“Dynamic framework for strategic forecasting of the bank consumer loan market: Evidence from Ukraine”

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DYNAMIC FRAMEWORK FOR STRATEGIC FORECASTING OF THE BANK CONSUMER LOAN MARKET: EVIDENCE FROM UKRAINE

Abstract

Accurate forecasting of consumer loan market behavior gives banks a huge potential to optimize their credit strategies by proactively adapting to external changes. This study aims to analyze and predict consumer loan demand, supply, and profitability in the Ukrainian banking sector. Using a systemic dynamic approach, the interplay of five key factors is considered: central bank policies, GDP fluctuations, changing competitive landscape driven by FinTech companies, investment in government bonds as an alternative to loan granting, and severity of credit risk management.

The developed dynamic model for the bank consumer loan market in Ukraine offers predictive capabilities enhancing decision-making and strategic planning in the banking sector and can be adapted in open small economies. Within the proposed systemic dynamic model, five scenarios were explored. Compared to the base scenario, a 4 p.p. increase in the key policy rate results in UAH 4.7 billion decrease in demand for bank consumer loans and a UAH 0.55 billion reduction in lending profitability based on the year's results. Fall in GDP by 6 p.p. leads to a decrease in the supply of bank consumer loans by UAH 6.9 billion and a decrease in lending income by UAH 1.3 billion based on the year's results. Scenario with the decline of FinTech portfolio by 20 p.p. quarterly leads to an increase in demand for bank consumer loans of UAH 8 billion. A 4 p.p. rise in government bond yields leads to a UAH 17 billion reduction in the supply of consumer loans in the same quarter.

Keywords banking, market behavior, loan portfolio, system dynamics, scenario analysis

JEL Classification G21, E44, E47

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INTRODUCTION

The consumer loan market in Ukraine has experienced remarkable developments over the years, becoming a complex system that includes various financial institutions such as banks, credit unions, financial companies, and pawnshops, each contributing a wide array of lending instruments. Fueled by the rapid advancement of financial technologies and digitalization, this market has skyrocketed.

Amidst this landscape, banks have emerged as the primary creditors in the Ukrainian consumer loan market. In particular, 2021 saw a significant increase in bank consumer lending, reaching 214,134 million hryvnias. This represents an approximate 70% growth compared to the levels observed in 2011, a decade earlier. Their nearest competitors, the financial companies, have substantially strengthened their position in household lending, showcasing a remarkable volume of 12,119 million hryvnias in 2021. This starkly contrasts the 1,037 million hryvnias of credit provided to both companies and households in 2011 (NBU, 2023).

The interplay of factors affecting consumer lending remains a critical consideration in this context. On the one hand, consumer loans play a pivotal role in stimulating economic growth by driving consumer demand. On the other hand, an uncontrolled and excessive expansion of consumer lending may lead to potential crises. Therefore, comprehending the dynamics and underlying factors shaping this market is vital to fostering sustainable growth and preventing crisis situations.

The key external factors that determine the development of the consumer banking market in Ukraine include the influence of the central bank, the level of economic growth, the level of competition among banks and non-banking institutions, and the availability of alternative options for lending or investment for financial institutions.

Consequently, the main question and problem to be addressed is how these factors can influence and determine the development of the consumer loan market and to what extent. Another critical question is how well banks conduct credit risk management and whether its organization corresponds to the challenges arising in the consumer loan market. Building a predictive model based on the example of the consumer market in Ukraine will offer new insights into solving these issues.

1. LITERATURE REVIEW

This study adopts a comprehensive perspective by treating the market of bank consumer lending (MBCL) as a dynamic and interconnected system. Several reasons contribute to this approach. Firstly, the MBCL encompasses multiple participants, including households as borrowers and depositors, banks as financial intermediaries, and the central bank as the regulatory authority (HKIB, 2012). Secondly, considering the MBCL from a behaviorist standpoint (Durkin et al., 2014) further accentuates its living and evolving nature. Thirdly, each country's unique parameters shape the dynamics of the MBCL (Onyiriuba, 2016). Fourthly, to shed light on the dynamics of the MBCL, five factors that exert influence are examined: the policies of the central bank (CB), the gross domestic product (GDP), the share of FinTech companies as the competitors in the lending market, the yield of government bonds that are alternative to loan granting, and the severity of credit risk management. Consequently, the literature review in this study concentrates on investigating the impact of these factors on the parameters of the MBCL, including demand, supply, non-performing loans rate (NPLs), and bank income.

The central bank's policies can be categorized into monetary and macroprudential policies. A study by Holló (2010) highlights the sensitivity of loan demand to interest rate fluctuations. Specifically, an increase in the key policy rate (instrument of monetary policy) leads to a decrease in the demand for loans. Bank lending is influenced by monetary and credit policies, as demonstrated by the study conducted by Aikman et al. (2018). The findings reveal that an increase in the key policy rate significantly impacts reducing bank lending. However, this effect is less pronounced in low-income countries, as Mishra et al. (2014) noted. Additionally, implementing liquidity requirements and other lending constraints (macroprudential policy instruments) negatively affects bank lending, as Abuka et al. (2019) mentioned. The interdependency between loan interest rates and borrower solvency is well-documented in the literature. For instance, Kashif et al. (2016) provide an insightful case study on Pakistan, illustrating the adverse consequences of a weak credit policy on the NPLs rate. A bank's income from consumer loans is contingent on loan issuance levels and reserve requirements. A decrease in the number of issued loans is expected to decrease a bank's income from lending correspondingly. Similarly, an increase in reserve requirements is likely to diminish income from lending (Kaminskyi & Versal, 2018).

