

Implementation of Basel III and Stress Testing of Ukrainian Banking System

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Abstract.

The article deals with scientific publications and recommendations of leading international organizations on conducting stress testing. The current stress testing methodology developed by the National Bank of Ukraine (NBU) in accordance with the implementation stages of Basel III recommendations is also researched. The results of stress testing of banks in Ukraine during 2014-2019 and current trends in the banking sector are presented. The disadvantages in the methodology of stress testing were pointed out, the necessity of its further research and development as effective instrument of banking system diagnostic was substantiated. Recommendations on improving the banking stress testing methodology are given.

Keywords: bank, stress testing, National Bank of Ukraine, core capital, regulatory capital

JEL Classification: G21, G28

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Introduction

In the recent years financial crises have raised a particular challenge for the central banks in different countries. Basel Committee of Banking Supervision has taken various steps to face these challenges by introducing Basel III with making the global banking sector more resilient.

The basic idea the introduction of Basel III in 2010 was to ensure that banks have sufficient capital to cover their risks, and to ensure that banks and banking systems are more resilient to economic and financial shocks. Additionally, stress tests came to be recognized as a powerful tool not only in risk management, but also in micro prudential and macroprudential policies. In 2010 the Federal Reserve launched the Comprehensive Capital Analysis and Review (CCAR) program to evaluate capital adequacy and internal capital planning processes of large banking groups (FRS website). In spite of the different stress testing programs, there are few studies

on the them implementation for assessment of financial stability of the banking system in countries, which integration into the European banking system. This paper is one of the few studies.

Analysis of recent research and publications.

The issues of assessing the financial stability of a banking system are studied by a sufficient number of foreign and domestic scholars. In particular, the policy of the stress-testing in the US, the UK, and the EU area wide describes in researches Bookstaber, Rick, Jill Cetina, Greg Feldberg, Mark Flood, and Paul Glasserman (2014), Sangha, Balvinder and Jane Lin (2013), Schuermann, Til (2014), Wall, Larry (2014), Goldstein, Morris (2017). Kapinos, Pavel, Oscar Mitnik, and Christopher Martin (2018).

Domestic researchers in the sphere of risk management and in particular in the field of stress testing are represented by such scientists as I. M. Posokhov, O.O. Khodyreva (2018), Bortnikov, H.P. and Liubich, O. O. (2016), Ramskyi A., Loiko V., Sobolieva-Tereshchenko O., Loiko D., Zharnikova V. (2017), Krykliy O., Luchko I., (2018). However, the fact that the use of stress testing is not wide-spread, makes it possible to judge about certain problems of the adaptation of the proposed methods to the current realities of the banking sector of the Ukrainian economy.

The purpose of the article is the study of special features and approaches to conducting stress testing of the banks in Ukraine, in the context of the implementation of Basel III recommendations on banking regulation of and expansion of Ukraine's cooperation with the IMF, as well as the assessment of the financial stability of a banking system after results of stress testing of Ukrainian banks in 2014-2019.

Presentation of the main material.

The current study is based on the information collected from the different sources such as research papers, published reports, published articles, newspapers, conference proceedings, science publications, Basel Committee of Banking Supervision, Reports of Credit Rating Agencies and others.

The purpose of stress testing is to assess to what extent an individual bank, group of banks or the banking system as a whole are resistant to exceptional, but plausible shocks. Stress tests are aimed at determining the sensitivity of a bank's portfolio or the whole banking system to negative shocks, carrying out a forecast impact assessment of the effects of these shocks on financial indicators and capital of banks, and further defining measures to enhance the resilience of the banking system to such shocks. Basic approaches to the interpretation of the concept of stress testing are given in Table 1.

