MACROPRUDENTIAL POLICY IN
UKRAINE: SUCCESS, FAILURE OR
TOO EARLY TO SAY?

by

Danylo Krasovytskyi

A thesis submitted in partial fulfilment of
the requirements for the degree of

MA in Economic Analysis.

Kyiv School of Economics

2022

Thesis Supervisor: _____ Professor Sergii Kiiashko

Approved by _____
        Head of the KSE Defense Committee, Professor

        _____

        _____

        _____

Date _____

Kyiv School of Economics

Abstract

MACROPRUDENTIAL POLICY IN
UKRAINE: SUCCESS, FAILURE OR
TOO EARLY TO SAY?

by Danylo Krasovytskyi

Thesis Supervisor: <u>Professor Sergii Kiiashko</u>

After 2014-2015 devastating economic crisis, Ukraine has started to implement macroprudential policy in order to make its financial system more stress resilient. In this thesis, I use a dynamic panel model to estimate the effectiveness of macroprudential policy in Ukraine based on a supervisory bank-level data. Macroprudential policy index computed according to Cerutti et al. (2017) is used as a proxy for macroprudential policy. The results are mixed. I find that the macroprudential policy in Ukraine was effective in reducing and limiting credit demand. However, the policy was not efficient in decreasing NPL ratio. In addition, I test whether bank ownership affects bank's response to macroprudential policy and find that ownership type matters for the impact of policy on loan provision. The findings of the paper can be of interest to the National Bank of Ukraine because they show partial effectiveness of already implemented measures.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

I would like to express the highest gratitude to my Thesis Advisor Prof. Sergii Kiiashko. Without his suggestions and desire for constant improvement, this work would never see the world.

I am also grateful to all KSE professors, who, without exaggeration, changed my life forever. Being taught by you was an honor.

Special thanks goes to my groupmates Mykyta Horovoi, Dmytro Dushko and Herman Bondarenko. Hope to work with you in the future again.

LIST OF ABBREVIATIONS

BIS. Bank of International settlements

CAR. Capital adequacy ratio

CPI. Consumer price index

DL. Deposits-to-liabilities ratio

MaP. Macroprudential policy

NBU. National Bank of Ukraine

NIM. Net interest margin

NPL. Non-performing loans

SA. Securities-to-assets ratio

INTRODUCTION

The objective of this paper is to shed light on the effectiveness of macroprudential policies (MaP) in Ukraine during 2017-2021 using supervisory bank-level data. Macroprudential policy – is a policy oriented on preventing shocks and crises in the financial system. Early stages of MaP occurred in 2016, when bank stress test was introduced, but official implementation took place in 2018 after the introduction of NBU's MaP strategy. The NBU has already introduced liquidity coverage ratio, net stable funding ratio, debt-to-income ratio, debt service-to-income ratio and has started implementing capital buffers since then, but the latter was postponed by pandemic in 2020-2021 and then by the war in 2022.

This study is novel because, to the best of my knowledge, no papers have studied the effectiveness of macroprudential policy in Ukraine. However, it is worth mentioning that it is important to study MaP. Even though MaP usually limits growth, it also makes falls not so pronounced. Besides, each country has its own financial system's particularities and features and it is impossible to copy other central banks. Therefore, it is essential to constantly monitor and assess which instruments work, which are effective and which has to be recalibrated in order to achieve policy goals.

The study is also interesting because it is the first one, which assesses whether the ownership type of bank matters in terms of MaP response. This is especially crucial in Ukraine, where more than 50% of banking system assets are concentrated within state-owned banks.

In this study, the "effectiveness" of macroprudential policy is defined analogously to similar studies of advanced and emerging economies. For example, Cantu et

al. (2020) mention that effectiveness should be analyzed with respect to the specific goal MaP is aimed at. Namely, MaP is effective if it achieves an ultimate goal and has a significant impact on economic indicators of interest. For instance, if central bank aims at decreasing bank risk measured as a share of NPL in total loans, then policy is effective if it has negative and significant effect on this share.

According to the NBU's MaP strategy, the main goal of the MaP instruments is to achieve financial stability (NBU 2021). Since there are several definitions of "financial stability", I focus on the following tactical goals mentioned in the NBU's MaP strategy:

1) Strengthen the resilience of financial infrastructure. In the thesis, I consider the goal to be achieved if NPL level decreases in response to MaP tightening

2) Limit exposure concentrations – how dependent bank is on a specific group of clients. The goal is considered to be achieved if there is negative or no growth in household and firm loan provision in response to MaP tightening.

3) Limit the systemic impact of misaligned incentives – how banking system in general affects performance. This is accomplished if there is no impact on the important banking efficiency measure – net interest margin.

There are other goals in the NBU's MaP strategy; however, their assessment is problematic/impossible due to lack and low quality of data.

There are three hypotheses tested in this thesis. The first hypothesis is that MaP instruments reduced NPL share in total loan portfolio. The second one is that MaP measures were effective in decreasing loan provision to households and firms. The last hypothesis is that MaP measures had no impact on bank profitability measured as net interest margin.

As additional subject of interest, I consider testing whether bank ownership type plays role in MaP response.

To measure the effectiveness of MaP, I follow the methodology by Cantu et al (2020). I incorporate dynamic panel model with bank-specific fixed effects to catch the lagged and dynamic nature of MaP. The panel bank-level data includes information on financial indicators of existing 71 banks from 2017M1-2021M12 as well as macroeconomic conditions during the same period. The control variables include macroeconomic conditions (GDP, CPI and key policy rate) as well as bank-specific characteristics (securities-to-assets ratio, net assets, ownership dummy, capital adequacy ratio, and deposits-to-liabilities ratio).

It is worth noting that survivorship bias may affect the results, but this effect is likely to be rather small, since during the bank fall of 2014-2016 no huge banks went bankrupt. That means that total asset share of failed banks was small and as a result total effect diminutive.

The main finding is that macroprudential policy in Ukraine was effective in reducing and limiting credit growth for both households and firms. However, the policy was not efficient in decreasing NPL ratio. Additionally, I find that ownership type matters for the impact of policy on loan provision. The MaP had also no impact on net interest margin during observed period, which is considered a sign of efficiency.

In addition, the results of this research are useful for different groups of people. For policymakers to understand which banks respond to MaP measures the best: big, medium, or small; state-owned, foreign, or private. Besides, the results of the paper are handy for the implementation of the next stage of MaP in Ukraine. Before the war, our country was on the verge of the inception of Basel III regulations (and is going to be there after recovery), so it is important to measure the effectiveness of introduced instruments before proceeding with new measures. For banks, it is useful because it allows seeing the complex picture of how MaP influenced the whole system.

The rest of this paper is organized as follows. The literature review is presented in chapter 2. Chapter 3 explains the methodology with potential issues, and Chapter 4 provides data description. Chapter 5 presents estimation results, and Chapter 6 concludes the research with providing recommendations that follow logically from research.

LITERATURE REVIEW

There are three main streams of the literature that study the effectiveness of MaP. The first one uses bank-level panel data and measures how tightening or easing MaP instruments affects credit growth in the economy, thus preventing overheating. The second stream examines the connection between MaP and monetary policy. Finally, there is relatively new literature that studies the impact of MaP on economic growth in general.

In this chapter, I initially provide an overview of papers looking into impact of MaP on banking variables. After that, I go on with papers describing interaction of MaP and economic growth in general. The chapter is concluded by review of papers, which are relevant for modeling choices and estimation of the model.

