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Relationship Between Business Models of Banks and Stability of Economic Development

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ABSTRACT

Depending on the chosen business model, banks can act as both shock absorbers and crisis catalysts. In this regard, the analysis of the relationship between banks' business models and financial cycles becomes a useful tool for diagnosing and predicting crisis phenomena. The **purpose** of the research is to identify the relationship between the volume of debt of the banking and the debt burden of the economy. The research uses econometric methods. The key result of the research is two new econometric models, which were calibrated for the Russian economy. The models differ from each other by the types of bank liabilities used in the calculation of independent variables. The models also differ from the existing models by the calculation algorithm of independent variables. The source of information is the official statistics of the Bank of Russia for the period 2008–2019. The tests of the models confirmed the presence of a statistically significant cointegration relationship between the debt burden of the banking sector and the debt burden of the economy. Coupling coefficients in the models are identified as debt multipliers of the banking sector and characterize the multiplier effect of changes in the debt burden of banks. For the model containing banks' balance sheet liabilities, the debt multiplier for the Russian economy was 6.7; and for the model using banks' total liabilities was 3.1. The developed models are easy-to-use for forecasting financial cycles.

Keywords: economic stability; banks; business models; credit burden; credit cycles

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ОРИГИНАЛЬНАЯ СТАТЬЯ

Исследование взаимосвязи бизнес-моделей банков и стабильности экономического развития

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АННОТАЦИЯ

В зависимости от выбранной бизнес-модели банки могут быть как амортизаторами, так и катализаторами кризиса. В связи с этим анализ взаимосвязи бизнес-моделей банков и финансовых циклов становится полезным инструментом диагностики и прогнозирования кризисных явлений. Цель исследования — выявление связи между объемом задолженности банковского сектора и долговой нагрузкой экономики. В исследовании используются эконометрические методы. Результатом исследования являются две новые эконометрические модели, которые были откалиброваны применительно к российской экономике. Модели отличаются друг от друга видами банковских обязательств, используемых при расчете независимых переменных, а от существующих моделей — алгоритмом вычисления независимых переменных. Источником информации является официальная статистика Банка России за период 2008–2019 гг. Тесты моделей подтвердили наличие статистически значимой коинтеграционной связи между долговыми нагрузками банковского сектора и экономики. Коэффициенты связи в моделях идентифицируются как мультипликаторы долга банковского сектора и характеризуют мультипликативный эффект изменения долговой нагрузки банков. Для модели, содержащей балансовые обязательства банков, мультипликатор долга для экономики России составил 6,7; а для модели с использованием

показателя совокупных обязательств банков — 3,1. Разработанные модели удобны в использовании для прогнозирования финансовых циклов.
Ключевые слова: стабильность экономики; банки; бизнес-модели; долговая нагрузка; кредитные циклы

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INTRODUCTION

The financial crisis and the new regulatory requirements proposed by the Basel Committee on Banking Supervision have had a profound impact on the international banking sector. R. Roengpitya et al. [1] indicate that many banks responded to economic challenges by attempting to transform their business models. According to C. Kok, C. More, M. Petrescu [2], D.V. Tran, K. Hoang, C. Nguyen [3] such restructuring of banks has led to a transformation of their business strategies and balance sheet business models.

However, as P. Cavelaars et al. [4] have rightly pointed out, wrong business models could lead to financial problems in the future. P.M. Tanzi, E. Aruanno, and M. Suardi, M. [5], R. Karkowska [6], M. Farnè M. and A.T. Vouldis [7] come to a similar conclusion.

In general, studies show that the analysis of the relationship between business models of banks and financial cycles serves as a useful tool for a better understanding of the nature of risk inherent in each business model of banks and its contribution to systemic risks. At the same time, an analysis of the scientific literature and regulatory documents shows that research on the relationship between the business models of banks and the financial stability (cyclicality) of the economy is based primarily on the indicators of assets and equity, as well as leverage (in this case, this indicator is seen as the ratio of debt to bank assets), and liquidity indicators.

Our study consists of several sections. The first section is an overview of current research on the transformation of banks' business models and their impact on the financial stability of the economy. The second section includes a description of a sample of data, indicators, methods, and models. The third section is model-based testing and interpretation of results. The next section is devoted to discussion. The last section contains the principal findings.

