Ukrainian Banks' Business Models under Systemic Risk

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Abstract. In this article we analyze specific origin of business models in Ukrainian banking system over the period of 2014-2017. Using K-mean clustering techniques five basic business models were identified due to the combination of bank asset items and liabilities sources, retail and corporate focus, equity to assets ratio which appears to be abnormally high for frozen banks. We produced migration matrix for business models from the start of systemic crisis in 2014 till recovery in 2017. We analyzed how defined strategies have affected risk and efficiency of Ukrainian banking system under systemic instability.

The results of the study contribute to a deeper understanding of riskiness of business models through different periods of financial cycle. Retail and particularly "non-scheme" corporate bank business models were the most sustainable compared with "retail funding to corporate lending" type of banks. Our results enable to develop more efficient macroprudential tools grounded on heterogeneity of bank business strategies.

Keywords: banks' business models, universal banks, frozen banks, systemic risk, financial crisis, banking system of Ukraine.

1 Introduction

The crisis of Ukrainian banking system during 2014-2017, have highlighted strong business models impact on banks' financial sustainability. For instance, among the defaulted banks local private banks that were associated with industrial business groups held leading position. Such banks performed related party lending risky policies at the expense of individuals. Other group of liquidated banks was presented by banks with non-transparent ownership structure, some of them also was involved in money laundering. Since the configuration of the banking system by key parameters such as ownership structure, size, business strategy main features affects its risk profile, there is a need for identification and in-depth research of banks' business models frameworks of the Ukrainian banking system.

The main findings of presented research were confirmed by the use of quantitative methods. Using unsupervised learning techniques of cluster analysis, five key business models were identified and described: universal, retail, corporate, "retail finance to corporate lending" (RF-CL) and frozen. The inter-clusters migration, the level of financial sustainability of each business model and its adaptability to the systemic risk implementation during the 2014-2017, were investigated.

The cluster approach, despite its mechanistic nature, proved to be a useful tool for grouping of existing banks by key business model types. Its results not only confirmed a number of our existing hypotheses regarding the peculiarities of the development process and effectiveness of banking strategies under uncertainty, but also enriched with new insights that complemented the ongoing discussions on financial stability in the professional, business and political circles. For example, the empirical results confirmed such hypotheses as: 1) the insider banking business model, which is inherent in the local private banks, failed to pass the systemic crisis; 2) the majority of the failed banks due to the cleansing policy was in RL-CL and frozen clusters; 3) the strategy of focusing on the retail or classical corporate direction proved to be less popular in Ukraine, however, the most effective and sustainable during the realization of systemic shocks; 4) the universal banking business model, in spite of long-standing problems with toxic loan portfolio and low efficiency (especially in the sub-segment of public banks), shows the first signals to the recovery and continue to define the structure of the banking system.

The rest of the paper is organized as follows. Section 2 reviews recent research papers on banks business models and the systemic risk. Section 3 describes the methodology of the presented research to identify business model clusters and presents the data sample. Section 4 discusses our main findings related to identification, financial performance and risk evolution of banks in each business model. Section 5 concludes.

2   Literature Review

The process of identification and characterizing of banks' business models is widely disclosed in numerous publications of foreign researches, such as: Ayadi et al. (2016), Japparova & Rupeika-Apoga (2017), Soares (2017), Farnè & Vouldis (2017), Lautenschläger (2017), Hryckiewicz & Kozlowski (2014), Demirgüç-Kunt & Huizinga (2010), Roengpitya et al. (2014), Mergaerts et al. (2016), Köhler (2015), Van Oordt et al. (2014), Grossmann & Scholz (2017), Tomkus (2014), Ferstl & Seres (2012), Altunbas et al. (2011).

Among Ukrainian scholars and practitioners, the theme of banks business models has become much less widespread, with the exception of Panasenko & Bortnikov (2016), Zarutskaya (2012), Ivasiv et al. (2014), Lyubich et al. (2016), Rashkovan & Pokidin (2016).

Our work is considered as the continuation of the above-mentioned studies on this topic. One of the goals of our paper is to confirm the findings of previous studies using the different methods of quantitative analysis for identifying business models. At the same time, our article covers a wider time interval of financial instability, which allows to form a better and more consistent view of banking system evolution under systemic risk.

