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**Filipenko A.**

*Doctor of Economics, Professor,  
The Department of World Economy and International Economic Relations,  
Taras Shevchenko National University of Kyiv, Ukraine;  
e-mail: anton.filipenko@ukr.net; ORCID ID: 0000-0001-8458-2770*

**Bazhenova O.**

*Doctor of Economics, Professor,  
The Department of Economic Cybernetics,  
Taras Shevchenko National University of Kyiv, Ukraine;  
e-mail: bazhenova\_olena25@gmail.com; ORCID ID: 0000-0003-3197-8426*

**Korol M.**

*Ph. D. in Economics, Associate Professor,  
The Department of International Economic Relations,  
Uzhhorod National University, Ukraine;  
e-mail: marynak762@gmail.com; ORCID ID: 0000-0003-4031-0858*

**Stehnei M.**

*Doctor of Economics, Associate Professor,  
Dean of the Faculty of Economics, Management and Engineering,  
Mukachevo State University, Ukraine;  
e-mail: stegney@gmail.com; ORCID ID: 0000-0002-4688-6447*

#### **DYNAMICS AND STRUCTURE OF MAIN INDICATORS OF THE AMERICAN BANKING SYSTEM**

**Abstract.** The driving force of any country with market economy is the banking sector, which, as banking crises have shown, is not perfect and therefore needs more detailed study. This article from the series «Analysis of main indicators of the Anglo-Saxon banking system» is devoted to the study of the dynamics of main indicators of the American banking system for the period from 2000 to 2019 inclusive. Over the last decade, the number of commercial banks has decreased, including the United States (USA) ones. Based on data from the Federal Deposit Insurance Corporation (FDIC) with the separation of main studied indicators of the banking system and their detailed analysis, it was found that the financial crisis of 2008—2009 negatively affected the assets and liabilities of commercial banks, the dynamics of their net profit and increased the amount of outstanding loans. It is substantiated that despite the increase in private sector loans in the US, the latter do not show a high debt burden. It was also found that evidence of the consolidation process is an increase in specific gravity of the Top 5 largest banks in the country in total US banking assets. In this research, an attempt to study the effect of crisis in 2008—2009 indicators characterizing assets and liabilities of commercial banks in the United States has been made. Thus, to do this hypothesis to testify relationship of crisis in 2008—2009 and indicators characterizing assets and liabilities of commercial banks in the United States have to be tested. On the basis of the investigation, the conclusion was drawn that the dynamics of the main indicators of the American banking system for the period under study shows a positive trend, except for the financial crisis of 2008—2009. The number of banks is constantly decreasing, which is explained not so much by their liquidation as by their mergers and acquisitions. During the financial crisis of 2008, banks operated only with a profit of 10.2 billion dollars, which is 59.8% less than the previous year 2007. This is the lowest annual income since 1989. However, the significant increase in revenues in 2018 can be explained by the changes in taxation. At the same time, the share of outstanding loans has been declining every year since 2009, which is the evidence of prudent credit policy.

**Keywords:** Federal Reserve System, commercial banks, savings institutions, mergers and acquisitions of commercial banks, assets of commercial banks, liabilities of commercial banks.

**JEL Classification** G21, G34

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**Філіпенко А. С.**

*доктор економічних наук, професор,  
кафедра світового господарства та міжнародних економічних відносин,  
Київський національний університет імені Тараса Шевченка, Україна;  
e-mail: anton.filipenko@ukr.net; ORCID ID: 0000-0001-8458-2770*

**Баженова О. В.**

*доктор економічних наук, професор,  
кафедра економічної кібернетики,  
Київський національний університет імені Тараса Шевченка, Україна;  
e-mail: bazhenova\_olena25@gmail.com; ORCID ID: 0000-0003-3197-8426*

**Король М. М.**

*кандидат економічних наук, доцент,  
кафедра міжнародних економічних відносин,  
Ужгородський національний університет, Україна;  
e-mail: marynak762@gmail.com; ORCID ID: 0000-0003-4031-0858*

**Стегней М. І.**

*доктор економічних наук, доцент,  
декан факультету економіки, управління та інженерії,  
Мукачівський державний університет, Україна;  
e-mail: stegney@gmail.com; ORCID ID: 0000-0002-4688-6447*

## **ДИНАМІКА І СТРУКТУРА ОСНОВНИХ ПОКАЗНИКІВ АМЕРИКАНСЬКОЇ БАНКІВСЬКОЇ СИСТЕМИ**

**Анотація.** Рушійною силою будь-якої країни з ринковою економікою є банківський сектор, який, як показали банківські кризи, не є досконалим і тому потребує більш детального вивчення. Ця стаття із серії «Аналіз основних показників англосаксонської банківської системи» присвячена дослідженню динаміки основних показників американської банківської системи за період з 2000 року до 2019-го включно. За останнє десятиліття кількість комерційних банків зменшилась, у тому числі у Сполучених Штатах Америки (США). На основі даних Федеральної корпорації зі страхування депозитів (FDIC) із виділенням основних вивчених показників банківської системи та їхнього детального аналізу було встановлено, що фінансова криза 2008—2009 рр. негативно вплинула на активи і пасиви комерційних банків, динаміку їхнього чистого прибутку і збільшила суму непогашених позик. Обґрунтовано, що, попри збільшення часткових позик у США, останні не демонструють високого боргового навантаження. Також було встановлено, що свідченням процесу консолідації є збільшення питомої ваги п'яти найбільших банків країни в загальній сумі банківських активів США. У цьому дослідженні зроблено спробу вивчити вплив кризи у 2008—2009 рр. за показниками, що характеризують активи і пасиви комерційних банків у США. Таким чином, для того, щоб зробити цю гіпотезу, яка засвідчує взаємозв'язок кризи у 2008—2009 роках, показники, що характеризують активи та пасиви комерційних банків у США, повинні бути перевірені. На підставі дослідження було зроблено висновок, що основні показники американської банківської системи за досліджуваний період демонструють позитивну динаміку, за винятком фінансової кризи 2008—2009 років. Кількість банків постійно зменшується, що пояснюється не стільки їхньою ліквідацією, скільки злиттям і поглинанням. Під час фінансової кризи 2008 року банки функціонували лише з прибутком 10,2 млрд дол., що на 59,8 % менше, ніж попереднього, 2007-го. Це найнижчий річний дохід із 1989 року. Однак значне збільшення доходів 2018 року можна пояснити змінами в оподаткуванні. Водночас частка непогашених позик щороку зменшується з 2009 року, що є свідченням розсудливої кредитної політики.