LITERATURE REVIEW

The term "business model" is interpreted quite broadly, but in most cases, a business model is described as a "list of ways to make a profit" R. Roengpitya et al [1], A. Blundell-Wignall, P. Atkinson, and C. Roulet [8], G. Abuselidze [9]. The experts of the Bank of International Settlements point out that banks dependent on short-term interbank financing are more exposed to risk than banks involved in traditional lending [1].

The expert review of the European banking sector states that it is still the large banks that follow a business model focused on short-term financing in the interbank and stock markets [10, 11]. At the same time, M. Brunnermeier and L. Pedersen [12], note that such banks can experience serious liquidity problems even if there is little financial turbulence.

A large amount of research is devoted to analysing the relationship between banks' equity capital and the cyclical nature of the economy. For example, studies by M. Olszak, S. Roszkowska and I. Kowalska [13] confirmed the pro-cyclical effect of bank capital on lending. U. Noreen, F. Alamdar, and T. Tariq [14], C. Bui, H. Scheule and E. Wu [15] concluded that a moderate increase in the banks' capital buffers is sufficient to sustain the stability of the financial system, as credit supply may be impeded if the banks' capital level is too high. A. Hodbod, S.J. Huber and K. Vasilev [16] identified the extent to which different models of bank capital requirements influence the business cycle. F. Dong and Z. Xu [17] proved that excessive credit creation by the frictional banking sector can lead to overinvestment and, consequently, to endogenous boom and bust cycles.

Several authors note the importance of the impact of bank debts on financial stability. For instance, T. Virtanen et al. [18] analysed the economic stability and concluded that a financial crisis is usually preceded by bubbles of borrowed funds. S.G. Gadzo, H.K. Kportorgbi and J.G. Gatsi [19] and S. Bressan [20] argue that excessive debt in the banking sector can lead to unstable dynamics. Its regulation has a more profound impact on risk than capital regulation [21]. M. King [22] stresses the need to limit bank debt to ensure sustainable economic development. They point out that banks should be funded much more through own equity rather than debt. Furthermore, in an environment of underdeveloped capital markets, especially risk capital markets such as venture capital and private equity, limits on bank borrowing may allow these alternative forms of financing to thrive. This idea underpins the EU Commission's proposals for building a European Union capital markets union.[1]

[1] EU Commission, 2015. Building a capital markets union. EU Commission Green Paper, Brussels. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52015DC 0063 (accessed on 14.01.2022).

Another area of research on the impact of balance sheet business models of banks on financial stability is the analysis of the relationship between the leverage of banks and the cyclical nature of the economy. J. Mankart, A. Michaelides and S. Pagratis [23] analysed the impact of regulatory leverage requirements on bank lending. The authors concluded that stricter leverage requirements lead to increased lending and lower bankruptcy rates. J. de Haan, Y. Fang and Z. Jing [24] examined the predictive power of these balance sheet variables for future banking crises. As a result, the authors concluded that a low level of liquid assets and domestic financial liabilities, a high level of external liabilities, and rapid growth of financial leverage are the main indicators of banking crises. Similar conclusions were reached by M. Jarmuzek and R. Rozenov [25] and D. Schoenmaker and P. Wierts [26]. In their publications, they note that leverage can be used as an indicator of the cyclical nature of the economy. In doing so, the predictive power of leverage is approximately comparable to the predictive power of financial predictors commonly used for forecasting. E. Kaya and Y. Koksal [27] concluded that leverage is procyclical. Leverage procyclicality can trigger financial cycles and credit cycles during periods of bank asset growth. Similar conclusions were reached by M. Gross, J. Henry and W. Semmler [28]. In their research, they proved that a banking system with high leverage can lead to volatile dynamics.

Overall, the research and professional literature analyses the transformation of the business models of banks primarily in terms of changes in assets, equity, debt, and leverage of banks, as well as the impact of these changes on the size of banking risks and the sustainability of the economy. The ratio of borrowed funds to equity reflects the level of relative debt burden in the banking sector and serves as a convenient tool for identifying the relationship between banks' debt and the debt cycles of the economy.