Economic and financial parameters are known to be significantly influenced by changes in gross domestic product (GDP). However, discerning whether changes in GDP act as a cause or a consequence of these parameters can pose challenges. This issue is also relevant within the framework of the model proposed in this study, particularly when examining the relationship between GDP fluctuations

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and shifts in the demand for consumer loans. The effect of GDP changes on a banks' supply of consumer loans is more obvious, which is confirmed by many studies. Thus, Beck points out the controversial link between GDP and household loans (Beck et al., 2012). Simultaneously, many other sources indicate that GDP growth leads to an increase in household lending. The study by Brasliņš et al. (2022) shows that it is complicated to determine whether lending leads to GDP growth or vice versa and that this depends on the industry, but at the same time, it is pointed out that GDP is a key factor in lending growth. Also, Coletta et al. (2014) emphasize that the growth of household loans occurs with the growth of GDP. However, the growth in household lending, especially just before the economic downturn, leads to more pessimistic forecasts for the economic recovery in the post-crisis period (Hunt, 2015). The IMF report on global stability indicates that a "5 percent increase in household debt to GDP over a three-year period forecasts a 1.25% decline in real GDP growth three years ahead" (IMF, 2017). The link between GDP changes and the supply of consumer loans by banks is positive during the periods of economic growth. Banks become more optimistic about households' creditworthiness and solvency as the economy expands. This leads to increased loan volumes offered to households, accompanied by lending standards easing. However, this can have negative consequences when the economy enters a decline phase. Lending standards easing may result in riskier lending practices and loans being granted to less creditworthy borrowers. This can lead to deteriorating loan quality, a rise in non-performing loans, and potential instability in the banking sector. Therefore, while the positive link exists during economic expansion, it is crucial for banks to maintain prudence and appropriate lending standards to mitigate risks during downturns. As GDP expands, there is typically an increase in both the supply and demand for household loans, leading to a more diverse loan portfolio. Consequently, this diversification should positively impact banks' income. Conversely, during economic downturns, lending standards easing and elevated household debt levels can contribute to an increase in non-performing loans (NPLs), potentially resulting in a decline in bank income. These interrelationships are indirectly supported by studies such as Laryea et al. (2016), which indicate that a decrease in GDP is associated with increased NPLs, subsequently leading to reduced profitability. The inverse correlation between the NPL rate of consumer loans and GDP has been corroborated by research conducted by Zheng et al. (2019), Beck et al. (2013), and Klein (2013). These studies emphasize the pivotal role of GDP growth in mitigating problem loans. Furthermore, Rinaldi and Sanchis-Arellano (2006) highlight the influence of household wealth on NPLs, particularly during economic downturns. Similarly, Kupčinskas and Paškevičius (2017) identify GDP and unemployment as significant factors influencing fluctuations in the NPL rate.

The emergence of Financial Technology (FinTech) has significantly influenced the landscape of bank consumer lending. According to Hill (2018), FinTech companies have successfully offered loans through alternative lending platforms, including peer-to-peer lending and marketplace lending. This study examines the potential "threat" of FinTech lending to traditional bank consumer lending. Insights from a survey of 300 executives from traditional financial institutions indicate that 65% of respondents believe FinTechs will pose a substantial threat starting from 2022 (Harvard Business Review Analytic Service, 2019). However, Cornelli et al. (2023) suggest that lending by FinTech and BigTech companies complements, rather than replaces, other forms of lending. Their research, conducted across 79 countries, indicates that digital lending is more prevalent in countries with higher GDP per capita, higher banking sector markups, and less stringent banking regulations. Contrasting perspectives emerge regarding the efficiency and impact of banks versus FinTech in lending. Hughes et al. (2022) comprehensively analyze lending technologies and risk management, highlighting the differences between banks and FinTech companies. The development of FinTech lending has resulted in decreased demand for bank loans, particularly in the consumer lending segment. FinTech companies, with their lower lending standards and more borrower-centric approaches, have posed challenges to traditional banks that operate with depositors' money and adhere to stricter regulations. Recent studies in this area reveal that banks are losing ground to FinTech companies (Michlitsch, 2020) unless they adopt shadow banking practices (Buchak et

al., 2017). To remain competitive, banks are embracing digitalization and transforming into digital banks (Versal et al., 2022). While banks benefit from brand recognition and customer trust, FinTechs leverage agile business practices and simplified customer experiences (Harvard Business Review Analytic Service, 2019). The impact of FinTech on banks can be summarized as "biting a considerable chunk" of the borrower market. Banks respond to the impact of FinTech by digitalizing their processes to enhance their competitive advantage. However, with decreasing demand for loans, banks may reduce the number of loans granted and potentially relax their risk standards to attract borrowers. As a result, the non-performing loans (NPLs) rate may increase when banks lower their risk requirements in a highly competitive lending market. Furthermore, the development of FinTech lending companies can lead to declining banks' income. Studies by Phan et al. (2020) and Kondova and Bandyopadhyay (2019) have highlighted the negative impact of FinTech lenders on bank performance in this regard.