The main aim of this paper is to identify and analyse the core economic characteristics, financial performance and risk profile evolution of the different business models of Ukrainian banks under systemic risk pressure.

3   Methodology

3.1   Data

The study was based on the financial data published by the National Bank of Ukraine (NBU) on quarterly basis. For the study, panel data of the general population of banks were used as of 01.01.2014 (pre-crisis dataset) and 01.10.2017 (post-crisis dataset). Pre-crisis dataset contains financial indicators of 180 banks while post-crisis one includes 86 banks. In both cases this is a total number of banks operated on the Ukrainian market. These datasets allowed to detect banking business models structure changes due to the systemic crisis.

3.2   Research Methods

The identification of business models took place with the help of k-means clustering method, which is often described by our predecessors as "state-of-the-art" analytic tool. Cluster analysis is an appropriate statistical technique for grouping a set of our bank/year observations into distinct clusters (which represent different business models) to confirm a certain degree of similarity within each cluster. The basis of this assignment is a set of indicators chosen by researchers to measure the distance of each variable's value from others [Ayadi et al. (2014)]. The data collection exercise spanned over thirty indicators in the pre- and post-crisis datasets. The distinctness of each clustering solution was checked by relying on plot of the total within-groups sums of squares (WSS) against the number of clusters in each K-means solution. Here the Elbow method was used, which is based on the total WSS as a function of the number of clusters: we choose a number of clusters so that adding another cluster doesn't improve much better the total WSS [Kassambara, (2017)].

3.3   Variables

The indicator selection procedure generated the following set of variables as the most definite and easiest to interpret, which was used in the clustering:

1. **Retail loans to total loans** (%). Identifies the share of retail loans in the total loans, which is expected to be greater for retail-oriented banks that are more active lenders to general public. For corporate-oriented banks the indicator moves close to zero.

2. **Retail deposits to liabilities** (%).The instrument shows the share of retail deposits in total liabilities, which is great for banks that concentrate their funding activity in the retail deposit markets. Much like retail loans to total loans indicator, small value of this variable is a useful parameter to indicate corporate-oriented business model.

3. **Non-deposit resources to liabilities** (%). Calculated by dividing the sum of other banks funds and issued debt to total liabilities, the variable is negatively correlated with customer deposit funding. Wholesale funding exposures are typical for banks with corporate or investment business models and could imply risks emanating from interconnectedness.

4. **Equity to assets ratio** (%). On the one hand lower value of this instrument indicates higher bank's financial leverage, on the other hand abnormally large capital adequacy ratio represents the balance sheets of inactive frozen or "zombie" banks, which have not access to the deposit and funding markets.

5. **Net assets** (logarithm). The instrument is a good bank size proxy to divide financial institutions into small and large ones which have different possibilities in economy of scale and choice of business strategy.

That final set of indicators used in identifying the business models is given in Appendices in Table 1. Then variables on bank activities, financial position, financial performance, risk factors, as well as regulatory indicators were constructed from pre-crisis and post-crisis subsets. Descriptive statistics of the variables used in further assessing of chosen clusters is given in Table 2.

4   Empirical Findings

4.1   Clusters Identification

As a result of the cluster analysis, there were identified 5 groups of banks that had common business models of input indicators, namely: universal, retail, corporate, "retail finance to corporate lending" (RF-CL) and frozen (see Fig. 1).

The **universal** business model is characterized by a combination of retail and corporate business directions both from the point of view of attraction of funds and credit activity. As the analysis showed, it is the largest group in terms of assets, which includes all systemically important banks.

The **retail** business model is typical to banks that use public deposits for retail lending. In Ukraine, they are characterized by a wide branches network and a high margin of main banking products.

Corporate banks focus on service for legal entities, while the share of retail is low or absent. Some of these banks, including the those with foreign capital, perform classical corporate and investment activities, while others during the pre-crisis period were captive, lending to related non-financial corporations or conducted semilegal scheme operations without any retail activities.

RF-CL or "retail finance to corporate lending" banks can be called typical Ukrainian banks during the pre-crisis period. RF-CLs base their business model on retail financing, transforming the proceeds into mostly corporate loans that were often provided to related parties.

