

Impact of National Economic Conditions on the Level of Non-Performing Loans in the Commercial Banks of Cyprus

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Abstract—The purpose of this paper is to assess and analyse the impact of the national economic conditions on the Level of Non-performing loans (NPLs) in the Commercial banks of Cyprus, as well as determine the nature and magnitude of relationship between them.

The object of this study is the existing scientifically based theoretical approaches to the study of non-performing loans, as well as economic processes that affected the dynamic of those loans.

The paper reviews the impact of the changes in national economic conditions on the Level of Non-performing loans in the Commercial banks of Cyprus between 2005 and 2018. The national economic conditions studied include: Public Debt, Budget Balance and Interest Rate.

The results of this study confirms that statistically significant linear dependency exists between Public Debt, Interest Rate and NPLs in Cyprus. In turn, the study confirms that there is not enough evidence to prove that statistically significant linear dependency exists between Budget Balance and NPLs in Cyprus.

Keywords: *Non-performing loans, Commercial banks, Public Debt, Budget Balance, Interest Rate, Coefficient of Correlation, Coefficient of determination*

I. INTRODUCTION

Over the past decade, the global banking system, including the banking system of Cyprus, has been hit hard by the financial crisis of 2007-2008. The consequences of the global financial crisis have made the problem of non-performing loans again relevant. The danger of a high level of non-performing loans generate risks of financial instability, restrain the country's economic growth and reduce economic efficiency due to their adverse economic consequences [1-3].

Among the determining factors, the scientific literature identifies a number of factors that help explain the evolution of NPLs. There are many studies focusing on the problem of the default rate of loans in the banking sector, most of which are focused on the relationship between macroeconomic determinants and NPLs [4-6]. A number of studies are devoted

to the fact that the effect of macroeconomic conditions on the level of non-performing loans can be significant [7-9].

Moreover, non-performing loans create the link between banking sector vulnerabilities and regional and national macro-financial shocks [10, 11].

So despite the fact that the Republic of Cyprus, in accordance with the provisions of the European Stability and Growth Pact [12], has developed and is implementing its next Stability Program [13] for the period 2019-2022, approved by the Council of Ministers of Cyprus April 17, 2019, and a further decrease in the high level of non-performing loans is one of the nine strategic goals of the Stability Program, at the end of 2018 the level of non-performing loans in Commercial banks in Cyprus remains, as before, very high and amounts to 30.5% [14].

Thus, given the high level of NPLs in Cyprus, it remains interesting to consider the extent to which the impact of national economic conditions has on the Level of NPLs on the Commercial Banks in Cyprus. These questions become particularly pressing as Cyprus emerged from the 2013 banking crisis and is facing a gradual economic recovery.

The aim of the study is the scientific justification of the impact of national economic conditions on the level of non-performing loans, in order to prevent the risk of financial instability and accelerate economic growth in the modern economy of the European Union conditions.

To achieve the aim of the paper it was necessary to solve the following research objective:

To define and justify the impact of national economic conditions on the level of non-performing loans in Commercial banks in Cyprus.

The research object of the paper is the existing scientifically based theoretical approaches to the study of non-performing loans, as well as economic processes that affected the dynamic of those loans.

The research subject of the paper is the economic relations that objectively develop between economic agents in the process of formation and development of non-performing loans.

The methodology of the research is based on the theoretical and methodological analysis of the scientific literature, observations and analysis, comparative method, statistical and econometric methods, modeling.

The methodology of the study is based on theoretical and methodological analyses of scientific literature, statistical and econometric methods, as well as on observations, comparative method, description, measurements, analysis and modeling. In order to develop the statistical models, representing the relationship between national economic conditions and NPLs in Cyprus, the author is using a Simple linear correlation and such data analysis methods as Coefficient of correlation and Coefficient of determination.

II. METHODS OF RESEARCH

To achieve the aim of this paper, the author used the analysis of scientific literature. Among the determining factors of non-performing loans, the scientific literature identifies national economic conditions, which include Federal public finances (Public Debt and Budget Balance both as a share of Gross Domestic Product) and Interest Rate [10, 15, 16]. Annual average Interest Rate on new residential loans was used by the author.

There are studies that are based on the fact that Federal public finances have a positive effect on non-performing loans, since the deterioration of state finances leads to a decrease in confidence in national banks, and thus banks begin to experience difficulties with liquidity. In turn, a decrease in bank liquidity leads to a reduction in lending, and debtors cannot refinance their debt to pay off loan obligations on more favourable terms. Moreover, an increase in public debt can lead to fiscal consequences, especially to a reduction in social spending and payments made to households, such as unemployment benefits [17, 18].