Various effects of MaP on selected banking variables have been a subject of interest of Bank of International Settlements. One of the most recent and valuable papers is Chantu et al. (2020) (hereinafter called BIS report), which aggregates four researches of MaP effectiveness on bank-level in Australia, New Zealand, Thailand, and Indonesia. Authors conclude that MaP tightening is effective in reducing both growth in household credit and NPL in selected countries. These four papers use the same methodology: dynamic panel model and the tightening/easing dummies for MaP change. However, these researches have their limitations, which we have to take into account before making conclusions. The first is that they do not capture the exact effect of the magnitude of MaP instruments change; they just apprehend the effect of change in general. The second one is that they concentrate on asset-based instruments, such as debt service-to-income ratio and loan-to-value ratios. They do not see liquidity coverage ratio as an instrument and use it just as a bank control variable. Despite

these limitations, a similar approach has been used by many other authors (Kuttner and Shim (2016), Alpanda et al. (2018)), with similar conclusions.

Another approach to analyzing MaP effectiveness on the bank level was proposed by Belkhir et al. (2020). Authors predict the probability of systematic bank crisis based on past data using Cerutti et al. (2017) MaP index and other banking and economic characteristics as independent variables. Moreover, researchers use ML estimation, which is different from standard panel data models. Authors reach significant results that MaP tightening decreases the probability of a crisis in spite of the obvious problem of irregularities of crisis in 2000-2016 across the world and a widespread introduction of MaP measures after the 2008-2009 financial crisis.

Papers about impact of MaP on economic growth study this topic from 2 perspectives. The first perspective is infinite DSGE models such as in Clerc et al. (2015), which considers IRFs from shocks to productivity, housing and capital depreciation, bank risk, and their combinations under different capital requirement conditions. The authors came up with an expected conclusion that under EU parameter calibration if the capital requirements are low, shock propagation and amplification is large. The second perspective is a panel VAR modeling like in Kim and Mehrotra (2019). This paper estimates MaP effect on selected macroeconomic variables (GDP, CPI, real credit to private sector, policy interest rate). The aim of this paper is not only to provide insight on how MaP works and what results it gives, but also to compare MaP and monetary policy. Authors use data from 19 developed and 13 emerging markets and conclude that tightening MaP instruments and increasing interest rate in certain situations can work as substitutes, especially when it comes to GDP and price level. Discussing effects of different instruments, Kim and Mehrotra (2019) contradict Alpanda et al. (2018). While the first one found out that capital-based instruments do not affect the interest rate, the latter states that indeed they affect. A possible

explanation for that is the larger dataset and different methodology applied by Kim (2019). Besides, Kim (2019) uses the so called "macroprudential index", which is the same as in Cerutti et al. (2017). Although this index is relatively simple to calculate, it does not necessarily reflect the true nature of MaP policy in the country. That is because all subindexes have equal weight, and in reality, central bank can rely more on one group of instruments and do not pay much attention to others.

Conclusions about the impact of MaP on consumption and other parts of GDP are contradictory, and there is still no consensus in the literature. It is sometimes believed that if MaP impacts credit, then it should also have some effect on consumption. For example, Kim and Mehrotra (2019), on their 32-country dataset, found out that there is no direct connection between consumption and MaP. However, Alam et al. (2019) using 100-country dataset, prove that consumption decreases when MaP is tightened. The same situation applies to investment: Ayyagari et al. (2018) found a significant relationship, while Kim and Mehrotra (2019) did not. From this we can conclude, that results of modelling depend much on data.

Another important issue covered in both general economy and bank level studies is asymmetric nature of tightening and easing MaP instruments. Araujo et al. (2020) report that 46% of tightening measures covered in the literature have a significant effect while only 39% of easing are significant at 10% level. Definitely, it is difficult to compare different studies based on individual datasets. That is why authors conclude that among 13 papers that compared both tightening and loosing 61% of former and 37% of latter had a significant effect on variables of interest. Moreover, Araujo et al. (2020) found that in about 57% of cases, the estimated coefficients for tightening measures are larger in absolute value than those for easing. Altunbas et al. (2017) support this argument, however, do not provide any theoretical explanation.

Banking empirical studies, irrespective of the topic, have some similar patterns. The first and most important is adding the first or more lags of independent variables. That is done to control for lasting effects from previous periods and capture the effect of change in the next one. Sometimes banks report incomes or expenses later than they really happen, so that lagged nature is present. That is common both for MaP researchers such as Wijayanti et al. (2020) and for other studies such as Borio, Gambacorta, and Hofmann (2017). The second pattern is controlling for the size of banks based on their assets. Dobson (2020) did this for MaP, while Marinkovic (2014) did this for net interest margin. That is done to discover which banking group has the highest effect on the financial system and reacts the most on MaP measures. The third pattern is adding interaction terms of variables of interest and control indicators. The goal of this inclusion is to check whether the effect varies under different conditions. BIS report (2020) in this field is the best example since this paper analyses different monetary conditions, bank type, and stages of the financial cycle.

From previous studies, we can summarize a wide scope of literature on macroprudential policy. It is mainly concentrated on bank level panel data models with a conclusion that MaP tightening has a significant negative effect on credit growth, NPL and sometimes GDP. Literature is also varied in terms of datasets used for studies and is not limited to advanced economies. However, the significance of many effects, especially but not only when it comes to MaP easing, is very sensitive to time horizon, level of data aggregation, and the number of individuals (banks or countries).

This paper takes something from all worlds. From the first group of studies, it takes GMM methodology. From the second group, we take MaP index, which in a more simplified form (as separate indicators) is used also in BIS studies. From general banking paper, this paper inherited lags of variables and controlling of the size.

This paper brings also new in the field of banking and macroprudential literature, since it is the first to check whether ownership type of bank plays role in policy response. This is done through introduction of simple dummy variables, with state-owned banks as based category.

This paper is also different since it uses monthly data instead of quarterly, because Ukraine is a newbie to MaP. That is why we can observe more immediate effects, when banks try to do their best in order to fulfil new requirements in the short period of time.

METHODOLOGY

3.1 MaP transmission mechanism

It is important to cover MaP transmission mechanism, before discussing the model itself.
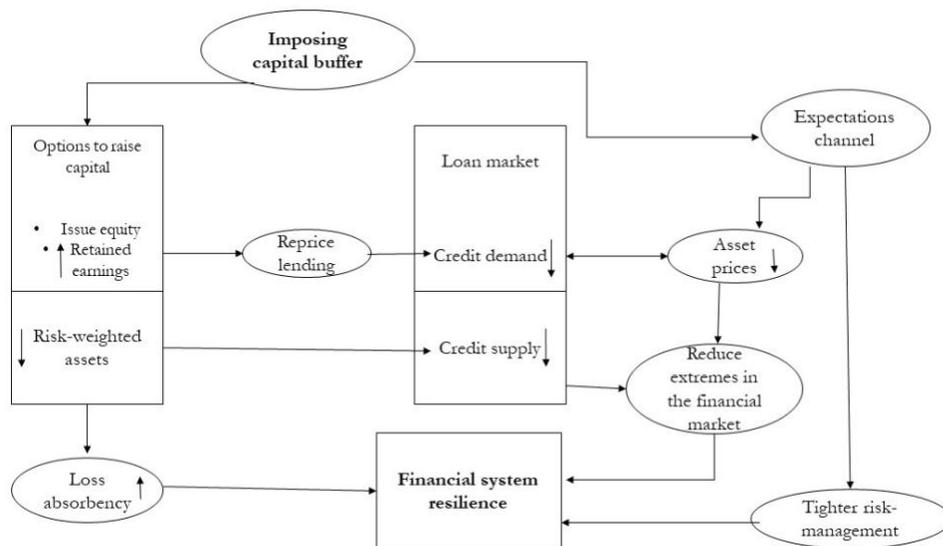

Figure 1. MaP transmission mechanism
Source: Rogers (2013)

Figure 1 presents MaP transmission mechanism as it is in Rogers (2013). This is a specific example of just one instrument, but it shows the overall complexity of the process.