The yield on government bonds influences demand for bank consumer loans. The relationship between these two variables is complex and challenging to assess. Typically, when the profitability of government bonds increases, interest rates on bank loans also rise, leading to a decrease in the demand for loans from households due to higher borrowing costs. However, this relationship may not always hold true, as government support programs or optimistic expectations of households may lead them to continue borrowing despite higher interest rates. Changes in the yield of government bonds can also impact the supply of consumer loans by banks. Rather than being solely viewed as a monetary policy instrument, government bonds are considered as an alternative asset for banks. When yields on government bonds rise, this can reduce banks' willingness to supply loans to households. Alternatively, the supply may remain at the same level but with higher interest rates. Gennaioli et al. (2018) and Bouis (2019) argue that increased investment in government bonds leads to a slowdown in overall lending growth. The yield of government bonds also influences the NPL rate of consumer loans. Higher yields on government bonds can result in a shift in the structure of bank assets, leading to a decrease in lending volume to households, which, in turn, can contribute to a reduction of NPLs. Additionally, if banks raise lending standards while investing in government bonds, NPLs will likely be reduced. However, further research is needed to explore this relationship fully. The impact of changes in the yield of government bonds on bank income from consumer loans depends on the strategic choices made by banks. If banks opt to transition to riskier consumer loans, there will likely be an increase in income. Conversely, if banks choose less risky loans, income may decrease or remain at the same level.

Risk management severity defines the loan portfolio quality and size. The potential borrowers previously rejected by banks may switch to FinTech lenders and stop applying for new bank loans. But high loan interest rates of non-banking lenders may, over a long period, influence them to apply for bank loans again. The severity of risk management directly influences the supply of loans by defining the share of applications that will be approved. Banks set the severity of risk management based on their risk appetite. The level of risk appetite is not constant. According to Minsky (1986), banks change their appetite to risk through the economic cycle corresponding to their experience and expectation about future income. That means the long periods of high income increase banks' risk appetite. In case of crises, banks quickly become more cautious. There are two approaches to setting the severity of risk management. The first is a basic cut-off approach when applications with scores lower than acceptable are rejected. The higher the cut-off, the lower the NPL rate will be achieved. The second one is to use a probabilistic pricing approach, which is more recommendable (Stein, 2005). Moreover, the quality of scoring models influences the NPL rate of loan portfolios. The better models provide a more precise estimation of the NPLs rate. The severity of risk management has a non-linear effect on banks' income (Kaminskyi & Petrovskyi, 2019). In case of low severity, the number of issued loans will be high, which initially provides higher income. In case of tight severity of risk management, the NPLs rate will be low, but income will also be low due to the smaller amount of issued loans. There is an optimal level of severity that provides maximal profit.

This comprehensive literature review provides valuable insights into the complexities and interdependencies within the MBCL and crystallizes the impact

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Table 1. The impact of external factors on model parameters: in total

Parameters Factors	Demand for banks loans	Supply of loans by banks	NPLs rate	Banks' income from lending
The policies of the CB (increase of key policy rate)	↓	↓	↓	↓
GDP (increase in GDP)	↑/↓	↑	↓	↑
The share of fintech companies (increase in competition)	↓	↓	↑/↓	↑/↓
The yield of government bonds (increase of yields)	↑/↓	↓	↓	↑/↓

of factors on its parameters (Table 1). This influence can be negative (↓), positive (↑), or indefinite (both tracks have met in practice) (↑/↓), according to the literature review provided above. In this study, this defines the conceptual basis to construct a full-fledged model.

Understanding the potential influence of these factors can be achieved through modeling. In this study, the MBCL is viewed as a system, and an approach based on system theory, as demonstrated by Luhmann (2012), can be utilized. Bossel (2007) highlights the effectiveness of state space analysis and system dynamics in capturing the dynamic processes of causal systems. These approaches enable the modeling of decision processes by actors and agents. Similarly, Sterman (2001) presents a method for modeling complex dynamic systems. These frameworks have been applied to financial systems in works such as Wheat's (2007) macroeconomic modeling of the banking sector, Ishtiaq's (2015) examination of risk management processes in banks, and Lukianenko and Faryna's (2016) development of models for analyzing financial stability.

Ultimately, this study aims to analyze and predict the demand, supply, and profit from bank consumer lending in the Ukrainian banking sector using a systemic dynamic approach.

2. METHOD

The MBCL is a dynamic system that undergoes changes and evolution due to external and internal factors. The System Dynamics (SD) method was employed to investigate and model such a system. The concept of SD models involves studying the influence of factors on system elements and their interactions, achieved through the creation of a system of equations, as presented in the research results. Consequently, the possibility of applying scenario analysis arises, allowing for the modeling of a base scenario and scenarios that anticipate changes in key factors in various directions. The base scenario constructed in the study is based on the utilization of historical data. In this study, the primary source of data for the MBCL is the data from the National Bank of Ukraine (2023).

The MBCL, in this approach, is considered as a system with four external factors: the policies of the CB, GDP, the share of FinTech companies as the competitors in the lending market, the yield of government bonds that are alternative to loan granting and one internal factor – the severity of risk management. The state of MBCL is described by demand for bank loans, supply of loans by banks, NPLs rate, and banks' income from lending.

Based on the findings, the causal loop diagram (CLD) of MBCL was created, which describes the dependency between the main elements of the system and the influence of external factors. The arrow with "+" means that increasing the original element will increase another one. For example, an increase in GDP will lead to a rise in demand for bank loans. The arrows with "–" means the opposite. For example, the increase in severity of risk management will reduce NPLs rate. The CLD depicted reinforcing and balancing loops that describe how banks change their risk appetite.

