

Mile Bošnjak, PhD

Assistant Professor
Faculty of Economics and Business, University of Zagreb
E-mail: mile.bosnjak76@gmail.com
Orcid: <https://orcid.org/0000-0002-7663-198X>

Jurica Vukas, PhD

Advisor
Croatian National Bank
E-mail: jurica.vukas@gmail.com
Orcid: <https://orcid.org/0000-0002-4438-4611>

Ivan Šverko, PhD

Associate Professor
Eurizon Asset Management Croatia d.o.o.
Head of Risk Management
E-mail: ivansverko@yahoo.com
Orcid: <https://orcid.org/0000-0003-1697-6625>

PREDICTING NPLs FOR CROATIA WITH MACROECONOMIC VARIABLES¹

UDC / UDK: 336.77:330.101.541](497.5)

JEL classification / JEL klasifikacija: G31, G33

DOI: 10.17818/EMIP/2021/2.13

Review / Pregledni rad

Received / Primitljeno: March 30, 2021 / 30. ožujka 2021.

Accepted for publishing / Prihvaćeno za tisak: December 8, 2021 / 8. prosinca 2021.

Abstract

This paper aims to examine some of the macroeconomic drivers of nonperforming loans (NPL) in Croatia. Unemployment rate, industrial production index, construction works volume and the number of tourist arrivals were evaluated as the drivers on a quarterly data sample from 2008q4 to 2020q4. Following quantile regression approach, unemployment rates and construction works volume appeared as significant drivers of NPL in Croatia. Furthermore, empirical findings from this paper suggest asymmetric effects on NPL from its drivers. While decrease in construction works volume and increase in unemployment rates were found to correspond with increase in NPL, an increase in construction works volume and decrease in unemployment rates were not correlated with decrease in NPL. Consequently, the paper brings implications for credit institutions in Croatia within the context of COVID-19 pandemic crises.

Keywords: asset quality, macroeconomic determinants, coronavirus crisis

¹ The views expressed in this article are those of the authors and do not necessarily reflect the position of the Croatian National Bank

1. INTRODUCTION

One of the major consequences of the coronavirus pandemic in the banking sector is the increase in loan loss provisions (which is in Croatian case mainly seen in much higher LLP costs than in 2019). Major US and eurozone lenders had different pace in booking provisions for bad loans caused by the fallout from the coronavirus pandemic.

US lenders presented the rapid speed at which US banks increased their loan loss provisions with the slower pace in Europe. The ECB, which supervises the most important banks in the eurozone, responded to the pandemic last year by allowing lenders to use several of the extra capital buffers it had previously imposed on the sector. Notwithstanding, only nine banks did so last year, and others were reluctant to follow this practice, worrying about how long the relief will last and the reputational risk among investors (Financial Stability Review, ECB, November 2020, pp 51-67). The ECB has previously said the capital relief would last until at least the end of 2021 crisis.

At some point in 2020 ECB warned that in one possible scenario, non-performing loans at eurozone banks could reach €1.4tn, well above the levels of the 2008 financial crisis and the ensuing EU sovereign debt crisis (Financial Stability Review, ECB, November 2020, pp 62-63). Part of the European banks is still working through non-performing loans incurred after the previous crisis. Interestingly, non-performing loans at the largest eurozone banks fell from €506bn to €485bn in the first nine months of last year (Financial Stability Review, ECB, November 2020, pp 62-63). European banks had marginally increased their loan loss provisions to just under €16bn in the fourth quarter and the biggest increase is noticed in Italian banking sector. (Financial Stability Review, ECB, May 2021, pp 52-53). However, that was less than half the level of provisions taken in the second quarter of last year when Europe was plunged into a record post war recession.

The question in this paper is whether Croatian banks face increase in loan loss provisions and non-performing loans and what are the arguments for the development of the situation in the Croatian banking sector. The **Hypothesis 1** is the following: Croatian banks realized increase in NPLs during coronavirus pandemic. **Hypothesis 2**: The level of the NPLs of Croatian banks is linked to the macroeconomic indicators. These Hypotheses are backed on literature review.

Hypotheses were tested with numerical and descriptive methods to find out the development in Croatian banking sector in the period of pandemic. The results would show the influence of the pandemic on non-performing loans and the arguments for the development in domestic banking sector.

The structure of the paper is the following: after introduction and literature review, the pandemic situation and its influence on global and domestic economy and financial sector are explained. The following chapters describe

basic credit risk developments of Croatian banks. Final chapters analyze the link between NPL levels and major macroeconomic indicators.