An increase in real credit rates increases the value of borrowers' debt and makes debt servicing more expensive and thus affect the borrower's ability to service debt.

In addition, there is a view that the uncertainty of interest rates affects the sources of funds in banks, which, in turn, affects the growth of loans and, therefore, non-performing loans [19].

To achieve the aim of this paper, the author used the method of correlation analysis to develop models of the influence of Public Debt, Budget Balance and Interest Rate on the level of non-performing loans. Correlation is used when the author links Public Debt, Budget Balance and Interest Rate with non-performing loans to see if they affect each other [20, 21]. The degree of relationship is indicated by the correlation coefficient. To calculate the correlation coefficient, the author uses one of the formulas presented in the textbook on econometrics [22]. The correlation coefficient obtained as a result of calculations is interpreted by the author as well as a

qualitative assessment based on the Chaddock scale [23, 24]. In addition, the coefficient of determination is calculated and the critical values of the correlation coefficient are determined using the table of critical values for the correlation coefficient [25].

III. RESEARCH RESULTS AND DISCUSSION

A. The Model Nr1 of the influence of Public Debt on the level of non-performing loans

To accomplish the aim, the author builds an econometric Model Nr1 of a simple linear correlation of Public Debt and the Level of NPLs. The uses of the statistical data are presented in Table I.

TABLE I. PUBLIC DEBT AND NPLS IN CYPRUS (%), 2005-2018. COMPILED BY THE AUTHOR (BASED ON DATA FROM THE MINISTRY OF FINANCE OF CYPRUS [26] AND THE CENTRAL BANK OF CYPRUS [27])

Years	2005	2006	2007	2008	2009	2010	2011	2012
Public Debt (%)	62.8	58.7	53.5	45.1	53.8	56.3	65.7	79.7
NPLs(%)	7.1	5.4	3.4	3.6	4.5	13.3	17.3	27.1
Years	2013	2014	2015	2016	2017	2018		
Public Debt (%)	102.6	107.5	108	105.5	95.8	102.5		
NPLs(%)	43.2	47.5	45.3	46.4	42.5	30.5		

The results of the calculations from the data in the above table show that the Coefficient of Correlation (r) between Public Debt and NPLs is 0.966 and the Coefficient of determination (R2) is 0.933 (see Table II, Figure 1).

TABLE II. RESULTS AND INTERPRETATION OF THE OBTAINED MODEL NR1 CALCULATION. CREATED BY THE AUTHOR, OWN CALCULATIONS

Name	Coefficients	Results of analysis	Parameters
Coefficient of Correlation	r	0.966	0.9<0.966<0.99
Coefficient of Determination	R ²	0.933	0.933>0.7
Critical Values	-	±0.532	0.966 > 0.532

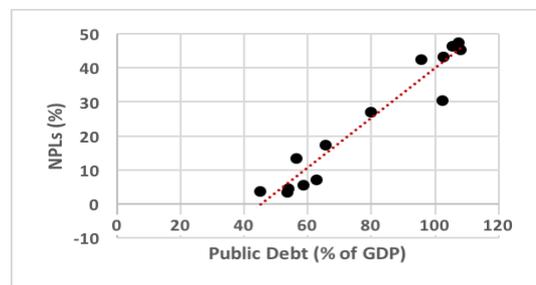


Fig. 1. The relationship between Public Debt and NPLs in Cyprus, 2005 - 2018. Created by the author, own calculations

Based on the research results, the following can be observed:

- There is a linear relationship between Public Debt and NPLs, since $-1 < 0.966 < 1$;
- Since the obtained correlation coefficient is a positive number, there is a positive relationship between Public Debt and NPLs, namely:
- - As the Public Debt increases, the level of NPLs loans increases;
- - As the Public Debt decreases, the level of NPLs loans decreases;
- The magnitude of the relationship between Public Debt and NPLs is very high (near to perfect), since the Chaddock Scale is $0.9 < 0.966 < 0.99$;
- 93.3% of NPLs are directly related to Public Debt (and vice versa), since the Coefficient of determination (R^2) is equal to 0.933;
- Since in this study $n = 14$, and the degrees of freedom are 12 ($df = n - 2$ and $14 - 2 = 12$) and using the table of critical values for the correlation coefficient $df = 12$ with $\alpha = 0.05$, the author determines that critical values are ± 0.532 . Since $r = 0.966$ and $0.966 > 0.532$, the correlation coefficient of Public Debt and NPLs in Cyprus is statistically significant. There is a significant relationship between Public Debt Rate and Non-performing loans in Commercial banks in Cyprus;
- The linear model between Public Debt and NPLs is near perfect.