3. RESULTS

3.1. Model

The model was created according to the causal loop diagram of MBCL (Figure 1).

The total demand for consumer loans depends on the economic situation (GDP) and lending interest rate. An assumption that demand equals 8% of the average GDP for the last two quarters to smooth the seasonality of the Ukrainian

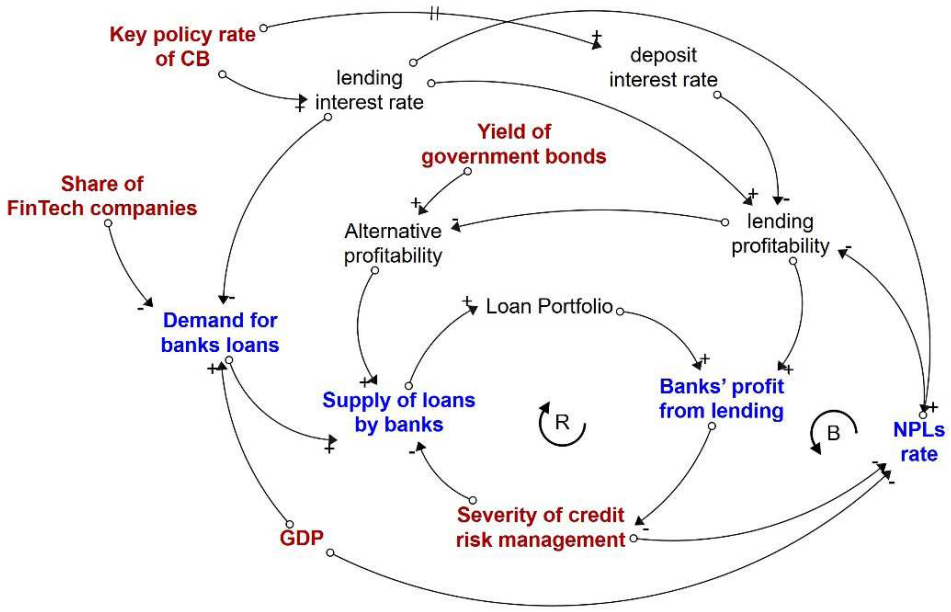

Figure 1. Causal loop diagram of MBCL

economy is used. The influence of lending interest rate is expressed by semi-elasticity calculated by Calza et al. (2001), which equals –1.01. The demand for banks' loans is estimated as the total demand for loans except for the share of FinTech.

The amount of issued loans (supply of loans by banks) is calculated as a share of demand for loans approved by risk management and limited by the amount of funds available for lending. If banks decide to invest in government bonds instead of loan granting, new loans will not be issued, but banks will extend current loans that are about to finish. This amount of extended loans is limited by funds available for lending. Banks will prefer purchasing government bonds only if their profitability is higher than lending probability.

The severity of credit risk management is defined as the share of loan applications that will be approved. To be approved, the expected probability of default (PD) by loan application must be lower or equal to the acceptable NPL rate. An example of the distribution of applicants and their PD from FICO (2019) is used.

Funds available for lending are calculated as the difference between all available funds and funds already used for lending and investments in government bonds.

The lending interest rate consists of four components (Diette, 2000): the funding costs, the operating costs, the risk premium to compensate for the risk of default, and a bank's targeted profit margin. The actual lending profitability differs from the targeted one by the difference between acceptable and actual NPL rates.

The profit from lending is calculated as the difference between banks' income and expenses from lending. Bank income from lending is calculated as a multiplication of the loan portfolio except for NPLs on the lending interest rate. To calculate it on a quarterly basis, the lending interest rate is divided by 4. Banks' expenses consist of operational expenses, write-offs of NPLs, and deposit funding costs.

The change in acceptable NPLs rate happens as the result of changes in the perception of risk by banks through the economic cycle. An example of changes in bank lending standards: from 2000 to 2007, the FICO score of mortgage borrowers decreased but increased after 2007 (Breeden & Canals-Cerdá, 2018). The equation represents the influence of a certain level of profit from lending on banks' appetite to risk.

The actual NPL rate represents the current quality of the loan portfolio, which is influenced by external factors. In the moment of lending, the applicant's PD equals the acceptable NPL rate (every ap-

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plicant with a higher PD is rejected). Later, factors like GDP change and changes in lending interest rate start to influence loan PD. The coefficient of influence of GDP change is based on Szarowska's (2018) study.

The adj time is an auxiliary variable that shows how much time is needed for the action to happen and is also used for unit consistency when stocks' values are used in the flow variables. For example, the stock Loan Portfolio, which accumulates outstanding consumer loans, has a unit UAH, and it is used in the variable banks' income, which is calculated based on other variables and has a unit UAH/quarter.

The model is shown as a stock and flow diagram in Figure 2.

