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An Econometric Approach on Performance, Assets, and Liabilities in a Sample of Banks from Europe, Israel, United States of America, and Canada

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Abstract: The 2008 financial crisis had a major impact on financial markets, especially on the banking system. Mortgage-backed security investments were among the causes that determined the tremendous shortage of cash. Before the crisis, American banks were considered important investors on these markets, as indicated by the structure of their assets and liabilities. How grounded were their investment decisions? To answer this question, the study examined the influence of financial performance on bank assets and liabilities of the most important 45 banks from Europe and Israel, United States of America, and Canada during the period 2006–2020. Through a panel generalized method of moments approach, empirical results indicated a strong impact of bank assets and liabilities ratios on financial performance indicators. The study emphasizes that bank managers, researchers, regulators, and supervisors should consider investment policies, especially for bank assets and liabilities. Therefore, a high level of interest income is an important tool for increasing assets and liabilities. At the same time, fees are other levers that could improve bank benefits and ultimately develop the lending activity when interest income enters a descending trend.

Keywords: banking industry; assets structure; liabilities structure; performance

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1. Introduction

Within the business sector, commercial banks play an important role in mobilizing and distributing funds to their clients under the form of deposits and loans. The final goal of each bank is to maximize profit, prevent risks, ensure liquidity, and increase its market share. Achieving these goals depends heavily on how credit institutions leverage their financial performance and the structure of their assets and liabilities. Moreover, since banking assets cannot always be liquid, especially during challenging periods such as financial crises, credit institutions have to also maintain a sound balance between assets and liabilities [1–5].

As a general rule, assets and liabilities included in the balance sheet indicate the financial position of the bank and are used to determine liquidity, solvency, and different categories of risks. According to the rules of liquidity management, banks are required to monitor liquidity and solvency levels by establishing internal prudential limits approved by their supervisory boards.

The main goal of this investigation focusing on the banking industry was to analyze the link between assets, liabilities, and performance based on financial information retrieved from financial statements (i.e., balance sheet, income statement). Namely, the study investigated the influence of bank performance ratios on the structure of bank assets and liabilities.

The novelty of this approach is that it takes a closer look at the cycle of funds. Namely, considering that the cycle of funds within the banking system is 'money–money' and not 'money–merchandise–money', as in the case of manufacturers and trading companies, the study shows that the starting point of the cycle is represented by money. In other words, money is lent to other banks and companies, it becomes a part of their income statements via profit and is ultimately used to increase the level of bank assets.

The study analyzed the aforementioned link by using data from 45 banks operating in countries from Europe, in Israel, United States of America, and Canada during the period 2006–2020. All banks were listed on the New York Stock Exchange (NYSE). The focus was on financial institutions from these particular regions because the global financial crisis burst in the USA and spread rapidly across European countries, Israel, and Canada. Results emphasized the significance of monitoring assets and liabilities ratios for the banking system and the degree to which performance impacts on investors' wealth in the banking industry.

The importance of this empirical research stems from the need of increasing liquidity and solvency levels, two of the most frequent challenges for the banking sector, especially after the 2008 global financial crisis. The contribution to the existing literature is that the study considered major components in the structure of assets and liabilities to evaluate how they were impacted by bank performance before, during, and after the crisis. So far, much to my knowledge, these components have never been used in an investigation regarding the banking sector.

The research methodology is varied in that financial data were examined with different types of analyses: descriptive statistics, correlation analyses, and econometric modelling via panel generalized method of moments (GMM). For that matter, the use of multiple methods of analysis when investigating the link between predictors and outcome variables represents a standard approach in order to estimate and report strong, reliable empirical results.

The remainder of the article has the following structure. Section 2 highlights relevant studies tackling the relationship between performance, assets, and liabilities within the banking sector. Section 3 details on the variables of interest, research hypotheses, and general econometric model. Section 4 presents the proposed econometric models and estimated outcomes. Section 5 synthesizes the main results of the study, addresses limitations, and draws various policy implications, while presenting future research directions.

2. Literature Review

In the opinion of Lalić and Mirović [6], modern management of banks and other financial institutions is based on information provided by means of financial statements such as the balance sheet and the income statement.

In the balance sheet, assets, liabilities, and equity are the main categories representing sources of funds and funds used in the banking industry. Concerning financial performance, revenues and expenses are funds resulting from management decisions aimed at increasing asset levels and reducing liability levels, with data provided by the income statement. For a commercial bank, the main income source consists of the interest on investments made by the bank, while the main expense is represented by the interest corresponding to client deposits. As Robert Wilmers, a prominent American banker, chairman and Chief Executive Officer of the M&T Bank, used to say, "in the simplest sense, the key of the performance of any traditional commercial bank … is the profitability of the loan it makes".

According to the literature, there are different approaches to the causes underlying the problems banks must face, especially in times of crisis. One approach considers that risks depend on variations in the income and expenditures levels. For that matter, Balanagagurunathan et al. [7] focused on how banks protect themselves against financial risks. In their opinion, achieving this goal depends on monitoring the level of crucial ratios such as: (a) sensitive assets ratio; (b) sensitive liabilities ratio; (c) interest sensitivity ratio; (d) net interest income ratio; (e) net interest margin ratio.

When talking about crises, several authors link their studies to the 2008 financial crisis, because it negatively affected the performance of most banking sectors around the world [8–15]. Thus, Mirzaei [16] analyzed the impact of market structure and efficiency on the profitability and stability of 6,540 banks from 49 emerging and advanced countries during the period 2007–2010. Results indicated that bank profitability and stability were negatively affected by market concentration and positively influenced by banking efficiency.

Handorf [17] examined the causes of bank failures over the past 150 years in the United States, which has experienced multiple recessions and crises. According to his observations, these negative consequences stemmed from lacking regulations in the banking industry and completely disregarding the Basel Agreements. In this respect, one must mention that relatively low spreads are assigned to these banks in the credit default swap (CDS) market. Moreover, regulatory ratios are essential to assess credit quality during economic recession or to spot financial panic during economic growth. Nevertheless, credit rating agencies and the overall market show concern when bank ratios might reflect suspicious asset quality and resultant loan losses. Despite efforts to minimize the existence and consequence of "too big to fail" credit institutions, larger banks in general obtain better credit ratings and lower CDS spreads than smaller banks. For instance, Ippolito et al. [18] showed that, before a crisis, more exposed banks actively managed liquidity risk by granting fewer credit lines to firms than during a crisis period.

With respect to the relationship between assets and liabilities on the one side and performance on the other side, the general approach reported in the extant literature is that assets and liabilities influence bank performance [19–22]. In the opinion of Eatman and Sealey [23], studies on data from commercial banks did not focus on the relationship between liability management and earning asset adjustments. Therefore, by increasing or decreasing earning assets, commercial banks could create or eliminate deposits that influenced money supply and loans. Wang and Kuo [24] proposed a decision support system offering information regarding assets and liabilities of business groups in order for decision-makers to have a clear support when distributing funds.