All this predetermines the need to study the potential of financial leverage (as a ratio between borrowed and own funds) in analyzing the debt burden of the banking sector and its relationship with the debt burden of the economy.

This research aims to identify the relationship between the debt burden of the banking sector in the form of a ratio between borrowed and own funds of banks and the debt burden of the economy, which makes it possible to assess the debt multiplier of banks (the multiplier effect from changes in their business models).

MATERIALS AND METHODS

Sampling and Data

Since the economies and banking systems of the countries differ in the level of development and mechanisms of state regulation, one country — Russia — was chosen as the subject of the research. The research used a 100% sample of banks with different types of ownership (banks with state participation, banks with foreign capital participation, other banks). This allowed considering the Russian banking system as a natural experimental platform for studying the debt burden of the banking sector and its multiplier effect.

The source of information is the official statistical data of the Bank of Russia for the period 2008–2019 (from April 1, 2008, through July 1, 2019). The limitation of the period is due to the lack of available data on financial stability, which began to be published by the Bank of Russia in 2008.

The database includes quarterly data on the Russian economy and monthly data on the entire Russian banking sector. Quarterly data on financial stability were converted to monthly values. The conversion assumed that these data would change evenly within one quarter.

Measurement of Financial Indicators

This section describes the key variables used in building regression models. It should be noted in advance that the dependent variable measured the credit cycle, while the independent variable was used to measure the debt burden of banks.

Dependent Variable

Currently, the main measure of the credit cycle phase is the Credit Gap, Credit-to-GDP, debt service ratio, and credit cycle indicators (main and auxiliary) [BCBS, 2010 and Bank of Russia 2016].

Each of the above indicators has its advantages and disadvantages. They consist of the following.

1. The Credit Gap indicator was recommended by the Basel Committee on Banking Supervision[2] to assess the credit cycle phase of countercyclical macroprudential regulation. It is calculated as a deviation of the actual Credit-to-GDP ratio from its long-term trend. The credit gap indicators are practically applicable both to the credit market as a whole and to its segments. In addition, these indicators are quite informative. At the same time, they do not predict crisis periods equally well in all the domains. For example, the European Systemic Risk Board[3] notes that the credit gap is not always a reliable benchmark for determining the level of countercyclical mark-ups

[2] Basel Committee on Banking Supervision (BCBS), 2010. Guidance for national authorities operating the countercyclical capital buffer. URL: https://www.bis.org/publ/bcbs187.htm (accessed on 16.01.2022).

[3] European Systemic Risk Board (ESRB), 2018. The ESRB handbook on operationalising macro-prudential policy in the banking sector. URL: https://www.esrb.europa.eu/pub/pdf/reports/esrb.report180115_handbook~c9160ed5b1.en.pdf (accessed on 16.01.2022).

and recommends that European countries use different approaches to calculating credit gaps.

Also, scientific publications regularly criticize this indicator [28, 29]. However, the main drawback is that the indicator does not apply to countries with emerging markets, which are characterized by structural shifts in the development of the economy and financial sector. Thus, the analytical papers by the Bank of Russia[4] note that in emerging markets the GDP gap does not perform better than the usual indicators of the credit cycle.

2. The "Credit-to-GDP" indicator is a standard indicator of the credit burden of the economy. It is defined as the ratio of loans and other placed funds provided to non-financial organizations and individuals to the gross domestic product. Most countries use this indicator as an alternative measure of the credit cycle phase.4 The ECB also uses this indicator due to its good predictive power.

3. The debt service coverage ratio (DSC) is defined as the ratio of the principal and interest payments flow of current income.[5] The DSC is calculated for the aggregate liabilities of individuals and non-financial organizations. However, due to the lack of regularly updated statistics on the value of the debt service coverage ratio, its use in scientific research is very limited.

4. The credit cycle indicators, as well as the credit gap indicators, belong to the class of early warning indicators, which indicate the possibility of future crisis events in advance. The main indicator of the credit cycle is a binary variable, which is calculated based on five indicators[6]: annual GDP growth rate; debt service coverage ratio; banks' liabilities to non-residents (in % of domestic credit); the share of value-added produced by the financial sector of GDP; deviation of domestic credit to GDP ratio from the trend (based on the HP filter, $\lambda = 400{,}000$). In terms of its content, this indicator is a combination of previous indicators, so it aggregates not only their strengths but also their weaknesses.