Table 1 - Interpretation of the concept of stress testing

International Monetary Fund	The term “stress testing”- a range of techniques used to assess the vulnerability of a portfolio to major changes in the macroeconomic environment or to exceptional, but plausible events. The objective of a stress test is to make risks more transparent by estimating the potential losses on a portfolio in abnormal markets/ Stress tests are often used to complement the internal models and management systems used by a financial institution for capital allocation decisions.
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World Bank	Stress testing is a useful risk management assessment tool to identify potential weaknesses both within an individual bank and banking sector as a whole to avoid potential risks. A set of statistical methods for assessing the vulnerability of financial institutions and financial systems to exceptional, but plausible events.
Basel Committee on Banking Supervision	Stress testing is now a critical element of risk management for banks and a core tool for banking supervisors and macroprudential authorities. Stress testing is integral to banks’ risk management and banking supervision, in that it alerts bank management and supervisory authorities to unexpected adverse outcomes arising from a wide range of risks, and provides an indication to banks and supervisory authorities of the financial resources that might be needed to absorb losses should large shocks occur.
Federal Reserve System	Dodd-Frank Act supervisory stress testing is a forward-looking quantitative evaluation of the impact of stressful economic and financial market conditions on firms’ capital. The supervisory stress test that is carried out pursuant to the Dodd Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) and the Board's rules serves to inform the Federal Reserve, firms, and the general public of how institutions’ capital ratios might change under a hypothetical set of stressful economic conditions developed by the Federal Reserve.
National Bank of Ukraine (NBU)	Stress testing is a method of quantitative risk assessment, which is meant to determine the magnitude of the unmatched position, which may expose the bank to risk, and to assess the shock value of changes of external factors - the exchange rate, interest rate, etc. The combination of these variables gives an idea about the amount of losses or revenues the bank would receive if events were to develop based on assumptions. Stress testing is widely used to assess credit risk, liquidity risk, currency risk, interest rate risk and asset value. The purpose of stress testing is the assessment of risks and the determination of the ability of the bank to avoid shocks in the financial market.

Thus, stress testing is used by the leading central banks of the world as an incentive to improve the quality of internal audit and risk management in banks, shifting the focus of banking supervision from the traditional analysis of the current state of liquidity and capitalization to their possible implications in the future under the influence of extreme events.

The world economic community created a number of documents with recommendations on conducting stress testing. The main contributions were made by the following organizations: The Financial Stability Board; Basel Committee on Banking Supervision; the Council for European Banking Supervision; the Institute of International Finance. These regulatory acts contain basic recommendations for conducting stress tests, but there is no specific list of actions for their implementation. This allows banks to develop their own stress testing methods based on the proposed principles, taking into account the specifics of their business models. Basic approaches to the stress testing are given in Table 2.

Table 2 - Comparison of stress testing approaches

Country	UK	USA	EU	UA
Program	Bank of England stress test	Dodd-Frank Act Stress Test (DFAST)	EU- wide stress test (EBA)	NBU stress test

Essence	Bottom-up micro prudential exercise. Banks submit their projections, BoE uses those submissions as a starting point for the stress test, making its own adjustments (top-down approach).	Primarily top-down micro prudential exercise using individual bank and industry level data to assess the impact of stressful economic and financial market conditions on the solvency of banks.	Supervisory Mechanism: a bottom-up micro prudential exercise. Macroprudential top down: a top-down macroprudential exercise.	Top-down approach. The NBU`s estimate of the bank's capital adequacy based on the results of stress testing under the baseline and adverse macroeconomic scenarios.
Scenario	Baseline, annual cyclical, biennial exploratory	Baseline, adverse, severely adverse	Baseline, adverse	Baseline, adverse
Institutions	7 major UK banks and building societies	31 BHCs	123 banking group from 22 countries	29 UA banks
Stess testing horizon	5 years	9 quarters	3 years	3 years
Coverage of exercise	Include all PRA-regulated banks and building societies with total retail deposits greater than £50 billion.	The banks represent approximately 80% of domestic bank assets.	All SSM SIs would represent roughly 80% of the total euro area bank assets.	The banks represent 93% of domestic bank assets.
Disclosure	Detailed disclosure of aggregate bank results, capital-ratio data on individual banks.	both CCAR and DFAST post-stress capital ratios are publicly disclosed at bank level.	Results for banks in the EBA sample are made public.	Results for banks are made public.