Cenktan and Begumhan [25] studied whether different approaches in allocating assets and liabilities improved bank performance. Their results emphasized the importance of liability allocation and deposits as primary sources of funding.

Berger and Bouwman [26] focused on the degree to which capital influenced the performance of US credit institutions during a four-decade time span comprising regular periods without any major disruptions, bank crises, and market crises. Depending on the size of the credit institution, authors reported some interesting results. Namely, small banks managed to continue their operations and generate profit during the entire time span, irrespective of the economic challenges on a particular period. Medium and large banks reached a certain performance level following a capital inflow, especially during banking crises.

Boateng et al. [27] used data from 111 commercial banks in China to analyze the determinants of bank profitability for the period 2000–2012. Their results reported that the equity to liability ratio significantly influenced overall performance. In the same line, Zhang [28] examined the relationship between assets, liabilities, and performance using data from the baking sector in China. Empirical results indicated that the deposit ratio was positively connected to bank performance measured by the return on assets ratio, while loan ratio was negatively connected to bank performance.

Ozyildirim and Ozdincer [25] analyzed the banking sector in Turkey and concluded that deviations in the structure of bank liabilities significantly influenced bank performance. Kadioglu et al. [29] investigated the degree to which bank performance was driven by non-performing loans on data from 55 banks in Turkey during the period 2005–2016. According to their results estimated via panel regressions, there was a negative relationship between loans and performance: a higher level of non-performing loans yielded a lower return on equity ratio and a lower return on assets ratio. Using data from the same country, Dinc [30] showed the degree to which retail loans impacted on profitability in the banking sector.

In the light of the abovementioned, it can be stated that this research endeavor taking on a different perspective—the impact of performance on bank assets and liabilities—will be very informative and beneficial for bank managers interested in securing an efficient activity in the long run and overcoming other crises.

3. Materials and Method

For the purpose of the investigation, performance ratios were regarded as independent variables, while assets and liabilities ratios were regarded as dependent variables. To the best of my knowledge, the financial indicators considered in this investigation with regards to the relationship between bank assets, liabilities, and performance have never been used before in the banking literature. Hence, the novelty of the study stems also from this aspect.

Therefore, 45 large banks operating in Europe, Israel, United States of America, and Canada were included in the study sample (see the detailed bank list in the Appendix A). Besides testing the relationship between performance, assets, and liabilities on the overall sample, the study examines the particularities of this relationship for two main subsamples: European and Israeli banks; US and Canadian banks. The rationale for conducting an in-depth analysis is that credit institutions within a subsample follow the same banking guidelines. On the one hand, European and Israeli banks have been constantly applying the banking supervision regulations under the Basel II and III Accords before, during, and after the financial crisis. Moreover, Israeli banks are strongly interconnected with European banks because Israel has partnered with the European Union under various frameworks (e.g., European Neighbourhood Policy, European Peacebuilding Initiative). On the other hand, US and Canadian banks have followed a similar approach of banking supervision and have not relied on the Basel framework before or during the financial crisis. Only in recent years have North American credit institutions showed an increased interest in following the Basel standards with the aim of preventing future financial downturns.

The focus was on the time span 2006–2020 in order to capture the periods before, during, and after the 2008 global crisis. Banks were selected based on their market capitalization among the most important credit institutions listed on the New York Stock Exchange (NYSE). The sample was homogeneous in terms of bank size and their banking activity. Financial data were retrieved from the annual financial statements of the selected banks, which are publicly available on their official webpages.

In terms of *assets*, the following variables were considered:

- Deposits at credit institutions ratio (*DCIR*), computed as a ratio of deposits at credit institutions (*DCI*) to total bank assets (*TA*):

$$DCIR = \frac{DCI}{TA}$$

- Client loans ratio (*CLR*), computed as a ratio of client loans (*CL*) to total assets (*TA*):

$$CLR = \frac{CL}{TA}$$

- Debt securities ratio (*DSR*), computed as a ratio of debt securities (*DS*) to current assets (*CA*):

$$DSR = \frac{DS}{CA}$$

For the category of bank *liabilities*, the following variables were considered:

- Loans from credit institutions ratio (*LCIR*), determined as a ratio of loans from credit institutions (*LCI*) to the total of liabilities and equity (*TLE*):

$$LCIR = \frac{LCI}{TLE}$$

- Client deposits ratio (*CDR*), determined as a ratio of client deposits (*CD*) to the total of liabilities and equity (*TLE*):

$$CDR = \frac{CD}{TLE}$$

- Marketable debt securities ratio (*MDSR*), determined as a ratio of debt securities (*MDS*) to the total of liabilities and equity (*TLE*):

$$MDSR = \frac{MDS}{TLE}$$

With respect to *performance*, the following indicators were chosen:

- Net income interest ratio (*INIR*), computed as a ratio of income interest (*II*) to total revenue (*TR*):

$$INIR = \frac{II}{TR}$$

- Net income fees ratio (*IFER*), computed as a ratio of income fees (*IFE*) to total revenue (*TR*):

$$IFER = \frac{IFE}{TR}$$

- Interest expenses ratio (*INER*), computed as a ratio of interest expenses (*INE*) to total expenses (*TE*):

$$INER = \frac{INE}{TE}$$

- Fees expenses ratio (*FEER*), computed as a ratio of fees expenses (*FEE*) to total expenses (*TE*):

$$FEER = \frac{FEE}{TE}$$

EViews version 10 was used as a statistical software in order to perform the descriptive statistics, correlation analyses, and panel data modelling for the time series observations. In the first place, descriptive statistics were determined to properly characterize the distribution of each variable of interest. In this context, measures such as the mean, median, maximum and minimum values, standard deviation, skewness, and kurtosis were computed. Moreover, the Jarque-Bera test was applied to establish whether variables were normally or non-normally distributed.

In the second place, the reason behind running pairwise correlations was the need to identify possible high-level associations between independent variables, which could trigger potential multicollinearity biases for econometric estimations.

As a third step, estimations were based on a panel generalized method of moments (GMM) [31–33]. Following the recommendations from Baltagi [34], before estimating the link between performance, assets, and liabilities, the choice between fixed and random effects was disentangled through the Hausman test [35]. Under the null hypothesis of this test, random effects should be included in an econometric model because random effects and fixed effects produce comparable estimations. Under the alternative hypothesis, fixed effects should be included. In the case of this study, the alternative hypothesis was accepted, and coefficients were estimated via fixed effects.

The generalized method of moments (GMM) estimation was introduced by Hansen [36]. This method is recommended for large panel data since it removes the endogeneity bias from the coefficient estimations [37] by employing "lagged levels of the regressors as suitable instruments" [38] (p. 4). As a general rule, endogeneity biases are due to potential correlations between the independent variables and the error term.

According to Hansen [36] (p. 1034), the GMM estimator is defined as follows:

"GMM estimator $\{b_N : N \geq 1\}$ is a sequence of random vectors such that $b_N(\omega) \in B_N(\omega)$ for $N \geq N^*(\omega)$ where $N^*(\omega)$ is less than infinity for almost all ω in Ω".