A summary of the results of the analysis shows that the best measure for the credit cycle phase is the Credit-to-GDP indicator. An additional advantage of this indicator is that the debt of financial organizations is not taken into account when calculating the amount of debt. This avoids double-counting when identifying the relationship between the debt burden of the banking sector and the debt burden of the economy.

Independent Variable

The relative debt ratio of banks was used as an independent variable as the ratio of the banks' liabilities to equity. The banks' liabilities are known to be reflected in both on and off-balance sheet items. Therefore, to better account for the debts of banks, two measures of debt were considered: balance sheet (includes only balance sheet liabilities) and total (includes both on-balance sheet and off-balance sheet liabilities).

The off-balance sheet liabilities were included in calculations for three main reasons.

First, accounting for off-balance sheet transactions of banks meets the basic principles, requirements, and standards of Basel III.

Second, off-balance sheet liabilities occupy a high share of the total debt of Russian banks, and this share tends to grow (*Fig. 1*).

Third, changes in the volume of off-balance sheet liabilities are highly volatile (*Fig. 2*).

Based on the above, the debt ratios of the banking sector (financial leverage) can be calculated using the following formulas:

$$Zb = B / C, \quad (1)$$

$$Zo = (B + V) / C, \quad (2)$$

where Zb — balance sheet leverage; Zo — total leverage; B — balance sheet liabilities of the banking sector, mln rub; V — off-balance sheet liabilities of the banking sector, mln rub; C — capital of the banking sector, mln rub.[7]

Compared to the indicators already used in banking sector analysis, the proposed indicator has the following advantages:

- It implies a simplified nature of settlements, which increases the possibility of its use by analytical services that do not have access to all primary bank reports;
- Official statistics on this indicator are available and are updated regularly;
- The indicator can be used to measure the debt burden of the banking sector at both the macro and micro levels of the economy.

The use of two measures of bank debt (1), (2) necessitated the study of two types of relationship

[4] Bank of Russia, 2016. Report on the national countercyclical capital buffer requirement. Bank of Russia. URL: http://www.cbr.ru/Content/Document/File/50246/Report_1612.pdf. (accessed on 20.01.2022).

[5] Bank of Russia, 2019a. On determining the stage of the credit cycle and the procedure for establishing a national countercyclical capital buffer requirement. Public consultation report. URL: http://cbr.ru/Content/Document/File/72455/Consultation_Paper_190617.pdf (accessed on 16.01.2022).

[6] Bank of Russia, 2016. Report on the national countercyclical capital buffer requirement. Bank of Russia. URL: http://www.cbr.ru/Content/Document/File/50246/Report_1612.pdf (accessed on 20.01.2022).

[7] Bank of Russia, 2018. On methods of determining own funds (capital) of credit institutions (Basel III). Bank of Russia regulation No. 646-P dated 04.07.2018 (ed. 06.06.2019). URL: http://docs.cntd.ru/document/901853155 (accessed on 30.01.2022).