Frozen banks are similar showing low business activity due to the anomalous share of equity and a low amounts of working assets. Banks in this cluster are either so-called bank-licenses, or previously active banks, which for certain reasons reduced their business activity.
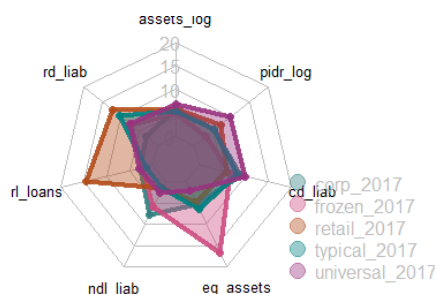
Fig.1. Comparison of business model clusters, 01.10.2017

As the result of systemic risk realization in 2014-2017 the largest number of failed banks is observed in the RF-CL (typical Ukrainian) cluster, that indirectly indicates a lower financial sustainability of particular business model under the systemic shocks. (see Fig. 2). Thus, of the 77 banks that belonged to this business model in 2014, 46 became insolvent during crisis, and 25 banks remained in this cluster.
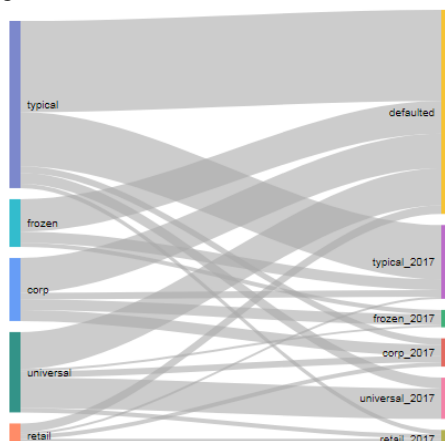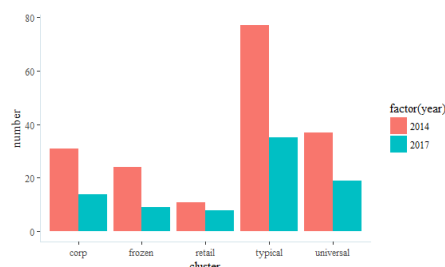

Fig.2. Migration of Ukrainian banks' business models during 2014-2017

From the cluster of frozen banks, 68% were withdrawn from the market by 2017, proved to be the least adaptable to the systemic risk business model. A rather high level of default is recorded in corporate (55%) and universal (46%) clusters. Apart from liquidated banks, a significant part of banks remained within their clusters. However, the cluster of corporate banks was a rather mobile business model during the crisis, of which only 17% retained the business model by 2017, while 17% were in the frozen cluster and 10% were RF-CL. Such process can be explained by the high share of private local banks in the corporate cluster, which were forced to close down their business or request retail financing during the crisis.

The configuration of the banking system changed under the influence of the systemic crisis, due to the cleansing policy of the NBU and the insolvent banks defaults. Despite the active migration of banks between clusters over the investigated

period, the share of each cluster in the overall structure has not faced radical changes (see Fig. 3).

Fig.3. Quantities of Ukrainian banks' business models during 2014-2017

As of 2014, the largest cluster in terms of the number of banks was RF-CL, the second place was shared by universal and corporate. The relatively high share of frozen banks, which at the beginning of the crisis was more than 12%, during the post-crisis period declined to 8%.

In spite of the comparatively large amount of banks in RF-CL cluster, its share in total assets in the Ukraininan banking system (UBS) was only 11% at the beginning of the crisis, and at the end of the crisis had fallen to 3.2%, which is almost in 4 times. The reason is that such business model has historically been popular among small local banks involved in related-party lending (see Fig. 4).
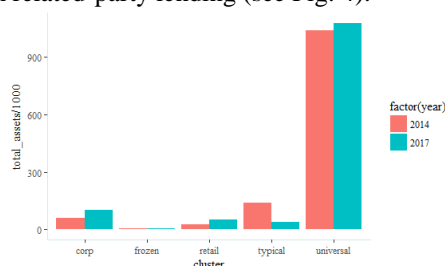
Fig.4. Net Assets of Ukrainian banks' business models during 2014-2017, UAH mln

The assets of universal banks cluster are 84% (81% before the crisis) of the assets of the Ukrainian banking system, mainly due to the public and foreign owned system-forming banks that have diversified structure of financing and credit activity. Banks belonging to the frozen cluster do not have a significant impact to the UBS, given that their aggregate market share is close to zero.