2. LITERATURE REVIEW OF NON-PERFORMING LOANS AND MACROECONOMIC ENVIRONMENT

The global economy entered severe recession because of the coronavirus pandemic. The consequences of global recession are high levels of non-performing loans (NPLs) or loans that are in or close to default. The problems with the high levels of NPLs are the following: the problems with bank balance sheets and postponement of economic recovery. High non-performing loans numbers were the consequence of crisis in European countries during global recession so nowadays this scenario could repeat during coronavirus pandemic.

Loan loss provisions and their high levels are a characteristic of economic and banking crises and are included in a numerous study. Laeven and Valencia (2013) concluded that maximum level in non-performing loans take place during crises. Ari, Chen and Ratnovski (2020) narrow this gap by presenting development of non-performing loans during 88 banking crises since 1990. Their research encompasses financial crises around the globe and studies non-performing loans in the context of banking crises, so their research is not perfectly suitable to the COVID-19 events. Results of their study point out the difference in NPL development during coronavirus pandemic and global recession.

According to them, the non-performing loans typically follow an inverse U-shaped pattern with sudden increase followed by stabilization and decrease and sometimes even M shaped pattern with another peak after decline. While there is much of similarity during the development of non-performing loans, the development during NPL resolution differs. The decrease in non-performing loans could be quite fast in some cases and long lasting in others.

According to literature review, economic decline is quite strong after a banking crisis. Reinhart and Rogoff (2010) concluded that GDP decrease is 9 percent after a crisis, whereas Cerra and Saxena (2008) calculated GDP decline of 7.5% over a decade following negative event. More extensive credit problem that is accompanied with a stronger recession is presented in Jordà, Schularick, and Taylor (2013).

The characteristic of coronavirus is that it is not a credit boom caused crisis. If the crisis becomes temporary, most of post coronavirus NPLs may be related to illiquid companies, rather than insolvent firms. The IFRS 9 accounting standard may provoke faster non-performing loan recognition and resolution due to their forward-looking character. Most European countries are faced with less profitable banks and higher public debt accompanied by problematic corporate sector when compared to global recession of 2008, and that are the characteristics

that have previously complicated NPL resolution. If the economic expansion would be slow, the problems with credit losses could escalate.

Given the importance of non-performing loans, problems with faster economic growth and measure implementation, an effective NPL resolution is crucial in the post coronavirus world creating globally a crucial forward-looking financial policy issue.

Corporate lending increases after adverse shocks in a number of cases. After the inception of coronavirus pandemic, commercial lending rises up dramatically, whereas consumer loans remained on the same pre-crisis level. Coronavirus episode represents a macroeconomic event with a huge impact on cash flow of many companies. This increase in bank loans is explained by reduction of existing credit instruments, rather than new credit issuance (Acharya and Steffen, 2020; Li, Strahan and Zhang, 2020) and it is related to the largest companies. (Chodorow-Reich et al., 2020).

Khwaja and Mian (2008) use fixed effects approach on these companies with term loans from multiple banks, whereas Greenwald, Kreiner and Paul (2020) find that banks experiencing larger their credit line reduction decrease their term loans by more and the effect is not compensated by deposit inflows.

Furthermore, Škarica (2014) employed panel data approach and analyzed drivers of changes in non-performing loans between Q3:2007 and Q3:2012 for seven Central and Eastern European (CEE) countries including Croatia. The results point to the GDP, unemployment, and the inflation rate as the main determinants of (NPL) ratio. Curak et al. (2013) used Generalized Method of Moments as an estimator based on the sample of 69 banks in 10 countries between 2003 and 2010 considered to be the macroeconomic and bank-specific drivers of NPL. The results obtained suggested economic growth, inflation and higher interest rate as macroeconomic determinants of non-performing loans while bank size, performance (ROA) and solvency were found to be the bank specific drivers NPL. Jolevska and Andovski (2015) provided an insightful comparison of NPL development in Croatia, Serbia and North Macedonia while pointing out the highest deterioration in loan quality for Croatia. Tomas Žiković et al. (2015) examined the relationship between macroeconomic performance and non-performing loans (NPL) ratio in Croatia during 2001q4 - 2014q1 period. The analysis considered two different loans to households and corporate loans separately to reveal similarities and differences between the considered loan categories. The research results revealed strong effects from economic slowdown to NPL ratio for both categories. Unemployment rate was found significant for corporate loans. The effects from Interest rates to NPL were different both in the long-run and short-run. In the long run the relationship was positive while in the short run there was a negative relationship between interest rates and NPL ratio. Tanasković and Jandrić (2015) analyzed macroeconomic and institutional drivers of NPL of growth. The analysis considered selected CEEC and SEE countries in the period 2006-2013. Following the panel data approach, a combination of country-specific and financial macroeconomic indicators were examined. The

