be assumed (dL = 1.3893 and dU = 1.8395, whereas d = 1.8475). The models' fit is satisfactory with the R-squared of approximately 67%. The goodness of fit is presented in Figure 4.

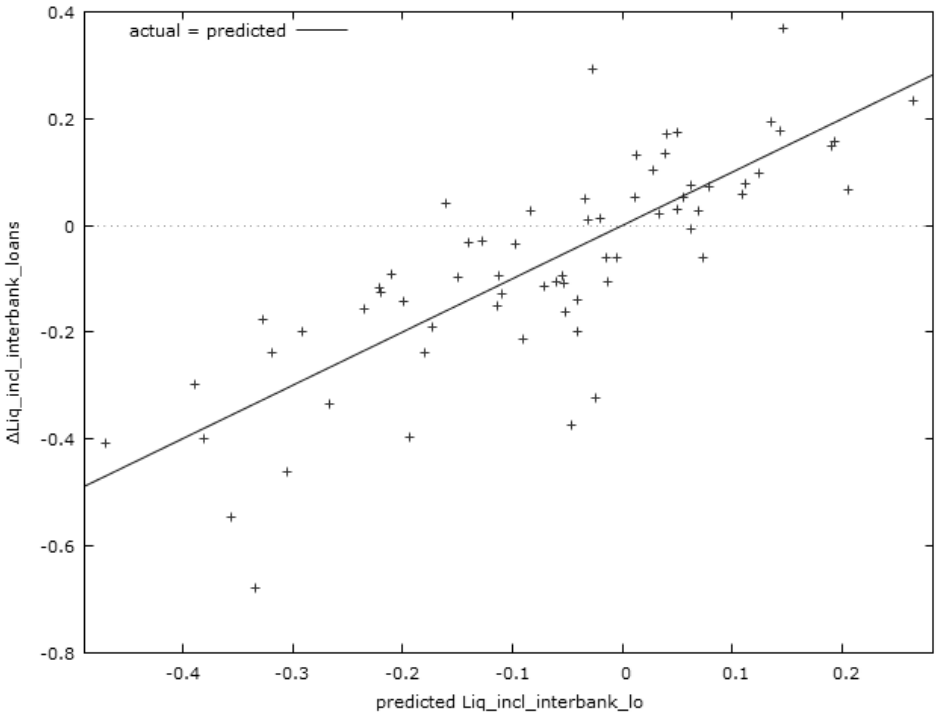

Figure 4: Fitted vs. Actual plot (1)

6.2 The liquidity buffer exclusive of the interbank loans as the dependent variable

The results of the second pooled ordinary least square regression are presented in Tables 7 and 8. The dependent variable used in this estimation was defined as the buffer of liquid assets that were exclusive of the interbank loans relative to the total assets. The results point to similar conclusions as in the case of the first regression model. The drivers of changes in the liquidity buffers included the profitability of households' loans outstanding (Δ*Profit_host*) in the host country, as well as the future cash flow structure of banks (Δ*CashFlow*), the credit supply of banks (Δ*CredSuppl*) and the capital adequacy of the parent banks (Δ*CapAdeq_parent*). The relationship between the dependent variable and the changes in the private sector indebtedness (Δ*PrivSectorIndebt_host*) proved to be no longer statistically significant. The same conclusion was revealed with regard to the changes in the relative importance within the group structure (Δ*GroupImp_v1*) and the profitability of the parent bank (Δ*Profit_v2_parent*) . In turn, it was found that the credit quality of banks (Δ*CredQual_v2*) and the credit quality in the home countries' banking sectors (Δ*CredQual_home*) were among the drivers of the liquidity buffers of banks. Interestingly, an increase in the

growth rate of the ratio of the impaired loans relative to the total gross loans (Δ*CredQual_v2*) led to an increase in the growth rate of the liquidity buffers of the sample of examined banks. Banks were probably acting precautionary in response to the increased cost of credit risk. . In the case of the foreign-owned banks, on the other hand, an increase in the growth rate of the bank non-performing loans relative to the total gross loans in the home countries (Δ*CredQual_home*) led to a decrease in the growth rate of the liquidity buffers. It can be therefore assumed that the foreign-owned banks could have been potentially transferring the liquid assets to their parents abroad in order to safeguard them from the potential losses resulting from the deteriorating credit quality of loans.