Banks usually have choices on which part of their balance sheet to change in response to MaP. As we see from Figure 1, banks can decrease risk-weighted assets as well as increase equity. These processes are of completely different nature, take different time and require different level of analysis.

Furthermore, loan market is close to pure competence. It means that MaP changes will affect both credit demand and supply. Again, it takes different time to adjust both bank policy and consumer sentiments to new reality.

Therefore, it is essential to include several items in order to measure impact from MaP modifications. Firstly, include several lags in order to capture the lagged effect. Secondly, add controls from both sides of balance sheet. Thirdly, as there is nothing about macroeconomic conditions in the scheme presented in Figure 1, it is essential to control for them, because economic fluctuations can influence transmission process on each stage.

3.2 Model

I follow the methodology applied in the Chantu et al (2020), which is a dynamic fixed-effects panel model.

The model, which is expected to explain the MaP effectiveness, was first proposed by Arellano and Bond (1991) and is used in this paper:

$$Y_{t,i} = c_i + \sum_{j=1}^{k} \alpha_j Y_{t-j,i} + \delta X_{t-1,i} + \sum_{j=0}^{k} \beta_j MaP_{t-j} + \sum_{j=0}^{k} \gamma_j MaP_{t-j} * X_{t-1,i} + \theta macrovars_{t,i} + u_t$$

$$(1)$$

where $Y_{t,i}$ is an endogenous bank-specific variable of respectively loan provision growth to households and firms, NPL ratio, net interest margin. $X_{t-1,i}$ is a vector of exogenous bank-specific variables (securities-to-assets, size, ownership dummy, CAR and deposits-to-liabilities ratio), macrovars is a vector of macroeconomic variables (CPI, GDP approximated as the industrial production index, key policy rate). MaP_t is MaP index calculated specifically for Ukraine as in Cerutti et al. (2017), which is explained in detail below. c_i is a vector of constants. The baseline model is estimated on monthly data over the sample period 2017M1-2021M12. It is also consistent with the one presented Cerutti et al. (2017).

The consensus in the banking literature is that the effect of MaP can be measured as a sum of all lagged coefficients of independent variable of interest. A coefficient is added even if it is insignificant. This approach captures the long run impact.

There are no formal pre-estimation tests on how to select number of lags in dynamic panel models. There exist post estimation tests, but they are concentrated around autocorrelation, which is usually present, and number of instruments, which is chosen automatically. Therefore, the only formal idea is to compare models on post-estimation phase of research. However, in BIS (2020) research authors use quarterly data, which means that it makes sense to use number of lags which will correspond to quarters (3, 6, 9 or 12). Since, Ukraine is a newbie to MaP it makes sense to use 3 lags. That is natural: when banks face a new instrument, they will adjust as quickly as possible. In addition, since MaP policy is a new practice in Ukraine results are very sensitive on when is the first observation.

This model specification perfectly fits to the mechanism presented in 3.1. To start with, the bank specific variables are not chosen by chance. As it was discussed

earlier, banks can change different articles of their balance sheets. That is why we choose most common and at the same time diverse indicators: securities-to-assets and net assets (asset side), deposit-to-liabilities and capital adequacy ratios (liabilities and equity side respectively). Then, it perfectly incorporates lags to measure prolonged effects. Finally, it also controls for macroeconomic conditions.

Since dynamic panel models are relatively new in economics, there are no formal robustness tests yet. The most popular post-estimation test for this kind of models, however, is Hansen J-test on overidentification of instruments. The process of choosing instrument is automatic, and depends on number of observations and variables. Carrasco and Doukali (2022) prove that on large samples this test does not work properly. They also suggest that results of the test are sensitive to the number of iterations in the model and can easily change completely with adding one more iteration. Arellano and Bond (1991) empirical findings support their theoretical proofs. Therefore, for this research we will not interpret Hansen test results. Since our sample is huge (even bigger than in Arellano and Bond studies), we will adjust standard errors as suggested in Windmeijer (2005). Furthermore, as suggested by Hansen and Jagannathan (1997) we are using identity matrix for the weighting procedure. This is a choice for cases when the model is with low number of independent variables and with a single equation estimated per run. Besides, we are in line with Cantu et al. (2020), where possible robustness checks were suggested to be done later.

Because we set the goal to check whether ownership type plays role in MaP response, there is question how to measure it. There are three groups of banks: state-owned (4 banks), foreign (20 banks) and private (47 banks). The issue is that despite there are only four state-owned banks, they play important role in the whole system, and Privat and Oschad are the biggest banks in Ukraine. Because this study is the first that aims at discovering how ownership type influences MaP

13

response, there are no suggestions in the literature, how to deal with this type of imbalances. State-owned banks are also very different in Ukraine in terms of their size, so it is difficult to use numerical values. Since ownership itself is a categorical variable with three options, we introduce two dummy variables. If there is a relationship between MaP response and ownership, then codification should result in at least 90% of observations equal to one. So, let us introduce one dummy for foreign banks (1- foreign, 0-otherwise) and one for private (1-private, 0 – otherwise). In this way, government banks will be coded as 0-0 for both variables, and it is going to be easy to use them as a baseline category.

3.3 MaP Index

The key endogenous variable, MaP index, is based on the paper Cerutti et al. (2017).

$$MaP = LTV + DTI + DP + CTC + RR \qquad (2)$$

Where **LTV** is Loan-to-Value ratio, **DTI** is debt-to-income ratio, **DP** is Loan-loss provision requirements, **CTC** is countercyclical buffer, **RR** is a reserve requirement ratio. There are more indicators that are discussed in the original paper; however, NBU does not employ them as MaP instruments. Loan-to-Value ratio is not used directly by the NBU as a MaP tool, but used by individual banks for the purpose of accepting/rejecting loans. NBU calculates a weighted average of loan-to-Value ratio, which is going to be used for this research. Debt-to-income ratio is also not used by NBU directly and is not calculated explicitly in any form, but it can be proxied by debt service-to-income ratio, which is debt-service-to-income ratio. countercyclical buffer has been announced previously,

but due to the COVID-19 pandemic has been postponed, and while Ukraine experiences crises will not be effective. On the other hand, NBU forces banks to use net stable funding ratio, which is a minimal fraction of long-term funding to the sum of total assets weighted by respective coefficients. It is a new instrument, implemented in 2021, but it is already in use and has already been tightened two times. Despite reserve requirements are not mentioned as MaP tool by NBU, they definitely contribute to decreasing credit growth. Besides, IMF recognizes them as a MaP tool and uses changes in them as an indicator for MaP index.

The index is computed as the sum of changes in policy instruments, where +1 is tightening, 0 is no change and -1 is easing: The absolute value of instruments under this methodology is not important, only direction of changes matters. As Cerutti (2017) mentioned attaching a specific value to the degree of intensity of a particular measure will cause a certain degree of subjectivity that we want to avoid at this point of MaP development in Ukraine. While the level of each instrument may evolve over time, these may not capture the exact degree to which the instruments are actually binding. Similarly, it is difficult to code the variations in the use of instruments objectively as a tightening or a loosening.