empirical findings suggested a negative relationship between increases in GDP and rise of the NPL ratio. Furthermore, foreign currency loans ratio and exchange rate level were positively related with the increase of NPL ratio. The results pointed out foreign currency close in loan portfolio and underdevelopment of financial market as significant drivers NPL level.

Altogether, NPL levels depend on many macroeconomic and microeconomic variables.

3. COVID-19 AND MACROECONOMIC ENVIRONMENT

The economic circumstances in 2020 can be characterized as a steep global economic slowdown due to the outbreak of coronavirus pandemic. Most countries imposed numerous measures such as lockdowns, travel and business restrictions to limit the spread of the pandemic and ease the pressure put on the healthcare system. Coronavirus pandemic resulted in severe recessions worldwide and minimized economic activity for the first quarter of 2020. Considering the global growth, World Economic Outlook Update (WEO) (2020, 2021) reports a -4.4% fall in 2020 (Table 1). Consumption, in terms of aggregate demand, decreased along with investments, while savings increased as a precaution to pessimistic forecasts. Dramatic decrease in economic activity is anticipated to continue due to the second and third cycle of the virus outbreak.

Table 1

Global economies: Real GDP (Annual percent change)

	2020	2021 (estimate)	2022 (estimate)
Europe	-5,2	4,5	3,9
Advanced Europe	-6,8	4,5	4,0
Emerging Europe	-2,0	4,4	3,9
Asia	-1,5	7,6	5,4
Advanced Asia	-3,1	4,1	3,0
Emerging Asia	-1,0	8,6	6,0
ASEAN	-3,4	4,9	6,1
North America	-4,1	6,1	3,5
South America	-6,6	4,4	2,8
Central America	-7,2	5,6	4,1
Middle East and C. Asia	-2,9	3,7	3,8
Sub-Saharan Africa	-1,9	3,4	4,0
World	-4,4	4,9	3,4

Source: *World Economic Outlook (2021)*

Financial markets were temporarily highly volatile because of the increase in uncertainty as the pandemic rapidly intensified. Commodity prices, mostly oil, have fallen sharply due to depressed mobility and a fall in the global demand. Debt levels considerably increased since governments and central banks introduced various policies to protect businesses and population from the consequences of a sudden stop in the activity. According to OECD (2020), during shutdowns, economic activity collapsed by 20 to 30% in some countries. Government intervention in form of subsidies to workers and firms supported the economy during an extraordinary market shock. On the other hand, central banks had to deploy monetary tools of conventional and unconventional monetary policies to suppress the crisis and prevent it from spilling into a financial one.

Activity in 2021 should be of higher intensity than in 2020 due to the additional measures conducted by fiscal and monetary authorities. The support from governments as additional fiscal stimulus as well as support from central banks via further asset purchase programme will push global growth and keep inflation under control.

Contraction in 2020 is estimated at -4.4%, and the growth of global economy is forecasted to 4.9 percent in 2021 and 3.4 percent in 2022. The development reflects the stronger recovery on average, especially in the US and Japan with slower recovery in the UK and the European Union. The recovery is dependent on public health responses to infections, flexibility and adaptability of economic activity to new circumstances. Therefore, the projection is that the US and Japan would reach the 2019 GDP level by the end of 2021 while the UK and EU should reach that level by the end of 2022 (WEO) (2020, 2021).

Due to better than expected economic recovery, global trade will increase by around 8% in 2021 and by 6% in 2022. Trade in goods is going to recover faster than trade in services which are highly dependable on labor intensive activities such as tourism. Small and medium sized enterprises reported highest losses, especially those directly participating in the service sector. Labor-intensive industries faced downsizings, which surged the unemployment rate and left workers without a job. Companies had to adapt to a new work environment by reducing the working hours and transferring to work from home practices (WEO) (2020, 2021).

Croatia's GDP contracted by 8.4% in 2020, while it is expected to rise at a rate of 5.3% in 2021 and 4.6% in 2022, the European Commission says in its latest winter 2021 Economic Forecast. The economy's contraction in 2020 is the result of the impact of the coronavirus pandemic on personal demand and consumption related to industry. Exports based particularly on tourism faced a huge demand fall due to coronavirus pandemic.