Table 7: Model Pooled OLS (2) using 74 observations, including 11 cross-sectional units; time series length: minimum 3, maximum 10; dependent variable: Δ*Liq_excl_interbank_loans*

Variable	***Coefficient***	***Std. Error***	***t-ratio***	***p-value***
Δ*Profit_host*	−0.728783	0.223442	−3.262	0.0017***
Δ*CredQual_v2*	0.191806	0.0567706	3.379	0.0012***
Δ*CashFlow*	0.240827	0.110571	2.178	0.0329**
Δ*CredSuppl*	−0.441349	0.152648	−2.891	0.0051***
Δ*CredQual_home*	−0.178955	0.0771786	−2.319	0.0234**
Δ*CapAdeq_parent*	0.487990	0.210615	2.317	0.0235**

Source: own work.

Table 8: Output from the regression analysis (2)

Mean dependent var	−0.001536	S.D. dependent var	0.242884
Sum squared resid	2.282969	S.E. of regression	0.183230
R-squared	0.469894	Adjusted R-squared	0.430916
F(6,68)	10.04604	P-value(F)	6.30e-08
Log-likelihood	23.70631	Akaike criterion	−35.,41262
Schwarz criterion	−21.58823	Hannan-Quinn	−29.89791
rho	−0.121485	Durbin-Watson	1.799673

Source: own work.

The relationship between the dependent variable and the independent variables used in this estimation is presented in Figure 5.

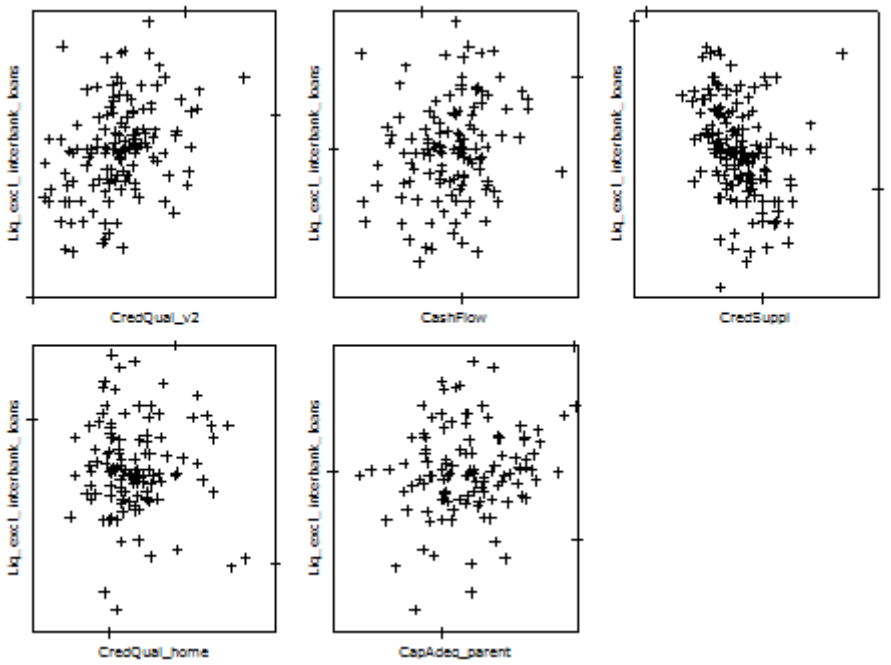

Figure 5: Multiple scatter plots for the dependent variable exclusive of the interbank loans

Multicollinearity is not an issue in the case of the variables used in the estimation (2), as indicated by the results of the Variance Inflation Factors test (Table 9).

Table 9: Variance Inflation Factors (2)

Variable name	**VIF**
Δ*Profit_host*	1.157
Δ*CredQual_v2*	1.231
Δ*CashFlow*	1.094
Δ*CredSuppl*	1.153
Δ*CredQual_home*	1.092
Δ*CapAdeq_parent*	1.148
Minimum possible value = 1.0 Values > 10.0 may indicate a collinearity problem VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient between variable j and the other independent variables	

Source: own work.

The residuals are normally distributed, as presented in Figure 6. It can be observed that the heteroscedasticity is not present (White's test with the p-value of 0.198087).