3.4 Hypotheses and potential issues

The preliminary hypothesis is that MaP tightening in Ukraine has a significant negative effect on NPL ratio as well as household and firm loan provision. Dobson (2020) and Wijayanti et al. (2020) reach the same conclusion in their analysis of Australia and Indonesia respectively.
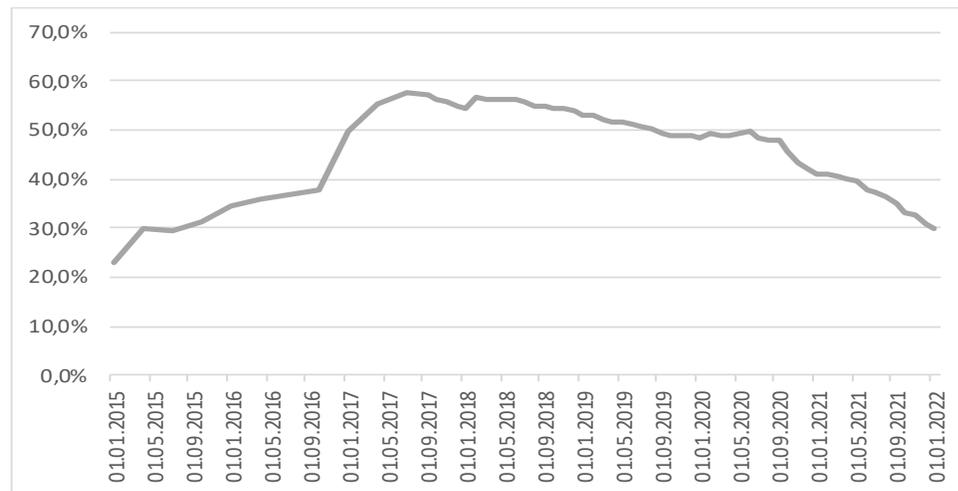
Figure 2. Dynamics of NPL across banking system during 2015-2021
Source: NBU

I focus on the time period from 2017 till 2021 because the data on NPL is monthly. Prior to 2017, the data was quarterly.

The NPL-MaP relationship is not obvious at all. The main reason for that is that due to changes in bank business models (orientation on riskless assets, providing loans to business groups etc.) and reporting policy during the studied period, some banks showed a significant increase in NPL (like IIB from 11% in 2018 to 37% in 2019) or showed a dramatic loss in credit. Keeping in mind these issues we may not be able to find significant relationship. Yao and Lu (2019), who studied New Zealand, support this absence of statistically significant relationship.

There is also a widespread hypothesis in media that many banks substitute loans with government bonds, so MaP will have no impact on bank loan policy. That is because if banks have a stable cash flow from riskless assets, then why should they provide new loans? If this fact is true, then we are not going to find significant relationship between MaP and loan provision.

I use GDP as a control variable for macroeconomic conditions. Since GDP data is quarterly, I use monthly industrial production index as a proxy, as it is done in Borsuk (2021).

All hypotheses, which correspond to the efficiency criteria, discussed in the introduction, are presented in the table 1.

Table 1. Dependent variables and expected signs of MaP index effect

Variable	Description	Expected effect
NPL share	Main goal of MaP is to decrease bank risk, which is usually measured as NPL	-
Household loan provision	Loans are the main assets of banks and tightening MaP requires banks to decrease loan provision	-
Firm loan provision		-
Net interest margin	MaP is designed not to decrease number of banks or make them unprofitable, it is the policy that prevents crisis	No effect

We do not explicitly specify hypothesis for ownership type, because there are no examples in the literature. The only assumption is that ownership response to MaP is uncertain.

Although, MaP literature usually employs quarterly data, this paper uses monthly data. There are two reasons for that. First, otherwise there would be only 16 time periods which is too short for any dataset. Second, it takes time for MaP to have an impact. Moreover, the impact of MaP starts not from the point of formal implementation but the announcement. That is why it is important to have a longer dataset to obtain a more precise time horizon of MaP effect.

As mentioned in the BIS report (2020), a limitation of usual OLS estimation strategy is that there could be endogeneity issue: the current state of the banking sector could also have an impact on MaP itself. To address the issue, we use a dynamic generalized method of moments (GMM) panel methodology to get estimates of the relationship between MaP and the dependent variables. According to Bayangos (2020), endogeneity is between bank loan provision and NPLs with bank-specific characteristics and macroeconomic indicators. This methodology is also necessary because we use a lagged dependent variable in the model. Lagged dependent variable is correlated with independent variables themselves, thus OLS will be biased. Thus, GMM usage is essential. It also takes into account the heterogeneity of the data caused by unobservable factors affecting individual banks.

I transform variables according to Blundell and Bond (1998). The exogenous variables are transformed in first differences, while the endogenous regressors are instrumented by their lags in levels. In addition, we consider all bank-specific characteristics lagged at 1 period, to be consistent with bank literature and avoid endogeneity problems.

DATA

For this analysis, we use monthly data from different sources. The primary variable of interest, MaP index is calculated manually by the author according to Cerutti et al. (2017) with some modifications as discussed in Chapter 3.

Banks submit their balance sheet to the NBU on a monthly basis, which allows directly compute securities-to-assets ratio and net interest margin; CAR, NPL and loan provision are provided by NBU. GDP and other macroeconomic variables are provided by SSU.

Figure 3 represents the dynamics of MaP index calculated as in Cerutti et al. (2017). The key challenge is with debt service-to-income ratio and loan-to-value ratios since they are not regulated by the NBU and are set by the market. Since the volatility of debt service-to-income ratio is higher than in loan-to-value, we will use changes in debt service-to-income ratio as a proxy for both of them.

During most of the researched period index was equal to one, which is equivalent to tightening of just one macroprudential instrument. However, we can also observe periods of no changes and easing. The first policy easing was in the middle of 2018 when mortgage market started to grow, and thus debt service-to-income ratio decreased due to increased competition. The second period was in 2020, when the NBU decided to postpone the implementation of capital buffers to boost the economy and support the banking system.
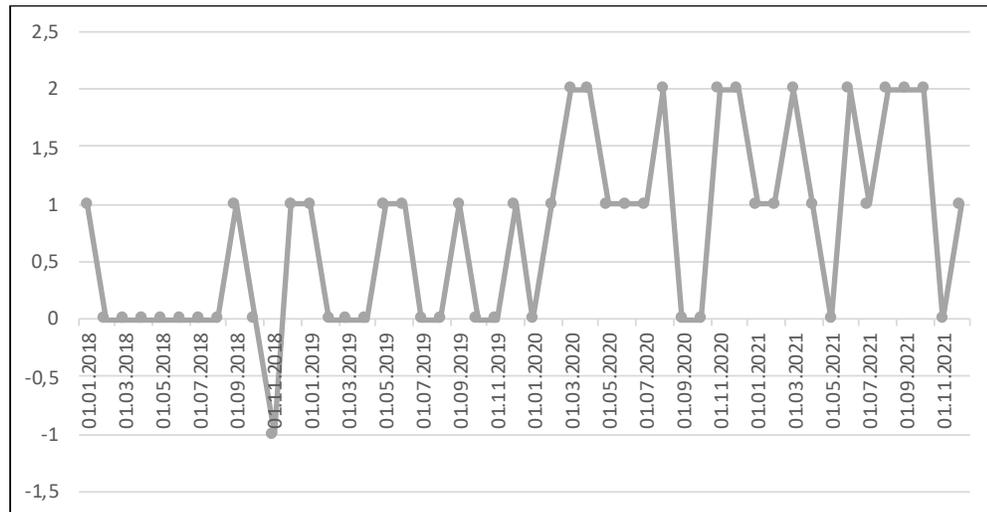
Figure 3. Dynamics of MaP index during 2018-2021
Source: calculated by author

The key problem with MaP index is its calculation procedure. It takes into account only direction of change in MaP tool, not the absolute value of the difference. Another problem is that all tools have equal share. The reason for that lies in the field of MaP diversity across countries. The index has been developed in order to compare countries' policy that is why it has to bring everything to the common denominator. Despite all instruments are measured in percentage points, their meaning is completely different: 1 p.p. increase in capital buffer is a very sensitive change for banks, while 1 p.p. increase in liquidity coverage ratio is imperceptible (because usual changes are in dozens of percentage points). Besides, some instruments are not used in some countries, so in order to compare policies it was proposed to measure changes. This approach is also flexible when the new instrument is introduced or stopped being used: it is just equivalent to tightening/easing.