The development of Croatian economy in 2021 and 2022 is highly dependable on coronavirus pandemic because of high share of service industry, especially tourism, in gross domestic product. Personal consumption is going to increase after a period of savings in 2020 as well as investment and construction

owing to the ongoing projects and earthquakes. Exports of goods should recover fast, whereas the recovery of service sector will take longer time.

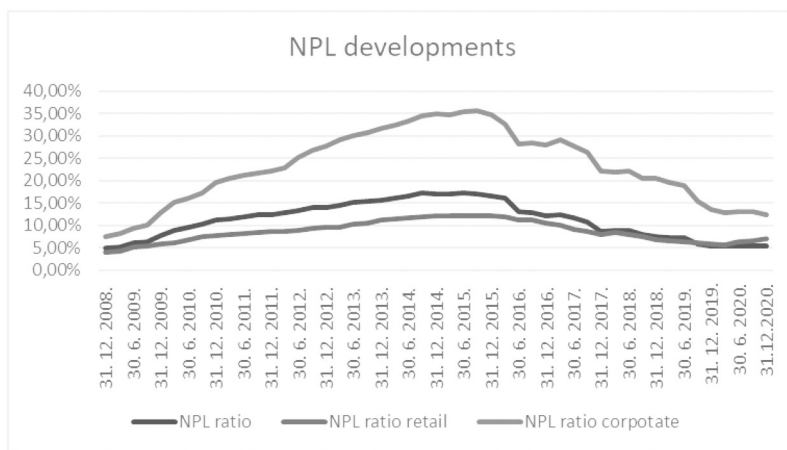
4. ASSET QUALITY OF THE CROATIAN BANKING SECTOR

Credit risk is the risk of possible loss due to credit default. Since banks hold an adequate amount of equity (high capital adequacy) in relation to the value of assets, it is sufficient that a certain part of total loans becomes uncollectible, and the bank may find itself on the verge of insolvency. Many studies have shown that of all the risk exposures in credit institutions, credit risk is by far the most significant. Caprio and Klingebiel (1999) found that over 90% of bank failures worldwide are caused by the credit risk exposure.

Credit risk has been in the focus for a very long time. Besides the fact that market and operational risk do attract the modern research, credit risks are still the major reasons of bank failures and therefore remain the most important risk in the banking business. According to Duffie and Singleton (2003) credit risk basically shows the possibility of losses due to the deorientation of some credit investment.

As in other countries, credit risk exposure is the most important and the most relevant risk exposure of the banking sector in the Republic of Croatia. This is especially true in the times of financial crises – which Croatian economy is now facing during the pandemic of Covid 19.

Data as of December 2009 shows that Croatian banks had a loan portfolio of HRK 373bn, which represents 83.57% of the total assets of the total banking sector. The quality of the portfolio exposed to credit risk can be seen through different parameters. The most important one is the level of nonperforming loans (NPL) in the total loans' exposure. Nonperforming loans and their level in the total loan portfolio are one of the main indicators of the credit risk in every bank. The same is valid for the Croatian banking sector. The level of NPLs in the total loan portfolio of Croatian banks is currently at the level of 5.5%. However, the development of this ratio is even more relevant. Besides the level of nonperforming loans, this work will try to analyze the level of total loan loss provisions of the Croatian banking sector, as well as the levels of specific and portfolio risk provisions for the sectoral data.



Graph 1 The developments of NPL loans in Croatian banks

Source: the data from Croatia National bank, www.hnb.hr and calculated by authors

As one can notice in the last 4 years there has been a downward trend of NPL loans (from the level of 12.07% to the level of 5.43%). This trend can be seen in both subsegments – corporate and retail loans. Moreover, speaking on the COVID crisis (in 2020) there is not much of the evidence of increasing NPL levels. The data for 2020 looks as follows:

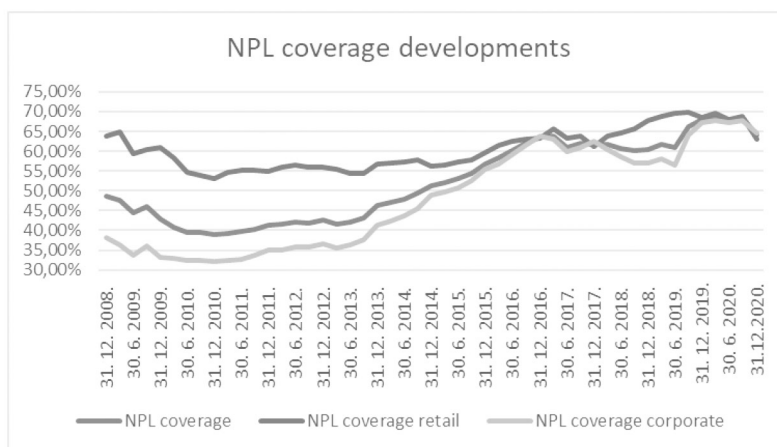
Table 2

Development of the NPL loans during COVID crisis

	31. 3. 2020.	30. 6. 2020.	30. 9. 2020.	31. 12. 2020.
NPL ratio	5.33%	5.45%	5.49%	5.43%
NPL ratio corporate	12.86%	13.03%	13.18%	12.48%
NPL ratio retail	5.65%	6.34%	6.60%	7.09%

Source: the data from Croatia National bank, www.hnb.hr and calculated by authors

Finally, the development of the NPL coverage (by Loan Loss provisions) is as follows:



Graph 2 The developments of NPL coverage in Croatian banks

Source: the data from Croatia National bank, www.hnb.hr and calculated by authors

As it can be seen from the above-mentioned graphs:

- In Croatian banking sector NPLs have been decreasing since 2015 until the COVID crisis;
- During the COVID crisis the NPL have been stabilized in corporate loans subsegment and increase in retail subsegment;
- In last few years the NPL coverage has been in constant increasing trend until again COVID crisis when firstly there was a stabilization trend and afterwards even a downward trend.

Finally, it should be stated that this relatively low change in NPLs is due to the Central bank moratorium measures. According to the CNB data the volume of loans covered by the moratorium, after peaking in September 2020, continued to decline, and at the end of March 2021 they covered 8.6% of loans to businesses and households, and were mostly targeted at hotels and restaurants.

All these developments have influenced the levels of interest rates (both on assets and liabilities sides), all profitability ratios and on the banks' potential to further support the economy.

5. METHODOLOGY

The second research topic of this article is in the analysis of the NPL ratio and its linkage to the macroeconomic indicators.

As illustrated in this section, previous literature considered the drivers of NPL in Croatia. However, results always depend on data selection and model specification. This paper extends previous literature with results from quantile regression approach that is considered as robust while considering effects from tourist arrivals and construction works as potential drivers of NPL underexamined in previous studies.

For this analysis authors have developed the database from December 2008 until December 2020. The included date pertains to the following:

- The NPL ratio (NPL)
- Industrial production (IP)
- Construction works (CWV)
- Unemployment rate (UN)
- Tourist arrivals (NTA)

The date has been taken from the web pages of the Croatian National Bank and the Croatian Bureau of Statistics.

The development of the observed series was illustrated in figure A1 in Appendix. To overcome the issue of seasonality the observed time series were X-13 seasonally adjusted. We firstly examined the properties of the observed series following the frequently used Augmented Dickey-Fuller (1979) (ADF) test. Afterwards, the econometric model specification in equation (1) was estimated.

$$NPL = \alpha + \beta_1 * UN + \beta_2 * IP + \beta_3 * CWV + \beta_4 * NTA + \varepsilon \quad (1)$$

Firstly, linear regression model was estimated using Ordinary Least Squares (OLS) as an estimator and variables in its stationary form. Descriptive statistics of variables in its stationary form is provided in Table A1 in Appendix. OLS estimator is well known for its properties as the Best Linear Unbiased Estimator (BLUE). However, in case of violated assumptions the estimates might be biased. Koenker and Bassett (1978) suggested quantile regression approach in case of violation in assumption of residuals normality. For the application of quantile regression approach see for example (Bošnjak et al., 2019; Bošnjak et al., 2020). Hence, equation (1) was estimated using quantile regression approach to illustrate the effects across quantile of a dependent variable.

6. EMPIRICAL RESULTS AND DISCUSSION

Following the research data and methodology, stationarity properties of the observed series are examined firstly, and results were summarized in Table 3.