Having studied the successful foreign experience, the National Bank of Ukraine also decided to use the stress testing tool to monitor and improve the financial sustainability of the country's banking system. According to the historical retrospective data, in the formation of the strategy of banking stress testing in Ukraine two stages of assessing the financial stability of the banking system are distinguished: the first stage - 2014-2017 and the second stage - 2018 to date.

The first stage is characterized by a set of diverse approaches to assessing the financial stability of banks using the basic macroeconomic scenario of stress tests. For the first time, the banking system for assessing the financial sustainability of banks began to analyze not only the banks' compliance with banking standards, but also to assess the macroeconomic environment. The specific features of this stage were significant fluctuations in the number of banks subject to stress testing, floating dates for assessing the diagnosis of banks, analysis of credit and currency risks. But

the most important factor was practical non-disclosure of the results of stress testing for wide public.

The second stage of banking stress testing strategy in Ukraine is linked to the NBU Board Resolution No. 141 “The Regulations on the Evaluation of the Resilience of Banks and the Banking System of Ukraine” (NBU, 2017). An annual assessment of the resilience of banks and the banking system of Ukraine initiated by the NBU unified the size of the banks' sample for research, the general approach to selecting auditors, the dates and periods of assessment of diagnosis, macroeconomic scenarios, individual and portfolio stress testing, types of risks analyzed. But the most important was the legislative approval of the publication of the results of stress testing. The indicators of macroeconomic scenarios of the first and second stage of the formation of the banking stress testing strategy in Ukraine are presented in Tables 3 and 4.

Table 3 - Basic macroeconomic stress-testing scenario (2013-2017)

Indicator	Basic macroeconomic scenario				
	2013	2014	2015	2016	2017
Change of real GDP	0,2%	-6,8%	-9,0%	2,0%	3,5%
Change of nominal GDP	3,2%	7,0%	26,4%	14,2%	13,7%
Exchange rate on IBM *, average	8,0	12,0	22,0	24,1	24,7
Exchange rate on IBM *, at the end	8,0	15,8	23,5	24,4	24,9
Rate of lending in UAH	15,7%	17,2%	21,1%	15,8%	13,7%
Rate of lending in USD.	9,5%	8,7%	8,3%	8,4%	8,5%
The rate of raising funds in UAH.	10,5%	11,7%	12,9%	9,3%	7,6%
The rate of raising funds in USD.	5,9%	6,7%	6,5%	5,8%	5,5%

*IBM –Interbank Market

The stress testing of Ukrainian banks in 2013-2017 clearly follows the continuous growth of exchange rates on the Interbank Market for 4 years. Also, the growth rates of attraction and lending in hryvnias (UAH) up to 2015 and the trend until their decrease in 2016 and 2017 are clearly evident. In the baseline macroeconomic scenario of stress testing, the rates of attraction of funds and lending in foreign currency are different from rates in the national currency. Over the course of 4 years, they are constantly fluctuating, but there is a tendency to reduce the spread between rates from 2013 to 2015 from 3.6 points to 1.8 points and its increase in subsequent years, respectively, 2.6 points in 2016 and 3 points in 2017.

The greatest fluctuations under the baseline macroeconomic scenario of stress testing of Ukrainian banks during this period are observed in changes in real GDP and nominal GDP. In addition, during the period from 2013 to 2017 they have opposite trends. For example, from 2013 to 2015 nominal GDP grows rapidly from 3.2% to 26.4%, while real GDP drops sharply from 0.2% to -9.0%. In the next two years, nominal GDP falls to 14.2% in 2016 and 13.7% in 2017, while real GDP grows to 2.0% and 3.5% respectively.

Such a gap between real and nominal GDP with the constant growth of exchange rates is attributable to the high level of dollarization of Ukrainian economy and to the regulator working out the method of stress testing, taking into account macroeconomic indicators. Starting from 2018, the NBU began to conduct

assessments of banks' resilience, which envisage three stages of analyzing the stability of banks and the banking system of Ukraine, including conducting stress testing for a separate list of banks for 3 years after the reporting date under the baseline and adverse macroeconomic scenarios.