All other variables and their descriptive statistics are shown in Table 1. Number of observations is 4189.

Table 2. Descriptive statistics of independent and dependent variables

Variable	Mean	Standard deviation	Max	Min
Household loan provision growth, %	2584	113074.7	6177389	-100
Firm loan provision growth, %	294.2	7637.82	343953.9	-100
NPL, %	23.66	23.64	99.64	0.00
Net interest margin, %	3.82	3.57	37.92	-5.82
SA, %	22.24	20.08	93.91	-0.02
DL, %	79.09	21.36	99.38	0.01
CAR, %	56.67	1090.65	18518,49	-74464.21
CPI, yoy %	15.69	15.25	60.9	1.7
Industrial production Index growth, %	-0.02	1.87	4	-6.52
Policy rate, %	16.47	6.88	33	6

Source: calculated by author

There is another important issue with Ukrainian data, which has to be discussed. Ukrainian banking sector has been changing for the last 7 years and there were numerous policy and other types of shocks to them. That is why some banks provided no new loans during some months and provided some of them during the following. So, the question arises: how can we measure in such cases loan provision growth? It is infinity, and it is impossible to estimate both growth level and change in growth in such cases. Assigning to such observations a huge number is also impossible, since there are banks that show rocketing growth, which is real. Assigning moving average values can also cause distortion to the dynamics. That is because if zero follows the positive value, then it means that growth is -100. Then if the period after infinity will have some small growth, then

average value would be negative. However, in reality infinity meant growth. Therefore, averages in such cases show negative values instead of positive. Thus, we will have to substitute these observations with NAs.

It is also important to mention that we expect negative sign for loan provision lags. From the first glance, it seems illogical and counterintuitive, because after growth in one month bank is expected to grow again. However, data shows the opposite. We observe in figure 4 (without outlier values) that always growth levels fluctuate and sometimes it is even around zero: after huge growth, we observe small, and vice versa.
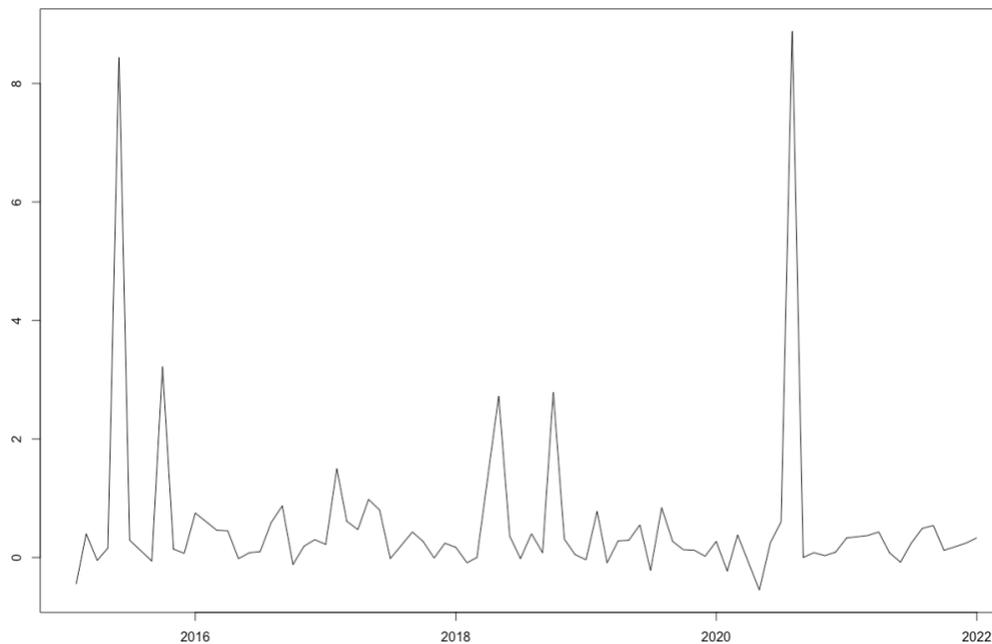
Figure 4. Dynamics of household loan provision growth across the system during 2015-2021
Source: calculated by author

In case of firm loan provision, this effect is even more pronounced (figure 5 without outliers). In our economic environment, it is natural for banks to expect small correction after huge increase.
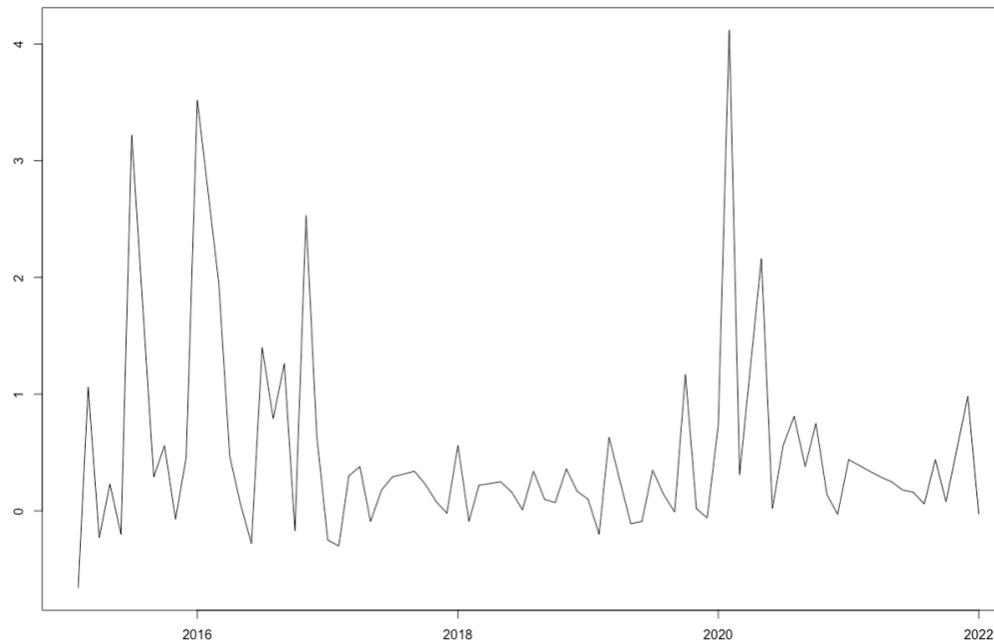
Figure 5. Dynamics of firm loan provision growth across the system during 2015-2021
Source: calculated by author

It is also important to remember that results in similar literature are very sensitive to the data and underlying indicators. Therefore, even if we are able to find contradiction to other studies, it means that Ukrainian data has its own essence. In addition, since banking variables such as credit usually go in line with general economic condition, results are very sensitive to the general macroeconomic environment during the studied period.