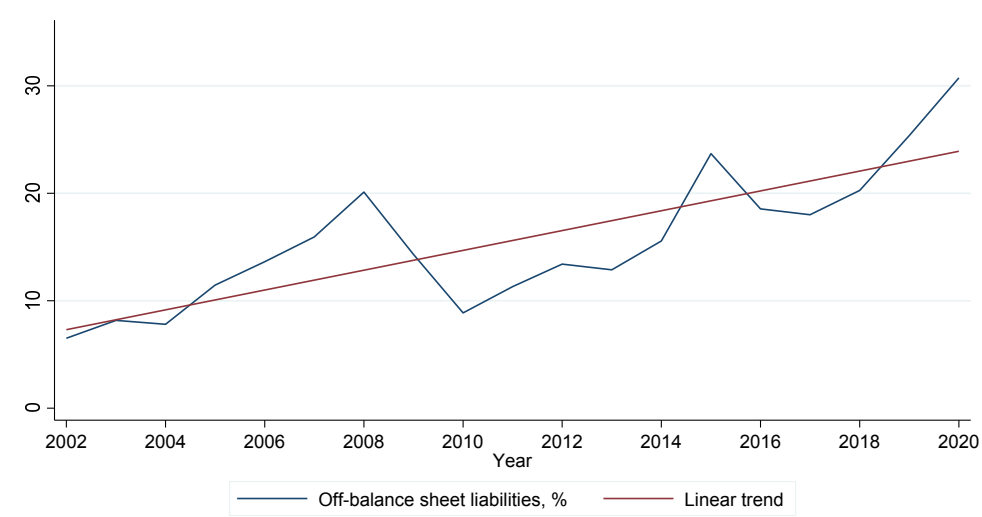

Fig. 1. **Share and Linear Trend of Off-Balance Sheet Liabilities in Total Russian Banking Sector Liabilities (%)**

Source: Compiled by the authors based on data from the official website of the Bank of Russia www.cbr.ru

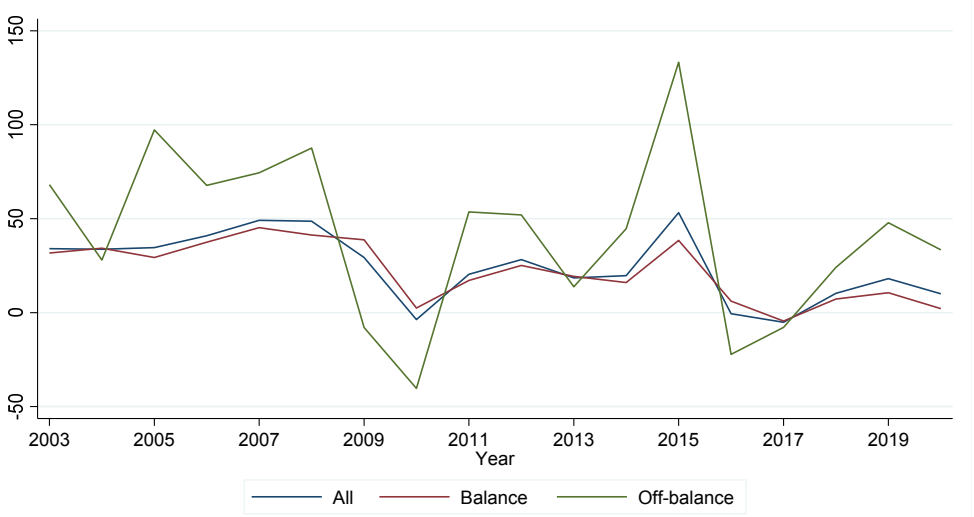

Fig. 2. **Growth Rates of Balance Sheet Liabilities, Off-Balance Sheet Liabilities, and All Russian Banking Sector Liabilities, %**

Source: Compiled by the authors based on data from the official website of the Bank of Russia www.cbr.ru

between bank debt and economic cyclicality. In theory, this relationship can be described in the following models:

$$Y = f(Zb), \quad (3)$$

$$Y = f(Zo), \quad (4)$$

where Y — Credit-to-GDP ratio.

RESULTS

Changes in the indicators under review over time are shown in *Fig. 3*.

Since the data used (*Fig. 3*) are similar to non-stationary time series, we start with the unit root tests. Each of them could be performed as the well-known Dickey-Fuller [44] test of $\rho = 1$ in the model:

$$y_t = \alpha + \rho y_{t-1} + \delta t + u_t, \quad (5)$$

where y_t is the value of indicator of interest in month t, and u_t is an identically independently distributed error term with zero average. However, in such a regression, serial correlation is possible. To control for that, we use the Augmented Dickey–Fuller (ADF) test which fits the model:

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta t + \sum_{j=1}^{k} \varsigma_j \Delta y_{t-j} + \varepsilon_t. \quad (6)$$

Testing $\beta = 0$ is equivalent to $\rho = 1$ that means that y_t is a unit root process. By other words, the null is that y_t contains a unit root, and the (one-sided) alternative is that the process is stationary.