Table 3

ADF test results for the observed series

Variable and test	Levels		First difference	
	Constant	Constant and trend	Constant	Constant and trend
ADF test	t-stat. (p-value)			
NPL	-1.082586 (0.7151)	-1.896881 (0.6407)	-3.774437 (0.0059)	-5.137997 (0.0006)
IP	-2.408002 (0.1451)	-2.590921 (0.2861)	-10.60912 (0.0000)	-10.49055 (0.0000)
CWV	-2.438463 (0.1369)	-5.476466 (0.0002)	-4.573056 (0.0006)	-4.614194 (0.0031)
UN	-1.982179 (0.2934)	-2.118384 (0.5219)	-3.334929 (0.0188)	-3.558016 (0.0447)
NTA	-0.617377 (0.8569)	-0.950083 (0.9413)	-8.549829 (0.0000)	-9.262169 (0.0000)

Source: authors` estimates

As illustrated in Table 3, based on test results from ADF test, all of the observed series, except construction works volume (CWV), are integrated of order one or exhibited stochastic trend. The results for Construction works volume indicated linear deterministic trend. Consequently, empirical analysis was carried out using de-trended variable representing construction works volume (CWV) while other variables were taken in its first differences. As illustrated in the section entitled Research data and methodology, equation (1) was estimated using OLS as an estimator.

Table 4

OLS estimates

Variable	Estimates (Std. Error)	t- value	p-value
α	0.0002428 (0.0009691)	0.251	0.80338
ΔUN	0.5481721 (0.1574263)	3.482	0.00116
ΔIP	0.0039606 (0.0186938)	0.212	0.83321
$CWV_{detrended}$	-0.0407994 (0.0203630)	-2.004	0.05144
ΔNTA	0.0058979 (0.0063980)	0.922	0.36176
Adjusted R-squared: 0.275	F-statistic: 5.458 p-value: 0.001208	JarqueBera test statistic = 85.239, p-value < 2.2e-16	

Source: authors` estimates

Table 4 illustrates liner regression estimates with OLS as an estimator. As indicated in Table 3, the estimated model suffers from non-normality distribution of its residuals. Therefore, to overcome the issue of non-normality, the quantile regression appears as a suitable solution. Estimates for the first quartile, median and the fourth quartile are provided in Table 5.

Table 5

Quantile regression estimates

Quantile	Variable	Estimates (Std. Error)	t- value	p-value
0.25	α	-0.00072 (0.00309)	-0.23199	0.81765
	ΔUN	0.71786 (0.38175)	1.88044	0.06683
	ΔIP	-0.00267 (0.04245)	-0.06300	0.95006
	<i>CWVdetrended</i>	-0.01450 (0.04662)	-0.31104	0.75727
	ΔNTA	0.00445 (0.02138)	0.20834	0.83595
0.5	α	0.00184 (0.00088)	2.08731	0.04282
	ΔUN	0.61463 (0.10080)	6.09730	0.00000
	ΔIP	-0.00831 (0.01699)	-0.48885	0.62743
	<i>CWVdetrended</i>	-0.01739 (0.01475)	-1.17929	0.24477
	ΔNTA	0.00805 (0.01302)	0.61847	0.53953
0.75	α	0.00422 (0.00070)	6.03675	0.00000
	ΔUN	0.49085 (0.06390)	7.68150	0.00000
	ΔIP	0.01685 (0.01184)	1.42354	0.16179
	<i>CWVdetrended</i>	-0.02173 (0.00899)	-2.41851	0.01989
	ΔNTA	0.00812 (0.00426)	1.90501	0.06348

Source: authors' estimates

Following the estimates provided in Table, 3 the smallest changes in NPL can be explained with changes in unemployment rate but only at significance of 10%. Median regression estimates illustrate more significant effects from change in unemployment to change in NPL. The highest changes in NPL can be explained with changes in unemployment and with changes in construction. Effects from unemployment as well as effects from constructions were in line with theoretical assumptions. Hence, an increase in unemployment corresponds with increase in NPL, while an increase in construction decreases the NPL level. The results indicate the vulnerability of banking loan portfolio to the

construction activity. Tourist arrivals and industrial production do not obtain the desired significance level at any of the considered quantiles. Conclusively, there was an asymmetry in NPL development. While decrease in NPL can hardly be explained by drivers assumed in this paper, an increase in unemployment rate and decrease in construction activity can be clearly linked to NPL development in Croatia.

7. CONCLUSION

The goals of the article were to understand and analyze if there were any changes in NPL levels due to COVID crisis and if there is a linkage between NPL levels and major macroeconomic indicators in the Republic of Croatia.

Speaking on the NPL levels, it has been shown that there are some changes in NPL levels (especially in retail segment) due to the COVID crisis. Most of these changes are still of relatively low volumes primarily due to the CNB reprograms and prolongation measures (which allowed commercial banks to prolong loans for customers with repayment problems due to the COVID 19 crisis).