**Ключові слова:** Федеральна резервна система, комерційні банки, ощадні установи, злиття і поглинання комерційних банків, активи комерційних банків, пасиви комерційних банків.

Формул: 1; рис.: 6; табл.: 3; бібл.: 35.

**Introduction.** Raising resources, using them at own risk or discretion — these operations are similar for commercial banks around the world. Commercial banks are a kind of blood vessels of any country, they are financial intermediaries for entities, involved in business, or the population itself. Despite all the above, the structure and functions of the US banking system are extremely unique. The United States is probably the only country in the world where banks have relatively recently been able to open branches or outlets in all states. Because of such restrictions on opening of branches, American banks are much smaller than in other countries. Moreover, the number of banks (4,518 banks and 659 savings institutions) operating in the country does not exist in any industrialized country in the world. Thus, despite the fact that the population of Japan and its economy is only twice less than the United States, it has about 100 banks.

The evolution of the paradigm of the American banking system at different stages of economic formation meant that until 1913 the country had no national banking system and until the last third of the 19th century there was no national currency, which provoked small and large financial crises in the country. The objective need to centralize the banking sector has led to the formation of the Federal Reserve System, which is unique and inimitable in its institutional structure.

Despite a large number of studies on the functioning of foreign banking systems, international economists undeservedly ignore the detailed analysis of the dynamics of the main indicators of the United States banking system.

**Literature review.** Foreign and domestic scientists have made a significant contribution to the development of the theory and practice of banking systems.

In particular, Professor Mishkin of Columbia University [29] studied the impact of monetary policy on the activities of financial markets and financial institutions, played an important role in the study of the United States banking system.

Dimitris K. Chronopoulos, Hong Liu, Fiona J. McMillan & John O.S. Wilson [4], in their work investigated the determinants of profitability for a large selection of US banks for the period 1984-2010. In particular, they assessed the extent to which short-term profits are maintained and whether they are affected by constant regulatory changes and the recent financial crisis.

Kevin J. Stiroh and Philip E. Strahan [30], found that the relationship between the relative efficiency of the bank and its further market share growth is significantly strengthened after deregulation, as the competitive effects of redistribution transmit assets to the best performers.

The opinion of scientists Lukianenko, I., Oliskevych, M., & Bazhenova, O. [27] and Zhylynska, O., Bazhenova, O., Chornodid, I. & Oliskevych, M. [35], who argue that linear regression models are the main tool for econometric analysis of economic variables, is shared.

Czech scientists Babecky Jan, Havranek Tomas, Mateju Jakub, Rusnák Marek, Smidkova Katerina, Vasicek Borek, [1], in their work argued that banking crises are the most expensive in terms of total production losses, and the resumption of production takes about six years. They also found indicators of early warning of the crisis, typical of developed economies. Their results showed that the onset of banking and currency crises is usually preceded by a boom in economic activity. In particular, the growth of domestic private credit, the increase in foreign direct investment inflows, the growth of money market rates, as well as the growth of world GDP and inflation were the general leading indicators of banking crises.

Scholars such as Süleyman Faruk Gözen, Yavuz Selim Elmas, Muhammed Tel [23] in one of their works focused mainly on the theoretical approach to the management of banking in the US economy in period before and after the crisis, analyzing historical and fundamental data. They believe that fiscal policy and governance are key to building a strong market structure to achieve a sustainable debt-to-GDP ratio.

To analyze the functioning of the American banking system based on the analysis of the dynamics of its main banking indicators.

**Methodological basis of the study.** The study is based on the analysis of the study of the American banking system based on indicators the number of banking institutions, their profitability / loss, the quality of the loan portfolio and analysis of the largest banks in the country. A systematic

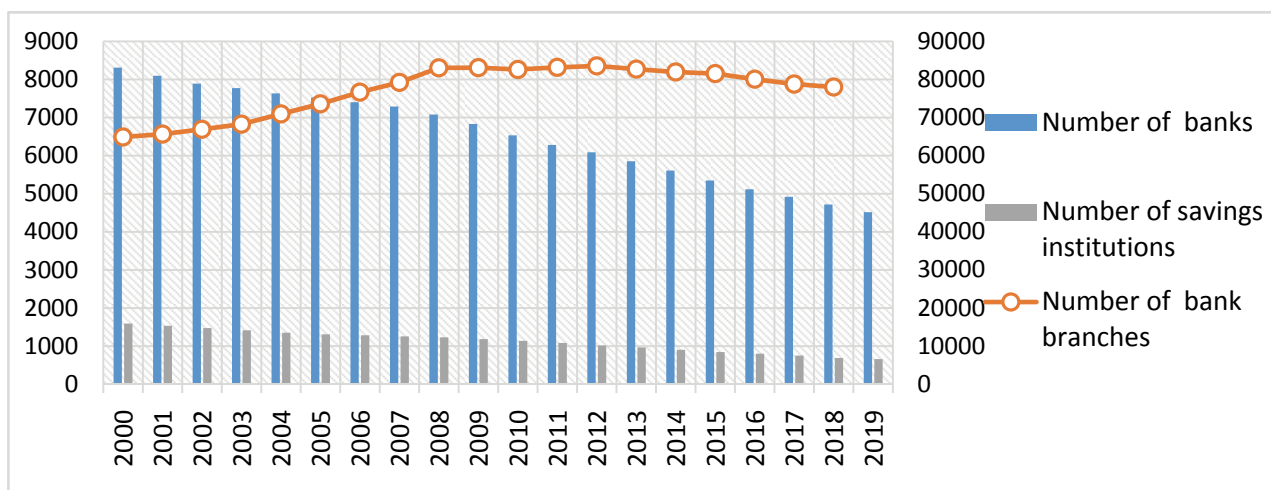
analysis of the quantitative and qualitative composition of the above-mentioned banking indicators, synthesis and generalization were used to generalize and formulate conclusions. To model the influence of crisis on assets and liabilities of commercial banks in the US the vector autoregression model that describes the dynamic relationships between different time series was chosen, when the previous values of the variables help to explain current in the best way.

Concerning the model, the influence of crisis on assets and liabilities of commercial banks in the US the vector autoregression model that describes the dynamic relationships between different time series was chosen, when the previous values of the variables help to explain current ones in the best way.

**Results & Discussion.** The number of banks has declined in most countries over the past decade.

The United States of America (USA) is no exception. Thus, at the end of 1998, about 8.8 thousand commercial banks operated in the United States, which is 40% less than in 1989 [33].