B. Model Nr.2 of the influence of Budget Balance on the level of non-performing loans.

To accomplish the aim, the author builds an econometric Model Nr2 of a simple linear correlation of Budget Balance and the level of NPLs. The uses of the statistical data are presented in Table III.

TABLE III. BUDGET BALANCE AND NPLS IN CYPRUS (%), 2005-2018. COMPILED BY THE AUTHOR (BASED ON DATA: CENTRAL BANK OF CYPRUS [28] AND THE MINISTRY OF FINANCE OF CYPRUS [29])

Years	2005	2006	2007	2008	2009	2010	2011	2012
Budget Balance (%)	-2.2	-1.0	3.2	0.9	-5.4	-4.5	-5.7	-5.5
NPLs(%)	7.1	5.4	3.4	3.6	4.5	13.3	17.3	27.1
Years	2013	2014	2015	2016	2017	2018		
Budget Balance (%)	-5.1	-0.4	-0.3	0.3	1.8	3.4		
NPLs(%)	43.2	47.5	45.3	46.4	42.5	30.5		

The results of the calculations from the data in the abovetable show that the Coefficient of Correlation (r) between Budget Balance and NPLs is 0.124, while the Coefficient of determination (R^2) is 0.015 (see Table IV, Figure 2).

TABLE IV. RESULTS AND INTERPRETATION OF MODEL NR2 CALCULATION RESULTS. CREATED BY THE AUTHOR, OWN CALCULATIONS

Name	Coefficients	Results of analysis	Parameters
Coefficient of Correlation	r	0.124	$0.1 < 0.124 < 0.3$
Coefficient of Determination	R^2	0.015	$0.7 > 0.015$
Critical Values	-	± 0.532	$ 0.124 < 0.532 $

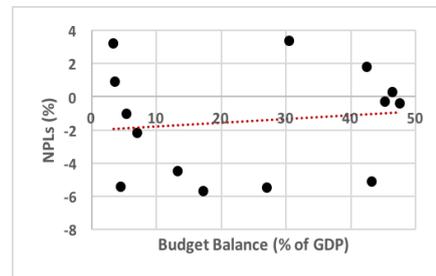


Fig. 2. The relationship between Budget Balance and NPLs in Cyprus, 2005-2018. Created by the author, own calculations

Based on the research results, the following can be observed:

- There is a correlation between Budget Balance and NPLs, since $-1 < 0.124 < 1$;
- Since the obtained correlation coefficient is a positive number, there is a positive correlation between the Budget Balance and NPLs, namely:
- - As the Budget Balance increases, the level of NPLs loans increases;
- - As the Budget Balance decreases, the level of NPLs loans decreases;
- The magnitude of the correlation between Budget Balance and NPLs is negligible, since the Chaddock Scale is $0.1 < 0.124 < 0.3$;
- 1.5% of NPLs are directly related to Public Debt (and vice versa), since the Coefficient of determination (R^2) is equal to 0.015;
- Since in this study $n = 14$, and the degrees of freedom are 12 ($df = n - 2$ and $14 - 2 = 12$) and using the table of critical values for the correlation coefficient $df = 12$ with $\alpha = 0.05$, the author determines that critical values are ± 0.532 . Since $r = 0.124$ and $0.532 > 0.124$, the correlation coefficient of Budget Balance and NPLs in Cyprus is not statistically significant. There is not significant relationship between Budget Balance and Non-performing loans in Commercial banks in Cyprus.
- The linear model between Budget Balance and NPLs does not describe the mentioned data.

C. Model Nr3 of the influence of Interest Rate on the level of non-performing loans

To accomplish the aim, the author builds an econometric Model Nr3 of a simple linear correlation of Interest Rate and the level of NPLs. The uses of the statistical data are presented in Table V.

TABLE V. INTEREST RATE AND NPLS IN CYPRUS (%), 2007-2018. COMPILED BY THE AUTHOR (BASED ON DATA FROM THE CENTRAL BANK OF CYPRUS [30] AND STATISTA [31])

Years	2007	2008	2009	2010	2011	2012	2013	2014
Interest Rate (%)	5.6	6.0	6.0	4.7	5.3	5.3	5	4.4
NPLs(%)	3.4	3.6	4.5	13.3	17.3	27.1	43.2	47.5
Years	2015	2016	2017	2018				
Interest Rate (%)	3.6	3.1	2.8	2.4				
NPLs(%)	45.3	46.4	42.5	30.5				

The results of the calculations from the data in the above table show that the Coefficient of Correlation (r) between Interest Rate and NPLs is -0.712 and the Coefficient of determination (R²) is 0.507 (see Table VI, Figure 3).