On the other hand, the article analyzed the linkage between NPL levels and macroeconomic indicators – having in mind the potential bad development of the NPL levels in months to come. The article has shown that there is evidence that unemployment rate and construction works have an impact on the NPL levels. The rising prices of material had partial impact on construction works. The price of iron ore increased 111% and the price of copper rose 32% in 2020 (according to Bloomberg information system). On the other hand, the article failed to find the linkage between tourist arrivals and industrial production with NPL levels.

Altogether, the effects of COVID crisis on the Croatian banking credit risk developments are still mild. However, these effects would be more evident in months to come. Prudent credit risk management will be a major issue determining the efficient, stable and profitable Croatian banks in the nearer future. Central bank task in this area would always be to support these developments and to protect the financial system.

LITERATURE

Acharya, V.; Steffen, S. (2020). "The Risk of Being a Fallen Angel and the Corporate Dash for Cash in the Midst of COVID". *The Review of Corporate Finance Studies*. <https://doi.org/10.1093/rcfs/cfaa013>

Ari, A.; Chen, S.; Ratnovski, L. (2020). "The dynamics of non-performing loans during banking crises: a new database". *ECB Working Papers*, No. 2395. Frankfurt am Main. <https://doi.org/10.2139/ssrn.3840981>

Bošnjak, M.; Kordić, G.; Budimir, I. (2019). "Odrednice međunarodnih deviznih pričuva u hrvatskoj: pristup kvantilne regresije". *Ekonomski misao i praksa*, Vol. 1, pp. 159-173.

Bošnjak, M.; Bilas, V.; Kordić, G. (2020). "Determinants of foreign exchange reserves in Serbia and North Macedonia". *Economic Annals*, Vol. 65, No. 226, pp. 103-120. <https://doi.org/10.2298/EKA2026103B>

Caprio, G.; Klingebiel, D. (1999). "Scope and fiscal costs of banking crises: compilation of information on systematic and non systematic banking crises from 1970s onward". Available at: www.worldbank.org.

Cera, V.; Saxena, S. C. (2008). "Growth Dynamics: The Myth of Economic Recovery". *American Economic Review*, Vol. 98, No. 1 (March), pp. 439-457. <https://doi.org/10.1257/aer.98.1.439>

Chodorow-Reich, G., Darmouni, O.; Luck, S.; Plosser, M. (2020). "Bank liquidity provision across the firm size distribution". NBER Working Paper, 27945. <https://doi.org/10.3386/w27945>; <https://doi.org/10.2139/ssrn.3716464>; <https://doi.org/10.2139/ssrn.3702725>

Curak, M.; Pepur, S.; Poposki, K. (2013). "Determinants of non-performing loans-evidence from Southeastern European banking systems". *Banks & bank systems*, Vol. 8, No. 1, pp. 45-53.

Dickey, D. A.; Fuller, W. A. (1979). "Distribution of the estimators for autoregressive time series with a unit root". *Journal of the American statistical association*, Vol. 74, No. 366a, pp. 427-431. <https://doi.org/10.1080/01621459.1979.10482531>; <https://doi.org/10.2307/2286348>

Duffie, D.; Singleton, K. (2003). *Credit Risk: Pricing, Measurement and Management*. Princeton: Princeton University Press.

Jolevska, E.; Andovski, I. L. (2015). "Non-Performing Loans in the Banking Systems of Serbia, Croatia and Macedonia: Comparative Analysis (Ненаплативи Кредити У Банкарском Систему Србије, Хрватске и Македоније Компаративна Анализа)". *Ekonomika*, Vol. 61, No. 1, pp. 115-130. <https://doi.org/10.5937/ekonomika1501115D>

Koenker, R.; Bassett Jr., G. (1978). "Regression quantiles". *Econometrica: journal of the Econometric Society*, pp. 33-50. <https://doi.org/10.2307/1913643>

Laeven, L.; Valencia, F. V. (2013), "Systemic banking crises database". *IMF Economic Review*, Vol. 61, No. 2, pp. 225-270. <https://doi.org/10.1057/imfer.2013.12>

Greenwald, D. L.; Krainer, J.; Paul, P. (2020). "The credit line channel". *Federal Reserve Bank of San Francisco*. <https://doi.org/10.24148/wp2020-26>

Khwaja, A. I.; Mian, A. (2008). "Tracing the Impact of Bank Liquidity Shocks". *American Economic Review*, Vol. 98, No. 4, pp. 1413-1442. <https://doi.org/10.1257/aer.98.4.1413>