We separately applied model (6) to each of Y, Zb, and Zo testing for unit root. The number of lags k in

Fig. 3. **Dynamics of *Y*, *Zb*, and *Zo***

Source: Compiled by the authors based on data from the official website of the Bank of Russia www.cbr.ru

Table 1

ADF Tests for Unit Root

	No trend	With a trend
Y	–1.065	–1.097
Δ*Y*	–5.047***	–5.090***
Zb	–0.832	–2.763
Δ *Zb*	–5.133***	–5.162***
Zo	–0.130	–3.029
Δ *Zo*	–4.447***	–4.664***

Source: Compiled by the authors.
Note: *** – significance level 1%.

ADF regressions was chosen based on the conditions for minimizing information criteria (FPE, AIC, HQIC). According to these criteria, $k = 4$ for series *Y* and $k = 1$ for *Zb* and *Zo*.

The results of the tests are presented in *Table 1*. The Table shows that the variables in focus are integrable processes of the first order, $I(1)$.

Taking into account that the series of interest are non-stationary in levels but stationary in the first difference, we estimate two cointegrating regressions in the form:

$$y_t = \beta_1 + \beta_2 x_t + z_t, \quad (7)$$

where *Y* was used as dependent variable and *Zb*, and *Zo* as explanatory variables in each of the both. After that two auxiliary regressions were estimated to reveal whether the residuals of (7), $\hat{z}_t = y_t - \hat{\beta}_1 - \hat{\beta}_2 x_t$, are *I*(0):

$$\Delta \hat{z}_t = \gamma \hat{z}_{t-1} + u_t, \quad (8)$$

the corresponding results are presented in *Table 2*.

R.F. Engle and C.W.J. Granger [30] suggest several tests for determining if z_t is stationary (which means that y_t and x_t are cointegrated). One of them, namely the Durbin-Watson (DW) statistic for the cointegration equation is also presented in *Table 2*.

DW value significantly different from zero rejects the hypothesis that residuals are a random walk [30]. The critical value at the 5% level for the hypothesis of *I* (1) versus *I* (0) is 0.17 [30], so that *Table 2* gives an evidence that *Y* and *Zb* are cointegrated. Unfortunately, we could not use the "classical" critical values for t-statistic in (8) to reject the null hypothesis of the unit root of the cointegrating residuals, $\hat{z}_t$.

To avoid the problem with critical values we use Johansen vector error-correction model (VECM) framework using Stata's command *vec*. The results are presented in *Table 3*.

Table 3 represents estimates of parameters of the following models:

$$\Delta y_t = \alpha \beta' y_{t-1} + \Gamma \Delta y_{t-1} + \gamma + \nu_t, \quad (9)$$

where y is a 2×1 vector of $I(1)$ variables, $\begin{pmatrix} Y \\ Zb \end{pmatrix}$ and $\begin{pmatrix} Y \\ Zo \end{pmatrix}$.

From the first column it is easy to see parameter estimates for the first model represented by (9):

$$\hat{\alpha} = (-0.007 \quad 0.020)$$

$$\hat{\gamma} = (0.022 \quad 0.008)$$

$$\hat{\Gamma} = \begin{pmatrix} 0.733 & -0.082 \\ 0.184 & -0.011 \end{pmatrix}$$

Table 2

Explanatory variables	Model (7)	Model (8)	Model (7)	Model (8)
Zb	5.546***			
	(0.273)			
Zo			3.140***	
			(0.156)	
$\hat{z}_{t-1}$		−0.106***		−0.052*
		(0.037)		(0.028)
Constant	1.920		14.296***	
	(1.955)		(1.367)	
Observations	136	135	136	135
R-sq. adjusted	0.753	0.052	0.749	0.019
F-st.	412.6***	8.4***	404.1***	3.6*
DW	0.19	2.02	0.01	1.91

Source: Compiled by the authors.

Note: Standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$.

By the same way we can identify VECM parameter estimates which correspond to the second column of *Table 4*. Vectors βs are also estimated and they are $\hat{\beta} = (1 \quad -6.678)$ and $\hat{\beta} = (1 \quad -3.064)$. These results with the necessary descriptive statistic are presented in *Table 4*.