C h a p t e r 5

ESTIMATION RESULTS

In this chapter, we present the estimation results. It is divided in 3 subsections, which correspond to the dependent variables of interest: NPL, loan provision growth and net interest margin. All subsections follow the same pattern: simple model, complicated model as in Dobson (2020) with interactions and the ownership type check on a simple model.

5.1 Impact on NPL

The simplest model, which is consistent with literature, is presented in the table 3 below. The dependent variable is NPL ratio and we can conclude that tightening of just one MaP instrument has a significant positive effect on NPL ratio. This result does not confirm preliminary hypothesis and contradict relevant literature. It is natural to have current value close to the previous one, since we use monthly data, because it takes time for banks to get rid of NPLs. Even under MaP tightening NPLs do not change that much and are close to previous values. We can see from the NPL dynamics presented previously that despite NPL across system decreased from 57% in 2017 to 30% at the start of this year, it was a long and gradual process with low variability. The value 0.032 indicates that even though from statistical point of view it is different from zero, from practical it is very small, because NPLs are already measured in percentage points.

Now let us be consistent with Dobson (2020), drop policy rate, and add interactions of MaP with selected banking variables.

Table 3. Impact of MaP on NPL, baseline model

	Estimate	Significance
Lag of NPL	0.495	***
Sum of MaP lags	**0.032**	*******
0 lag	0.116	***
1st lag	-0.027	
2nd lag	0.028	
3rd lag	-0.085	**
CAR	-0.022	***
SA	0.08	**
DL	0.127	***
Net assets	0	
GDP	0.03	
CPI	0.145	**
Interest rate	0	

*, ** and *** represent statistical significance at the 10, 5 and 1 per cent level.

We can again observe that the effect on NPL is statistically, but not economically significant (line 2 in Table 4). This number ($3*10^{-4}$) is even smaller than in previous case, keeping in mind that our dependent variable is in percentage points. Moreover, in the more complicated model even the lagged value of dependent variable makes no sense with its low value, which totally contradicts not only MaP literature, but also bank literature in general. Therefore, we can conclude that the model is wrong.

Now let us test hypothesis whether NPL response to MaP differs across banks. For this purpose, we apply simple model, without interest rate, and introducing dummies and dummy interactions with MaP index, keeping in mind that state-owned banks are a base category. We drop policy rate because it was highly insignificant and low in magnitude.

Table 4. Impact of MaP on NPL as in Dobson (2020)

	Estimate	Significance
Lag of NPL	$3*10^{-4}$	***
Sum of MaP lags	$3*10^{-4}$	*******
0 lag	10^{-4}	***
1st lag	10^{-4}	***
2nd lag	$3*10^{-5}$	***
3rd lag	$2*10^{-5}$	***
CAR	-0.012	***
SA	$-3*10^{-4}$	**
DL	$-9*10^{-4}$	***
Net assets	$-3*10^{-5}$	***
GDP	10^{-4}	***
CPI	10^{-5}	**
Interaction with CAR	-0.037	***
Interaction with SA	-0.003	***
Interaction with DL	0.019	***
Interaction with Net assets	0	

*, ** and *** represent statistical significance at the 10, 5 and 1 per cent level.

From table 5 below we can reach a conclusion that there is no economically significant difference between state-owned, private and foreign banks in terms of NPL share response to MaP policy. This result makes sense, if we come back to the graph presented above. During this period, policy was just at the early stage of development and all banks were obliged to it. There were no specific requirements and thus all banks had more or less same NPL policy and dynamics.

As a result of the analysis, during last 4 years there were found no significant relationship between MaP tightening and NPL share. That happens because during the observed period MaP fluctuated and NPL were gradually decreasing across the whole system. Because of this lack of variability and stable decrease, we are unable to find any relationship yet.

Table 5. Impact of MaP on NPL based on ownership type

	Estimate	Significance
Lag of NPL	0.239	***
Sum of MaP lags	0.032	***
0 lag	0.018	***
1st lag	0.145	***
2nd lag	-0.2	***
3rd lag	-0.058	***
CAR	-0.063	***
SA	0.123	***
DL	0.05	**
Net assets	0	
GDP	-0.042	***
CPI	-0.193	***
Private	**0.016**	*******
Foreign	**0.001**	*******

*, ** and *** represent statistical significance at the 10, 5 and 1 per cent level.

5.2 Impact on firm and household loan provision

Now let us analyze whether firm or household loan growth has significant response to tightening policy. We keep in mind that in the similar literature, results were very sensitive to definition of dependent variable and there was no common pattern.

The simplest model for loan provision does not make sense (Table 6). That is because we see that an increase in GDP growth by 1 p.p. increases loan provision growth by more than 50 p.p. for firms.

Although, the baseline model fails to confirm hypothesis for firm loan provision, it shows interesting patterns for households. MaP tightening of just one instrument decreases household loan provision growth by 0.12 p.p., which makes sense from theoretical point of view and confirms our preliminary hypothesis.

Table 6. Impact of MaP on firm and household loan growth, baseline model

	Firm loan	Significance	Household loan	Significance
Lag of dependent	-0.36	***	-0.238	***
Sum of MaP lags	**3.944**	******	**-0.12**	*****
0 lag	2.606	**	-2.021	**
1st lag	-1.752	**	4.289	***
2nd lag	-2.568	**	-0.434	
3rd lag	5.658	**	-1.949	
CAR	0.028		-0.02	
SA	134.45	**	-112.5	**
DL	-15.7	*	246.1	***
Net assets	0.126	***	-0.726	***
GDP	53.34	**	0.162	
CPI	-0.28		4.638	
Interest rate	-0.081		-0.003	

*, ** and *** represent statistical significance at the 10, 5 and 1 per cent level.

Furthermore, we see that the biggest effect is achieved immediately and 1 month before the observation, which means that constant tightening can result in huge losses for banks in terms of credit growth. For firm loan provision due to GDP effect (53 p.p. growth in response to growth in GDP by 1 p.p.) model makes no sense, so we can dismiss its result. It is impossible to expect such a huge growth, so this model is wrong.

Let us follow the previous subsection and check whether more complicated model with interactions performs better. This time, relationship again makes more sense (Table 7).

Table 7. Impact of MaP on firm and household loan growth as in Dobson (2020)

	Firm loan	Significance	Household loan	Significance
Lag of dependent	-0.356	***	-0.222	***
Sum of MaP lags	**-0.022**	****	**-0.1**	****
0 lag	0.03		-0.042	***
1st lag	0.011	**	0.043	***
2nd lag	-0.006	**	-0.085	***
3rd lag	-0.056	**	-0.011	**
CAR	-0.01		0.019	
SA	3.338	**	3.023	**
DL	-1.5	**	12.546	***
Net assets	-0.002		-0.008	
GDP	-0.146	***	0.032	**
CPI	0.038		0.8	**
Interaction with CAR	27.8	**	10.27	*
Interaction with SA	7.09	***	-0.434	**
Interaction with DL	-8.126	***	-10.63	***
Interaction with Net assets	0.004	**	-0.004	*

*, ** and *** represent statistical significance at the 10, 5 and 1 per cent level.

Adding interacting terms led to 0,02 p.p. decrease in firm loan growth in response to MaP tightening. That is not only statistically significant, but also practically, because growth is usually measured in small percentage points and it is typical to have growth around 1 p.p. (if we drop outliers). This result supports preliminary hypothesis and there is explanation. MaP tightening happens during economic growth times, when credit growth is also positive. This evidence is practically small, but without tightening, it would be higher. We observe that in response to

tightening during quarter there is very small decrease in growth in firm loans. Thus, MaP does not lead to decrease in loan provision; it leads to growth limitation to a very small number.