Table 4 - Stress testing scenario (2018-2019)

Indicator	s/y	Baseline scenario			Adverse scenario		
		2017*	2018	2019	2020	2018	2019
Real GDP	2,5%	3,4%	2,9%	2,9%	-3,3%	-3,8%	1,0%
Nominal GDP	25,1%	15,7%	11,3%	9,0%	18,8%	12,7%	11,6%
Consumer price index, at the end	13,7%	8,9%	5,8%	5,0%	18,7%	15,5%	9,3%
		According to «Focus Economics» estimates			According to NBU estimates		
Reduction in the rate of UAH to USD (s / y).	3,8%	5,4%	2,7%	1,5%	23,1%	11,1%	5,6%
	2018*	2019	2020	2021	2019	2020	2021
Real GDP	3,4%	2,5%	2,9%	3,7%	-4,1%	-3,7%	1,0%
Nominal GDP	19,1%	11,6%	9,4%	9,4%	17,6%	13,3%	11,4%
Consumer price index, at the end	9,8%	6,3%	5,0%	5,0%	15,8%	14,8%	8,8%
		According to «Focus Economics» estimates			According to NBU estimates		
Reducing the rate of UAH to USD (s / y)	2,2%	7,5%	3,3%	1,0%	23,2%	11,1%	4,1%

*S/y – the settlement year

According to the scenarios of stress testing of Ukrainian banks in 2018-2019, the forecast of real and nominal GDP indicators remained, but the exchange rates on IBM, rates for raising funds and lending in foreign currency and in national currency were replaced by two other indicators: the consumer price index and the rate of depreciation of UAH to USD. For forecasting, three macroeconomic scenarios were proposed - baseline, favorable and adverse. Scenarios of stress testing of Ukrainian banks for 2018 and 2019, unlike the basic macroeconomic scenarios of stress testing from 2013 to 2017, are more unified, systematic and logically related.

So, under the baseline scenario for 2018 and 2019 real GDP figures coincide - 3.4% (2018) and 2.9% (2020). The consumer price index at the end of 2020 is planned at 5.0%. Under the adverse scenario, the decline in the rate of UAH to USD, according to the NBU's estimate in 2019, remains at the level of 2018. The rate of depreciation of UAH to USD, according to "Focus Economics" estimates, under the baseline scenario is well below the NBU's forecast under the adverse scenario, indicating that the regulator takes into account the degree of dollarization of the country's economy under the adverse scenario.

Thus, Ukraine is currently in the second stage of developing a strategy for banking stress testing. It is characterized by the introduction of disclosure of information on the results of the assessment of stability for the sector as a whole on the website of the National Bank and by the intention of the regulator to improve approaches to stress testing of banks with the support of the robust IT systems.

Taking into account almost five years of experience of Ukraine, we note that assessing the stability of the banking sector by estimating the status of the core capital (CC) and regulatory capital (RC) of banks, analyzing the adequacy and needs of banks in capital as well as stress testing of a group of selected systemically important banks are effective. The results of three-year forecasting of financial stability of Ukrainian banking system under the baseline and adverse scenarios for Core capital and Regulatory capital are presented in Table 5.

Table 5 - Diagnostic results (comparison across groups of banks) as of 01.01.18

Indicator	Foreign banks*		State-owned banks		Private banks		All banks under stress test	
	Core capital, UAH mln	Regulatory capital, UAH mln	Core capital, UAH mln	Regulatory capital, UAH mln	Core capital, UAH mln	Regulatory capital, UAH mln	Core capital, UAH mln	Regulatory capital, UAH mln
Bank's data	18 665	30 684	39 599	47 294	8 337	10 495	75 475	98 836
AQR	18 382	29 986	39 180	46 862	6 145	8 035	69 231	91 285
Forecast year	Baseline scenario							
1st	30 460	34 012	43 180	60 016	6 065	7 218	84 467	106 886
2nd	42 434	45 224	58 180	74 422	8 687	9 723	112 632	133 579
3rd	55 296	57 514	76 689	91 665	12 506	13 428	148 540	167 533
Forecast year	Adverse scenario							
1st	24 190	26 750	3 400	8 969	-3 962	-3 483	21 748	30 955
2nd	33 930	35 522	-4 358	-256	-5 662	-5 212	17 974	24 181
3rd	46 298	47 526	2 487	11 536	-3 550	-2 668	38 845	50 120