Table 2. Equations of the main variables of the model

No.	Variables	Equations
1	Total demand for consumer loans	$\frac{Nominal\ GDP + DELAY(nominal\ GDP,1)}{2} \cdot 0.08 \cdot (1 + influence\ of\ lending\ interest\ rate)$
2	Demand for banks loans	$Total\ demand\ for\ consumer\ loans - FinTech\ loan\ portfolio \cdot adj\ time$
3	Supply of loans by banks	If $decision\ to\ buy\ bonds = 0$ then $MIN(Demand\ for\ banks\ loans \cdot (1 - Severity\ of\ credit\ risk\ management), funds\ available\ for\ lending)$ else $MIN(funds\ available\ for\ lending, loans\ for\ extension)$
4	Decision to buy bonds	If $bonds\ profitability - lending\ profitability > 0$ then 1 else 0
5	Severity of credit risk management	$GRAPH(NPLs\ rate\ acceptable\ /100)$
6	Funds available for lending	$Funds - (Loan\ Portfolio + Goverment\ bond\ portfolio) \cdot adj\ time$
7	Lending interest rate	$Key\ policy\ rate\ of\ CB + operating\ costs + target\ profit\ margine + NPLs\ rate\ acceptable$
8	Lending profitability	$Lending\ interest\ rate - Key\ policy\ rate\ of\ CB - operating\ costs - NPLs\ rate\ actual$
9	Banks' profit from lending	$Banks'income\ from\ lending - banks'expenses\ from\ lending$
10	Banks' income from lending	$(Loan\ Portfolio \cdot adj\ time - write\ off) \cdot lending\ interest\ rate\ /100\ /4$
11	Banks' expenses from lending	$Loan\ Portfolio \cdot adj\ time \cdot operating\ costs\ /100\ /4 + write\ off\ +$ $(Deposits - Government\ bond\ portfolio) \cdot adj\ time \cdot deposit\ interest\ rate\ /100\ /4$
12	Change in acceptable NPLs rate	If $Banks'profit\ from\ lending < -2,500,000,000$ then -4 else if $Banks'profit\ from\ lending < -1,000,000,000$ then -1 else if $Banks'profit\ from\ lending > 1,500,000,000$ then 0.5 else if $Banks'profit\ from\ lending > 500,000,000$ then 0.225 else 0
13	NPLs rate actual	$NPLs\ rate\ acceptable + GDP\ change \cdot (-0.43) + lending\ interest\ rate\ changed \cdot 0.05$

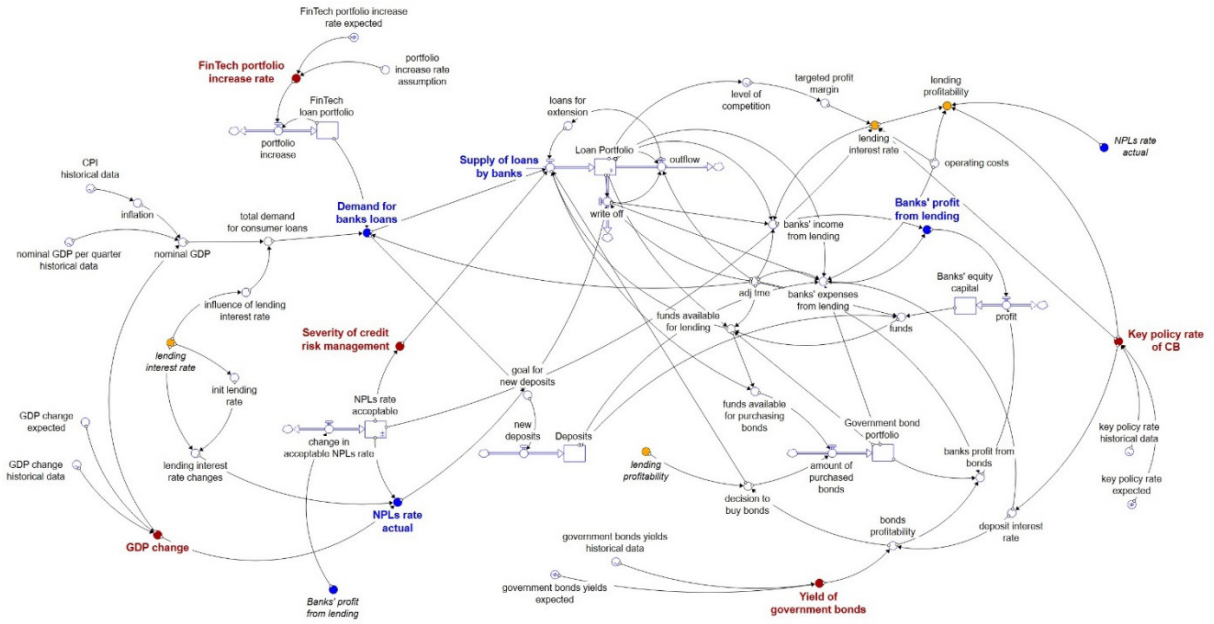

Figure 2. Stock and flow SD diagram of the model

3.2. Model validation

The model was calibrated on the historical data of the Ukrainian credit market 2017–2021 (NBU, 2023). Figures 3 to 6 compare the simulation and historical data of key variables. The variable total banks' portfolio of consumer loans shows a good fit to actual data (Figure 3). The model focuses only on the consumer lending part of banks' lending, while data provided by the central bank describes the general condition of banks. That means some variables of the model (like the portfolio of government bonds, banks' equity capital, and amount of write-offs) represent only some fraction of this value in central bank statistics. Their trends and not the exact values are compared to calibrate these variables.

Banks in Ukraine had a solid portfolio of government bonds (GB) before 2017. In the model, GB is viewed as an alternative to consumer loans. The initial GB portfolio is set to 0. In the simulation, banks bought government bonds in the second quarter of 2020, when it became more profitable than lending. Historical data shows rapid growth in the GB portfolio at that time (Figure 4).

In Figure 5, trends in overall banks' capital and the simulated capital that is used for funding consumer lending are compared. To a certain extent, the trends in capital increase are similar.