There are various methods of confirming the validity of a GMM estimator [39]. For the purpose of this study, the Arellano-Bond test was applied [40] in order to rule out potential second-order serial correlations. At the same time, the Hansen *J*-statistic [36] was used to confirm the validity of the GMM instruments.

The empirical analyses investigated the following research hypotheses:

Hypothesis 1 (H1). *There is a significant relationship between performance ratios (net income interest, net income fees, interest expenses, fees expenses) and assets ratios (deposits at credit institutions, client loans, debt securities).*

Hypothesis 2 (H2). *There is a significant relationship between performance ratios (net income interest, net income fees, interest expenses, fees expenses) and liabilities ratios (loans from credit institutions, client deposits ratio, marketable debt securities).*

The general form of the econometric model was:

$$Y_{jt} = a_0 + a_1 X_{1jt} + a_2 X_{2jt} + a_3 X_{3jt} + a_4 X_{4jt} + \delta_j + \theta_t + \varepsilon_{jt} \quad (1)$$

where,

- a_0 denotes the intercept;
- a_i denotes the coefficient of the independent variables ($i = 1, \cdots, 4$);
- X denotes the independent variables;
- j denotes the banks included in the sample;
- t denotes the analyzed time span (i.e., 2006–2020);
- δ_j denotes the time-invariant bank specific fixed effects;
- θ_t denotes the fixed effects controlling for the global financial crisis;
- ε_{jt} denotes the error term.

The bank specific effects (δ_j) were considered in order to compensate for the omission of other factors influencing the structure of assets and liabilities. Therefore, this component of the econometric model takes into account variables that are intrinsic to banking activities but do not tend to vary across time (as opposed to the chosen independent variables, which incur changes).

The fixed effects denoted by θ_t capture the impact of the 2008 financial downturn on the assets, liabilities, and financial performance of the 45 banks comprised by the sample.

Both hypotheses will be tested for the overall bank sample, for the European and Israeli bank subsample, and for the US and Canadian bank subsample, respectively.

4. Results

4.1. Descriptive Statistics

Table 1 indicates the main descriptive statistics (mean, median, standard deviation, skewness, kurtosis) for all variables of interest across the overall bank sample.

According to the values of the standard deviation, the variables that registered the highest volatility were interest expenses ratio and net income fees ratio, while the variables with the lowest volatility were fees expenses ratio and deposits at credit institutions ratio. Based on the skewness values, it can be stated that six variables were right-skewed while four variables were left-skewed. In terms of kurtosis, all variables had leptokurtic distributions. According to the values of the Jarque-Bera test, which scrutinizes the normality distribution, since they are all significant at the 1% and 5% levels, it can be stated that the variables of interest are non-normally distributed. The non-normal distributions do not pose a problem for the application of the subsequent analyses.

The following paragraphs will also analyze the descriptive statistics corresponding to the subsamples of European and Israeli banks and to the US and Canadian banks, respectively. Table 2 indicates the descriptive statistics (mean, median, standard deviation, skewness, kurtosis) for the European and Israeli bank subsample.

Table 1. Descriptive statistics for the overall bank sample.

	DCIR	CLR	DSR	LCIR	CDR	MDSR	INIR	INER	IFER	FEER
Mean	0.0544	0.4809	0.2457	0.1602	0.5318	0.0388	0.3907	0.3054	0.1323	0.0703
Median	0.0269	0.5038	0.2354	0.1198	0.5796	0.0165	0.4161	0.2972	0.1350	0.0594
Maximum	0.7438	1.4489	0.7486	0.7663	1.4058	0.2470	0.8252	2.4739	0.5387	0.6302
Minimum	−0.0003	0.0000	0.0000	−0.0286	0.0000	0.0000	−4.8287	−4.3672	−6.9224	−0.7744
Std. dev.	0.0898	0.2156	0.1326	0.1257	0.2111	0.0488	0.2455	0.3127	0.2839	0.0766
Skewness	3.8754	−0.1990	0.5012	1.4787	−0.5267	1.4557	−14.4132	−3.4981	−22.7385	−0.0187
Kurtosis	21.2987	3.9748	3.5525	6.0046	3.6545	4.7352	304.0638	82.7383	566.4909	34.7185
Jarque-Bera test	11,107 ***	31.1799 ***	36.8493 ***	499.9039 ***	43.2593 ***	323.0676 **	2,572,605 ***	180,201 ***	8,988,474 ***	28,295.55 ***
Observations	675	675	675	675	675	675	675	675	675	675

Note: ***, ** indicate significance at the 1% and 5% levels.

Table 2. Descriptive statistics for the European and Israeli bank subsample.

	DCIR	CLR	DSR	LCIR	CDR	MDSR	INIR	INER	IFER	FEER
Mean	0.0559	0.4657	0.2499	0.2170	0.4135	0.0253	0.4208	0.4008	0.1105	0.0588
Median	0.0352	0.5035	0.2364	0.1991	0.3957	0.0044	0.4456	0.3672	0.1324	0.0522
Maximum	0.7438	0.8453	0.7486	0.7663	0.8195	0.2470	0.8081	2.4739	0.2727	0.6081
Minimum	−0.0003	0.0000	0.0000	−0.0286	0.0000	0.0000	−4.8287	−4.3672	−6.9224	−0.2371
Std. dev.	0.0730	0.2046	0.1438	0.1418	0.1931	0.0395	0.3133	0.3717	0.3835	0.0550
Skewness	5.0770	−0.7615	0.5996	1.0024	−0.1854	2.1999	−13.7656	−4.7914	−17.9518	2.5267
Kurtosis	43.2304	2.9271	3.3476	4.3475	2.6904	8.9763	230.0563	85.3741	329.7312	33.5750
Jarque-Bera test	24,747 ***	33.41 ***	22.40 ***	83.88 **	3.35	791.70 ***	751,992 ***	98,861 ***	1,553,109 ***	13,805 ***
Observations	345	345	345	345	345	345	345	345	345	345

Note: ***, ** indicate significance at the 1% and 5% levels.

Table 3. Descriptive statistics for the US and Canadian bank subsample.

	DCIR	CLR	DSR	LCIR	CDR	MDSR	INIR	INER	IFER	FEER
Mean	0.0528	0.4969	0.2413	0.1008	0.6555	0.0529	0.3593	0.2058	0.1550	0.0822
Median	0.0130	0.5065	0.2352	0.0936	0.6764	0.0349	0.3851	0.1524	0.1410	0.0666
Maximum	0.5336	1.4489	0.6127	0.3956	1.4058	0.2302	0.8252	1.2850	0.5387	0.6302
Minimum	0.0000	0.0000	0.0000	−0.0171	0.0000	0.0000	0.0000	−0.6644	0.0000	−0.7744
Std. dev.	0.1046	0.2257	0.1199	0.0665	0.1493	0.0535	0.1375	0.1906	0.1017	0.0926
Skewness	3.2447	0.1992	0.2614	0.8401	−1.0047	0.9811	−0.8347	1.1007	1.2056	−0.8271
Kurtosis	13.0945	4.4492	3.5383	4.5270	12.4770	3.2044	4.1291	7.3108	4.6280	29.5478
Jarque-Bera test	1980 ***	31.05 ***	7.74 **	70.87 ***	1.290 ***	53.51 **	55.85 **	322.15 **	116.38 **	9728.46 ***
Observations	330	330	330	330	330	330	330	330	330	330

Note: ***, ** indicate significance at the 1% and 5% levels.