AQR - asset quality review*excl. Banks owned by Russia

Under the adverse scenario for the second year in the group of state-owned banks negative values appear for the indicators of Core capital and Regulatory capital. In the group of private Ukrainian banks, under the adverse scenario all three years have negative implications. And only a group of banks with foreign capital has positive values of Core Capital and Regulatory Capital under the adverse scenario. According to the baseline scenario, banks should ensure that the minimum requirements for CAR (H2 - 10%) and Core capital ratio (H3 - 7%) are met. Indicators H2 and H3 provided to banks and AQR determined by the NBU are shown in Figure 1

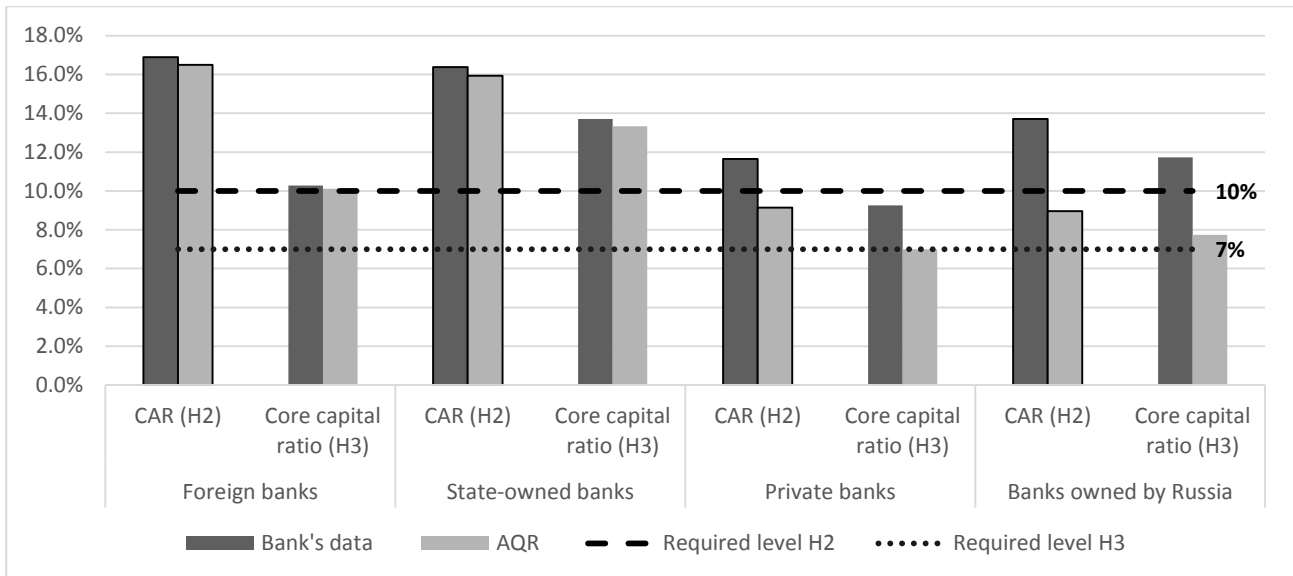


Fig.1. Diagnostic results of H2, H3 (comparison across groups of banks) as of 01.01.18

According to the banks ‘data, the norms CAR (H2) and Core capital ratio (H3) in 2018 met the normative value. At the same time, the indicator CAR (H2) by the result of Asset Quality Review (AQR) was not reached by a group of private Ukrainian banks and state-owned Russian banks, and accounted for 9.1% and 9.0%, respectively, at the regulatory value of 10%. The results of three years of forecasting the financial sustainability of the Ukrainian banking system under the baseline and adverse scenario for indicators H2 and H3 are presented in Table 6.