Figure 6 depicts the overall increase in bank reserves. Banks form reserves to cover risk loans.

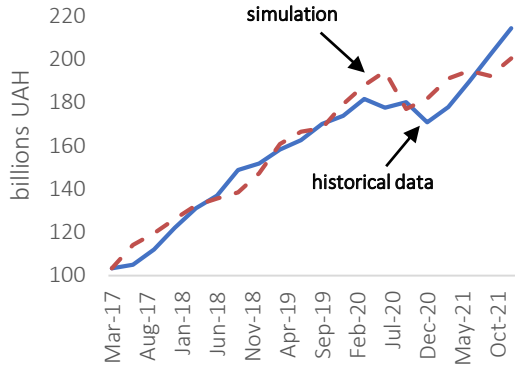

Figure 3. Consumer loan portfolio outstanding: comparison of historical data and simulation within the SD model

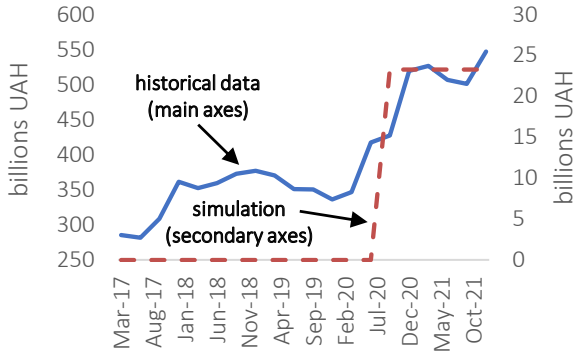

Figure 4. Portfolio of government bonds: comparison of historical data and simulation within the SD model

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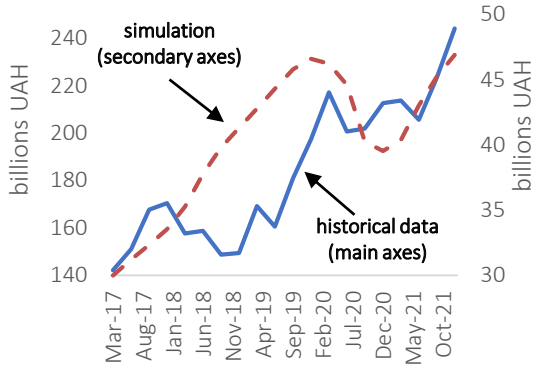

Figure 5. Equity capital: comparison of historical data and simulation within the SD model

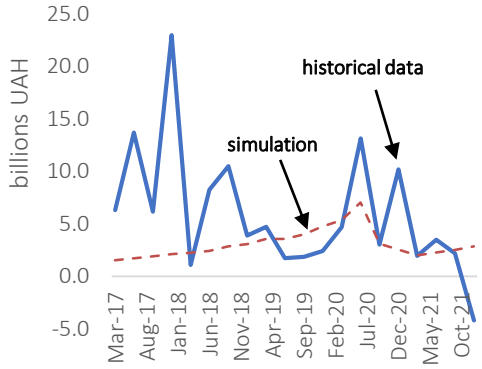

Figure 6. Reserves/write-offs: comparison of historical data and simulation within the SD model

When a loan is qualified as default, it should be 100% covered by reserves. To calibrate the quality of a loan portfolio, trends of data of reserves and simulation of write-offs representing defaulted loans are compared. In 2017–2018, Ukrainian banks underwent a process of reassessing their corporate loans and subsequently establishing reserves. This phenomenon elucidates the disparities observed in both the data and the simulation.

3.3. Scenario analysis

Using scenario analysis allows banks to estimate the future configuration of the market and prepare for it by adjusting their lending strategies. The scenarios are designed to identify the impact of each external factor on the lending market. Due to the Russian invasion into Ukraine, which started in February 2022, the model simulations are limited to the end of 2021. So, the possible outcomes of scenarios in 2021 are examined.

The scenarios were created to show how each of the external factors – the policies of the CB, GDP changes, FinTech, and GB yield – influences the condition of MBCL, which is represented by the demand and supply of consumer loans, bank loan portfolios, and banks' profit from lending.

The base case scenario is close to historical values with an increase in the key policy rate, growing GDP, a solid competitive FinTech sector, and a low-interest rate of government bonds. In the first scenario, the results of an increase in the key policy rate are being analyzed. The second scenario estimates how the GDP decline will influence the market. In the third scenario, the possibility that FinTech lenders will lose some part of their market share is considered. In the fourth scenario, the influence of the high yield of GB on consumer lending is evaluated.

Table 3. Data for scenario analysis

Input parameters	Scenarios				
	Base	1	2	3	4
Key policy rate expected %	8	12	8	8	8
GDP change expected, %	4	4	–2	4	4
FinTech portfolio increase expected, %	10	10	10	–10	10
GB yields expected, %	8	8	8	8	12

In every scenario, an increase in demand for banks' loans is seen as it is connected to nominal GDP. The inflation is set to be 6% for each scenario. The increase in the key policy rate and decrease in GDP leads to a corresponding decrease in demand for loans. The demand for bank loans will grow if banks can increase their competitive advantage towards FinTech lenders. The GB yield does not affect the demand for loans.

The amount of issued loans growing correspondingly to the demand for loans as the severity of risk management is similar except for scenario 2 when a decline in GDP increased the NPLs rate, resulting in higher severity of risk management. In scenario 4, the growth of GB yield makes it more profitable to invest in GB than grant loans in the first quarter of 2021.