Table 2 shows that the mean, median, and standard deviation values for all varia-bles corresponding to the European and Israeli banks are rather similar to the values registered by the overall bank sample. In terms of skewness, five variables were right-skewed and the other five were left-skewed. Except for two cases with platykur-tic distributions, the kurtosis values for the majority of variables were above 3, hence their distributions were leptokurtic. The Jarque-Bera test indicated non-normal distri-butions for 9 of the 10 variables. The outlier was the client deposits ratio, which had a normal distribution. The non-normal distributions do not pose a problem for the ap-plication of the subsequent analyses.

In the same manner, Table 3 indicates the descriptive statistics of the US and Ca-nadian bank subsample.

Data in Table 3 show that mean, median, and standard deviation values in the case of US and Canadian banks were similar to the ones registered by the overall sample and by the European and Israeli subsample. Skewness values indicated that three variables were right-skewed, while seven variables were left-skewed. Since kurtosis registered values above the threshold of three across all variables, their distributions were leptokurtic. As indicated by the Jarque-Bera test, the 10 variables of interest were non-normally distributed at the 5% and 1% levels. The non-normal distributions do not pose a problem for the application of the subsequent analyses.

4.2. Correlation Analysis

Correlation analyses are prerequisite metrics that need to be determined before running any econometric analysis [41] because they can signal potential multicollinearity problems between predictors. In case such correlations exceed the value of 0.9, multicollinearity might pose a problem for further econometric estimations.

Therefore, pairwise Pearson correlations were conducted for the overall bank sample and the two subsamples. Pearson's correlation coefficients were determined based on the formula:

$$r = \frac{\sum(x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum(x_i - \overline{x})^2 \sum(y_i - \overline{y})^2}}, \tag{2}$$

with symbols denoting the following:

- r indicates the Pearson correlation coefficient;
- x_i indicates the values of the x variable;
- $\overline{x}$ indicates the mean of the values for the x variable;
- y_i indicates the values of the y variable;
- $\overline{y}$ indicates the mean of the values for the y variable.

As revealed by the correlation analysis (Table 4) conducted on the overall bank sample, the largest correlation was established between the variables named net income interest ratio and net income fees ratio ($r = 0.69$), while the smallest correlation was registered between interest expenses ratio and fees expenses ratio ($r = -0.19$). Since none of Pearson's coefficients exceeded the value of 0.9, it could be concluded that multicollinearity would not pose any problem for the subsequent econometric estimations.

When considering the subsample of the European and Israeli banks (Table 5), the highest correlation was established between the variables named net income interest ratio and net income fees ratio ($r = 0.88$), while the lowest correlation was established between the variables named interest expenses ratio and fees expenses ratio ($r = -0.54$). Pairwise correlations between other independent variables were not significant. Hence, it was concluded that multicollinearity would not bias the estimated econometric results.

Given the results in Table 6 regarding the US and Canadian bank subsample, multicollinearity was considered not to pose any problems for the estimated results. The largest significant correlation was registered between the variables named net income interest ratio and net income fees ratio ($r = -0.74$), while the smallest correlation was the one between net income interest ratio and fees expenses ratio ($r = -0.15$).

Table 4. Correlation matrix of the variables of interest for the overall bank sample.

	DCIR	CLR	DSR	LCIR	CDR	MDSR	INIR	INER	IFER	FEER
DCIR	1									
CLR	−0.198	1								
DSR	0.121 *	−0.416 **	1							
LCIR	0.002	0.163 *	0.027	1						
CDR	0.006	0.432 **	−0.128 *	−0.380 **	1					
MDSR	0.196 *	−0.107 *	0.044	−0.215 **	−0.001	1				
INIR	0.017	0.190 *	−0.065	0.169 *	−0.017	−0.097	1			
INER	0.105 *	0.008	0.007	0.274 **	−0.277 **	0.037	0.063	1		
IFER	0.023	−0.108	0.086	−0.068	0.131 *	0.015	0.696 ***	−0.218 **	1	
FEER	−0.065	0.059	0.023	−0.019	0.142 *	−0.095	−0.094	−0.197 *	0.052	1

Note: ***, **, * indicate significance at the 1%, 5% and 10% levels.

Table 5. Correlation matrix of the variables of interest for the European and Israeli bank subsample.

	DCIR	CLR	DSR	LCIR	CDR	MDSR	INIR	INER	IFER	FEER
DCIR	1									
CLR	−0.260 **	1								
DSR	0.071	−0.301	1							
LCIR	0.167 *	0.220 **	0.044	1						
CDR	0.052	0.492 **	−0.223	−0.226 **	1					
MDSR	0.036	−0.055	−0.044	−0.088	−0.175 *	1				
INIR	0.010	0.058	0.054	0.120 *	0.094	−0.132 *	1			
INER	0.058	−0.007	0.072	0.185 *	−0.121 *	0.015	−0.053	1		
IFER	0.023	−0.023	0.020	−0.027	0.104	−0.027	0.884 ***	−0.213	1	
FEER	0.068	−0.017	0.082	0.001	−0.021	0.059	−0.057	−0.538 ***	−0.010	1

Note: ***, **, * indicate significance at the 1%, 5% and 10% levels.

Table 6. Correlation matrix of the variables of interest for the US and Canadian bank subsample.

	DCIR	CLR	DSR	LCIR	CDR	MDSR	INIR	INER	IFER	FEER
DCIR	1									
CLR	−0.159 *	1								
DSR	0.173 *	−0.553 ***	1							
LCIR	−0.279 **	0.282 **	−0.066	1						
CDR	−0.010	0.476 **	0.013	0.021	1					
MDSR	0.303 **	−0.188 *	0.152 *	−0.155 *	−0.257 **	1				
INIR	0.029	0.571 ***	−0.434 **	0.158 *	−0.006	0.028	1			
INER	0.204 **	0.110 *	−0.187 *	0.023	−0.148 *	0.361 **	0.391 **	1		
IFER	0.058	−0.542 ***	0.464 **	−0.115 *	0.167 *	0.043	−0.736 ***	−0.179 *	1	
FEER	−0.120 *	0.087	−0.008	0.165 *	0.148 *	−0.240 **	−0.146 *	0.236 **	0.215 **	1

Note: ***, **, * indicate significance at the 1%, 5% and 10% levels.