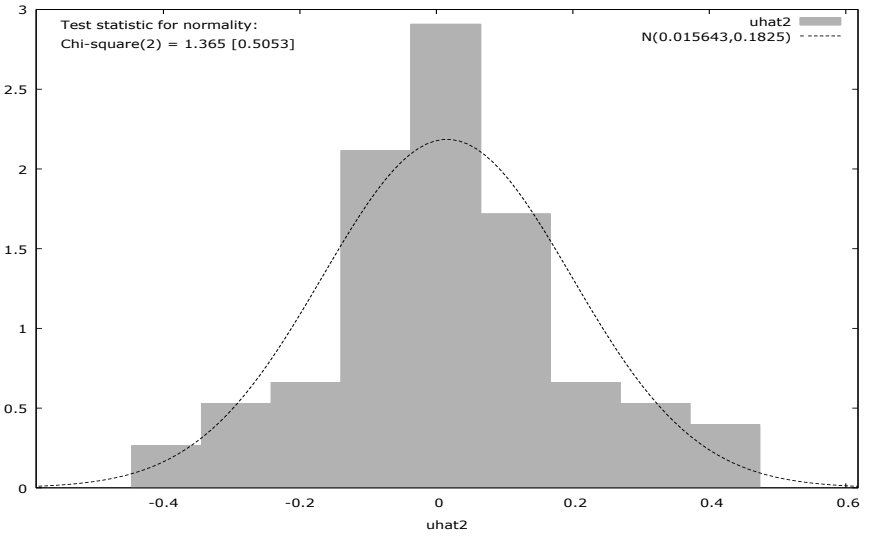

Figure 6: Distribution of residuals (2)

The diagnostic tests point to a proper specification. Although the Durwin-Watson test is inconclusive (dL = 1.4529 and dU = 1.8014, whereas d = 1.799673), the results are acceptable. The models' fit is satisfactory with R-squared of approximately 43%. The goodness of fit is presented in Figure 7.

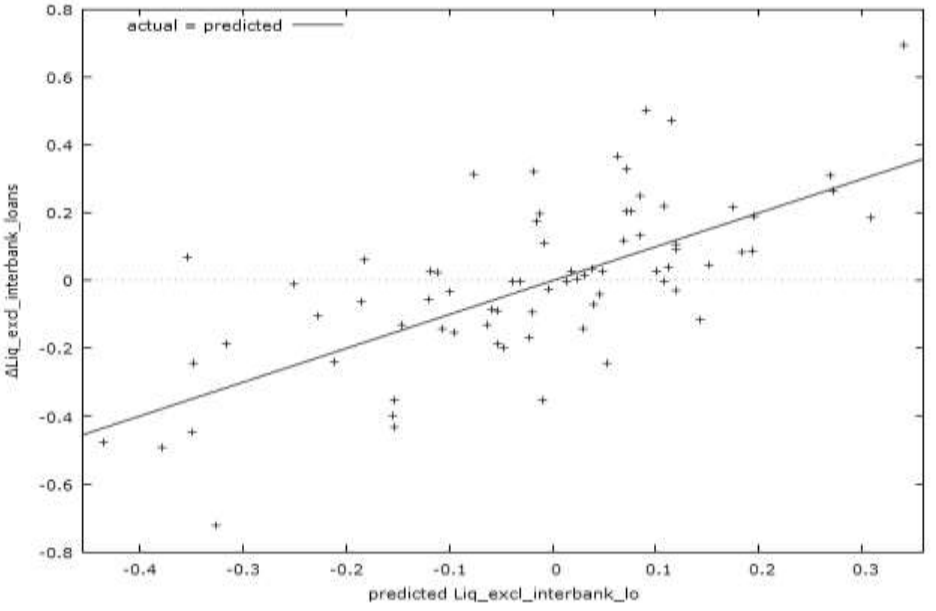

Figure 7: Fitted vs. Actual plot (2)

7 Conclusions

In this study, two regression analyses have been proposed that allowed for the identification of the drivers of the liquidity position of the sample of Polish commercial banks, including those that are foreign-owned. The conclusion that can be drawn is that the changes in the liquidity position of the banks examined were strongly driven by the changes in the households' interest rates for outstanding loans (negative relationship), the expected cash flows of the banks (positive relationship), the credit supply of the banks (negative relationship) and the capital adequacy of the parent banks (positive relationship).

All in all, it was possible to confirm the first and second research hypotheses (in both regression models). It can, therefore, be assumed that the changes in the liquidity position of banks can be influenced by changes in the bank-specific factors as well as the macroeconomic conditions and market characteristics of the host country. It was also possible to confirm the third research hypothesis (in both regression models), which means that the changes in the liquidity position of the foreign-owned banks can be driven by the changes in the idiosyncratic risk factors of the parent banks. Moreover, it was possible to confirm the fourth research hypothesis, although the assumption of the changes in the liquidity position of the foreign-owned banks that were driven by the changes in the market characteristics or economic conditions in the home countries was the weakest (only one such factor was found to be statistically significant in the regression model (2), namely the credit quality in the home countries).

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