The difference in the amount of issued loans explains the difference in the loan portfolio. In the

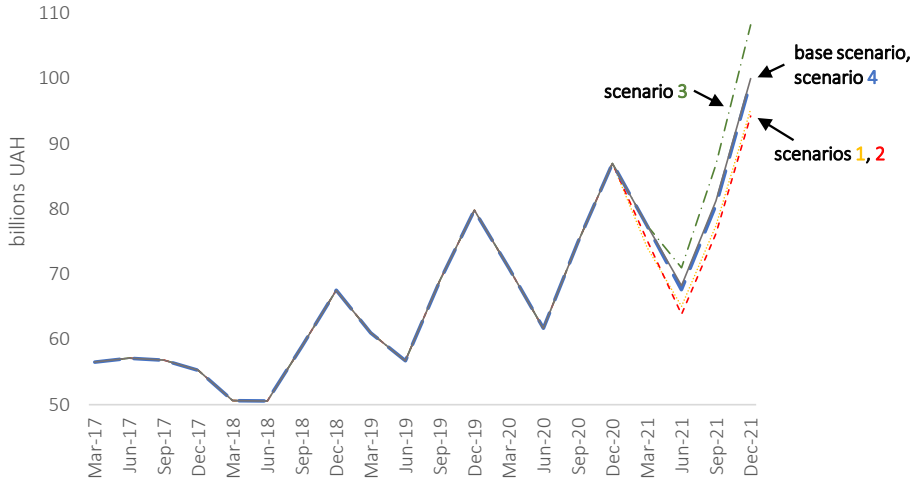

Figure 7. Scenario analysis demand for new bank consumer loans

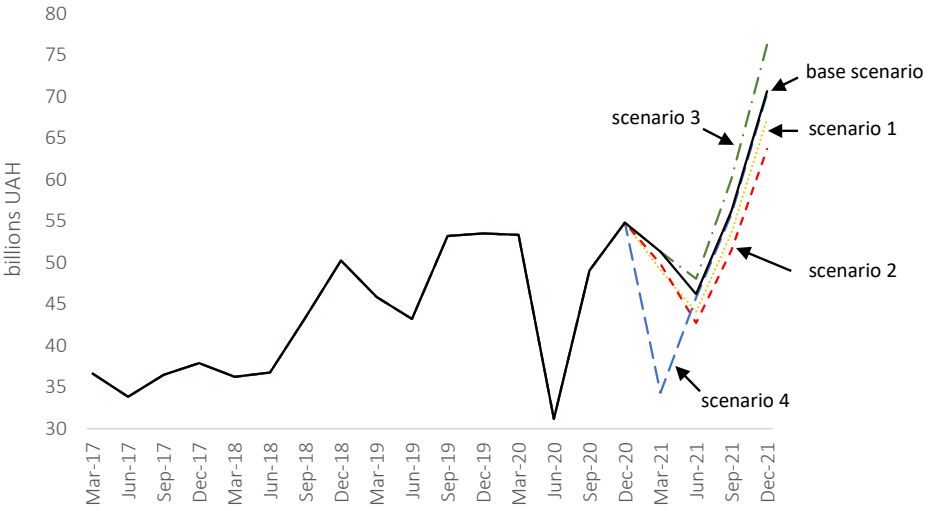

Figure 8. Scenario analysis of supply of new consumer loans by banks

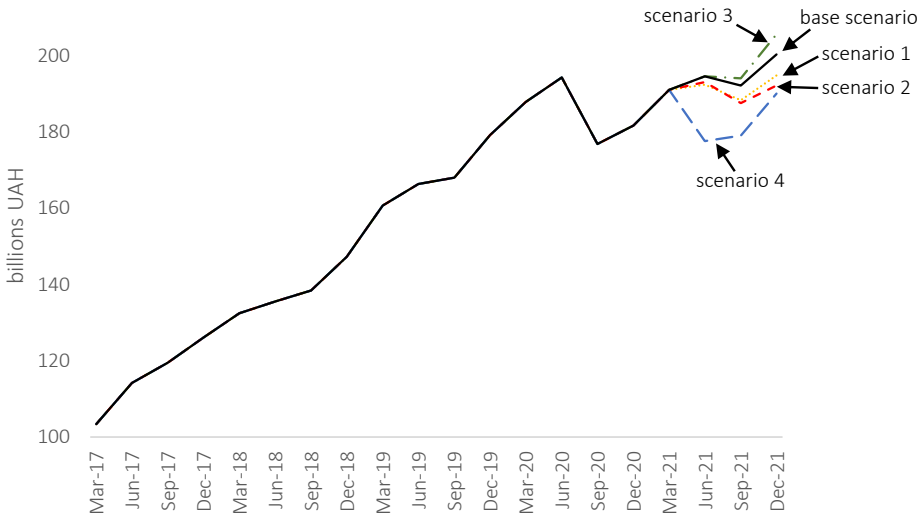

Figure 9. Scenario analysis of consumer loan portfolio outstanding

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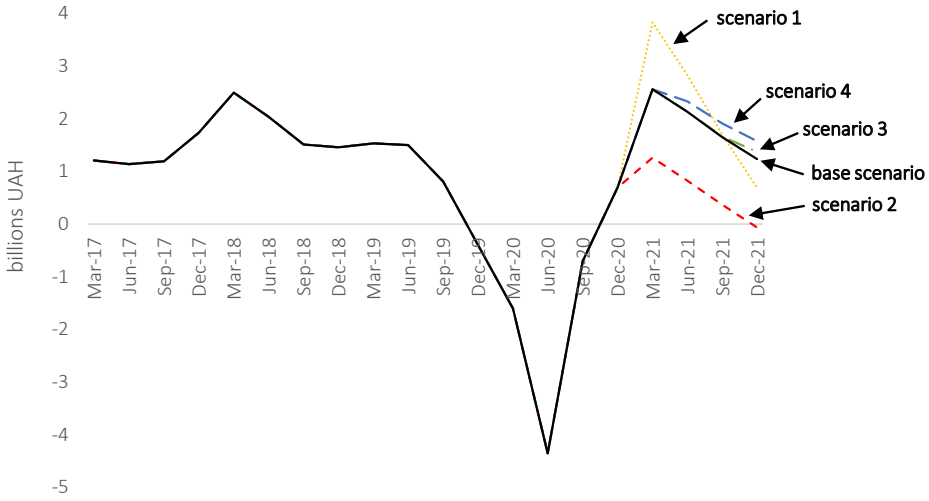

Figure 10. Scenario analysis of profit from bank consumer lending

second scenario, a loan portfolio is also affected by a higher amount of write-offs due to increased NPL rates.

The profit from banks' lending depends on the size of the loan portfolio and its quality. The decline in profit in each scenario at the end of 2021 relates to an increase in banks' risk appetite and lower quality of loans as a result. The second reason is that the amount of deposits grows faster than the loan portfolio, increasing expenses.

4. DISCUSSION

Modeling economic systems using system dynamics tools is relatively new in the field of applications of this tool. The choice of the way of application generates the scientific discussion of the methodological base. So, Radzicki (2009) presents three principal ways in which system dynamics can be applied to economic modeling. The first way is to formalize the existing economic model through system dynamics tools. The second way embraces an approach to constructing an economic model from scratch by a system dynamics paradigm. Namely, Sterman (2002) describes the conceptual differences between the two approaches. This study used the third of the existing ways, "hybrid". Its essence is to use the basic well-known economic model and develop it to make superstructures and modifications. This study has used as the basis theory of bank credit developed by Hahn and Hagemann (2015). However, conceptual points were added, such as the appearance of competitors in the form of FinTech and alternative investing into bonds to the model using the SD toolkit.

On the one hand, adding fintech is an essential element of the modern consumer lending market. On the other hand, its appearance and development are very rapid, and the established "classical" economic model, in our opinion, has not yet been formed. Cornelli et al. (2023) identified the factors of fintech development (ease of doing business, investor protection transparency and disclosure, and the efficiency of the legal system), which are logical to include in future models.