For household loan provision, more complicated model showed the same results as simple one. While for simpler one there was confirmation of hypothesis, Dobson model found nearly the same impact of MaP on household loan growth. However, in simple model (Table 6), effect was immediate; here we see that it is actually prolonged in time (Table 7).

In terms of loan provision for different bank types results differ. We can see that foreign and private banks have higher loan growth for firms than state-owned (Table 8, column 2). Private ones are even less responsive, their growth is 1% higher than within state-owned. This result is a little bit misleading since private banks is the biggest group in terms of number of banks, and they are mostly small banks with huge fluctuations of growth values (small base bias). So even though their growth of provisions are higher, that is mostly caused by their size . Foreign banks are better than state-owned in terms firm loan provision, but worse in terms of household (Table 8, line 14). Possible explanation can be that many foreign banks in Ukraine are oriented on firms and pay more attention to them. They are also obliged to the similar MaP rules in their home countries, which is why it is relatively simplier for them to follow. As a result, they provide more loans for firms. Besides, some MaP rules are oriented against unsecured household loans, which are mostly concentrated in state-owned banks, so foreign and private banks are able to respond faster.

For loan provision on firm and household levels, we observe partial confirmation of preliminary hypothesis.

Table 8. Impact of MaP on firm and household loan growth based on ownership type

	Firm loan	Significance	Household loan	Significance
Lag of dependent	-0.36	***	-0.237	***
Sum of MaP lags	**2.84**	******	**-0.66**	*****
0 lag	1.48	***	-2.654	***
1st lag	-1.08	**	4.597	***
2nd lag	-1.767	**	-0.151	
3rd lag	4.208	**	-2.452	***
CAR	0.028		-0.019	
SA	133.55	**	-110	***
DL	-15.47	*	245.68	***
Net assets	0.127	***	-0.727	***
GDP	50.1	**	1.737	***
CPI	-0.194		4.67	***
Private	0.985	**	-2.35	***
Foreign	0.43	**	-0.16	**

*, ** and *** represent statistical significance at the 10, 5 and 1 per cent level.

While for households there is acftual decrease in loan provision growth, for firms it is limited to a very small number. This result is partially confirmed in the literature by Kim and Mehrotra (2019), who proved that there is negative dependence between MaP tightening and household loan provision, but were unable to find the same relationship with firm loans. We also are able to identify that the biggest effect is achieved immediately and 1 months after the announcement of tightening. There was also found significant difference between bank types in terms of lending. Private and foreign banks respond better than state-owned.

5.3 Impact on net interest margin

Now let us check whether MaP instruments have impact on profitability measured as net interest margin.

Table 9. Impact of MaP on net interest margin, baseline model

	Estimate	Significance
Lag of NIM	-0.05	***
Sum of MaP lags	**0.045**	*******
0 lag	0.101	***
1st lag	0.321	***
2nd lag	-0.322	***
3rd lag	-0.055	**
CAR	0.01	**
SA	-0.08	**
DL	0.029	***
Net assets	0	
GDP	-0.03	
CPI	0.1	**
Interest rate	0	

*, ** and *** represent statistical significance at the 10, 5 and 1 per cent level.

For net interest margin, the result confirms our hypothesis even under the simplest model: the total impact is very close to zero despite overall significance. This means that MaP was effective under this condition (Table 9).

Applying more complicated model does not change results much (Table 10): confirmation of hypothesis. We can see that some lags compensate each other, and those that do not are very small in magnitude, since net interest margin is already measured in percentage points.

Table 10. Impact of MaP on net interest margin as in Dobson (2020)

	Estimate	Significance
Lag of NIM	$-3*10^{-4}$	***
Sum of MaP lags	**-10^{-4}**	*******
0 lag	0	
1st lag	$3*10^{-5}$	**
2nd lag	$-1*10^{-4}$	***
3rd lag	$-2*10^{-5}$	***
CAR	$-5*10^{-4}$	
SA	-0.002	***
DL	-0.001	***
Net assets	-10^{-4}	***
GDP	10^{-4}	*
CPI	$-5*10^{-5}$	**
Interaction with CAR	-0.001	***
Interaction with SA	-0.006	***
Interaction with DL	-0.011	**
Interaction with Net assets	0	

*, ** and *** represent statistical significance at the 10, 5 and 1 per cent level.

We can also observe (Table 11) that there is no economically significant difference in terms of net interest margin response by bank types. The effect is neglectable, even though state-owned banks are relatively worse than foreign and private ones. The explanation can lie in the field of business model, and fact that state-owned banks are less responsive to all policies, but it makes no sense to discuss this evidence, due to low magnitude of effect.

We reach the conclusion that the preliminary hypothesis for net interest margin is confirmed. There is no impact at all on bank profitability and banks ownership type has no significant influence on net interest margin response as well. This makes NBU's policy effective, but the explanation for that is bank's ways of making this margin. Before the war, it was common for many small banks to take refinancing loans from NBU and to invest them in government bonds. It was

relatively riskless way of investing, with stable interest margin, and no impact from instruments oriented on loans or deposits.

Table 11. Impact of MaP on net interest margin based on ownership type

	Estimate	Significance
Lag of NIM	-0.067	***
Sum of MaP lags	0.049	***
0 lag	0.104	***
1st lag	0.295	***
2nd lag	-0.27	***
3rd lag	-0.08	***
CAR	$-6*10^{-5}$	**
SA	-0.082	***
DL	0.014	**
Net assets	0	
GDP	0.026	***
CPI	-0.014	
Private	**0.087**	*******
Foreign	**0.014**	*******

*, ** and *** represent statistical significance at the 10, 5 and 1 per cent level.

CONCLUSIONS AND POLICY RECOMENDATIONS

In this study, we show three main results: (i) macroprudential policy in Ukraine has no effect on NPL ratio across system (ii) it has economically significant effect on limiting household and firm loan growth (iii) it has no impact on bank efficiency measured as a net interest margin.

Regarding the first conclusion, NPL decrease during this period was gradual and stable, while MaP was variable. Decrease started even before than active policy and was not a result of it, but rather the fear of bank owners that they will suffer the fate of failed banks during 2014-2015 crisis.

Second, MaP tightening has an economically significant negative effect on household loan growth. During a quarter of tightening banks household loan provision growth is 0,1 p.p. lower than without it. With firm's loan growth situation is a little bit more complicated. There is very small negative effect, which is interpreted as a no growth in response to tightening. It is consistent with literature, where sometimes firm loan provision has no response to MaP tightening.

Third, MaP is effective if it does not hurt banks business models and has no impact on their efficiency. For this paper, we measure it as a net interest margin and we found out that there is no effect.

In the introduction chapter we introduced that macroprudential policy is effective if it has:

1) A negative impact on NPL

2) A negative impact on household and firm loan provision growth

3) No impact on net interest margin

The key conclusion is that macroprudential policy in Ukraine was partially effective as there is no statistically significant impact on NPL.

In addition, I find that bank ownership has a substantial effect on bank loan provision. Private and foreign banks provide more loans for firms than state-owned do in response to tightening. On contrary, state-owned provide more loans for households than private and foreign do. A potential explanation could be that they have different business models. State-owned ones are huge banks that serve physical clients all over the country, mostly with savings function as well as providing unsecured consumer loans. That is why in response to tightening these banks do not decrease their loan provision to households. With firm's loans situation is the opposite: they are in the center of models for foreign banks, who serve their international clients and big Ukrainian companies, and small private banks, who are funding specific business interests. It is also important to mention that private banks with several exceptions are small and larger effect is not only logical from economic side, but is also partially caused by smaller base and as a result higher growth rate.