Table 6- Diagnostic results H2, H3 (comparison across groups of banks) as of 01.01.18

Indicator	Foreign banks		State-owned banks		Private banks		All banks under stress test	
	CAR (H2)	Core capital ratio (H3)	CAR (H2)	Core capital ratio (H3)	CAR (H2)	Core capital ratio (H3)	CAR (H2)	Core capital ratio (H3)
Bank's data	16,9%	10,3%	16,4%	13,7%	11,6%	9,3%	15,5%	11,9%
AQR	16,5%	10,1%	15,9%	13,3%	9,1%	7,0%	14,4%	10,9%
Forecast	Baseline scenario							
1st	18,9%	16,9%	22,3%	16,1%	8,7%	7,3%	17,8%	14,1%
2nd	25,0%	23,5%	27,8%	21,7%	11,8%	10,5%	22,4%	18,9%
3rd	31,7%	30,5%	34,0%	28,4%	16,2%	15,1%	27,9%	24,7%
Forecast	Adverse scenario							
1st	14,5%	13,1%	3,5%	1,3%	-4,1%	-4,6%	5,3%	3,7%
2nd	19,2%	18,3%	-0,1%	-1,8%	-6,2%	-6,7%	4,2%	3,1%
3rd	25,4%	24,7%	4,7%	1,0%	-3,1%	-4,1%	8,7%	6,7%

Prospects for further research. The banking system is an important element of the economy of any country. Today, many scholars and experts in the field of banking regulation consider Basel III recommendations of the Basel Committee on

Banking Supervision as an effective tool for assessing the financial stability of the banking system and study the experience of stress testing in other countries

The experience of Ukraine shows that the framework of stress testing should be clearly articulated and formally defined. Models and methodologies for assessing the impact of scenarios and sensitivity should be consistent with the purpose. The obtained results of stress testing confirm the conclusion that banks with foreign capital are the most stable in the banking system of Ukraine. A group of state-owned and Ukrainian private banks needs special attention from the regulator.

In 2019 stress testing should be passed by 29 institutions that account for more than 93% of the assets of the banking system. These 29 banks were rated as the largest as of November 1, 2018 by three indicators: risk-weighted assets (40%), individual deposits (50%) and retail loans (10%).

For the last five years, the objects of stress testing of the NBU were state-owned and private banks and banks with foreign capital, which together accounted for more than 90% of assets of the banking sector in Ukraine. As a result of stress testing of Ukrainian banks in the period from 2014 to 2019 aimed at improving the financial stability of banks and clearing the banking system, the number of banks has decreased by almost 2 times. With a generally reduced number of banks in Ukraine from 180 in 2014 to 76 in 2019, i.e. almost by 2.4 times, the number of banks with foreign capital decreased by only 1.37 times. At the same time, over a five-year period, the number of banks with 100% of foreign capital has even increased by 21%, starting with 19 banks in 2014 to 23 banks in 2019. So, banks with foreign capital more stability in Ukrainian bank system. (Ramskyi A., et al. (2017). Using the baseline approach, the data of eight banks with foreign capital were used to forecast the baseline scenario, taking into account the growth of the exchange rate and interest rates on new household deposits in UAH.

Table 7- Diagnostic results of H2, H3 (comparison across groups of banks) (2019-2020)