The estimations of the econometric models testing the relationship between performance ratios and assets and liabilities ratios within the banking industry are presented in the following paragraphs.

4.3. Econometric Modeling

4.3.1. Testing the First Research Hypothesis

The first research hypothesis was tested for the overall bank sample, for the European and Israeli bank subsample and for the US and Canadian bank subsample, respectively.

In all cases, the three econometric models were the following:

$$DCIR_{jt} = a_0 + a_1 INIR_{jt} + a_2 INER_{jt} + a_3 IFER_{jt} + a_4 FEER_{jt} + \delta_j + \theta_t + \varepsilon_{jt} \quad (3)$$

$$CLR_{jt} = a_0 + a_1 INIR_{jt} + a_2 INER_{jt} + a_3 IFER_{jt} + a_4 FEER_{jt} + \delta_j + \theta_j + \varepsilon_{jt} \quad (4)$$

$$DSR_{jt} = a_0 + a_1 INIR_{jt} + a_2 INER_{jt} + a_3 IFER_{jt} + a_4 FEER_{jt} + \delta_j + \theta_t + \varepsilon_{jt} \quad (5)$$

Table 7 displays the estimated results for the overall bank sample. As indicated by **model 11**, 58.79% of the variance in bank assets was due to changes in performance indicators. According to estimates, the net income interest ratio negatively influenced *DCIR*, while the other three predictors had a positive impact. Namely, an increase of 1% in *INIR* would trigger a decrease of 0.08% in *DCIR*. Moreover, should *INER*, *IFER*, and *FEER* augment by 1%, company assets would also increase by 0.009, 0.06, and 0.02%, respectively. Overall, the probabilities corresponding to the *J*-statistic test and the Arellano-Bond test ($p > 0.05$) indicated that the combined effect of the independent variables on bank assets was statistically significant.

Table 7. Econometric models including the dependent variables *DCIR*, *CLR*, *DSR* (overall bank sample).

	Model 11: $DCIR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t + \varepsilon_{jt}$	**Model 12**: $CLR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t + \varepsilon_{jt}$	**Model 13**: $DSR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t + \varepsilon_{jt}$
a_1INIR_{jt}	−0.0831 *** (−30.484)	0.1475 *** (18.5697)	0.0998 *** (4.7681)
a_2INER_{jt}	0.0092 *** (8.7756)	0.0248 *** (5.6943)	−0.0043 (−0.5282)
a_3IFER_{jt}	0.0550 *** (33.2156)	−0.0667 *** (−8.2097)	−0.0736 *** (−4.2180)
a_4FEER_{jt}	0.0214 *** (2.8488)	0.2710 *** (29.4533)	0.0260 (0.9709)
White cross-section standard errors & covariance (d.f. corrected)	Yes	Yes	Yes
Cross-section effects	Fixed	Fixed	Fixed
R^2	0.6173	0.6456	0.7095
Adjusted R^2	0.5879	0.6185	0.6872
J-statistic	41.7777	39.4362	40.7397
Prob (*J*-statistic)	0.3935	0.5402	0.4377

Table 7. *Cont.*

	Model 11: $DCIR_{jt}=a_0 + a_1 INIR_{jt} + a_2 INER_{jt} + a_3 IFER_{jt} + a_4 FEER_{jt} + \delta_j + \theta_t + \varepsilon_{jt}$	**Model 12:** $CLR_{jt}=a_0 + a_1 INIR_{jt} + a_2 INER_{jt} + a_3 IFER_{jt} + a_4 FEER_{jt} + \delta_j + \theta_t + \varepsilon_{jt}$	**Model 13:** $DSR_{jt}=a_0 + a_1 INIR_{jt} + a_2 INER_{jt} + a_3 IFER_{jt} + a_4 FEER_{jt} + \delta_j + \theta_t + \varepsilon_{jt}$
Arellano-Bond test AR(2) (*p*-value)	0.9745	0.9995	0.8992
Instrument rank	45	46	45
Observations	585	585	585

Note: Robust *t*-statistics are displayed in parentheses; *** shows statistical significance at the levels of 1% level. Multicollinearity was investigated by means of the variance inflation factor (VIF). For all econometric models, no multicollinearity problems were identified. In addition, the White test rejected the null hypothesis of heteroscedasticity. The validity of the GMM estimator was confirmed by the Arellano–Bond test for AR(2): the test was statistically insignificant, as it indicated a lack of the second-order serial correlation and it satisfied the validity of its instruments. The Hansen *J*-statistic of over-identifying restrictions was not significant, therefore the null hypothesis of valid instruments could not be rejected. This confirmed the validity of the econometric models.

According to **model 12**, 61.85% of the variation in assets measured via *CLR* was explained by the chosen performance ratios. Again, all predictors yielded significant influences, but this time only the impact of net income fees ratio was negative. In other words, should *IFER* increase by 1%, *CLR* would decrease by 0.07%. At the same time, a 1% increase in *INIR*, *INER*, and *FEER* would be followed by a similar trend, with *CLR* increasing by 0.15, 0.02, and 0.27%. According to the *p*-values corresponding to both the *J*-statistic test and the Arellano-Bond test, the impact of predictors was significant.

Model 13 showed that 68.72% of the changes in assets were caused by changes in performance ratios. This time, only two predictors turned out to be relevant: a 1% increase in *INIR* would be followed by a similar change of 0.09% in assets; should *IFER* improve by 1%, assets would mitigate by 0.07%. Based on the *p*-values of the *J*-statistic and Arellano-Bond test, it could be stated that the estimated model was statistically significant.

The following paragraphs will focus on the results estimated for the European and Israeli banks (Table 8). **Model 111** indicated that 14.89% of the variance in assets was triggered by changes in performance ratios. That is, with the exception of *INIR*, all the other three predictors had a negative impact on the dependent variable. If *INIR* increased by 1%, *DCIR* would also increase by 0.23%. At the same time, should *INER*, *IFER*, and *FEE* improve by one unit, *DCIR* would mitigate by 0.007, 0.16, and 0.07 units. This model yielded significant results as confirmed by the *J*-statistic and Arellano-Bond tests.

In the case of **model 121**, no predictor exerted a significant influence on the assets measured via *CLR*.

According to **model 131**, 72.24% of the variance in *DSR* was explained by the changes in two predictors, *INIR* and *IFER*. In other words, a one-unit increase in *INIR* would cause a 0.12-unit increase in *DSR*. At the same time, a one-unit increase in *IFER* would be mirrored by a 0.1-unit decrease in *DSR*. The influence of the other two predictors played no part in the *DSR* variance. The econometric model was statistically significant, as shown by the *J*-statistic and Arellano-Bond tests.

The following econometric models will report on the results from the US and Canadian bank subsample (Table 9).

According to **model 112**, 80.7% of the variance in *DCIR* was due to the predictor's net income interest ratio and net income fees ratio. That is, should net income interest ratio augment by 1%, *DCIR* would mitigate by 0.35%. Similarly, should net income fees ratio increase by 1%, *DCIR* would follow a similar trend with 0.19%. The *p*-values corresponding to the *J*-statistic and Arellano-Bond confirmed the statistical significance of the proposed econometric model.