Tables 3 and *4* indicate that the models fit well. *Table 4* reports coefficient on *Zb* and *Zo* in the cointegrating equations are statistically significant. The results indicate strong support for that $Y - 6.678Zb + 5.445$ and $Y - 3.064Zo - 15.705$ should be stationary series.

DISCUSSION

As a result of the study, two econometric models were constructed that characterize the impact of business models of Russian banks on the sustainability of economic development. The indicator "Credits to GDP" was used as a dependent variable in both models. An independent variable in one model is the indicator "Ratio of balance sheet liabilities to the capital of banks", and in the other model — "The ratio of total (balance sheet and off-balance sheet) liabilities to the capital of banks".

It is important to note that the ratio "liabilities to equity" is similar to "leverage" in its traditional interpretation. This indicator is widely used in the analysis of the stability of the non-financial sector of the economy, but it is never applies to the banking sector. In their study of banking leverage as a tool for diagnosing and regulating financial stability, most authors rely not on financial leverage, known as the debt-to-equity ratio, but on other types of leverage: balance sheet, economic, and embedded E. Kaya and Y. Koksal [27]. Moreover, the regulatory requirements for banks imposed by international financial institutions and national regulators are also based on a specific interpretation of the leverage ratio. For example, to improve the effectiveness of bank regulatory reform, the Basel Committee on Banking Supervision has recommended that central banks in countries introduce a new standard with requirements for the leverage ratio. The leverage ratio was defined by the BCBS as the ratio of Tier 1 capital to total assets (including balance sheet and off-balance sheet items), unweighted by risk. The proposed leverage ratio is essentially similar to the capital adequacy ratio, the only difference being that its calculation is based on a very wide range of assets, including off-balance sheet liabilities.[8] This ratio makes it difficult for banks to use many of the strategies created to circumvent capital requirements and acts as an additional capital requirement for banks. Based on BCBS recommendations, central banks use the term "leverage" in a similar interpretation. For example, starting from January 01, 2018, the Bank of Russia introduced a financial leverage ratio (H1.4), which is calculated as the ratio of a bank's fixed capital to the amount of balance sheet assets weighted by credit risk (100%); credit risk on credit-related contingent liabilities; credit risk on transactions with derivatives; credit risk on transactions for the purchase and sale of securities without derecognition with the obligation to resell (buy) securities and on securities lending transactions[9] (Bank of Russia, 2019b). The H1.4 calculation algorithm shows that the financial leverage ratio, despite its name, remains essentially a capital adequacy requirement for banks and not a requirement to limit the volume of resources raised.

[8] Basel Committee on Banking Supervision (BCBS), 2014. Basel III leverage ratio framework and disclosure requirements. URL: https://www.bis.org/publ/bcbs270.htm (accessed on 30.01.2022).

[9] Bank of Russia, 2019b. On mandatory norms and surcharges to capital adequacy ratios of banks with universal license. Instruction of the Bank of Russia No. 199-I dated 29.11.2019. URL: http://docs.cntd.ru/document/564062416 (accessed on 22.01.2022).

Table 3

Explanatory variables	Model (9) for $y=\begin{pmatrix} Y \\ Zb \end{pmatrix}$	Model (9) for $y=\begin{pmatrix} Y \\ Zo \end{pmatrix}$
Adjustment coefficient α	−0.007	−0.013
	(0.008)	(0.008)
ΔY_{t-1}	0.733***	0.719***
	(0.062)	(0.062)
ΔZb_{t-1}	−0.082	
	(0.104)	
ΔZo_{t-1}		−0.028
		(0.079)
Constant	0.022	0.019
	(0.023)	(0.023)
Adjustment coefficient α	0.020***	0.014
	(0.007)	(0.009)
ΔY_{t-1}	0.184***	0.217***
	(0.052)	(0.070)
ΔZb_{t-1}	−0.011	
	(0.088)	
ΔZo_{t-1}		0.032
		(0.089)
Constant	0.008	0.018
	(0.020)	(0.027)
Observations	134	134
AIC	−2.582	71.413
SBIC	0.190	0.742
HQIC	0.075	0.627
Log likelihood	9.3	−27.7
R-sq. 1	0.570	0.574
chi2 1	172.3	175.2
R-sq. 2	0.130	0.091
chi2 2	19.5	13.0

Source: Compiled by the authors.