In 2018, there were 4,718 banks, 78,014 bank branches and 691 savings institutions insured with the FDIC in the country. As can be seen in Fig. 1 for the study period, positive dynamics was observed only for the number of bank branches until 2008. Thus, the number of commercial banks decreased by 42%, savings institutions — 57% during 2000—2018.



**Fig. 1. Dynamics of the number of banks, their branches, and savings institutions, 2000—2019**

Source: generalized and constructed on the basis of sources Federal Deposit Insurance Corporation, 2018 a; Federal Deposit Insurance Corporation, 2018 c; Federal Deposit Insurance Corporation, 2019.

Regarding the number of departments per 100,000 people (adults), from 2008—2018 they decreased by 13% and amounted to 35 and 31 departments per person, respectively [34].

In 2019, the number of banks and savings institutions also decreased to 4 518 and 659 respectively (FDIC Quarterly, 2020, p. 25). The decrease in the number of banks can be explained by mergers and acquisitions of banks, while the number of liquidated banks is not significant (Table 1). The current system of regulation and control in the United States, in particular by the Federal Deposit Insurance Corporation (FDIC), allows the rehabilitation of banks without leading them to bankruptcy.

Table 1

**Dynamics of the number of acquisitions and bankruptcies of banks, 2000—2019**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Acquisition of banks	2	4	7	3	3	0	0	3	25	129	149	90	47	23	18	8	5	8	0	4
Bankruptcies of banks	-	-	4	-	1	-	-	-	-	11	8	2	4	1	-	-	-	-	-	-

Source: generalized based on the source Federal Deposit Insurance Corporation, 2020.

The banking crisis of 2008 resulted in the closure of 11 banks, and the acquisition of 129 banking institutions by other banks. 2010 was the year of the maximum acquisition of the number of banks by other banks for the entire study period.

During 2019, 13 new banks were established, 226 institutions were merged, and four banks were acquired by other banks. The number of institutions in the list of troubled banks FDIC decreased from 55 at the end of the 3rd quarter of 2019 to 51 at the end of the 4th quarter of 2019. The assets of troubled banks fell from \$ 48.8 billion. in the 1st quarter of 2019 to 46.2 billion dollars in the 4th quarter of 2019 [11, p. 4].

As of April 6, 2020, the American banking system is represented by 5,108 banks, including 782 national banks (15%), 10 — foreign banks, 325 — savings institutions (6%) and 286 — savings banks (6%). Of these, 2,965 banks (58%) are not members of the Fed, and 740 (14%) are members of the Fed [12; 13].

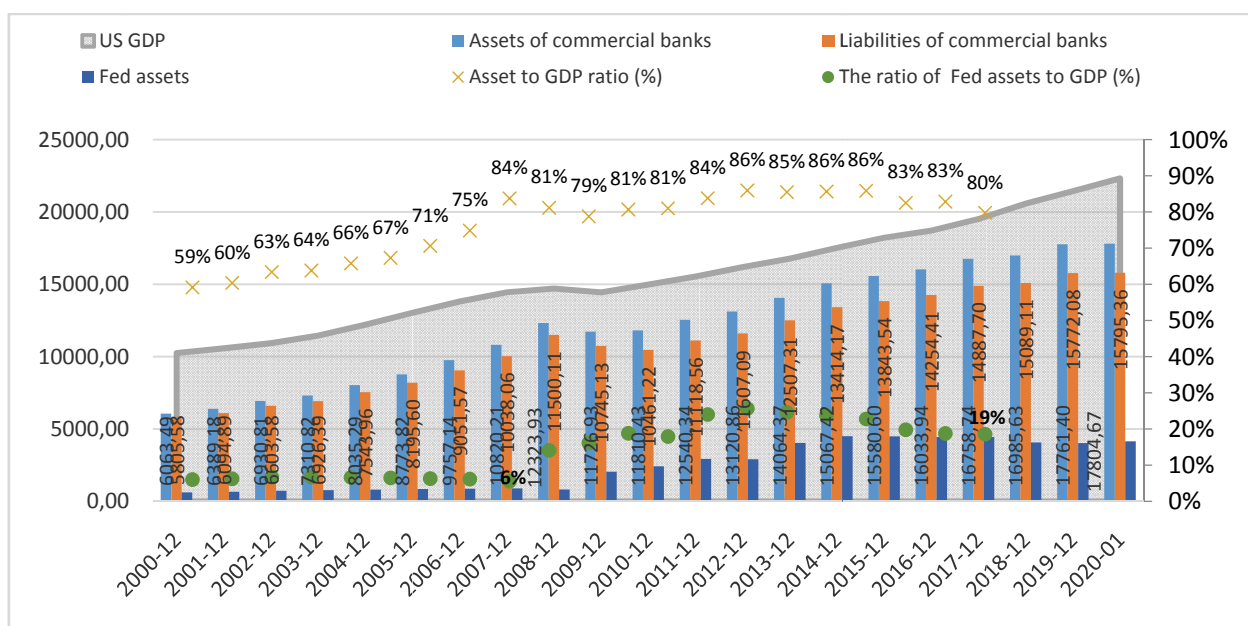


Fig. 2. Dynamics of banking indicators from 2000—01.2020

Source: generalized based on sources INTERNATIONAL MONETARY FUND, 2020; INTERNATIONAL MONETARY FUND, 2020; Federal Reserve Statistical releases, 2000; Federal Reserve Statistical releases, 2001; Federal Reserve System, 2020; Federal Reserve System, 2019.