Foreign Bank	01.01.2018 AQR		01.01.2018 1st year Baseline scenario		01.01.2019 Baseline scenario (course -1, 35%, deposits +9,93%)		01.01.2020 Baseline scenario (course +4, 78%, deposits +3,77%)	
	CAR (H2)	Core capital ratio (H3)	CAR (H2)	Core capital ratio (H3)	CAR (H2)	Core capital ratio (H3)	CAR (H2)	Core capital ratio (H3)
Alfa-Bank	9,8%	6,0%	10,6%	6,6%	24,6%	9,8%	24,5%	9,6%
Credit Agricole Bank	18,6%	10,1%	22,3%	17,5%	27,6%	12,6%	27,1%	12,3%
Idea Bank	15,2%	7,6%	34,7%	31,4%	19,9%	11,2%	19,7%	11,0%
Kredobank	15,5%	9,9%	20,9%	19,7%	34,1%	9,1%	34,3%	9,0%
OTP Bank	15,8%	11,7%	20,9%	20,9%	20,0%	9,7%	19,8%	9,5%
Procredit Bank	14,2%	11,2%	20,8%	20,8%	15,8%	7,8%	15,8%	7,5%
Raiffeisen Bank Aval	19,1%	10,6%	20,8%	20,0%	23,5%	11,9%	23,4%	11,6%
Ukrsibbank	22,2%	13,8%	19,3%	17,8%	20,0%	13,3%	19,9%	13,0%

According to the forecast on 01.01.2019, actual data of changes in the exchange rate of the US dollar to the hryvnia at the NBU rate as of January 1, 2018 (1 USD = 28.06 UAH) and 2019 (1 USD = 27.68 UAH) as well as the NBU data on rates of deposits in hryvnia on new household deposits in January 2018 (7.2%) and January 2019 (7.9%) are taken into account. Accordingly, the forecast includes the reduction of the dollar value in the hryvnia for January 1, 2019 to the dollar value in UAH as of January 1, 2018, which was minus - 1.35%, as well as the growth rates on deposits by 9.93% in January, 2019 relative to January, 2018.

According to the forecast on 01.01.2020, actual data of changes of the exchange rate of the US dollar to the hryvnia at the rate of the NBU as of January 1, 2019 (1 USD = 27.68 UAH), the rate laid down by the Cabinet of Ministers in the budget for 2019 (1 USD = 29.40 UAH), and the NBU data on the rates of deposits in UAH on new household deposits in January 2019 (7.9%) as well as the forecast for January 2020 (data for May, 2019 - 7.2%) are all taken into consideration. Accordingly, the forecast includes the increase in the dollar value expressed in hryvnias on January 1, 2020 to the value of the dollar in hryvnias as of January 1, 2019, which was - 4.78%, as well as growth of rates on deposits by 3.77% in January 2020 relative to January 2019.

In the forecasts for 2019 and 2020, banks with foreign capital comply with norms H2 and H3. In the group of banks with foreign capital, the least optimal indicators are in Procredit and Idea Bank, and the best are in Kredobank and Credit Agricole Bank. Banks that will not comply with these requirements following the results of the stability assessment will have to develop and execute a capitalization program and / or an action plan to maintain or restore capital levels. Information on the results of the stability assessment for the sector as a whole will be made public in December 2019 on the National Bank's website.

Conclusions

The introduction of such a tool as stress testing allows to identify both current and future risks for banks and to form their own capital sufficient to minimize future risks, which will enhance the stability of the banking system and protect the interests of depositors and bank lenders. The study of specific features and approaches to stress testing of banks in Ukraine in the period from 2014 to 2019, in the context of the implementation of Basel III recommendations on the banking regulation and the expansion of Ukraine's cooperation with the IMF, permitted to identify the following aspects of formation of the strategy of banking stress testing: to concentrate on further implementation of Basel III recommendations in the banking system of Ukraine; the stress testing framework should have well-formulated and officially adopted goals; models and methodologies for assessing the impact of scenarios and sensitivity should be consistent with the purpose, stress testing models, results and frameworks should be questioned and reviewed regularly, stress testing results should be made public and used as a risk management tool and an instrument of informing about business decisions.

Asset quality assessment and stress testing are a permanent practice of leading international financial organizations. It provides an opportunity to prevent excessive

accumulation of systemic risks and prepare banks for possible future crises. The conclusions and proposals received on the basis of the study of Ukraine's experience will not only improve the financial stability of Ukrainian banking system, but ultimately contribute to overall financial stability. Next researches are required to development the complicated measurement techniques and sound regulatory framework to form a resilient banking sector.

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