In terms of **model 121**, the variance in *CLR* could not be explained by the chosen predictors for US and Canadian credit institutions.

Model 131 reported that 72.24% of the variance in assets measured via *DSR* could be attributed to changes in *INIR* and *IFER*. Namely, should *INIR* improve by 1%, *DSR* would augment by 0.12 %. At the same time, a one-unit increase in *IFER* would yield a 0.1-unit decrease in *DSR*. The other two predictors were not relevant for the variance in question. The significance of the model was supported by the *J*-statistic and Arellano-Bond tests.

Hence, the nine econometric models proposed so far supported the first research hypothesis (**H1**).

Table 8. Econometric models including the dependent variables *DCIR*, *CLR*, and *DSR* (European and Israeli bank subsample).

	Model 111: $DCIR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 121**: $CLR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 131**: $DSR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$
a_1INIR_{jt}	0.2302 *** (11.1314)	−0.1498 (−0.6465)	0.1215 *** (4.1073)
a_2INER_{jt}	−0.0076 * (−1.7224)	−0.0572 (−1.1697)	−0.0124 (−0.5899)
a_3IFER_{jt}	−0.1553 *** (−9.8306)	0.1242 (0.8673)	−0.1011 *** (−3.9829)
a_4FEER_{jt}	−0.0671 *** (−2.7744)	−0.6089 (−1.3659)	−0.2615 (−1.2940)
White cross-section standard errors and covariance (d.f. corrected)	Yes	Yes	Yes
Cross-section effects	Fixed	Fixed	Fixed
R^2	0.2132	0.5783	0.7434
Adjusted R^2	0.1489	0.5438	0.7224
J-statistic	21.4553	75.5204	20.3663
Prob (*J*-statistic)	0.2571	0.8628	0.3126
Arellano-Bond test AR(2) (*p*-value)	0.9242	0.5105	0.8859
Instrument rank	23	95	23
Observations	299	299	299

Note: Robust *t*-statistics are displayed in parentheses; ***, * show statistical significance at the levels of 1% and 10%. Multicollinearity was investigated by means of the variance inflation factor (VIF). For all econometric models, no multicollinearity problems were identified. In addition, the White test rejected the null hypothesis of heteroscedasticity. The validity of the GMM estimator was confirmed by the Arellano–Bond test for AR(2): the test was statistically insignificant, it indicated a lack of the second-order serial correlation and it satisfied the validity of its instruments. The Hansen *J*-statistic of over-identifying restrictions was not significant, therefore the null hypothesis of valid instruments could not be rejected. This confirmed the validity of the econometric models.

Table 9. Econometric models including the dependent variables *DCIR*, *CLR*, *DSR* (US and Canadian bank subsample).

	Model 112: $DCIR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 122**: $CLR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 132**: $DSR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$
a_1INIR_{jt}	−0.3450 *** (−18.4467)	0.3319 *** (16.5136)	−0.2487 *** (−3.5071)
a_2INER_{jt}	0.0972 (8.4408)	−0.0878 *** (−8.2886)	0.1335 *** (2.7175)
a_3IFER_{jt}	−0.1889 *** (−13.5335)	−0.1775 *** (−4.1226)	0.1147 * (1.8911)
a_4FEER_{jt}	0.0357 (0.9626)	0.2484 *** (26.8931)	−0.2015 *** (−2.9953)
White cross-section standard errors and covariance (d.f. corrected)	Yes	Yes	Yes
Cross-section effects	Fixed	Fixed	Fixed
R^2	0.8228	0.7385	0.6670
Adjusted R^2	0.8070	0.7154	0.6374
J-statistic	19.7475	21.9851	15.9916
Prob (*J*-statistic)	0.3472	0.2326	0.5244
Arellano-Bond test AR(2) (*p*-value)	0.9216	0.9997	0.9152
Instrument rank	23	23	22
Observations	286	286	286

Note: Robust *t*-statistics are displayed in parentheses; ***, * show statistical significance at the levels of 1% and 10%. Multicollinearity was investigated by means of the variance inflation factor (VIF). For all econometric models, no multicollinearity problems were identified. In addition, the White test rejected the null hypothesis of heteroscedasticity. The validity of the GMM estimator was confirmed by the Arellano–Bond test for AR(2): the test was statistically insignificant, it indicated a lack of the second-order serial correlation and it satisfied the validity of its instruments. The Hansen *J*-statistic of over-identifying restrictions was not significant, therefore the null hypothesis of valid instruments could not be rejected. This confirmed the validity of the econometric models.

4.3.2. Testing the Second Research Hypothesis

The second research hypothesis was also tested for the overall bank sample, for the European and Israeli bank subsample and for the US and Canadian bank subsample, respectively. In all cases, the three econometric models were the following:

$$LCIR_{jt} = a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j + \theta_t + \varepsilon_{jt} \quad (6)$$

$$CDR_{jt} = a_0 + a_1INIR_{it} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j + \theta_t + \varepsilon_{jt} \quad (7)$$

$$MDSR_{jt} = a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3FEIR_{jt} + a_4FEER_{jt} + \delta_j + \theta_t + \varepsilon_{jt} \quad (8)$$

Table 10 provides details on the econometric results estimated for the overall bank sample regarding the relationship between performance and bank liabilities. **Model 21** indicates that 58.7% of the variance in *LCIR* was due to the changes in all four predictors. For that matter, if *IFER* increased by 1%, *LCIR* would mitigate by 0.21%. At the same time, should *INIR*, *INER*, and *FEER* improve by one unit, *LCIR* would augment by 0.31, 0.04, and

0.18%. The statistical significance of these estimations was supported by the *J*-statistic and Arellano-Bond tests.

According to **model 22**, 71.14% of the variance in *CDR* was explained by the chosen predictors. That is, if *INIR* and *INER* augmented by 1%, *CDR* would decrease by 0.09 and 0.06%. At the same time, *CDR* would increase by 0.11 and 0.06% if *IFER* and *FEER* augmented by 1%. The *J*-statistic and Arellano-Bond tests supported these estimations.

Model 23 showed that all four predictors had again a relevant impact and explained 60.66% of the *MDSR* variance, which was confirmed by the two tests (i.e., *J*-statistic, Arellano-Bond). More specifically, *INIR* and *INER* exerted a negative impact on bank liabilities, while *IFER* and *FEER* had a positive impact. That is, a one-unit increase in *INIR* and *INER* would correspond to a 0.01-unit increase in *MDSR*. At the same time, should *IFER* and *FEER* improve by one unit, bank liabilities would decrease by 0.01 units.

Table 10. Econometric models including the dependent variables *LCIR*, *CDR*, and *MDSR* (overall bank sample).