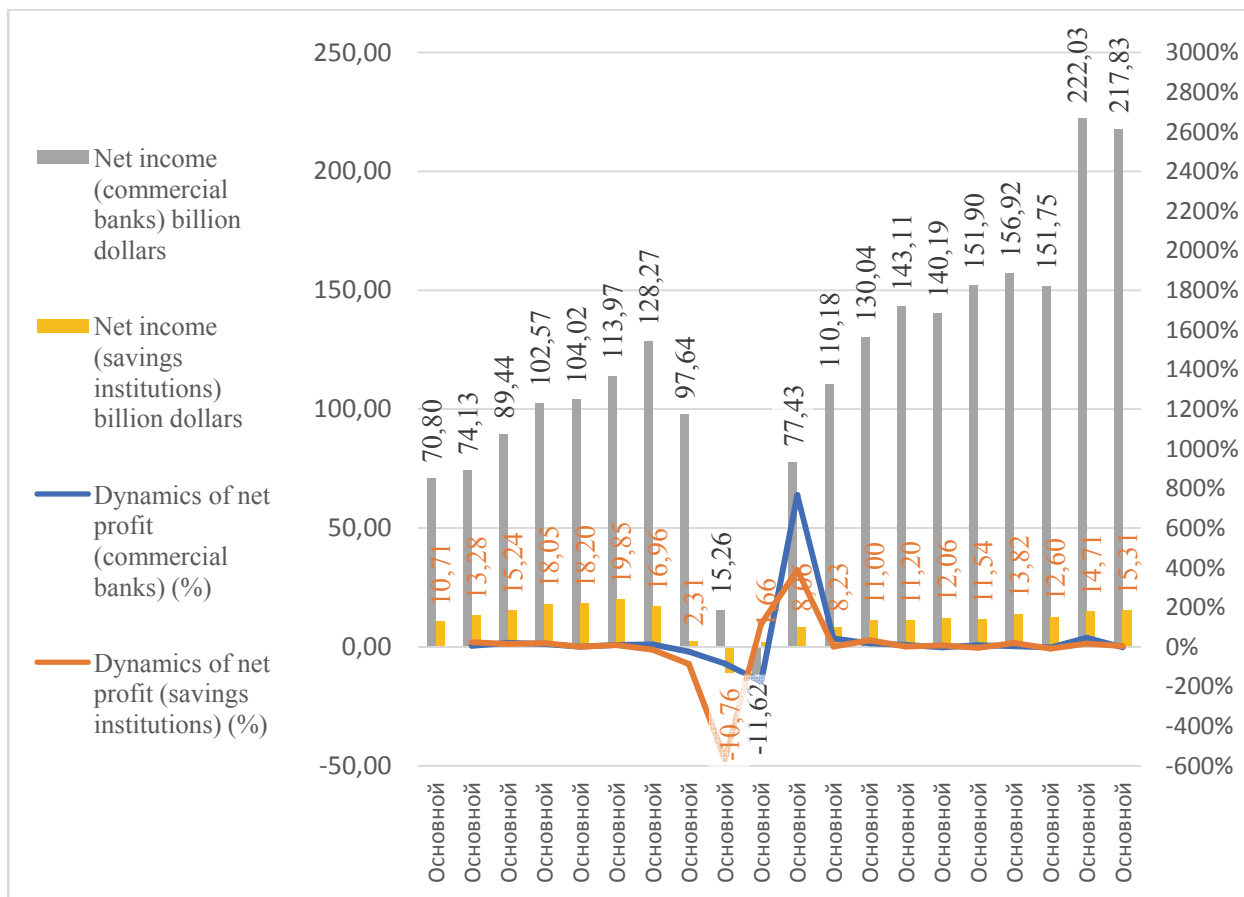
As it has been known, all national banks are required to be members of the Fed, which is not mandatory for full-time banks. In 1947, about 49% of banks were members of the Fed (maximum rate) [29, p. 422]. However, Fed member banks account for about 85% of the banking system’s assets. Today, almost all commercial banks are members of the FDIC, so further analytical indicators will consider the data of those commercial banks that are members.

It is fiscal policy and governance to achieve a sustainable debt / GDP ratio that is a key factor in building a strong market structure [23].

Thus, analyzing this figure, it can be stated that after the financial crisis of 2008, the ratio of Fed assets to US GDP increased from 6% in 2008 to 19% in January 2020. While comparing the charts of the Fed’s assets and commercial banks, it can be noticed that during the crisis period, namely from 2008—2009, the rate of commercial banks showed a decrease of 5% while the rate of the Fed increased by 149%. The period of the financial crisis also had a negative impact on the liabilities of commercial banks, which in 2009 decreased by 6.6% compared to 2008.

The opinion of Czech scholars that banking crises are the most expensive in terms of total production losses, and the resumption of production takes about six years is shared [1].

Regarding the profits of commercial banks and savings institutions, from 2000 to 2007 their net profits had a positive trend, which changed to negative in 2008 (Fig. 3).



**Fig. 3. Dynamics of net profit of commercial banks and savings institutions, 2000—2019**

Source: Constructed and generalized based on sources Federal Deposit Insurance Corporation, 2018 b; Federal Deposit Insurance Corporation, 2018 d; FDIC Quarterly, 2020, p. 7.

The net income of the banking sector for the whole of 2008 amounted to 10.2 billion dollars, having decreased by 89.8 billion dollars (by 89.8%) from the 100 billion received in the sector in 2007, the net loss amounted to 32.1 billion dollars USA. This is the lowest annual income since 1989, when net income was \$10.0 billion, the average return on assets (Return on Assets, ROA) for the year was 0.08%, and it was the lowest since 1987. Almost every fourth institution (23.6%) was unprofitable in 2008, and almost two out of every three institutions (62.8%) reported lower profits during the year than in 2007 [6].

Analyzing the data shown in Fig. 3, a significant increase in **net profit in 2018** should be noted: 46% — commercial banks and 17% — savings institutions, compared to 2017. Increase in net operating income (by USD 53.1 billion, by 7%) combined with lower expenses on income tax (decrease by USD 36.9 billion or by 37.7%) and on unprofitable reserves loans (by USD 1.1 billion, or by 2.2%) was reflected in 2018 in the growth of net profit of the banking sector to 236.7 billion, which is 72.4 billion dollars (44.1%) higher than indicator of 2017 [14].

The consequence of such a positive trend was changes in taxation. Thus, in the United States, instead of the existing progressive scale of corporate income tax, a single nominal rate of 21% was set. The new rate was significantly lower than its previous maximum rate (35%) and the maximum rate of individual income tax (37%). In 2019, the nominal income tax rate, including state and local taxes, was 25.89% in the United States (this is lower than in Germany (29.89%), France (32.02%), Belgium (29.58%), Greece (28%), Italy (27.81%), Portugal (31.5%) and Japan (29.74%)) [3].

If the tax rate that existed before the new tax law is applied, the net profit for the whole year in 2018 should be 207.9 billion US dollars [14].

For 5,177 commercial banks and savings institutions insured by the FDIC, net income for the entire **2019** amounted to \$233.1 billion, or \$3.6 billion (1.5%) less than in 2018. The decline was primarily due to a slowdown in net interest income growth (to \$5.5 billion or 1%) and higher loan

reserves (by \$5 billion, or 9.9%). The average net interest margin (NIM) decreased from 3.40% in 2018 to 3.36% in 2019, as average return assets grew faster than net interest income. The average return on assets (Return on Assets ROA) decreased from 1.35% in 2018 to 1.29% in 2019 [12; 13].