Laeven, L.; Valencia, F. V. (2013). "Systemic banking crises database". *IMF Economic Review*, Vol. 61, No. 2, pp. 225-270. <https://doi.org/10.1057/imfer.2013.12>

Li, L.; Strahan, P.; Zhang, S. (2020). "Banks as lenders of first resort: Evidence from the COVID-19 crisis". *The Review of Corporate Finance Studies*, Vol. 9, No. 3, pp. 472-500. <https://doi.org/10.1093/rfcs/cfaa009>

Škarica, B. (2014). "Determinants of non-performing loans in Central and Eastern European countries". *Financial theory and practice*, Vol. 38, No. 1, pp. 37-59. <https://doi.org/10.3326/fintp.38.1.2>

Tanasković, S.; Jandrić, M. (2015). "Macroeconomic and institutional determinants of non-performing loans". *Journal of Central Banking Theory and Practice*, Vol. 4, No. 1, pp. 47-62. <https://doi.org/10.1515/jcbtp-2015-0004>

Tomas Žiković, I.; Žiković, S.; ArbulaBlecich, A. (2015). "The drivers behind household and corporate non-performing loans ratio: The case of Croatia". *Privredna kretanja i ekonomska politika*, Vol. 24, No. 2 (137), pp. 7-35.

Financial Stability Review (2020). ECB, November 2020, pp 51-67.

APPENDIX 1

Table A1

Descriptive statistics of variables in its stationary form

	npl	dun	ip	nacwv	nta
Min.	-0,0316096	-0,0094	-0,092	-0,113173	-0,784867
1st Qu.	-0,0033747	-0,00573	-0,03075	-0,041719	-0,064473
Median	0,0011115	-0,00156	0,002	-0,007987	0,006266
Mean	0,0001636	-0,00086	0,001333	-0,011984	-0,017583
3rd Qu.	0,0047793	0,002769	0,03725	0,020989	0,068527
Max.	0,0120311	0,021981	0,113	0,072417	0,138843

Source: the data from Croatia National bank, www.hnb.hr, Croatian Bureau of Statistics www.dzs.hr and calculated by authors

Dr. sc. Mile Bošnjak

Docent
Sveučilište u Zagrebu, Ekonomski fakultet
E-mail: mile.bosnjak76@gmail.com
Orcid: <https://orcid.org/0000-0002-7663-198X>

Dr. sc. Jurica Vukas

Savjetnik
Hrvatska narodna banka
E-mail: jurica.vukas@gmail.com
Orcid: <https://orcid.org/0000-0002-4438-4611>

Dr. sc. Ivan Šverko

Izvanredni profesor
Eurizon Asset Management Croatia d.o.o.
Voditelj upravljanja rizicima
E-mail: ivansverko@yahoo.com
Orcid: <https://orcid.org/0000-0003-1697-6625>

PROGNOZIRANJE NEPRIHODONOSNIH KREDITA (NPL) U HRVATSKOJ S MAKROEKONOMSKIM VARIJABLAMA²

Sažetak

Cilj je rada istražiti neke od makroekonomskih pokretača neprihodonosnih kredita (NPL) u Hrvatskoj. Stopa nezaposlenosti, indeks industrijske proizvodnje, obujam građevinskih radova, i broj dolazaka turista ocijenjeni su kao pokretači na tromjesečnom uzorku podataka od 2008q4 do 2020q4. Kvantilna regresija pokazala je da su stope nezaposlenosti i obujam građevinskih radova značajni pokretači neprihodonosnih kredita u Hrvatskoj. Nadalje, rezultati ovog empirijskog istraživanja ukazuju na asimetrične učinke pokretača na neprihodonosne kredite. Iako je utvrđeno da smanjenje obujma građevinskih radova i povećanje stope nezaposlenosti odgovaraju povećanju neprihodonosnih kredita, povećanje obujma građevinskih radova i smanjenje stope nezaposlenosti nisu povezani sa smanjenjem te vrste kredita. Slijedom toga, rad donosi implikacije za kreditne institucije u Hrvatskoj u kontekstu krize uzrokovane COVID-19 pandemijom.

Ključne riječi: kvaliteta imovine, makroekonomske odrednice, kriza izazvana korona virusom.

JEL klasifikacija: G31, G33.

² Iznescena stajališta su osobna i ne odražavaju nužno stajališta Hrvatske narodne banke.