As comparative analysis showed in the pre- and post-crisis periods, the most viable model was retail banking in terms of aggregate asset growth (+ 84%) and the lowest number of defaulted banks (-27%). The second most resistant to systemic shocks was corporate model, its assets grew by 69%, despite the 55% decline in amount of banks. The least sustainable models were frozen and RF-CL, with the largest reduction in the number (by 62% and 54% respectively) and assets (-47% and -71% respectively) in the process of cleansing the UBS and the realization of systemic risk.

In the process of research, 2 banks from the frozen cluster left the banking market on the initiative of owners without termination of a legal entity. They revoked the banking license, which is an additional confirmation of the sufficient predictive ability of the proposed methodology for cluster analysis of business models of banks.

4.2 Financial Performance

The next stage of the study is the analysis of the effectiveness of the identified business models according to return on assets (ROA), net interest margin (NIM), cost-to-income ratio (CIR).

As we see in Figure 5, after the crisis, the average efficiency of banks (median ROA) increased for retail, corporate, universal and partly to RF-CL business models. Consequently, we can state the positive effect of the regulator's cleansing policy, since financially stable banks remain on the market and the overall efficiency of the banking system has increased. However, it should be noted that the variability in the distribution of activity performance in terms of ROA has become wider in all business models, indicating incomplete overcoming the crisis consequences for a number of banks, regardless of the business model.

The only business model which efficiency has not risen is frozen, with ROA indicator of the vast majority of the banks banks were in a negative zone.
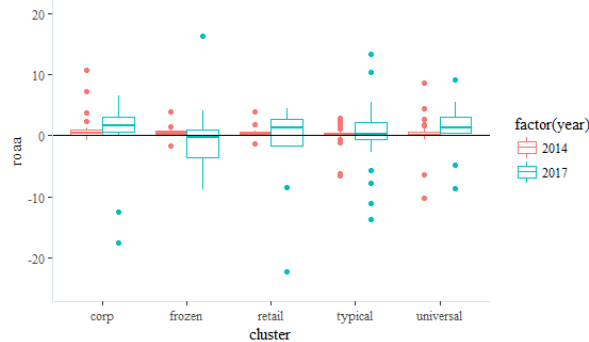
Fig.5. Return on Assets (ROA) by business models at 2014 and 2017

By results of the crisis and recovery, Net Interest Margin (NIM) grew in all business models. For the retail cluster, this was due to the possibility of developing a high-margin business, characterized by high effective interest rates due to the demand of consumer loans recovery in 2017 (see Fig. 6).
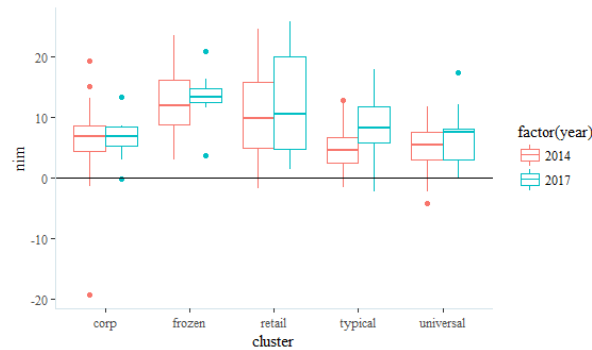
Fig.6. Net Interest Margin (NIM) by business models at 2014 and 2017

The maximum growth of the median NIM in the RF-CL cluster contributed to the general trend of deposit rates declining over the period 2016-2017. In addition, the cleansing of the market from high risk banks that offered high rates had the greatest impact on this cluster of banks, thus contributing to the growth of the average margin. Relatively insignificant growth and an absolute level of NIM are observed in a group of universal banks. This cluster consists of large, low interest income state banks that avoided cleansing due to big to fail considerations, while retaining a significant proportion of toxic assets and impossibility to reduce interest rates on deposits. The second component of this cluster is large foreign and part of domestic private banks that during the operation period accumulated significant amounts of NPLs. In the absence of new lending opportunities due to the lack of high performance borrowers, they favored investments in lower yielding government bonds, which adversely affected their interest margin.

The abnormally high NIM for the frozen group of banks can be explained by low funding costs due to high equity share and absence of toxic assets compared to banks from other clusters.