Wholesale financing is inherent in states that are unable to attract a sufficient level of retail deposit financing, they tend to increase the cost of loans due to concerns about the possible difficulties of debt prolongation [26, p. 35].

That is why after the crisis of 2008 the use of deposit financing increased. At the same time, enterprises have largely shifted to less complex and less capital-intensive activities, including retail banking and, in some cases, capital management. These patterns are manifested both in the strategic changes made by many banks and in the structure of their balance sheets and revenues.

In general, the share of loans in bank assets tends to grow, although the movement varies considerably from country to country, with Canada, India, Mexico, and Switzerland showing the largest growth. The structure of banks' assets, as a rule, reflects the reduction of debt securities in the post-crisis period. The main exceptions are Italy, where the volume of government securities has increased significantly, and in the United States [5, p. 18—19].

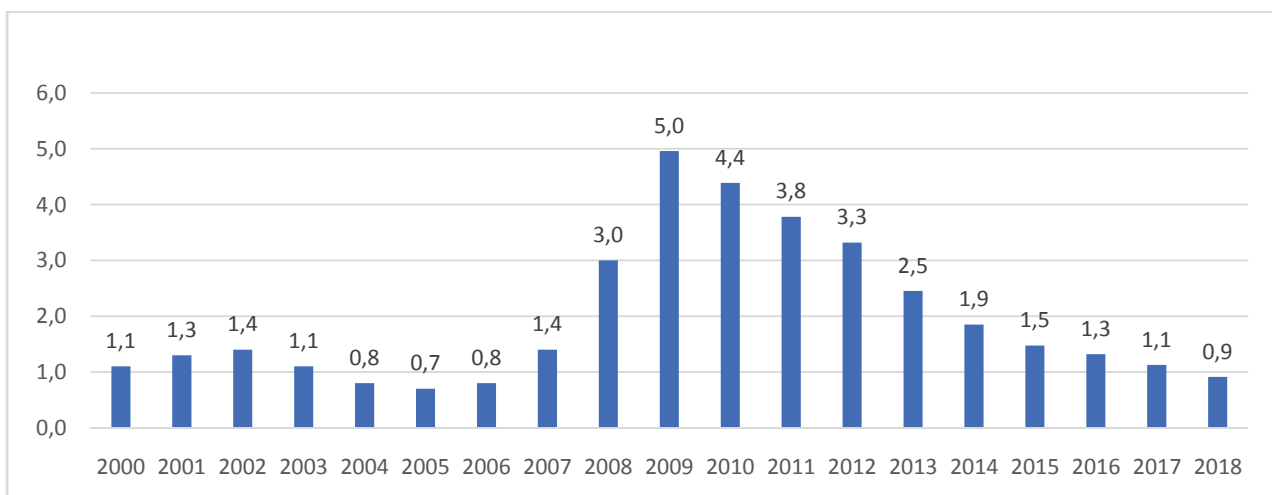
In particular, **the share of loans** in the asset portfolio of US commercial banks did not show significant deviations: in 2002 — 60%, in 2008 — 57%, and in 2019 — 56% [5, p. 84].

The share of **business loans** (including non-residential mortgages) has not changed significantly. Thus, in 2008 this figure was 40% [5, p. 91], while in 2019 its volume was 47% (24% — commercial and industrial loans and 23% non-residential mortgages of total loans). The share of loans for the purchase and **pledge of housing for individuals** in 2008 amounted to 29%, and in 2019 — 23% of total loans and 13% of all assets of US banks.

It should also be noted that there have been a few major changes in banks' asset portfolios, which are evidence of the abandonment of more complex or capital-intensive assets in favor of assets that usually pose less risk. The most noticeable trend after the crisis in this regard is the increase in the share of liquid asset funds, including in Australia, several European countries, the United Kingdom, and the United States. In some countries, the increase is due to higher cash balances, while there has been a significant increase in government debt ownership. As the share of available-for-sale debt securities for liquidity purposes has generally increased, many banks have reduced their share of interbank assets (which is reflected in the decrease in interbank liabilities) [5, p. 19].

**The share of non-performing loans** in the total number of loans increased sharply in the euro area (remains quite high in Italy and Spain), the United Kingdom and the United States.

Let us consider in more detail the quality and condition of the loan portfolio of American banks. Thus, in 2009 the highest share of non-performing loans (interest payments and principal, overdue for up to 90 days or more) to the total gross loan (total value of the loan portfolio) was observed (*Fig. 4*).



**Fig. 4. Share of outstanding loans from gross loans in the US, %, 2000—2018**

Source: World Bank, 2020.

Moreover, the amount of the loan recorded as non-performing includes the gross value of the loan recorded on the balance sheet, and not just the amount that is overdue. Since 2009, the share of outstanding loans has been declining every year.

Regarding household credit indebtedness, it grew rapidly from 2003 to 2008, mainly due to an increase in mortgage debt, which at its peak in the 3rd quarter of 2008 amounted to 9.29 trillion dollars US or 86% of total household debt. After 2008—2009, the total debt and mortgage debt showed a negative trend, declining by an average of 1% quarterly, reaching its minimum in the second quarter of 2013 — 11.23 trillion dollars (7.84 trillion was a mortgage or 70% of the total). However, since the third quarter of 2013, household debt has grown by 1% quarterly, which can be considered, on the one hand, a positive sign, as it may indicate an improvement in household income, on the other hand, increasing loans may reduce their quality (Fig. 5).

Despite the increase in loans, households in the United States do not show signs of a high debt burden higher than in 2008, as the ratio of household debt to gross domestic product — 66% is significantly lower than during the peak period — 87% in the first quarter of 2009 .