	Model 21: $LCIR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 22**: $CDR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 23**: $MDSR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$
a_1INIR_{jt}	0.3097 *** (45.1206)	−0.0865 *** (−58.8307)	0.0113 *** (4.5605)
a_2INER_{jt}	0.0363 *** (8.1269)	−0.0578 *** (−8.4815)	0.0097 *** (4.0032)
a_3IFER_{jt}	−0.2106 *** (−37.8422)	0.1114 *** (44.8594)	−0.0092 *** (−3.7825)
a_4FEER_{jt}	0.1842 *** (13.0185)	0.05745 *** (11.9346)	−0.0100 *** (−2.8451)
White cross-section standard errors and covariance (d.f. corrected)	Yes	Yes	Yes
Cross-section effects	Fixed	Fixed	Fixed
R^2	0.6164	0.7320	0.6347
Adjusted R^2	0.5870	0.7114	0.6066
J-statistic	36.9074	42.5335	40.1487
Prob (*J*-statistic)	0.6103	0.4049	0.4636
Arellano-Bond test AR(2) (*p*-value)	0.4960	0.9997	0.2177
Instrument rank	45	46	45
Observations	585	585	585

Note: Robust *t*-statistics are displayed in parentheses; *** shows statistical significance at the level of 1%. Multicollinearity was investigated by means of the variance inflation factor (VIF). For all econometric models, no multicollinearity problems were identified. In addition, the White test rejected the null hypothesis of heteroscedasticity. The validity of the GMM estimator was confirmed by the Arellano–Bond test for AR(2): the test was statistically insignificant, it indicated a lack of the second-order serial correlation and it satisfied the validity of its instruments. The Hansen *J*-statistic of over-identifying restrictions was not significant, therefore the null hypothesis of valid instruments could not be rejected. This confirmed the validity of the econometric models.

Table 11 reports on the estimations for the European and Israeli bank subsample. **Model 211** provided the estimations regarding the variance in *LCIR*, which could be explained in a percentage of 48.85%. The four independent variables played a relevant part:

except for *IFER*, all the other independent variables generated a positive impact. Namely, *LCIR* would increase by 0.46, 0.06, and 0.36% after an increase in *INIR*, *INER*, and *FEER*. At the same time, bank liabilities would mitigate if *IFER* improved by 1%.

Model 221 indicated that 71.77% of the variance in *CDR* would be due to the changes in all predicting variables. The significance of the estimations was supported by the two statistical tests included in the table. If *INIR*, *INER*, and *FEER* improved by 1%, *CDR* would mitigate by 0.2, 0.02, and 0.14%. At the same time, should *IFER* improve by 1%, bank liabilities would follow the same trend with 0.17%. The *J*-statistic and Arellano-Bond tests confirmed the significance of the estimations.

Table 11. Econometric models including the dependent variables *LCIR*, *CDR*, and *MDSR* (European and Israeli bank subsample).

	Model 211: $LCIR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 221**: $CDR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 231**: $MDSR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$
a_1INIR_{jt}	0.4551 *** (15.3448)	−0.2038 *** (−4.0368)	−0.0366 *** (−141.5373)
a_2INER_{jt}	0.0560 *** (3.0066)	−0.0169 *** (−0.6521)	−0.0029 *** (−26.8396)
a_3IFER_{jt}	−0.3211 *** (−11.6358)	0.1681 *** (4.1538)	0.0176 *** (129.7938)
a_4FEER_{jt}	0.3593 ** (2.0347)	−0.1386 *** (−0.9297)	−0.1125 *** (−9.2291)
White cross-section standard errors and covariance (d.f. corrected)	Yes	Yes	Yes
Cross-section effects	Fixed	Fixed	Fixed
J-statistic	17.9357	17.3138	20.0423
Prob (*J*-statistic)	0.4599	0.5016	0.3920
Arellano-Bond test AR(2) (*p*-value)	0.1039	0.0566	0.9915
R^2	0.5274	0.7391	0.3886
Adjusted R^2	0.4887	0.7177	0.3347
Instrument rank	23	23	249
Observations	299	299	299

Note: Robust *t*-statistics are displayed in parentheses; ***, ** show statistical significance at the levels of 1% and 5%. Multicollinearity was investigated by means of the variance inflation factor (VIF). For all econometric models, no multicollinearity problems were identified. In addition, the White test rejected the null hypothesis of heteroscedasticity. The validity of the GMM estimator was confirmed by the Arellano–Bond test for AR(2): the test was statistically insignificant, it indicated a lack of the second-order serial correlation and it satisfied the validity of its instruments. The Hansen *J*-statistic of over-identifying restrictions was not significant, therefore the null hypothesis of valid instruments could not be rejected. This confirmed the validity of the econometric models.

In terms of **model 231**, the impact of all predictors explained 38.86% of the variance in bank liabilities measured via *MDSR*, which was supported by the two statistics. Namely, if *INIR*, *INER*, and *FEER* managed to increase by one unit, bank liabilities would decrease by 0.04, 0.002, and 0.11%. Only when *IFER* improved by at least 1% would *MDSR* increase by at least 0.02%.

Table 12 offers insights on the relationship between bank liabilities and performance for the US and Canadian bank subsample. According to **model 212**, the four independent variables explained 36.42% of the variance in *LCIR* (also confirmed by the *J*-statistic and Arellano-Bond test). When *FEER* improved by 1%, bank liabilities decreased by 0.08%. At the same time, should *INIR*, *INER*, and *IFER* augment by 1%, *LCIR* would also augment by 0.08, 0.13, and 0.04%.

Table 12. Econometric models including the dependent variables *LCIR*, *CDR*, and *MDSR* (US and Canadian bank subsample).

	Model 212: $LCIR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 222**: $CDR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$	**Model 232**: $MDSR_{jt}=a_0 + a_1INIR_{jt} + a_2INER_{jt} + a_3IFER_{jt} + a_4FEER_{jt} + \delta_j+\theta_t+\varepsilon_{jt}$
a_1INIR_{jt}	0.0773 *** (2.6276)	0.6236 *** (11.1604)	−0.0653 *** (−4.2111)
a_2INER_{jt}	0.1289 *** (21.8147)	−0.4185 *** (−9.5372)	0.0111 (0.8651)
a_3IFER_{jt}	0.0420 ** (2.1856)	−0.0795 *** (−3.8029)	−0.0544 ** (−2.2066)
a_4FEER_{jt}	−0.0821 *** (−10.4011)	0.2799 *** (7.7532)	−0.0167 (−0.4179)
White cross-section standard errors and covariance (d.f. corrected)	Yes	Yes	Yes
Cross-section effects	Fixed	Fixed	Fixed
J-statistic	19.5861	18.9273	19.5897
Prob (*J*-statistic)	0.3566	0.3327	0.3564
Arellano-Bond test AR(2) (p value)	0.9999	0.3929	0.3476
R^2	0.4160	0.4655	0.7327
Adjusted R^2	0.3642	0.4181	0.7090
Instrument rank	23	22	23
Observations	286	286	297

Note: Robust *t*-statistics are displayed in parentheses; ***, ** show statistical significance at the levels of 1% and 5%. Multicollinearity was investigated by means of the variance inflation factor (VIF). For all econometric models, no multicollinearity problems were identified. In addition, the White test rejected the null hypothesis of heteroscedasticity. The validity of the GMM estimator was confirmed by the Arellano–Bond test for AR(2): the test was statistically insignificant, it indicated a lack of the second-order serial correlation and it satisfied the validity of its instruments. The Hansen *J*-statistic of over-identifying restrictions was not significant, therefore the null hypothesis of valid instruments could not be rejected. This confirmed the validity of the econometric models.