During the observation period, there was a general increase in the efficiency of interest expenses, expressed by the decrease of Cost-to-Income Ratio (CIR) for all clusters. The largest drop due to the effects of recovery from the systemic crisis and cleansing policy was the CIR of RF-CL, which median dropped by 20 % below the 50% level. (see Fig. 7).
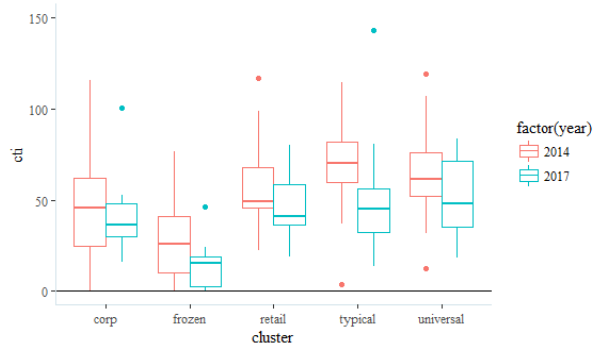
Fig.7. Cost-to-Income Ratio (CIR) by business models at 2014 and 2017

The best CIR indicators are observed in groups of corporate and retail banks, which confirms the higher efficiency of costs of specialized business models versus universal ones. The minimum cost-to-Income Ratio in the group of frozen banks is due to the low cost of borrowed capital, given its negligible share in the structure of liabilities.

As a result, the findings of financial performance show that the returns of banks, net interest margins, as well as cost efficiency across all business models have increased since the financial crisis and post-crisis recovery during 2014-2017. The effectiveness of the retail-oriented and corporate banks appeared to be the highest after financial crisis, while the greatest positive changes in the average returns occurred in the RF-CL cluster, where median values of the most effectiveness indicators became closer to the figures of the other clusters.

The main drivers of the higher efficiency for the Ukrainian banks was the effects of concentration, consolidation and cleansing processes, which enhance the most solvent banks among survived financial institutions in 2017 recovery period in spite of huge systemic shocks and loan portfolio losses in 2014-15. The results of the cost-cutting measures, disappearing of adverse herd behavior in retail deposit market and stabilization of inflation period have been sufficient too during 2016-17 post-crisis.

4.3 Evolution of Risk

This part provides a risk attributes of Ukrainian bank business models since banking system crisis. The key risk indicators that are discussed are Capital Adequacy Ratio (CAR), Cash-to-Assets Ratio, Loan Loss Provision Ratio (LLPR).

As a result of the post-crisis recovery, most survived banks (with the exception of some universal ones) managed to increase the Capital Adequacy Ratio, which was under great pressure during the 'perfect storm' period. One of the reasons for improving the capital adequacy ratio as a whole for each cluster was significant structural changes in the banking system, after which the market left about a hundred mostly undercapitalized banks. On the other hand, stress-testing, the strengthening of regulatory capital requirements and the revaluation of credit risk have been driven by the

process of previously noncollectible pre-capitalization and the formation of reserves for a deteriorated loan portfolios, which was the result of an increase in own capital at the background of stabilization or even reduction of net volume assets.

The Capital Adequacy Ratio suggests that the retail and corporate oriented banks, as well as "retail funding for corporate lending" financial institutions have significantly higher median risk weights than the most of universal banks (see Fig. 8).
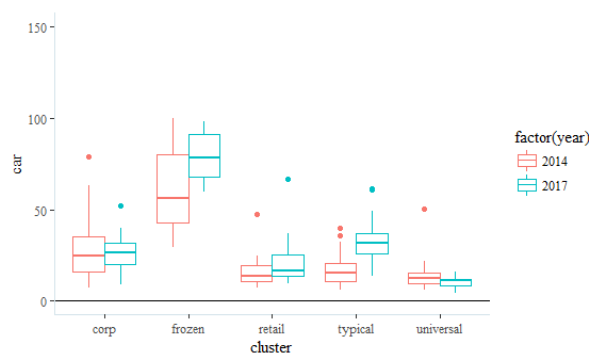

Fig.8. Capital Adequacy Ratio (CAR) by business models at 2014 and 2017

The comparatively lower equity of universal banks is the result of the scale effect due to the need for significantly higher levels of capitalization to cover bad loans accumulated by systemically important banks and other major players in the lending market. The lower share of equity capital in the liabilities of large universal banks contributed to the cherry-picking effect on the deposit market. After all, foreign and state banks, forming the basis of a universal cluster, were considered depositors as 'safe haven' in the period of system turbulence.