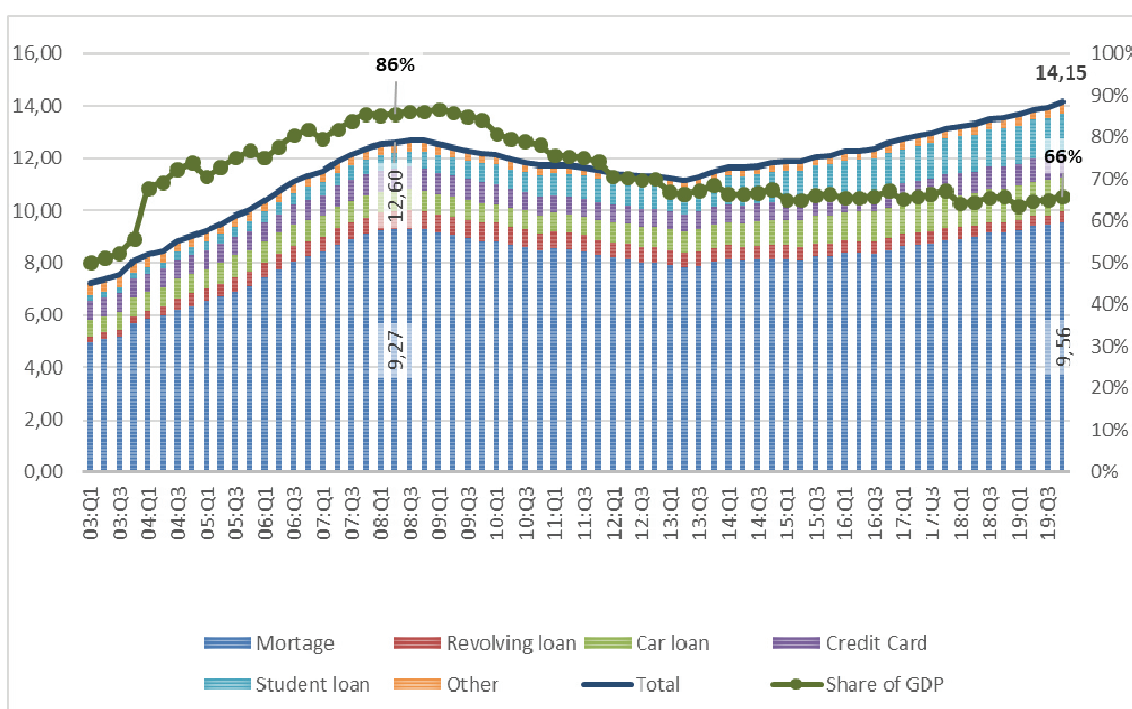


Fig. 5. Structure and volume of household loans, 2003—2019

Source: Federal reserve bank of New York, 2003; Federal reserve bank of New York, 2020.

The total debt of households in the United States in the fourth quarter of 2019 has increased by 601 billion dollars compared to the previous year, exceeding 14 trillion dollars. Mortgage lending increased by \$ 120 billion up to 9.56 trillion. Total debt for people aged 18 to 29 has risen to a record \$ 1.04 trillion, and by age structure the largest share of mortgages is received by citizens aged 40—49 — 27% and 50—59 — 24%. Positive dynamics also can be traced in student debt — an increase of 1.46 trillion. dollars (2018) to 1.51 trillion dollars (2019). Almost \$ 100 billion in student debt belongs to citizens over 60. According to the age structure, this type of loan is more concentrated in citizens aged 30 to 39 years (33%) (Tanzy, A., 2020. This trend, according to researchers, may deter young consumers, encouraging them to accumulate savings [28].

Total household debt balances increased by \$155 billion in the first quarter of 2020, what is 1.1% more and now is \$14.30 trillion. Mortgage balances amounted to \$9.71 trillion, which is \$156 billion more than in 2019. Increase in student loans by \$27 billion and \$15 billion on car loans was mainly offset by a seasonal decrease in credit card balances by \$34 billion. The decline in credit card balances was significantly larger than in the same period last year, which may reflect early signs of a reduction in consumer spending due to COVID-19.



Total credit card credit limits also increased by \$34 billion. US, amounting to more than \$3 trillion. As of March 31, 2020, 4.6% of outstanding debt was recorded, which is 0.1 percentage points less than in the fourth quarter of 2019 (from \$3.652 billion to \$449 billion). About 189,000 consumers filed for bankruptcy in their 2020 credit reports [17].

Evidence of the consolidation process is the increase in the share of the 5 largest banks in total US banking assets. According to the Federal Reserve System, which considers data from US commercial banks with assets of more than \$300 million USA, in 2019 the largest banks include JPMORGAN CHASE whose assets are 2.34 trillion dollars USA has the status of the National Bank), BANK OF AMERICA — 1.85 trillion dollars USA, WELLS FARGO — 1.71 trillion dollars USA, CITI BANK - 1.45 trillion dollars US and U S BK NA — 459.5 billion dollars USA. The total assets of the four banks are almost 44.2% of all bank assets in the United States [18].

In this research, an attempt to study the effect of crisis in 2008—2009 indicators characterizing assets and liabilities of commercial banks in the United States has been made.

Thus, to do this the hypothesis to testify relationship of crisis in 2008-2009 and indicators characterizing assets and liabilities of commercial banks in the United States has to be tested.

For this purpose, the quarterly data from 2000Q01 to 2020Q01 of Federal Reserve of the United States concerning assets and liabilities of commercial banks in the United States was retrieved. In models, such variables were used:

*assets\_tot* — total assets, all commercial banks, seasonally adjusted, annual growth rate (break adjusted),

*bank\_credit* — bank credit, all commercial banks, seasonally adjusted, annual growth rate (break adjusted),

*borrowings* — borrowings, all commercial banks, seasonally adjusted, annual growth rate (break adjusted),

*cash* — cash assets, all commercial banks, seasonally adjusted, annual growth rate (break adjusted),

*deposits* — deposits, all commercial banks, seasonally adjusted, annual growth rate (break adjusted),

*liabil\_tot* — total liabilities, all commercial banks, seasonally adjusted, annual growth rate (break adjusted),

*loans\_comm* — commercial and industrial loans, all commercial banks, seasonally adjusted, annual growth rate (break adjusted),

*loans\_consum* — consumer loans, all commercial banks, seasonally adjusted, annual growth rate (break adjusted),

*loans\_re* — real estate loans, all commercial banks, seasonally adjusted, annual growth rate (break adjusted).

Table 2 represents the descriptive statistics of these series as well as Jarque-Bera statistics and corresponding p-values for testing the normal distribution.