Note: Standard errors in parentheses; *** – significance level 1%.

Table 4

Cointegrating Equations

Variables	Coefficients	
Y	1	1
Zb	−6.678***	
	(0.985)	
Zo		−3.064***
		(0.747)
Constant	5.445	−15.705
Observations	134	134
chi2	46.0***	16.8***

Source: Compiled by the authors.

Note: Standard errors in parentheses; *** – significance level 1%.

This interpretation of financial leverage complicates the analysis of the formation of banks' funding base, identifies debt cycles in this sector of the economy, and develops regulatory requirements to maintain an optimal ratio between own and borrowed funds.

Model testing confirmed the presence of a statistically significant cointegration relationship between the analyzed indicators. Thus, the results of the study showed that changes in the business models of banks in terms of the ratio of borrowed and own funds are a good indicator for identifying the sustainability of economic development. This finding confirms the findings of P. Cavelaars et al. [4], P.M. Tanzi, E. Aruanno and M. Suardi [5], R. Karkowska [6], M. Farnè and A.T. Vouldis [7], which note that, depending on the chosen business model, banks can increase the procyclicality of the financial and economic system, and analysis of the relationship between banks' business models and financial cycles is a useful tool to better understand the nature of risk inherent in each business model of banks.

The regression coefficients obtained in the developed models indicate the presence of a direct dependence of the debt of banks from the debt of the economy. This conclusion is consistent with the findings for research by F. Dong and Z. Xu [17], S.G. Gadzo, H.K. Kportorgbi and J.G. Gatsi [19], E. Kaya and Y. Koksal [27], T. Virtanen et al. [18], M. Gross, J. Henry and W. Semmler [28] and others, who claim that debt in the banking sector can lead to unstable dynamics. The study also confirmed the findings of M. Jarmuzek and R. Rozenov [25] and D. Schoenmaker and P. Wierts [26]. J. de Haan, Y. Fang and Z. Jing [24], conclude that leverage can be used as an indicator of the cyclical nature of the economy.

The peculiarity of the study is that the developed models are based on aggregate indicators of bank liabilities and can be considered as a "core" for developing their modifications. Models can be modified and possibly improved by using only the most significant liabilities of banks in terms of their impact on the cyclical economy, and not the aggregate

liabilities of banks. In essence, these modifications will mean the transition from single-factor models to multi-factor ones. In addition, the developed models can be the subject of further research in terms of their adaptation to the economies of different countries.

CONCLUSIONS

The purpose of the study was to identify the relationship between the business models of banks and the cyclical nature of the economy. As a result of the study, two econometric models were constructed that characterize the relationship between the debt burden of banks and the debt burden of the economy. One of the models characterizes the impact of banks' balance sheet liabilities on the economy's cyclicality, while another model characterizes the impact of banks' total (balance sheet and off-balance sheet) liabilities on the economy's cyclicality. The coupling coefficients obtained in the models were interpreted as a multiplier of banks' debt.

The use of indicators "the ratio of balance sheet liabilities to the capital of banks" and "the ratio of total liabilities to the capital of banks" as independent variables in the models were not found in similar studies and characterizes the novelty of the developed models.

The resulting models were applied to the Russian economy. For the first model, the debt multiplier of Russian banks was 6.7, and for the second model was 3.1. This means that with an increase in the ratio of balance sheet liabilities of banks' capital by 1%, comes an increase in the debt burden of the economy by 6.7%; and with an increase in the ratio of total liabilities to the capital of banks by 1% — an increase in the debt burden of the economy by 3.1%. With a decrease in the debt burden of banks, there will be a corresponding decrease in the debt burden of the economy.

The models developed in this study apply to crisis forecasting in a manner similar to traditional early warning models. The advantage of models is simplicity and ease of use. The resulting bank debt multipliers are additional tools for predicting the phase of the credit cycle. In addition, the banking sector's debt multiplier can easily be included in financial stability supervisors' tools.

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