It should be noted that the abnormally high capital adequacy of the group frozen banks and some part of RF-CL banks is difficult to call positive characteristic due to the lost opportunity to generate net interest income. The key causes of the abnormally high CAR are: a) the absence of an effective business model for most small banks to expand active operations and exit the "frozen" state or old circuitry or captive activity; b) low opportunities for attracting deposit and loan resources; (c) the need for a larger capital buffer to protect against risks; d) compliance with regulatory requirements of the regulator regarding the minimum amount of capital and preparation for loan reservation on the consequences of diagnosing the quality of assets; e) the withdrawal from the market of many poorly funded banks during the period of purification, which provokes the growth of average capital adequacy values for these clusters [Kornyliuk (2017)].

The liquidity ratios of RF-CL business models are slightly higher than corporate and retail-oriented models, which may indicate their higher sensitivity to deposit outflows during a bank run (see Figure 9).
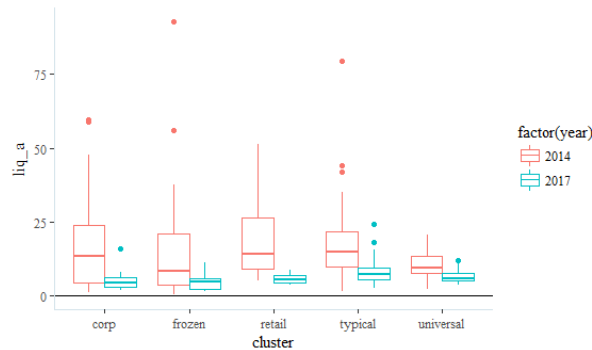
Fig.9. Cash-to-Assets Ratio by business models at 2014 and 2017

In general, the Cash-to-Assets Ratio dropped significantly from 2014-2017 by all business models. We are inclined to explain both the influence of the deposit panic and the development of the Ukrainian market of highly liquid assets such as government bonds and NBU deposit certificates, which are in much higher demand among banks than at the beginning of the crisis. From Fig. 9 it is clear that after the crisis, the market had left numerous banks with an abnormally high Cash-to-Assets Ratio, which in early 2014 more resembled "bags of money" for their beneficiaries, not financial intermediaries. After the crisis at the end of 2017, the overall level of security of high-liquid assets though decline, remains quite sufficient for classical banking.

Loan Loss Provision Ratio (LLPR) increased significantly by each business model during crisis and recovery periods because of huge rise of NPLs and more strict provision requirements (see Fig. 10).
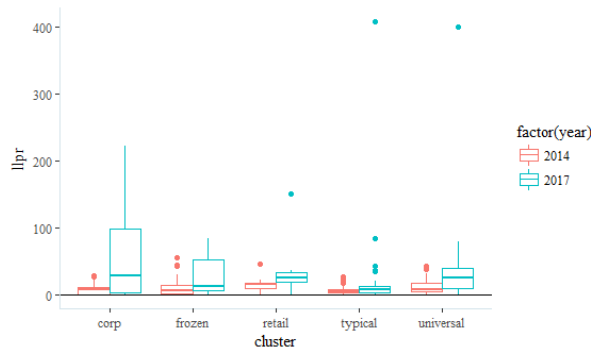
Fig.10. Loan Loss Provision Ratio (LLPR) by business models at 2014 and 2017

The most of retail, corporate and universal banks took the highest loan loss provision, while some RF-CL banks even released provisions. During the banking crises, the banks with state and foreign shareholders took the highest provisions, while the local private investors booked lower loan loss provisions because of recession and

bad performance indicators of related non-financial business structures. There are a lot examples of such loan poss provision *minimizing* activity: from Privatbank before its nationalization (LLPR= 16,6% in 01.10.2016, which jumped to 294,4% in 01.01.2017) to the wide range of previously defaulted oligarchic banks, such as Delta (8,6%), Finance&Credit Bank (7,5%), Brokbusinessbank (2,1%), VAB Bank (4,7%) etc.

Summarizing our analysis of the risk indicators of the main business models of Ukrainian banks during the periods of systemic crisis, cleansing and post-crisis recovery, it can be argued that most of the banks that managed to withstand shocks at the end of 2017 are more financially sustainable than before the crisis. This is generally expressed by a higher level of equity and credit risk reserves, especially for banks with a clear corporate and retail business model.