TABLE VI. RESULTS AND INTERPRETATION OF MODEL NR3 CALCULATION RESULTS. CREATED BY THE AUTHOR, OWN CALCULATIONS

Name	Coefficients	Results of analysis	Parameters
Coefficient of Correlation	r	-0.712	-0.9<-0.712<-0.7
Coefficient of Determination	R ²	0.507	0.7>0.507
Critical Values	-	±0.576	0.576 < 0.712

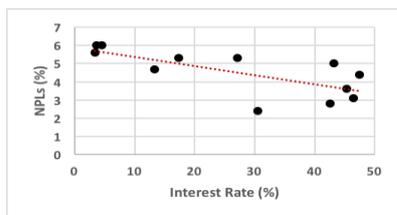


Fig. 3. The relationship between Interest Rate and NPLs in Cyprus, 2007 - 2018. Created by the author, own calculations

Based on the research results, the following can be observed:

- There is a linear relationship between Interest Rate and NPLs, since $-1 < -0.712 < 1$;
- Since the obtained correlation coefficient is a negative number, there is a negative relationship between Interest Rate and NPLs, namely:
- Since the obtained correlation coefficient is a negative number, there is a negative relationship between Interest Rate and NPLs, namely:
- - As the Interest Rate increases, the level of NPLs loans decreases;

- - As the Interest Rate decreases, the level of NPLs loans increases;
- The magnitude of the relationship between Interest Rate and NPLs is high, since the Chaddock Scale is
- $-0.9 < -0.712 < -0.7$;
- 50.7% of NPLs are directly related to Interest Rate (and vice versa), since the Coefficient of determination (R²) is equal to 0.507.
- Since in this study $n = 12$, and the degrees of freedom are 10 ($df = n - 2$ and $12 - 2 = 10$) and using the table of critical values for the correlation coefficient $df = 10$ with $\alpha = 0.05$, the author determines that critical values are ± 0.576 . Since $r = -0.712$ and $|0.712| > |0.576|$, the correlation coefficient of Interest Rate and NPLs in Cyprus is statistically significant. There is significant relationship between Interest Ratio and Non-performing loans in Commercial banks in Cyprus.
- The linear model between Interest Rate and NPLs is acceptable.

A number of studies are devoted to the fact that the effect of Interest Rate on the level of non-performing loans can be ambiguous, since it can be both significant and insignificant. Thus, there is an opinion that lending interest rates have a significantly positive impact on the NPLs [32]. As well as lending rates have a noticeable impact on consumer NPLs [7].

On the other hand, there is study that shows that the relationship between Interest Rate and non-performing loans is insignificant [10].

And there is also an opinion that the real interest rate affects non-performing loans positively and the NPL ratio worsens as interest rates increase [33, 34].

Consequently, according to the literature review, the relationship between inflation rates and non-performing loans can be significant and insignificant. And the research confirms that the significantly negative impact of Interest Rate on non-performing loans is not in line with findings in existing literature.

Moreover, researchers observe strong evidence in favor of the 'sovereign debt hypothesis'. And, therefore, the coefficients of the Debt variable are positive and statistically significant for all NPL types (consumer loans, business loans and mortgages). In addition, the impact of Public Debt is more pronounced on consumer NPLs [7]. Thus, higher Public debt significantly increase NPLs [10].

Comparing the findings for Public Debt and non-performing loans, the results match the overwhelming body of existing literature.

In addition, there is study that shows that the relationship between Budget Balance and non-performing loans is insignificant [10]. Thus, comparing the findings for Budget Balance and non-performing loans, the results match the overwhelming body of existing literature.

IV. CONCLUSIONS

Based on the research results, it is possible to draw that Public Debt and Interest Rate significantly affect NPLs in the Commercial banks of Cyprus. Thus, a reduction on Cyprus federal government's Public Debt will help lower NPLs. Moreover, higher Interest Rate significantly decrease NPLs in the Commercial banks of Cyprus. Furthermore, the findings of this research confirm that Budget Balance doesn't significantly affect NPLs in the Commercial banks of Cyprus.

The findings of this research bear further implications on macro-prudential policy. Based on the author's research, government and policy makers can consider the main group of determining factors of NPLs to create the good ideas in order to develop the banking industry and real economy in Cyprus.

The results obtained in this study provide various opportunities for further research. Adding more variables to those considered in this study is another suggestion. Such regional economic conditions can be tested for significance, as State housing price index and State home ownership rates.

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