Model 222 indicated that 41.81% of the variance in *CDR* would be triggered by changes in the chosen predictors. That is, when *FEER* and *INIR* improved by 1%, bank liabilities would also improve by 0.28 and 0.62%, respectively. Moreover, a one-unit increase in *INER* and *IFER* would have a negative impact on *CDR*, which would mitigate by 0.42 and 0.08%. The empirical results were supported by the two statistical tests.

Last but not least, **model 232** showed that two of the predictors were responsible for 70.90% of the variance in *MDSR*. Namely, when *INIR* and *IFER* decreased by one unit, bank liabilities would augment by 0.07 and 0.05 units. The *J*-statistic and Arellano-Bond tests supported the econometric estimations.

Hence, this second batch of nine econometric models proposed so far supported the second research hypothesis (**H2**).

5. Discussion, Conclusions, and Policy Implications

The research study reports analyses conducted on financial data retrieved from 45 commercial banks operating in Europe, Israel, United States of America, and Canada during the period 2006–2020 with a particular focus on the influence of bank performance regarding the structure of assets and liabilities. The study also draws on potential advantages and challenges when applying econometric techniques to data from the banking industry, since this approach could represent an important source for substantial improvements in this sector. For that matter, one of the main advantages of this approach stems from its ability to safely manage client deposits and prevent associated risks.

According to the econometric analyses, for both the overall bank sample and the two subsamples, the deposits at credit institutions ratio (*DCIR*) and debt securities ratio (*DSR*) were significantly influenced by the net income interest ratio (*INIR*) and net income fees ratio (*IFER*). At the same time, the client loans ratio (*CLR*) was significantly influenced by all four performance ratios in the case of the US and Canadian credit institutions, but not in that of European and Israeli credit institutions.

In the case of all credit institutions, the structure of liabilities was also influenced by the chosen performance indicators. Namely, overall and for each regional subsample (European and Israeli; US and Canadian), loans from credit institutions were impacted by all performance indicators. Moreover, various other similarities were identified between the two regional bank subsamples. Namely, the client deposits ratio was negatively influenced by the interest expenses ratio, while the marketable debt securities ratio was mitigated under the impact of net income interest ratios.

Hence, these empirical results favor a comparison between banks from the two subsamples, considering the differences with respect to banking supervisory regulations. Therefore, the study elicited that North American banks showed a particular interest for capital market investments. At the same time, European and Israeli banks directed most of their financial resources toward crediting individuals and companies, under the Basel framework.

The research study has multiple implications for the banking industry. First, with the help of the econometric models, banks could gain insights about efficient risk management strategies. In this sense, the study emphasizes the importance of assets, liabilities, bank income, and expenses in the process of ensuring a sound liquidity level based on the results generated by the main banking activities. Second, the study could offer solutions for properly structuring assets and liabilities in the banking system. Therefore, it focused on changes in the structure of assets and liabilities in order to establish whether banks had sufficient capacity of using funds to generate profit. Estimations indicated that banks faced challenges that could have been otherwise overcome by implementing econometric modeling.

The study stresses that bank managers, researchers, regulators, and supervisors should consider investment policies especially for assets and liabilities. Hence, a high level of interest income is an important tool for increasing assets and liabilities. At the same time, fees constitute other levers that could improve bank benefits and ultimately develop the lending activity when interest income enters a descending trend.

During the 2008 global financial crisis, while aiming to maintain liquidity and comply with government regulations [42–44], the majority of banks preferred to substantially invest more in loans granted to other banks, companies, and non-banking clients and invest less on stock markets. For this reason, the link between assets and performance was assessed by using the variance in the stability of different bank assets.

In terms of study limitations, it can be mentioned that the sample comprises banks that are listed on the New York Stock Exchange. Future studies might consider banks that are important players on other renowned stock markets across the global financial market. Secondly, the sample comprises credit institutions from Asia, Europe, and North America. In this line of thought, future studies could focus on expanding the sample by also including credit institutions operating on other major financial markets from South America, East Asia, Africa, Australia, and Oceania. This would enable telling comparisons on the degree to which performance influences the structure of assets and liabilities in the banking industry. Moreover, the impact of other relevant predictors could be investigated in relation to bank assets and liabilities.

All in all, the procedure of applying the proposed econometric models could vary from one financial institution to another (depending on their strategic model) and it could encompass a broad area of risks. Nevertheless, starting from these empirical results, the study advances the following measures for an efficient banking activity. As a first measure, banks need to optimize their resources, namely they should maximize assets in order to meet increasing liabilities. Banks should also monitor interests corresponding to assets and liabilities. In this sense, financial institutions are called to control for the interest rate risk, which can potentially cause a disproportion between assets and liabilities. Moreover, banks could also extend short-term borrowings and long-term loans to an optimum level by restructuring assets and liabilities or by using certain derivatives.

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Abbreviations

The following abbreviations were used in this manuscript:

CDR	Client deposits ratio
CLR	Credit loans ratio
DCIR	Deposits at credit institutions ratio
DSR	Debt securities ratio
FEER	Fees expenses ratio
IFER	Net income fees ratio
INIR	Net income interest ratio
INER	Interest expenses ratio
LCIR	Loans from credit institutions ratio
MDSR	Marketable debt securities ratio
VIF	Variance inflation factor

Appendix A

The sample includes the following banks from Europe, Israel, United States of America and Canada: Banco Bilbao Vizcaya Argentaria; Banco Santander; Bank Hapoalim; Barclays; BNP Paribas; Commerzbank; Credit Agricole; Credit Suisse Group; Danske Bank; Deutsche Bank; DNB Bank ASA; Erste Group Bank; HSBC Holdings; Intesa Sanpaolo; KBC Groep NV; Lloyds Banking Group; NatWest Group; Raiffeisen Bank International; Sberbank Rossii PAO; Groupe Société Générale; Standard Chartered; Svenska Handelsbanken; Swedbank; Bank of America; Bank of Montreal; Bank of New York Mellon; Bank of Nova Scotia; BankUnited; Canadian Imperial Bank of Commerce; Citigroup; Comerica; Fifth Third Bank; JPMorgan Chase; KeyCorp; M&T Bank; National Bank of Canada; Northern Trust; PNC Financial Services; Royal Bank of Canada; State Street; Toronto-Dominion Bank; Truist Financial; U.S. Bancorp; Wells Fargo; Western New England Bancorp.

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