Table 2

The descriptive statistics of used series

	<i>assets</i>	<i>bank_credit</i>	<i>borrowings</i>	<i>cash</i>	<i>deposits</i>	<i>liabil_tot</i>	<i>loans_comm</i>	<i>loans_consum</i>	<i>loans_re</i>
Mean	4.98	4.59	2.14	12.52	6.31	4.94	4.06	3.02	4.77
Median	4.80	5.20	3.90	2.10	6.40	4.90	7.50	4.10	3.90
Maximum	21.70	17.30	28.60	568.60	14.60	25.50	24.60	14.70	27.10
Minimum	-12.10	-8.80	-39.10	-30.80	-0.50	-15.80	-27.40	-9.30	-10.90
Std. Dev.	5.34	4.68	12.69	67.01	2.77	5.93	10.30	4.30	7.31
Skewness	-0.19	-0.57	-0.72	7.22	0.02	-0.39	-0.91	-0.99	0.49
Kurtosis	4.49	3.87	3.96	60.10	3.03	5.82	3.46	4.36	3.31
Jarque-Bera	7.98	7.01	9.94	11709.73	0.01	28.84	12.02	19.48	3.52
Probability	0.02	0.03	0.01	0.00	0.99	0.00	0.01	0.00	0.17

In addition, dummy variable *crisis* was used to indicate periods of growth decreases in the US during 2008—2009. Therefore, it equals «1» from 2008Q1 to 2009Q2 and «0» in other periods due to values of industrial production growth in the US.

As mentioned before [2; 27; 35], linear regression models are the main toolkit for econometric analysis of economic variables. To model the influence of crisis on assets and liabilities of commercial banks in the US a vector autoregression model was chosen that describes the dynamic relationships between different time series, when the previous values of the variables help to explain current in the best way.

Performed Augmented Dickey-Fuller test for unit root indicated stationarity of all series except *loans\_comm* and *loans\_re* that are first order integrated (Table 3).

Table 3

**The results of Augmented Dickey-Fuller test statistic**

Variable	t-Statistic	Prob.*
<i>assets_tot</i>	-5.394519	0.0000
<i>bank_credit</i>	-3.285086	0.0188
<i>borrowings</i>	-4.659305	0.0003
<i>cash</i>	-7.789307	0.0000
<i>deposits</i>	-5.787393	0.0000
<i>liabil_tot</i>	-5.772200	0.0000
<i>loans_comm</i>	-2.365411	0.1548
<i>loans_consum</i>	-3.629923	0.0335
<i>loans_re</i>	-1.674197	0.7532
<i>d(loans_comm)</i> (first difference of <i>loans_comm</i> )	-7.869060	0.0000
<i>d(loans_re)</i> (first difference of <i>loans_re</i> )	-6.817783	0.0000

\* MacKinnon one-sided p-values.

Therefore, all variables in levels except *loans\_comm* and *loans\_re* that were included in models in first differences were used.

Thus, nine vector autoregression models to analyze the influence of crisis of 2008-2009 on indicators concerning assets and liabilities of commercial banks in the US was constructed.

The specifications of these models are as follows:

$$Y_{1,t} = A_{10} + A_{11}Y_{1,t-1} + A_{12}Y_{1,t-2} + A_{13}Y_{1,t-3} + A_{14}Y_{1,t-4} + \epsilon_{1t},$$

$$Y_{2,t} = A_{20} + A_{21}Y_{2,t-1} + \epsilon_{2t},$$

$$Y_{3,t} = A_{30} + A_{31}Y_{3,t-1} + \epsilon_{3t},$$

$$Y_{4,t} = A_{40} + A_{41}Y_{4,t-1} + A_{42}Y_{4,t-2} + A_{43}Y_{4,t-3} + A_{44}Y_{4,t-4} + A_{45}Y_{4,t-5} + A_{46}Y_{4,t-6} + A_{47}Y_{4,t-7} + \epsilon_{4t},$$

$$Y_{5,t} = A_{50} + A_{51}Y_{5,t-1} + A_{52}Y_{5,t-2} + A_{53}Y_{5,t-3} + A_{54}Y_{5,t-4} + A_{55}Y_{5,t-5} + A_{56}Y_{5,t-6} + A_{57}Y_{5,t-7} + \epsilon_{5t},$$

$$Y_{6,t} = A_{60} + A_{61}Y_{6,t-1} + \epsilon_{6t},$$

$$Y_{7,t} = A_{70} + A_{71}Y_{7,t-1} + \epsilon_{7t},$$

$$Y_{8,t} = A_{80} + A_{81}Y_{8,t-1} + \epsilon_{8t},$$

$$Y_{9,t} = A_{90} + A_{91}Y_{9,t-1} + \epsilon_{9t}.$$

where  $Y_{1,t} = (assets\_tot_t, crisis_t)$ ,  $Y_{2,t} = (bank\_credit_t, crisis_t)$ ,  $Y_{3,t} = (borrowings_t, crisis_t)$ ,  $Y_{4,t} = (cash_t, crisis_t)$ ,  $Y_{5,t} = (deposits_t, crisis_t)$ ,  $Y_{6,t} = (liabil\_tot_t, crisis_t)$ ,  $Y_{7,t} = (d(loans\_comm)_t, crisis_t)$ ,  $Y_{8,t} = (d(loans\_comm)_t, crisis_t)$ ,  $Y_{9,t} = (d(loans\_re)_t, crisis_t)$  — vectors of endogenous variables,  $A_{10}, A_{20}, A_{30}, A_{40}, A_{50}, A_{60}, A_{70}, A_{80}, A_{90}$  — vectors of intercepts,  $A_{1j} (j = 1,4), A_{21}, A_{31}, A_{4j} (j = 1,7), A_{5j} (j = 1,7), A_{61}, A_{71}, A_{81}, A_{91}$  — coefficients matrixes,  $\epsilon_{1t}, \epsilon_{2t}, \epsilon_{3t}, \epsilon_{4t}, \epsilon_{5t}, \epsilon_{6t}, \epsilon_{7t}, \epsilon_{8t}, \epsilon_{9t}$  — vectors of disturbances.

The orders of the VAR models were chosen based on Schwarz information criterion values. Moreover, all VAR models are stationary due to inverse roots modulus values of AR characteristic polynomial estimated.

Thus, based on the VAR models the responses of indicators concerning assets and liabilities of commercial banks in the US to shock in *crisis* should be analyzed.

For this purpose, an impulse response functions as a response to Cholesky one standard deviation innovations was generated (Fig. 6).