In general, despite the formal effectiveness of the policy, it makes sense for NBU to conduct the same type of research after the war and reconstruction of the country. Results of policy and its analysis are very sensitive to the data, and possibly, during the times of economic prosperity they would be different and more meaningful.

WORKS CITED

Alam Zohair, Adrian Alter, Jesse Eiseman, R. G Gelos, Heedon Kang, Machiko Narita, Erlend Nier and Naixi Wang. 2019. "Digging Deeper--Evidence on the Effects of Macroprudential Policies from a New Database." *IMF Working Paper,* WP/19/66.

Alpanda, S., Cateau, G. and Meh, C. 2018. "A policy model to analyse macroprudential regulations and monetary policy." *Canadian Journal of Economics/Revue canadienne d' economique* 51(3): 828–863.

Altunbas, Y., Binici, M. and Gambacorta, L. 2016. "Macroprudential policy and bank risk." *Journal of International Money and Finance* Volume 81, March 2018: 203-220. https://doi.org/10.1016/j.jimonfin.2017.11.012.

Araujo, Juliana Dutra, Manasa Patnam, Adina Popescu, Fabian Valencia and Weijia Yao. 2020. "Effects of Macroprudential Policy: Evidence from Over 6,000 Estimates." *IMF Working Paper,* WP/20/67.

Arellano, M and S Bond. 1991. "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations." *Review of Economic Studies,* vol 58, no 2, April: 277–297. https://doi.org/10.2307/2297968.

Ayyagari, Meghana, Thorsten Beck and Maria Soledad Martinez Peria. 2018. "The Micro Impact of Macroprudential Policies: Firm-Level Evidence." *IMF Working Paper,* WP/18/267.

Bayangos, Veronica B and De Jesus Jeremy. 2020. "Have domestic prudential policies been effective? Insights from bank-level property loan data." *BIS Papers* №110.

Belkhir, Mohamed, Sami Ben Naceur, Bertrand Candelon and Jean-Charles Wijnandts. 2020. "Macroprudential Policies, Economic Growth, and Banking Crises." *IMF Working Paper,* WP/20/65.

Blundell, Richard and Bond, Stephen. 1998. "Initial conditions and moment restrictions in dynamic panel data models." *Journal of Econometrics, Elsevier*, vol. 87(1), August: 115-143.

Borio Claudio, Leonardo Gambacorta, Boris Hofmann. 2017. "The influence of monetary policy on bank profitability." *International Finance Volume20, Issue1 Spring 2017 Pages 48-63* https://doi.org/10.1111/infi.12104.

Borsuk, Yulian. 2021. Effectiveness of monetary policy in Ukraine: shedding light on the credit channel. Kyiv, Ukraine: Kyiv School of Economics.

Bruno, V, I Shim and H S Shin. 2015. "Comparative assessment of macroprudential policies." *BIS Working Papers,* no 502, June.

Bussière, Matthieu , Jin Cao, Jakob de Haan, Robert Hills, Simon Lloyd, Baptiste Meunier, Justine Pedrono, Dennis Reinhardt, Sonalika Sinha, Rhiannon Sowerbutts, Konstantin Styrin. 2020. "The interaction between macroprudential policy and monetary policy: Overview." *Wiley Special Issue Paper.*

Cantú, C, L Gambacorta and I Shim. 2019. "How effective are macroprudential policies in Asia-Pacific? Evidence from a meta-analysis." *BIS Papers* №110.

Carrasco, Marine and Mohamed Doukali. 2022. "Testing overidentifying restrictions with many instruments and heteroscedasticity using regularised jackknife IV." *The Econometrics Journal*, Volume 25, Issue 1, January 2022: 71–97. https://doi.org/10.1093/ectj/utab020.

Cecchetti, Stephen and Marion Kohler. 2014. "When Capital Adequacy and Interest Rate Policy Are Substitutes (And When They Are Not)." *International Journal of Central Banking, International Journal of Central Banking,* vol. 10(3): 205-231.

Cerutti, E, S Claessens and L Laeven. 2017. "The use and effectiveness of macroprudential policies: New evidence." *Journal of Financial Stability*, vol. 28(C): 203–24.

Clerc, L, A. Derviz, C. Mendicino, S. Moyen, K. Nikolov, L. Stracca, J. Suarez, A. Vardoulakis. 2015. "Capital Regulation in a Macroeconomic Model with Three Layers of Default." *International Journal of Central Banking*, vol. 11: 9-63.

Cozzi, Gabriele, Matthieu Darracq Pariès, Peter Karadi, Jenny Körner, Christoffer Kok, Falk Mazelis, Kalin Nikolov, Elena Rancoita, Alejandro Van der Ghote and Julien Weber. 2020. "Macroprudential policy measures: macroeconomic impact and interaction with monetary policy," Working Paper Series 2376, European Central Bank.Dobson, Corrine. 2020. "Assessing the effects of housing policy measures on new lending in Australia." *BIS Papers* №110.

Fang, Yao and Bruce Lu Harun. 2020. "The effectiveness of loan-to-value ratio policy and its interaction with monetary policy in New Zealand: an empirical analysis using supervisory bank-level data." *BIS Papers* №110.

Hansen, Lars and Jagannathan, Ravi. 1997. "Assessing Specification Errors in Stochastic Discount Factor Models." *Journal of Finance*, 52, issue 2: 557-90, https://EconPapers.repec.org/RePEc:bla:jfinan:v:52:y:1997:i:2:p:557-90.

Kadija, Yilla and Nellie Liang. 2020. "What are macroprudential tools?" *Brookings Institute, Up Front.*

Kim, Soyoung and Aaron Mehrotra. 2019. "Examining macroprudential policy and its macroeconomic effects - some new evidence." *BIS Working Papers*, No 825.

Kim, Soyoung. 2019. "Macroprudential Policy in Asian Economies." *ADB Economics Working Paper Series*, 577.

Kuttner, K. and Shim, I. 2016. "Can non-interest rate policies stabilize housing markets? Evidence from a panel of 57 economies." *Journal of Financial Stability,* vol. 26 (C): 31-44.

Marinković Srđan and Ognjen Radović. 2014. "Bank net interest margin related to risk, ownership and size: an exploratory study of the Serbian banking industry" *Economic research - Ekonomska istraživanja,* Vol. 27 No. 1, 2014 https://doi.org/10.1080/1331677X.2014.952114.

NBU. 2021. "Macroprudential Policy Strategy of the National Bank of Ukraine." Accessed December 10, 2021. https://bank.gov.ua/en/files/cshRTpMbhHJZpsw.

Rogers, Lamorna. 2013. "Unpacking the toolkit: the transmission channels of macro-prudential policy in New Zealand." *Reserve Bank of New Zealand consultation on "Macro-prudential policy instruments and framework for New Zealand."*

Tantasith, Chantawit, Nasha Ananchotikul, Chatlada Chotanakarn, Vorada Limjaroenrat and Runchana Pongsaparn. 2020. "The impact of LTV policy on bank lending: evidence from Thailand." *BIS Papers* №110.

Wijayanti, Rani, Nur M Adhi P and Cicilia A Harun. 2020. "Effectiveness of macroprudential policies and their interaction with monetary policy in Indonesia." *BIS Papers* №110.

Windmeijer, Frank. 2005. "A finite sample correction for the variance of linear efficient two-step GMM estimators." *Journal of Econometrics*, 126, issue 1: 25-51.