The discussion question is also the hypothesis accepted in this study that fintech "bites off borrowers" in the banking segment. This approach is supported by research by Harvard Business Review Analytic Service. However, Cornelli et al. (2023) justified different market dynamics. Namely, fintech complements other forms of credit, rather than substitutes them. The utilization of alternative financial resources by banks is another factor that is discussible. Because that heavily depends on the specific country's context. For instance, government bonds, due to offering exceptionally high returns and ease of investment compared to consumer lending, are attractive to Ukrainian banks as an alternative option. However, financial markets may present other alternatives in different countries, and their significance can vary considerably.

CONCLUSION

This study significantly contributes to enhancing the understanding of the market dynamics for bank consumer lending (MBCL). By employing a systemic dynamic approach, the study aims to provide a more nuanced understanding of this complex market in Ukraine.

Developing a model based on a systemic dynamic approach allows us to capture the interdependencies and feedback loops within the MBCL market, enabling a more accurate representation of its behavior over time. By considering the five factors, namely changes in central bank policies, GDP fluctuations, competition with FinTech lenders, government bond yields, and the severity of risk management, it is possible to forecast the demand and supply of consumer loans and their profitability for banks.

A comparison of four scenarios with the base scenario highlights that the changes in key policy rates, GDP, FinTech portfolio, and government bond yields have notable effects on the consumer loan market.

Increasing the key policy rate leads to a decrease in demand for bank consumer loans and a reduction in lending profitability. A decline in GDP results in a decrease in the supply of bank consumer loans and reduced profit from lending. Conversely, a decline in the FinTech portfolio leads to increased demand for bank consumer loans. Moreover, a rise in government bond yields reduces the supply of consumer loans.

These findings emphasize the significance of closely monitoring and adapting to changes in key economic factors for effective management of lending strategies and profitability in the consumer loan market.

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Investigation: Andrii Kaminskyi, Oleksii Petrovskyi.
Methodology: Andrii Kaminskyi, Oleksii Petrovskyi, Nataliia Prykaziuk.
Resources: Oleksii Petrovskyi.
Software: Oleksii Petrovskyi.
Supervision: Andrii Kaminskyi, Nataliia Versal.
Validation: Andrii Kaminskyi, Oleksii Petrovskyi.
Visualization: Andrii Kaminskyi, Nataliia Versal, Oleksii Petrovskyi, Nataliia Prykaziuk.
Writing – original draft: Andrii Kaminskyi, Nataliia Versal, Nataliia Prykaziuk, Oleksii Petrovskyi.
Writing – review & editing: Andrii Kaminskyi, Nataliia Versal, Oleksii Petrovskyi, Nataliia Prykaziuk.

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