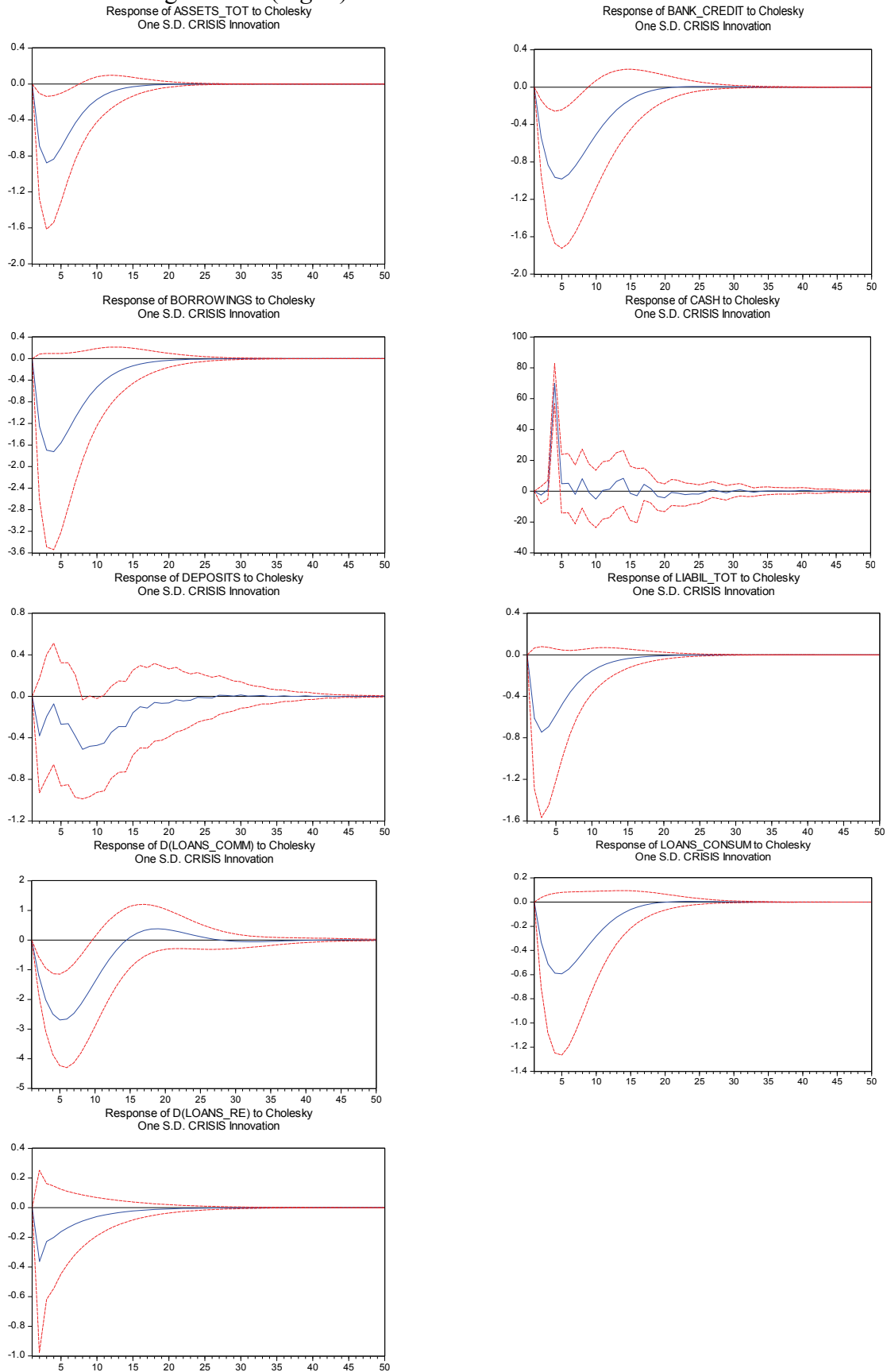


Fig. 6. Impulse response functions for indicators concerning assets and liabilities of commercial banks in the US to shock in crisis

Analysis of impulse response functions shows that all variables demonstrate similar dynamics after a shock in *crisis*, except cash assets in all commercial banks.

Thus, sharp decline in fourth- fifth quarters, then moderate rising with stabilization in 15<sup>th</sup>—20<sup>th</sup> quarters after the shock can be observed. In turn,  $d(loans\_comm)$  demonstrates the most decrease among all modelled variables, up to 3 per cent,  $d(loans\_re)$  — the least one. Such indicators as  $assets\_tot$ ,  $bank\_credit$ ,  $liabil\_tot$ ,  $loans\_consum$  felt up to 0,8 per cent due to shock in *crisis*. In turn, borrowings shows maximum decline at the level of near 1,8%.

Only *cash* demonstrates spur in the fourth quarter with peak approximately at 70 per cent.

**Conclusions.** In general, the dynamics of the main indicators of the American banking system for the period under study shows a positive trend, except for the financial crisis of 2008—2009.

During the financial crisis of 2008, banks made a profit of only 10.2 billion dollars, which is 59.8% less than in 2007. This is the lowest annual income since 1989. The significant increase in revenues in 2018 can be explained by changes in taxation. At the same time, the share of outstanding loans has been declining every year since 2009, which is evidence of a sensible and prudent credit policy. After the 2008 financial crisis, the ratio of FED assets to US GDP has been increasing.

Based on the VAR model, we analyzed the relevant indicators of assets and liabilities of commercial banks in the United States on the susceptibility to the shock during the financial crisis. In order to model the impact of the crisis on the assets and liabilities of commercial banks in the United States, a vector of the autoregression model is chosen, that describes the dynamic relationships between the different time series, when previous values of variables help to explain the current ones.

Commenting on the simulation results, it should be noted that after the onset of the shock there is a sharp decline in almost all studied indicators (except for cash assets of commercial banks) in the fourth or fifth quarters, then, we moderate a growth followed by the stabilization in 15-20 quarters. In its turn, the growth rate of commercial and industrial loans shows the largest decrease among all simulated variables, up to 3 percent, and the growth rate of real estate loans - the smallest decline.

In addition, it is worth noting that the indicators such as total assets, bank loans, total liabilities and consumer loans of commercial banks have decreased to 0.8% as a result of the impact. In its turn, the borrowing showed a maximum decrease of about 1.8%. Only the cash assets of commercial banks showed a significant increase in the fourth quarter, at almost 70 percent.

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# МУКАЧІВСЬКИЙ ДЕРЖАВНИЙ УНІВЕРСИТЕТ

89600, м. Мукачево, вул. Ужгородська, 26

тел./факс +380-3131-21109

Веб-сайт університету: [www.msu.edu.ua](http://www.msu.edu.ua)

E-mail: [info@msu.edu.ua](mailto:info@msu.edu.ua), [pr@mail.msu.edu.ua](mailto:pr@mail.msu.edu.ua)

Веб-сайт Інституційного репозитарію Наукової бібліотеки МДУ: <http://dspace.msu.edu.ua:8080>

Веб-сайт Наукової бібліотеки МДУ: <http://msu.edu.ua/library/>