However, there remain a lot of problem areas that require further solution in order to minimize systemic risk:

- in the group of universal banks - despite the successful up-grading and high loan portfolio reserve, the largest systemically important banks accumulated excessive amounts of NPLs, which become a source of future state budget spending for the state financial institutions and reduced opportunities for growth and strategic interest from private international investors to foreign banks;

- in the group of RF-CL banks, the intentional minimization of the amount of credit risk and adequate deductions in credit reserves is obviously indicate the lack of willingness or ability of local affiliated parties to strengthen the funding of their banking business at the expense of income from non-financial corporations.

- in the group of frozen banks - abnormally high CAR or LLPR figures indicate low credit and deposit activity and the absence of an effective business model that is capable to generate stable cash flow.

5   Conclusions

Our research of Ukrainian banking sector business models assesses the banking system structure through the changing financial and supervisory environment during 2014-2017 period. We gained new insights into the impact of different forms of business models to banking system stability. For example, we analyse the relation between Ukrainian banks business models and financial performance, risk profiles and response to anti-crisis regulatory policy through five identified clusters.

The majority of Ukrainian banks were predominantly a mix of universal and RF-CL. The core of the biggest (according to net assets) universal bank cluster is the state banks with problem with toxic assets and low quality of corporate governance. Another part of universal business models are foreign banks and the largest local ones. Despite their quantity, RF-CL banks became less powerful and systemically influential than universal group. This cluster reduced more after cleansing policy, improved its indicator to some extent, but their risk profile remains unstable. Main problems: deficit of funding (both from shareholders and depositors), higher sensitivity to regulatory pressure, lack of clear business strategy (small size – great costs).

Retail and particularly "non-scheme" corporate bank business models were the most sustainable compared with RF-CL type of banks. Frozen banks are the most likely candidates for the exit, as evidenced by the experience of previous years.

Further monitoring of Ukrainian bank business models is extremely important to develop our knowledge of this concept, to measure impact of external shocks on different types of banks and, finally, to detect the formation of systemic risk related to inherently unsustainable banking strategies.

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Appendices

Table 1. Descriptive statistics for the business models clusters of Ukrainian banks, 01.10.2017

		Retail loans to total loans (%)	Retail deposits to liabilities (%)	Non-deposit resources to liabilities (%)	Equity to assets ratio (%)	Net Assets (log)
Universal	Mean	14.55	36.56	13.03	10.22	17.20
	St.dev.	12.92	15.72	10.40	2.74	1.14
	Min.	0.46	0.04	2.01	4.11	15.72
	Max.	42.98	71.96	43.54	16.09	19.36
Retail	Mean	72.60	61.20	7.85	24.28	15.08
	St.dev.	19.91	17.36	6.32	19.12	1.06
	Min.	42.77	41.85	1.83	9.76	13.57
	Max.	97.34	89.39	22.40	66.71	17.28
Corporate	Mean	12.95	14.84	36.72	26.56	14.87
	St.dev.	22.74	14.77	26.99	11.60	1.41
	Min.	0.00	0.00	2.28	9.18	12.65
	Max.	71.06	42.66	76.38	52.09	17.52
RF-CL	Mean	7.35	49.77	7.66	32.20	13.75
	St.dev.	8.95	14.31	6.03	12.18	0.64
	Min.	0.14	28.45	1.03	13.68	12.89
	Max.	35.52	92.08	21.82	61.57	15.19
Frozen	Mean	10.07	30.85	32.61	78.86	12.69
	St.dev.	10.09	17.57	20.29	13.87	0.72
	Min.	0.00	0.00	6.26	59.64	12.00
	Max.	27.10	52.83	70.89	98.02	14.60

Table 2. Dynamic of assets and quantity of Ukrainian banks by business models in 2014-2017

Business model	Assets, UAH mln, 01.01.2014	Assets, UAH mln, 01.10.2017	Change of assets, %	Number of banks, 01.10.2017	Number of banks, 01.01.2014	Change of number, %
Universal	1 039 430	1 078 833	3,8	37	19	-48,6
Retail	28 501	52 603	84,6	11	8	-27,3
Corporate	61 062	103 281	69,1	31	14	-54,8
RF-CL	140 528	41 008	-70,8	77	35	-54,5
Frozen	7 988	4 270	-46,5	24	9	-62,5